



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



June 2014



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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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EXECUTIVE SUMMARY

This Executive Summary is organized as follows:

- Background — An overview of the regulations, approach and existing waterbody information.
- Findings — A summary of the key findings of the water quality data analyses, the water quality modeling simulations and the alternatives analysis.
- Recommendations — A listing of recommendations for improvements that are consistent with the Federal CSO Control Policy and the Clean Water Act (CWA). In addition, recommendations regarding suggested site-specific targets for the Alley Creek and Little Neck Bay waterbodies are provided. The site-specific targets are expected to advance the waterbody toward the Primary Contact WQ Criteria.

BACKGROUND

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), dated March 8, 2012 (2012 Order on Consent). The 2012 Order on Consent is a modification of the 2005 CSO Order on Consent (DEC Case No. CO2-20000107-8). Under the 2012 Order on Consent, the New York City Department of Environmental Protection (DEP) is required to submit 11 waterbody-specific LTCPs to the New York State Department of Environmental Conservation (DEC) by December 2017. The Alley Creek and Little Neck Bay LTCP is the first of the LTCPs under the 2012 Order on Consent to be completed. Previous versions of this LTCP were submitted to DEC on July 2 and November 12, 2013⁽¹⁾.

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 related guidance. In addition, the Goal Statement provides: *“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.”* DEP conducted water quality assessments where the data is represented by percent attainment with bacteria targets and associated recovery times. For this LTCP, in accordance with guidance from DEC, DEP considers that 95 percent attainment of applicable water quality criteria constitutes compliance with the existing WQS or the Section 101(a) (2) goals² conditioned on verification

¹ DEC indicated that the July submittal was not approvable as submitted. DEP re-submitted the LTCP with revisions in November 2013; DEC disapproved that submittal. DEP challenged the disapproval of the November submittal and believes that the LTCP was an approvable plan per the 2012 Order on Consent. However, DEP has made further revisions to the LTCP in response to DEC comments received in review letters dated September 12 and December 12, 2013, as well as in subsequent technical meetings held between DEC and DEP.

² This LTCP is designed to meet the existing WQS that have been promulgated by DEC. To the extent that this LTCP provides, analyzes, or selects alternatives that may lead to achievement of targets beyond what are required under existing WQS, DEP provides these analyses and/or commitments in order to improve water quality beyond the requirements of the CSO Control Policy and other applicable law. DEP reserves all rights with respect to any administrative and/or rulemaking process that DEC may engage in to revise WQS.

through rigorous post construction monitoring (PCM). The PCM will be reviewed for the Citywide LTCP and the percent attainment targets will be reviewed and possibly modified.

Regulatory Requirements

The waters of the City of New York are subject to Federal and New York State laws and regulations. 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. In New York State (NYS), CWA regulatory and permitting authority has been delegated to the DEC.

Currently, existing State WQS for navigable waters designate 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 bacteria indicator criteria that are currently in the DEC WQS in addition to recreational bathing pathogen indicator criteria in the Beaches Environmental Assessment and Coastal Health Act of 2000 (BEACH Act of 2000). 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).

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 enterococci as the new indicator organism with a requirement that the geometric mean (GM) concentration of enterococci not exceed 35 cfu/100mL. When this rule was promulgated, the EPA guidance document provided flexibility in the interpretation of the calculation of the GM. States were given the discretion by EPA to apply this new criterion as a seasonal GM, a monthly GM, or a rolling 30-day GM. Per DEC’s interpretation of the BEACH Act of 2000 and instruction to DEP, DEP has assessed the enterococci attainment calculations in this LTCP by applying a recreational season 30-day rolling GM to calculate enterococci attainment. The recreation season, as defined by DEC, is the period from May 1st to October 31st. When using a recreational season 30-day rolling GM, the more frequent and constant sources become less important in terms of attainment of the criterion and short-term sources become more important. In addition, DEC has recently advised DEP that it plans to adopt the 30-day rolling GM for enterococci of 30 cfu/100mL, with a not to exceed the 90th percentile statistical threshold value (STV) of 110 cfu/100mL, which is the EPA Recommended Recreational Water Quality Criteria “2012 EPA RWQC”. The analyses in this LTCP were performed prior to this recent communication, and thus used the 30-day rolling GM for enterococci of 35 cfu/100mL with a corresponding STV of 130 cfu/100mL. Sufficient time was not available to update all of the LTCP. The recommendations are not impacted.

This LTCP used the bacteria criteria shown in Table ES-1 to evaluate the proposed alternatives.

Table ES-1. Classifications and Standards Applied

Analysis	Numerical Criteria Applied		
	Alley Creek	Little Neck Bay	DMA Beach
Existing WQ Criteria	I (Fecal Monthly GM – 2,000 cfu/100 mL)	SB (Fecal Monthly GM – 200 cfu/100 mL) SB (Enterococci rolling 30-d recreational season GM - 35 cfu/100 mL)	SB (Fecal Monthly GM - 200 cfu/100 mL) SB (Enterococci rolling 30-d bathing season GM- 35 cfu/100 mL)
Primary Contact WQ Criteria ⁽³⁾	SC (Fecal Monthly GM – 200 cfu/100mL)	---	---
Future Primary Contact WQ Criteria ⁽⁴⁾	(Enterococci rolling 30-d recreational season GM – 35 cfu/100 mL + STV – 130 cfu/100 mL)	(Enterococci rolling recreational season 30-d GM – 35 cfu/100 mL+ STV – 130 cfu/100 mL)	SB (Enterococci rolling bathing season 30-d GM – 35 cfu/100 mL + STV – 130 cfu/100 mL)

Note: GM = Geometric Mean; STV = 90th Percentile Statistical Threshold Value; NYC DOHMH Bathing Season = Memorial Day to Labor Day; Recreational Season = May 1st to October 31st.

³ This water quality standard is not currently assigned to Alley Creek.

⁴ This Future Standard has not yet been proposed by DEC. For such standard to take effect, DEC must first adopt the standard in accordance with rulemaking and environmental review requirements. In addition, DEC must follow the required regulatory procedures to reclassify Alley Creek from I to SC.

The criteria assessed in this LTCP include the applicable existing WQS (Class I – secondary contact recreation for Alley Creek). Also assessed in this LTCP is what attainment would be if DEC were to reclassify Alley Creek to a Class SC - limited primary contact recreation. Regarding Little Neck Bay, this LTCP assesses existing WQS (Class SB – primary contact recreation). The bacteria criteria for Class SC are the same as for Class SB. The best usage of Class SC waters is fishing. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use of the waterbody for these purposes. It should be also noted that enterococci criteria do not apply to the tributaries such as Alley Creek under the BEACH Act of 2000, therefore, Alley Creek water quality assessments for Class SC considered the fecal coliform criteria only (Table ES-1). As described above, the 2012 EPA RWQC recommended certain changes to the bacterial water quality criteria for primary contact. DEC has indicated that NYS will seek to adopt those more stringent standards for both primary and secondary contact waterbodies. As such, this LTCP includes attainment analysis both for existing WQS and for the proposed 2012 EPA RWQC that is referred to as “future primary contact criteria.” A complete summary of existing and Future Primary Contact WQ Criteria is included in Table ES-1.

The attainment values with standards applied under Table ES-1 varied spatially and temporally at Alley Creek and Little Neck Bay locations. While the attainment with primary recreation fecal standard of 200 cfu/100 ml was high at all locations including Alley Creek (AC1) during the recreational season, when the standard is applied annually the resulting attainment value dropped to $\leq 95\%$ at the AC1 location. Attainment results with the primary recreation enterococci standard showed spatial variability among locations: while the attainment with GM of 35 cfu/100 ml enterococci was higher at LNB locations ($\geq 95\%$) during the recreational season, it was significantly lower (64%) at the Alley Creek tributary location (AC1).

When STV values are taken into account, the attainment values dropped significantly at all locations, ranging from 85% at the outer Bay (E11) to 10% at the Alley Creek location (AC1).

Alley Creek Watershed

Alley Creek watershed characteristics are as shown in Figure ES-1 and the CSO and stormwater outfalls are shown in Figure ES-2.

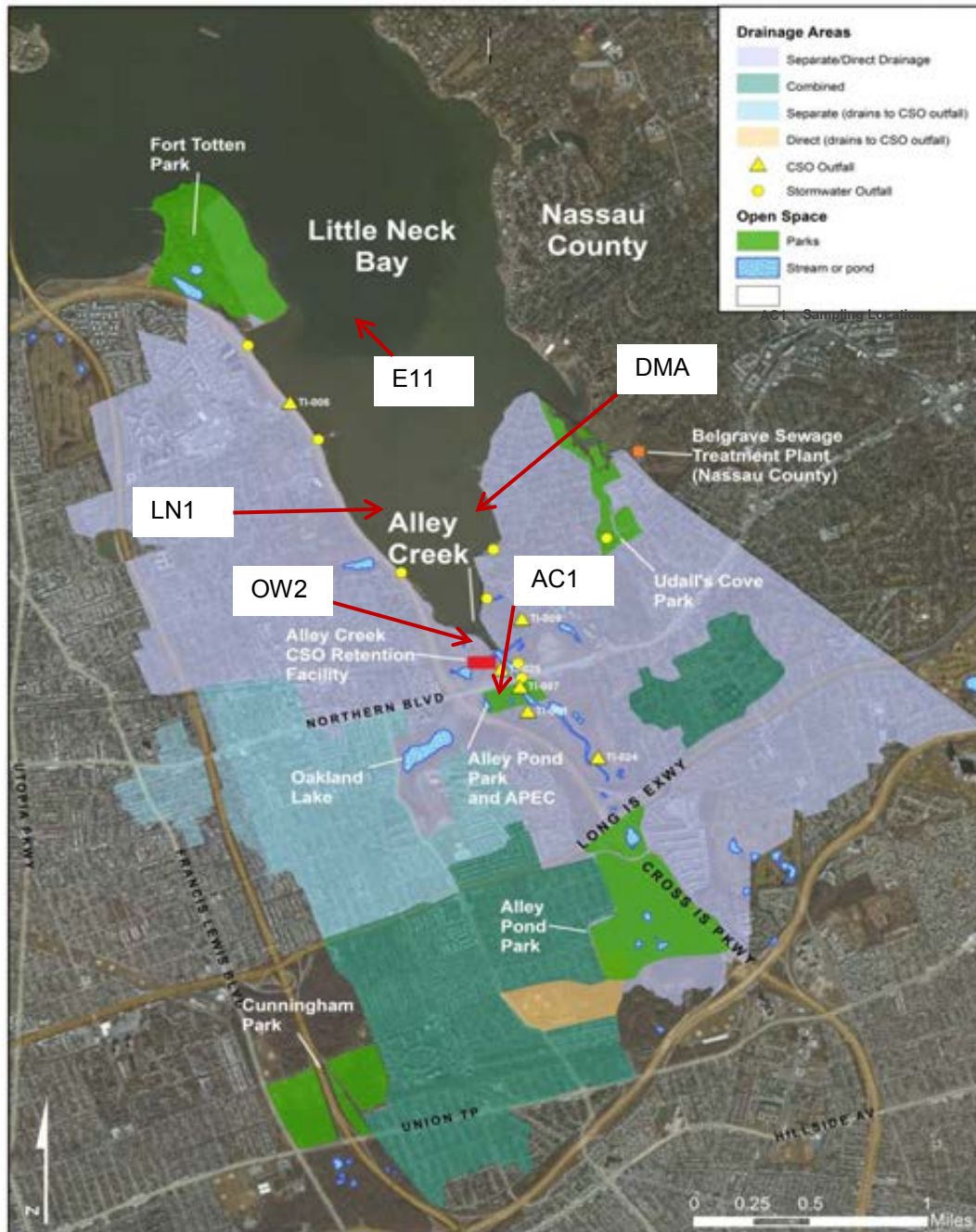


Figure ES-1. Watershed Characteristics and Sampling Locations

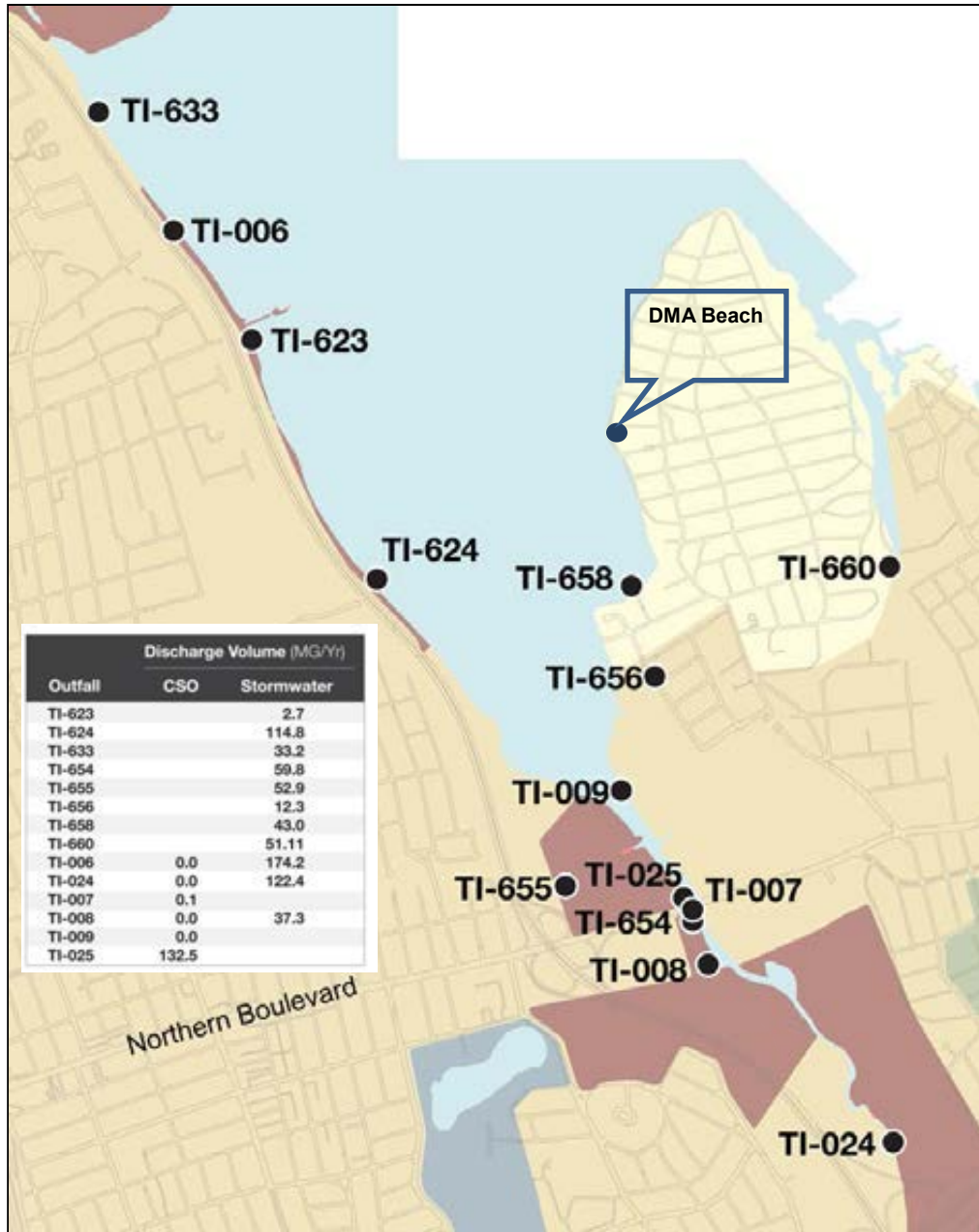


Figure ES-2. New York City Alley Creek and Little Neck Bay SPDES Permitted Outfalls

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 (DMA) manages a permitted private community beach known as DMA Beach, along Shore Road. 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.

For designated bathing beach areas, the BEACH Act of 2000 recommends a seasonal GM of 35 MPN/100mL and includes a single sample maximum enterococci value of 104 per 100mL 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 100mL that is used to trigger a beach closing. DOHMH also adopted the single sample maximum of 104 enterococci per 100mL that is used to issue beach advisories. Although these are the existing DOHMH rules for bathing beaches, the operating criteria will likely change in the future as a result of recommendations provided in the 2012 EPA RWQC.

Green Infrastructure

The Alley Creek and Little Neck Bay watershed has one of the smallest total combined sewer impervious areas among the NYC managed watersheds, totaling 1,490 acres. DEP has already made significant investments in the watershed and has been successful in significantly controlling CSOs through the construction of CSO facilities and sewer enhancements. Therefore, as part of this LTCP, DEP assumes no public investment in green infrastructure (GI) implementation in the right-of-way or onsite public properties. However, DEP projects that approximately 45 acres will 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 NYC Department of Buildings (DOB) building permit data from 2000 to 2011.

Findings

Analysis of water quality in Alley Creek and Little Neck Bay was based on data collected by the DEP Harbor Survey Program between January 2009 and March 2014 and from sampling performed in late 2012, 2013 and 2014 during the development of the Alley Creek and Little Neck Bay LTCP. The data indicate that bacteria 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 bacteria values are partially attributed to illicit connections to the storm sewers that discharge out of TI-024 during dry weather. A portion of these illicit connections have been corrected and track-down efforts are still underway to ensure that all illicit connections are addressed. Accordingly, the loadings attributed to the illicit connections are not included in the LTCP baseline conditions.

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 GM criterion of 35 MPN/100mL. Between 2009 and March 2014, the water quality at DMA Beach was in attainment with the bathing season (Memorial Day – Labor Day) 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.

The results of this sampling program revealed the highest levels of bacteria concentrations in Alley Creek and in the southern area of inner Little Neck Bay near the mouth of Alley Creek. Localized contamination was also evident from the sampling at the DMA Beach. 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, which serves as a separate stormwater outfall. Those illicit discharges found in 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 and 2014, prompted by high bacteria levels found in the Creek at location AC1 (Northern Boulevard), suggest that other illicit connections still exist. DEP is in the process of investigating and correcting these connections. Further, DEP will continue to conduct water quality sampling and connection 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 DEP will continue to sample and conduct water quality and pollution characterization investigations of the TI-024 outfall tributary area.

In addition to Alley Creek and lower Little Neck Bay, elevated bacteria concentrations were also found at the DMA Beach and have been a known chronic problem. These are believed to be caused by a 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 agencies which may have such jurisdiction including DEC, 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 small highway drainage pond south of the Long Island Expressway (LIE) known as the LIE Pond. Additional sampling was conducted for these areas during 2014 and bacteria concentrations were found to be representative of urban waters, likely the result of wildlife and not representative of waters with illicit connections.

Baseline Conditions, 100 Percent CSO Control and Performance Gap

Analyses utilizing computer models to evaluate the ability to bring Alley Creek and Little Neck Bay into compliance with the existing WQ criteria, as well as the Future Primary Contact WQ Criteria with 2012 EPA RWQC bacteria modifications were conducted as part of this LTCP. These analyses also evaluated the ability of Alley Creek to comply with the Primary Contact WQ Criteria (Class SC). The analyses focused on two primary objectives:

1. Determine the future baseline levels of compliance with water quality criteria with all sources being discharged at existing levels (exclusive of illicit discharges) to the waterbody. These sources would primarily be stormwater and CSO. This analysis is presented for existing WQ criteria, Primary Contact WQ Criteria for Alley Creek (Class SC) and future Primary Contact WQ Criteria with 2012 EPA RWQC for both waterbodies.
2. Determine attainment levels with 100 percent of CSO controlled or no discharge of CSO to the waterbody, keeping the remaining stormwater sources. This analysis is presented for the standards and bacteria criteria shown in Table ES-1.

DEP assessed water quality using the East River Tributary Model (ERTM), a water quality model that was created and calibrated during the development of the WWFP in 2009. The model was modified as part of this 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 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 bacteria concentrations within the waterbodies for a set of baseline conditions.

Baseline conditions were established in accordance with the guidance provided by DEC to represent future conditions. These included the following assumptions: the design year was established as 2040; Tallman Island Wastewater Treatment Plant (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 three percent coverage. In addition, the LTCP assumed baseline conditions with inflows from Oakland Lake and the LIE Pond as monitored in 2014.

The water quality assessments were conducted using continuous water quality simulations – a one-year (2008 rainfall) simulation for bacteria and dissolved oxygen (DO) assessment to support alternatives evaluation, and a 10-year (2002 to 2011 rainfall) simulation for bacteria for attainment analysis for developed alternatives. The gaps between calculated baseline bacteria as well as DO were then compared to the applicable bacteria and DO criteria to quantify the level of non-attainment. Because DO in Little Neck Bay and Alley Creek is highly influenced by the Upper East River and Long Island Sound, impacts from CSO overflows are minimal. Thus, the majority of the analyses focused on bacteria.

A summary of the baseline attainment results is presented in Table ES-2. Table ES-3 follows and presents projected level of attainment following 100 percent control of the CSO discharges.

Table ES-2. Baseline Compliance with Bacteria Criteria

Location		Existing WQ Criteria ¹		Alley Creek Primary Contact WQ Criteria (Class SC)		Future Primary Contact WQ Criteria
		Fecal Coliform ² (%)	Entero ³ (%)	Fecal Coliform ² (%)	Entero ³ (%)	Entero ³ (%)
Alley Creek	AC1	YES	NA	87	N/A	53
Little Neck Bay	OW2	YES	91	N/A		91
	LN1	YES	YES			YES
	E11	YES	YES			YES
Bathing Area	DMA	YES	YES			YES

Notes: YES indicates ≥ 95 percent attainment

1. Alley Creek – Class I, Little Neck Bay – Class SB.
2. Fecal attainment assessed on an annual basis.
3. Little Neck Bay including Bathing Area – Attainment shown for 35 MPN/100mL applicable to a 30-day rolling GM during recreational season.

Table ES-2 shows that the waterbodies achieve a high level of attainment with the existing WQ criteria. Levels of attainment are less for the Primary Contact WQ Criteria in Alley Creek and modification based on the 2012 EPA RWQC in both waterbodies.

Table ES-3. Compliance with Bacteria Criterion with 100 Percent CSO Loading Removal

Location		Existing WQ Criteria ¹		Alley Creek Primary Contact WQ Criteria (Class SC)		Future Primary Contact WQ Criteria
		Fecal Coliform ² (%)	Enterococci ³ (%)	Fecal Coliform ² (%)	Enterococci ³ (%)	Enterococci ³ (%)
Alley Creek	AC1	YES	NA	94	N/A	64
	OW2	YES	YES	N/A		YES
Little Neck Bay	LN1	YES	YES			YES
	E11	YES	YES			YES
Bathing Area	DMA	YES	YES			YES

Notes: YES indicates ≥ 95 percent attainment

1. Alley Creek – Class I, Little Neck Bay – Class SB.
2. Fecal attainment assessed on an annual basis.
3. Little Neck Bay including Bathing Area – Attainment shown for 35 MPN/100mL applicable to a 30-day rolling GM during recreational season.

Further, as indicated in Table ES-3, even with 100 percent control of all CSOs, through additional control of the existing Alley Creek CSO Retention Facility effluent, the projected attainment with the recreational season enterococci criteria only increases marginally for the same 10-year period. Although not presented in Tables ES-2 and ES-3, even less attainment occurs when the 2012 EPA RWQC modification enterococci STV value 90th upper percentile limits are applied. The reason that full compliance is not attained is due mainly to two primary factors, use of GM averaging for compliance determination and stormwater contributions that occur during virtually each rain event.

GM averaging, as required for DEC compliance analyses, minimizes the importance of low frequency-high numbers, thus the effects of the infrequent Alley Creek CSO Retention Facility discharges, approximately once per month, are de-emphasized. Stormwater contributions are more frequent, at essentially one discharge for every rain event per outfall, averaging ten events per month, and thus become important in the calculation of the GM. Water quality is thus highly influenced by frequency of stormwater discharges while removal of CSOs has a smaller effect.

In summary, the baseline modeling showed that Alley Creek and Little Neck Bay exhibit a high level of attainment with the existing WQ criteria. The attainment levels with the Primary Contact WQ Criteria (Class SC for Alley Creek) and the Future Primary Contact WQ Criteria are lower.

Public Outreach

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 who offered comments at public meetings held for this 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. The third meeting will present the final recommended plan to the public after DEC review of the LTCP.

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. The recent \$130M public investment in construction of the Alley Creek CSO Retention Facility, related collection system improvements and ecological restoration was well-received. No support was expressed for additional CSO controls or a higher standard for Alley Creek during the public participation meetings.

Evaluation of Alternatives

A three-step evaluation process was used to evaluate control measures and CSO control alternatives. The process was based on an evaluation process that considered factors related to environmental benefits; community and societal impacts; and implementation and O&M considerations. Following the initial or fatal flaw step and a more rigorous numerical evaluation second step, the most promising or retained alternatives were subjected to cost performance and cost attainment evaluations where economic factors were introduced. Table ES-4 contains the ten retained alternatives.

Table ES-4. Alley Creek and Little Neck Bay Alternatives Summary

Alternative	CSO Volume (MGY)	CSO Volume 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	5.4	-5.2	\$658
2A. 3.0 MG Additional Downstream Retention	98	25	12.1	10.1	\$93
2B. 6.5 MG Additional Downstream Retention	65	50	24.3	20.4	\$156
2C. 12 MG Additional Downstream Retention	33	75	36.5	30.7	\$310
2D. 29.5 MG Additional Downstream Retention	0	100	48.5	40.8	\$569
3A. 2.4 MG Additional Upstream Retention	98	25	18.5	14.5	\$113
3B. 6.7 MG Additional Upstream Retention	65	50	35.0	27.5	\$173
4. Recreational Season Disinfection Operation in Existing Alley Creek CSO Retention Facility	132	0	23.3	19.6	\$11.3
5A. 10 percent Green Infrastructure	112	15	5.9	5.2	\$63
6. Hybrid – HLSS plus 3.0 MG Retention	38	71	11.0	0.1	\$751
¹ CSO annual volume 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 three percent interest.					

Alternative 4, Recreational Season Disinfection Operation in Existing Alley Creek CSO Retention Facility, will need to address potential effluent toxicity from total residual chlorine (TRC). Therefore, DEP sought a balance to reduce a high level of human or CSO-derived bacteria while protecting the waterbodies from TRC. A potential operational strategy was developed and incorporated into Alternative 4. The

disinfection facilities would be operated during the recreational season to achieve a targeted 2-log bacteria kill (99 percent) while seeking to produce a minimum discharge of TRC to the extent possible. Consistent with the majority of the surveyed operating CSO disinfection facilities around the country, the effluent TRC in the Alley Creek CSO Retention Facility is expected to have a maximum concentration of 0.1 mg/L. This potential operational strategy is reflected in the results in Table ES-4, above, and the cost estimates. The DEPs approach for disinfection includes an interim facility and a permanent facility at the existing Alley Creek CSO Retention Facility. Section 8 and 9 provide an explanation and schedule for the disinfection facilities.

CSO Reductions, WQ Impact with the Selected Alternative

A summary of the results of the final step of the evaluation process for enterococci and fecal coliform are illustrated by Figure ES-3 and ES-4, which is a cost-performance curve for the various alternatives regarding enterococci and fecal coliform loading reductions at CSO outfall TI-025. The best-fit curve in the figure does not clearly show a knee-of-the-curve (KOTC). If the best-fit curve had encompassed the seasonal disinfection point rather than the annual equivalent disinfection point, a KOTC would stand out. The latter was used in the best-fit curve in order to present a uniform, consistent comparison between the various alternatives evaluated.

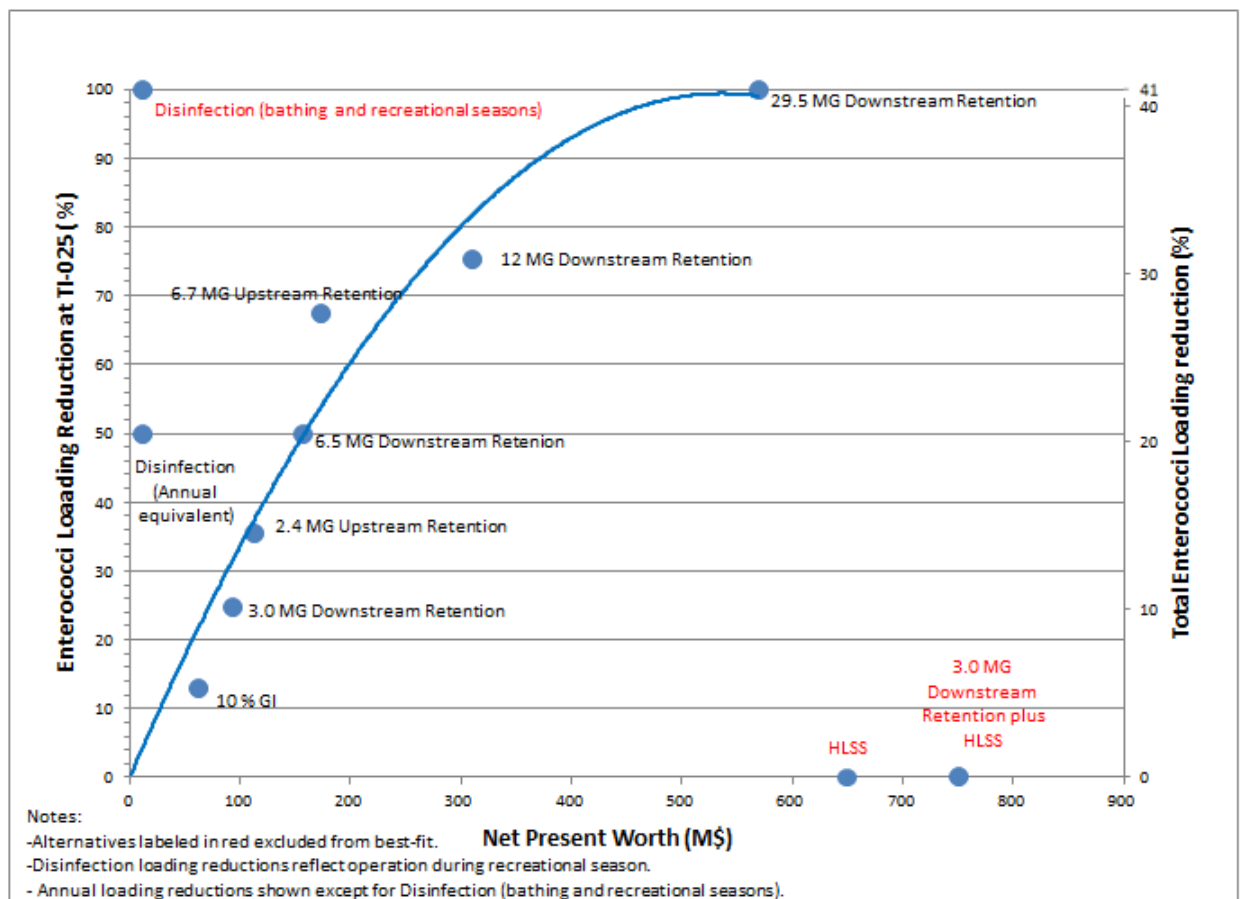


Figure ES-3. Cost vs. Total Enterococci Loading Reduction

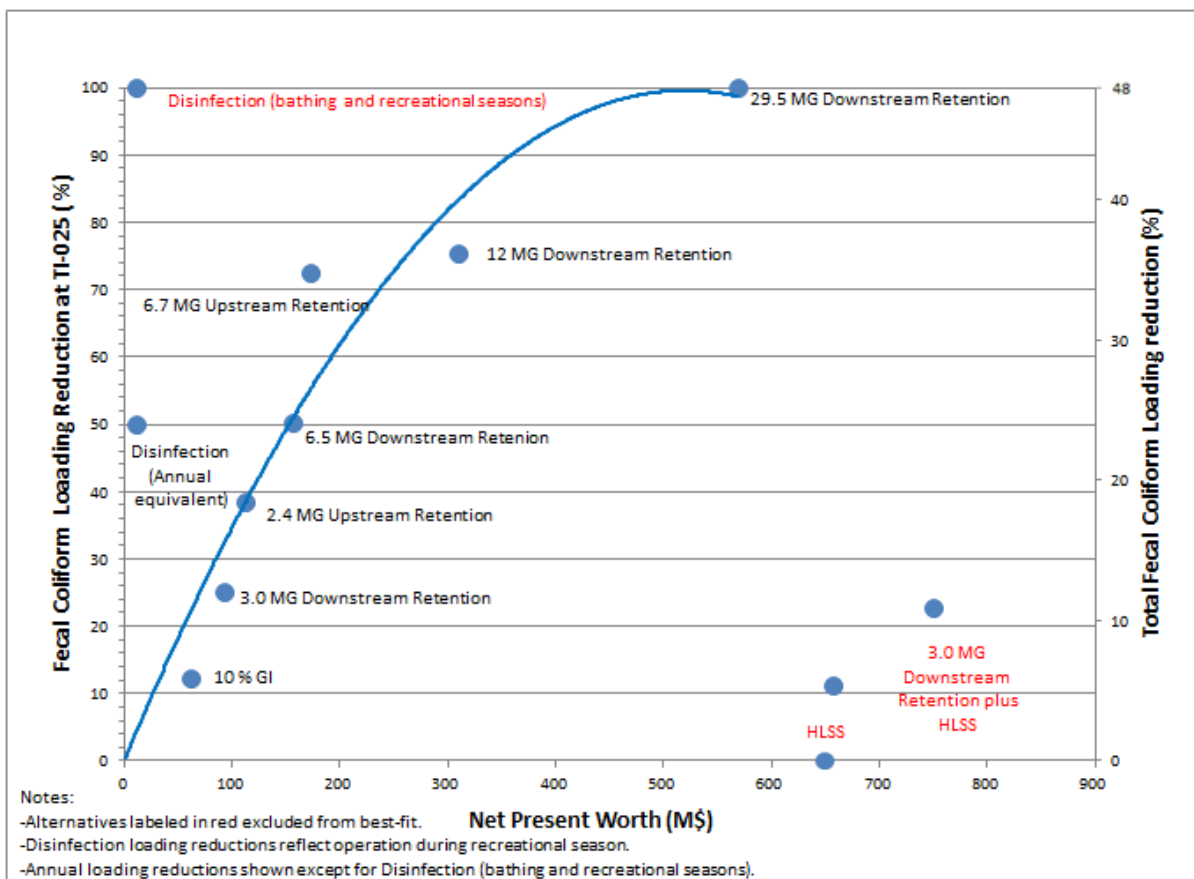


Figure ES-4. Cost vs. Fecal Coliform Loading Reduction – 2008 Rainfall

The cost-attainment curves that are presented in Section 8.5 did not show meaningful improvement in WQS attainment for any of the alternatives, including 100 percent CSO control. The least costly alternative is disinfection at the existing Alley Creek CSO Retention Facility. The analyses established that CSO discharges are not the primary factor in non-attainment of the Primary Contact WQ Criteria for Alley Creek (Class SC) or the Future Primary Contact WQ Criteria. However, due to findings from the cost-performance curves when focusing strictly on CSO discharges, Alternative 4 (see Table ES-4) stands out as a cost-effective means of controlling the remaining source of human bacteria, the CSOs. It is thus recommended as the selected alternative for the Alley Creek and Little Neck Bay LTCP.

This LTCP recommendation follows the findings and adaptive nature of DEP’s long established CSO planning and abatement efforts. The Alley Creek CSO Retention Facility was first proposed in the 2003 Facilities Plan, followed by a re-statement in the 2009 Waterbody/Watershed Facilities Plan. The \$130M investment in the Alley Creek CSO Retention Facility, related collection system improvements and ecological restoration were effective in reducing the volume of annual CSO overflows. This latest improvement resulting from this LTCP will further build upon these earlier efforts and will now specifically address the human or CSO-source bacteria in the periodic discharges from the facility.

The recommended disinfection will require improvements to the Alley Creek CSO Retention Facility that include: a new building, interim chlorination facilities, chlorination, possibly sodium bisulfite, pumps and mechanical equipment. Environmental reviews, permits, land acquisition or lease and multiple additional items will be needed to build the disinfection facility. The estimated probable bid cost is \$7.6M in 2013

dollars, and operations costs are estimated at \$0.25M annually, for a present worth cost of \$11.3M. A more complete description of the disinfection approach is described in Section 8.0.

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.** Potential delays may impact the disinfection project, including the approval process, public comment, permitting issues, land use and easement acquisition, impact on Parkland, environmental review of the creek biota and design/construction/operation requirements.

RECOMMENDATIONS

Long Term CSO Control Plan Implementation, UAA and Summary of Recommendations

DEP will implement the plan elements identified in this section after approval of the LTCP by DEC. This Long Term Control Plan recommends the continued operation of the Alley Creek CSO Retention Facility with the addition of seasonal disinfection to control human bacteria, and has identified potential site-specific water quality targets for the water body beyond the currently applicable water quality standards, based on the predicted performance of the selected CSO controls. **The targets are goals to move towards and are not enforceable.** Post construction monitoring data will be collected to assess and compared to the targets.

The potential site-specific water quality targets are based on a review of ten years of water quality model simulations and should be met the majority of time. **Achieving the targets will require that DEP continue to track down and eliminate remaining illicit connections.**

The LTCP analyses and recommendations for the Alley Creek and Little Neck Bay LTCP are summarized below for the following items:

1. Water Quality Modeling Results
2. Identified UAA Site-Specific Targets
3. Summary of Recommendations

Water Quality Modeling Results

The water quality modeling results for Alley Creek and Little Neck Bay are shown in Tables ES-5 and ES-6 for the recommended alternative. These results provide the calculated annual attainment of the fecal coliform and enterococci bacteria concentrations for the plan with a new disinfection facility at the Alley Creek CSO Retention Facility operating during the recreational season (May 1st – October 31st). The results show, for the different calculated levels of attainment, when concentrations would be at or lower than the Existing WQ Criteria, Primary Contact WQ Criteria for Alley Creek (Class SC) and Future Primary Contact WQ Criteria with 2012 EPA RWQC bacteria criteria modifications.

The recommended plan achieves annual attainment of the existing fecal coliform criteria as well as attainment of the existing recreational season 30-day rolling GM enterococci criterion, with bacteria

concentrations lower than the requirements throughout Little Neck Bay and with a very high level of attainment at the DMA bathing area. In Alley Creek, a high but not full level of attainment with the fecal coliform criterion for Class SC is projected to occur. With the recommended alternative, compliance with the 2012 EPA RWQC bacteria modifications remains low in Alley Creek, but increases in Little Neck Bay except for the inner (southern) portions of the bay (OW2).

Table ES-5. Compliance with Bacteria Criterion for the Recommended Alternative

Location		Existing WQ Criteria ¹		Primary Contact WQ Criteria (Class SC for Alley Creek)		Future Primary Contact WQ Criteria
		Fecal Coliform ² (%)	Enterococcus ³ (%)	Fecal Coliform ² (%)	Enterococcus ³ (%)	Enterococcus ³ (%)
Alley Creek	AC1	YES	N/A	90	N/A	64
	OW2	YES	YES	N/A		YES
Little Neck Bay	LN1	YES	YES			YES
	E11	YES	YES			YES
Bathing Area	DMA	YES	YES			YES

Notes: YES indicates ≥ 95 percent attainment

1. Alley Creek – Class I, Little Neck Bay – Class SB.
2. Fecal attainment assessed on an annual basis.
3. Little Neck Bay including Bathing Area – Attainment shown for 35 MPN/100mL applicable to a 30-day rolling GM during recreational season.

Attainment of the STV criterion of the Future Primary Contact WQ Criteria is difficult if not impossible to achieve, as shown in Table 8-18 of the LTCP report. As noted previously, the analyses performed for this LTCP are based on 35 cfu/100mL and 130 cfu/100 mL for the GM and STV criteria, respectively.

Potential UAA Site-Specific Targets

Since the recommended LTCP projects will not result in full compliance in Alley Creek with Primary Contact WQ Criteria (Class SC), DEP has prepared a UAA for Alley Creek that identifies potential site-specific targets with advisories based on the predicted performance of the selected CSO controls. Application of these targets will reduce the bacteria loads to Alley Creek, and will improve attainment with existing Class SB of Little Neck Bay. **The site-specific target is a goal to work toward during the period within which DEP’s MS4 stormwater permit will come into effect and additional bacteria loading reductions will be expected.**

These site-specific targets are based on water quality model simulations that account for CSO and stormwater sources, assume that seasonal disinfection is practiced, assume illicit discharges to storm sewers have been corrected and suspected DMA septic issues are corrected. Under these conditions, the pathogen water quality indicators should be less than the identified targets the majority of the time.

The recommended recreational season water quality targets are summarized in Table ES-6 in comparison to the existing and proposed bacteria WQ criteria. This table also provides a summary of the calculated bacteria criteria attainment. As noted in this table, the plan results in a high level of attainment with these proposed numerical targets.

Table ES-6. Proposed Site-Specific Bacteria Targets for Alley Creek and Little Neck Bay

Location	Existing WQ Criteria	Primary Contact WQ Criteria	Site-Specific Targets with Disinfection (cfu/100mL)	Attainment with Site-Specific Targets (%)
Little Neck Bay	Fecal Coliform ≤ 200	Fecal Coliform No change	Fecal Coliform ≤ 200	100
	Enterococci ≤ 35 ⁽²⁾	Enterococci ≤ 35 ⁽²⁾	Enterococci ≤ 35	95 ⁽³⁾ 100 ⁽⁴⁾
Alley Creek	Fecal Coliform ≤ 2000	Fecal Coliform ≤ 200	Fecal Coliform ≤ 200	98
			Enterococci ≤ 130	100
DMA Beach	Fecal Coliform ≤ 200	Fecal Coliform No change	Fecal Coliform ≤ 200	100
	Enterococci ≤ 35 ⁽¹⁾	Enterococci ≤ 35 ⁽²⁾	Enterococci ≤ 35	99

Notes: (1) Bathing season (Memorial Day – Labor Day)
 (2) Recreational season (May 1st – October 31st)
 (3) Inner Little Neck Bay
 (4) Outer Little Neck Bay

Water quality modeling analyses were conducted herein to assess the amount time following the end of rainfall required for Alley Creek and Little Neck Bay to recover and return to concentrations less than 1,000 cfu/100mL fecal coliform and 130 cfu/100mL enterococci for the recreation periods (May 1st to October 31st) abstracted from 10-years of model simulations. The time to return (or “time to recover”) to 1,000 or 130 was then calculated for each storm with the various size categories and the median time after the end of rainfall was then calculated for each rainfall category.

The results of these analyses are summarized in Table ES-7 for various locations within Alley Creek and Little Neck Bay. As noted the duration of time within which bacteria concentrations are expected to be higher than NYS DOH considers safe for primary contact varies with location and with rainfall event size. Generally, a value of around 24 hours is reasonable for Alley Creek (AC1) and Little Neck Bay (OW2).

Table ES-7. Time to Recover (hours) To Fecal = 1,000 cfu/100mL and Entero = 130 cfu/100mL

	AC1		OW2		LN1		DMA	
Interval	Fecal	Entero	Fecal	Entero	Fecal	Entero	Fecal	Entero
<0.1	-	-	-	-	-	-	-	-
0.1-0.4	5	10	-	-	-	-	-	-
0.4-0.8	8	21	4	11	-	-	-	-
0.8-1.0	12	26	5	16	-	-	-	2
1.0-1.5	12	31	7	27	-	7	-	4
>1.5	14	31	12	27	-	16	2	12

Primary contact uses may be suspended for 24 hours following rain events to protect public health.

Summary of Recommendations

Overall water quality in Alley Creek and Little Neck Bay is expected to be marginally improved with the recommendations presented in this LTCP. Human bacteria discharged to Alley Creek through the overflow from the Alley Creek CSO Retention facility are expected to be greatly reduced with these recommendations. Little Neck Bay's water quality is also expected to benefit from these recommendations.

The identified elements for the Alley Creek and Little Neck Bay LTCP are:

1. DEP will continue to use the Alley Creek CSO Retention Facility to capture CSOs thus reducing overflows by 132 mgd per year.
2. DEP will continue to implement the Green Infrastructure program.
3. DEP will implement the steps necessary (i.e. funding, design, permitting, etc.) to construct a new facility at the existing Alley Creek CSO Retention Facility to disinfect during the recreational season (May 1st to October 31st).
4. The LTCP includes a UAA that identifies feasible site-specific WQ targets based on the projected performance of the selected CSO controls. A post construction monitoring program will be initiated after the WWFP improvements are operational. Based upon the results of such monitoring, the site-specific WQ targets may need to be reviewed
5. DEP will establish with the NYC Department of Health and Mental Hygiene through public notification a 24-hour wet weather advisory during the Recreational Season (May 1 to October 31), during which swimming and bathing would not be recommended. The LTCP includes a recovery time analysis that can be used to establish the 24-hour wet weather advisory for public notification.

In summary, this LTCP is expected to reduce the human contributed CSO bacteria and bacteria discharged to Alley Creek from CSOs. Little Neck Bay is expected to benefit from disinfection at the Alley Creek CSO Retention Facility. The overall water quality attainment in Alley Creek and Little Neck Bay is anticipated to marginally improve but will be significantly impacted by the bacteria standards and the stormwater contributions. The recommendations are expected to provide improvement beyond the existing WQS.

DEP is committed to improving water quality in these waterbodies, which will be advanced by the improvements and recommendations presented in this plan. These goals and recommendations have been balanced with input from the public and awareness of the cost to the citizens of New York City. The use of the UAA process will allow DEP and DEC to advance the goal of achieving the primary contact WQ criteria in Alley Creek and improve the already high attainment of the Class SB WQ criteria for Little Neck Bay.

Since submittal of the last Alley Creek LTCP in November 2013, the following significant changes have been included in this June 2014 submittal:

- Additional data were collected and evaluated in Section 2.0:
 - Alley Creek CSO Retention Facility effluent data
 - Flow and bacteria data at Oakland Lake and Long Island Expressway (LIE) Pond
 - Microbial Source Tracking (MST) data on Oakland Lake
 - Harbor Survey Monitoring data in Alley Creek
 - Illicit discharge tracking data in Alley Creek
- Models were updated with the new data and the baseline analyses were updated in Section 6.0, as applicable.
- Recreational season disinfection and partial High Level Sewer Separation alternatives were added and more detailed revisions were made to Section 8.0.
- Recreational season disinfection was added as a recommendation in Section 9.0.
- For the BEACH Act of 2000, the 90-day enterococci seasonal GM was removed, and water quality compliance with it was assessed for Little Neck Bay as a rolling 30-day GM of 35 cfu/100mL during the recreational season.
- A revised recreational season period from May 1st through October 31st and a bathing season period from Memorial Day through Labor Day was used.
- RWQC criteria were evaluated. The GM of 35 cfu/100mL and STV of 130 cfu/100mL were applied. There was insufficient time to evaluate the 30 cfu/100mL and 110 cfu/100mL, respectively, although the conclusions are expected to be similar.
- Site-specific targets were identified that would allow waterbody improvements to be achieved.
- A recovery time analysis was added to assess the time to return to the site-specific targets after storm events of various sizes.
- A revised UAA for Alley Creek is provided.

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), dated March 8, 2012 (2012 Order on Consent). The 2012 Order on Consent is a modification of the 2005 CSO Order on Consent (DEC Case No. CO2-20000107-8). Under the 2012 Order on Consent, the New York City Department of Environmental Protection (DEP) is required to submit 11 waterbody-specific LTCPs to the New York State Department of Environmental Conservation (DEC) by December 2017. The Alley Creek and Little Neck Bay LTCP is the first of the LTCPs under the 2012 Order on Consent to be completed. Previous versions of this LTCP were submitted to DEC on July 2 and November 12, 2013⁽¹⁾.

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 Citywide 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) goals² of the Clean Water Act, or

¹ DEC indicated that the July submittal was not approvable as submitted. DEP re-submitted the LTCP with revisions in November 2013; DEC disapproved that submittal. DEP challenged the disapproval of the November submittal and believes that the LTCP was an approvable plan per the 2012 Order on Consent. However, DEP has made further revisions to the LTCP in response to DEC comments received in review letters dated September 12 and December 12, 2013, as well as in subsequent technical meetings held between DEC and DEP.

² This LTCP is designed to meet the existing WQS that have been promulgated by DEC. To the extent that this LTCP provides, analyzes, or selects alternatives that may lead to achievement of targets beyond what are required under existing WQS, DEP provides these analyses and/or commitments in order to improve water quality beyond the requirements of the CSO Control Policy and other applicable law. DEP reserves all rights to with respect to any administrative and/or rulemaking process that DEC may engage in to revise WQS.

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 a UAA for Alley Creek as discussed later in the LTCP.

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 also 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 (WQS) 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 or "list"). The list identifies the pollutant or stressor causing impairment, and establishes a schedule for developing a control plan to address the impairment. Placement on the 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.

DEC included Little Neck Bay in the 2014 Draft New York State Section 303 (d) list of impaired waterbodies for pathogens associated with CSO discharges, storm discharges, and urban runoff. DEC previously included Alley Creek on a separate supplemental list referenced as the 2012 Other Impaired Waterbody Segments not Listed, which includes waterbody segments not listed elsewhere because

“development of TMDL is not necessary” (Category 4b). This Category 4b designation includes waters of the state that do not fully support designated uses and are considered impaired. Alley Creek is listed as Category 4b based upon impairment for floatables and oxygen demand due to CSO discharges, storm discharges, and urban runoff (Table 1-1). Furthermore, DEC has listed Little Neck Bay under Category 4a (for waterbodies having a TMDL) based upon the fact that Little Neck Bay was included in the Long Island Sound TMDL.

Table 1-1. Waterbody Impairments and Listings (with Source of Impairment)

Waterbody	Pathogens	DO/Oxygen Demand	Floatables	Reference
Little Neck Bay	⁽¹⁾ Urban/Storm/CSO	^(4a) Municipal, Urban, CSOs	-----	2014 Draft NYS 303(d) Impaired Water List
Alley Creek	-----	^(4b) Urban/Storm/CSO	^(4b) CSOs, Urban/Storm	2012 Other Impaired Waterbody Segments not Listed

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 an LTCP, in accordance with the provisions of the CWA. The CSO Control Policy was first established in 1994 and later codified as part of the CWA in 2000.

1.2.c New York State Policies and Regulations

The State of New York (NYS) 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).

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 (NEIWPC), 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 citywide 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 Facility.

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, analysis of studies and reports, and collection of new data. The next phase involves the identification and analysis of alternatives to reduce the frequency of wet weather discharges and improve water quality. Alternatives include a combination of green and grey infrastructure elements that are carefully evaluated using both the collection system and receiving waterbody models. Following the analysis of alternatives, a recommended plan, along with an implementation schedule and strategy, is provided. If the proposed alternative does 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 DEC.

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. The LTCP integrates and builds on this existing body of work.

In June 2009, DEP issued the Alley Creek and Little Neck Bay Waterbody/Watershed Facility Plan (WWFP), which DEC approved in October, 2009. The WWFP, which was prepared pursuant to the 2005 Order on Consent, includes an analysis and presentation of operational and structural 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 Facility, along with

extensive improvements to the upstream combined and separate collections systems within the Alley Creek watershed.

Aside from the improvements in the Alley Creek drainage area, additional improvements have been made or are underway to improve the conveyance of wet weather flows to the Tallman Island Wastewater Treatment Plant (WWTP). This includes completed modifications to Regulator TI-R09 (increased open area of side-overflow windows, raised weir), and Regulator TI-R10 that was removed and replaced with a section of pipe. In addition, construction is underway to construct a parallel Whitestone Interceptor in conjunction with some regulator modifications that is projected to significantly increase the hours in which the Tallman Island WWTP will treat two times design dry weather flow (2xDDWF). DEP incorporated these sewer system improvements into the baseline conditions for this LTCP. Further discussion of these improvements is contained in Section 4.0.

1.3.b Coordination with DEC

As part of the LTCP process, DEP strove to share ideas, report on LTCP progress, and propose strategies and solutions to address wet weather challenges for the Alley Creek and Little Neck Bay LTCP with DEC.

During the early phases of the LTCP development, representatives from DEP and DEC, along with their technical consultants, conducted technical meetings during the development of the Alley Creek and Little Neck Bay LTCP. The purpose of these early meetings was to discuss 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 also convened for a larger progress meeting that typically included technical staff and representatives from DEP and DEC's legal departments, as well as department chiefs who oversee the execution of the CSO program.

In addition to these meetings, DEP and DEC co-hosted the LTCP public kick-off meeting, sharing the responsibility for presentation of material and execution of the event. While not co-hosting the second public meeting, DEC did send a representative who read an official statement from the department.

1.3.c Watershed Planning

DEP began to prepare its CSO WWFPs before the emergence of Green Infrastructure (GI) as an established method for reducing stormwater runoff. Consequently, the WWFPs did not include a full analysis of GI alternatives for controlling CSOs. Later and as GI became more accepted, community and environmental groups commented on DEP's WWFPs and voiced widespread support for GI, urging DEP to place greater reliance upon that sustainable strategy. In September 2010, the City published the *NYC Green Infrastructure Plan*, heretofore referred to as the GI Plan. Consistent with the GI Plan, the 2012 Order on Consent requires DEP to analyze the use of GI in LTCP development. As further discussed in Section 5.0, this sustainable approach includes the management of stormwater at its source through the creation of vegetated areas, bluebelts and greenstreets, green parking lots, green roofs, and other technologies.

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 interested parties informed about the project. A public outreach participation plan was developed and implemented throughout the process; the plan is posted and regularly 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 interested stakeholders;
- Integrate the public outreach efforts with all other aspects of the planning process; and
- Take advantage of other ongoing 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 7.0.

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

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 watershed is urbanized and sub-urbanized, comprised primarily of residential areas with some commercial, industrial, and open space/outdoor recreation areas. The Alley Creek and Little Neck Bay watersheds consist of 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 is adjacent to Alley Creek on its eastern, western, and southern shores, south of the Little Neck Bridge (Northern Boulevard). 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, the Alley Creek CSO Retention Facility.

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 the Alley Creek and Little Neck Bay drainage area 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 any 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, Long Island Expressway, Grand Central Parkway, and the Long Island Railroad (Figure 2-2). These transportation corridors limit access to some portions of the waterbodies, and must be taken into consideration when developing CSO control solutions.



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

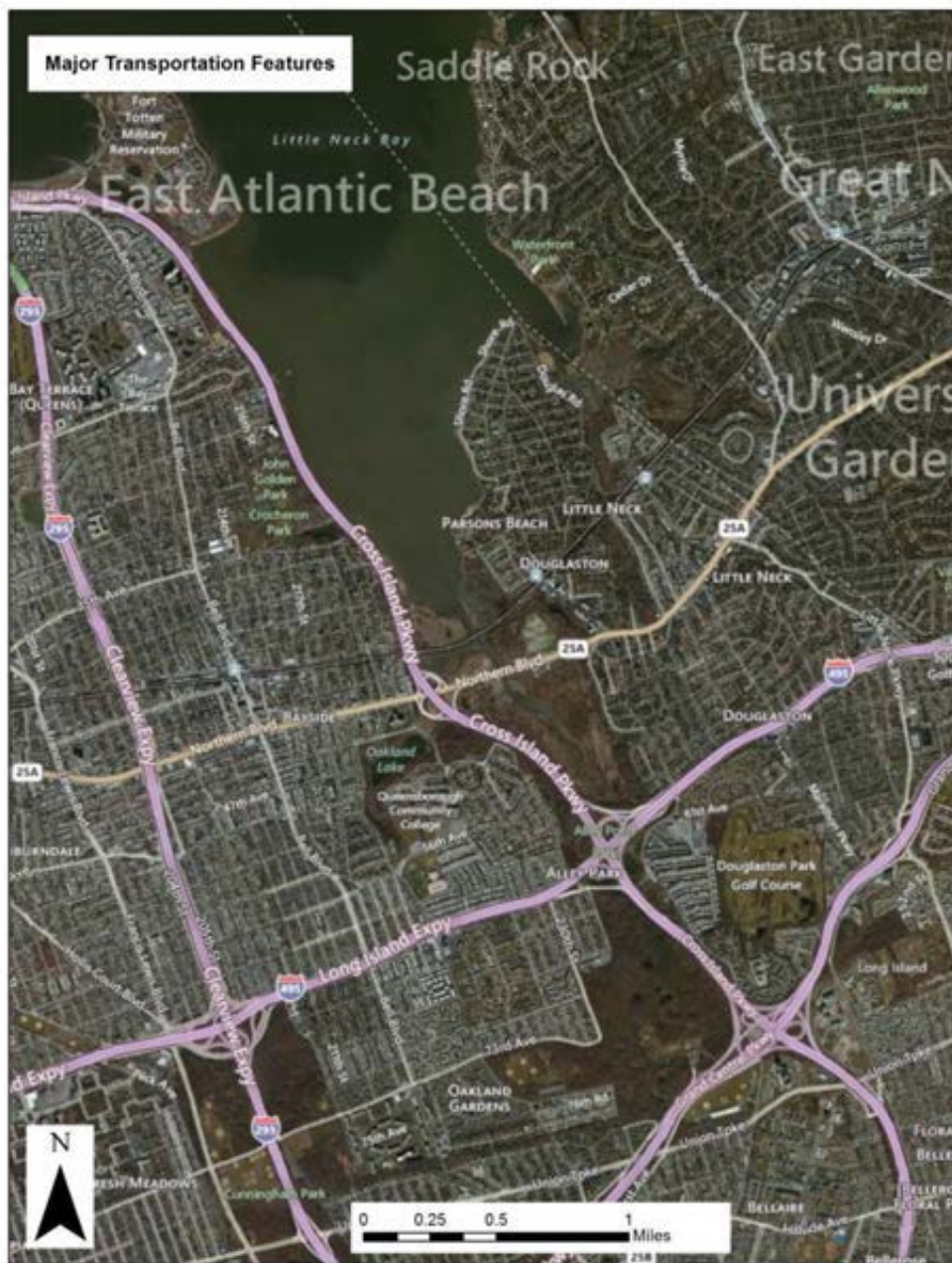


Figure 2-2. Major Transportation Features of Alley Creek and Little Neck Bay

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

Existing 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 NYC, 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-4 designation 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 NYC development projects in the Alley Creek or Little Neck Bay assessment area.

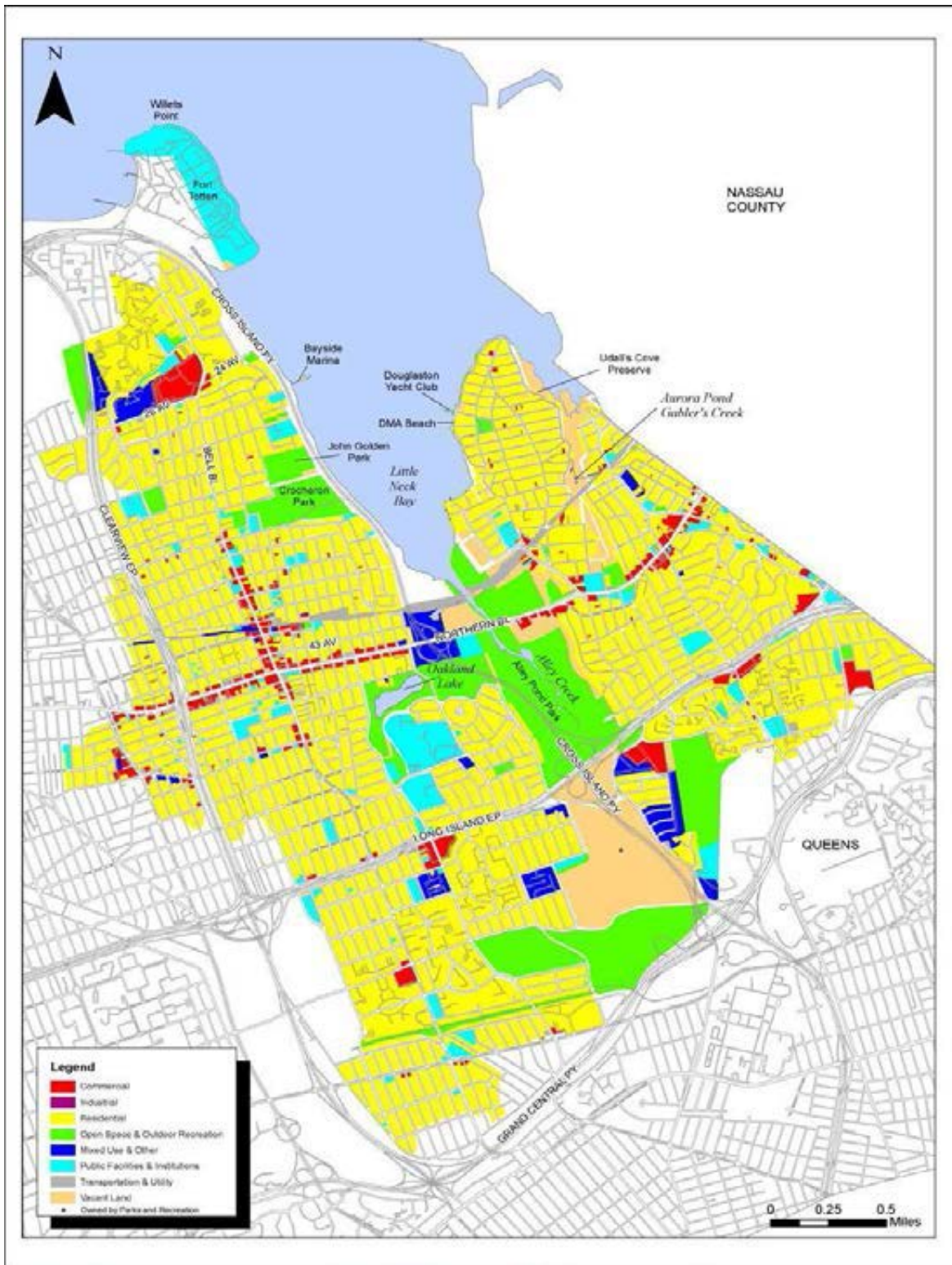


Figure 2-3. Land Use in Alley Creek/Little Neck Basin

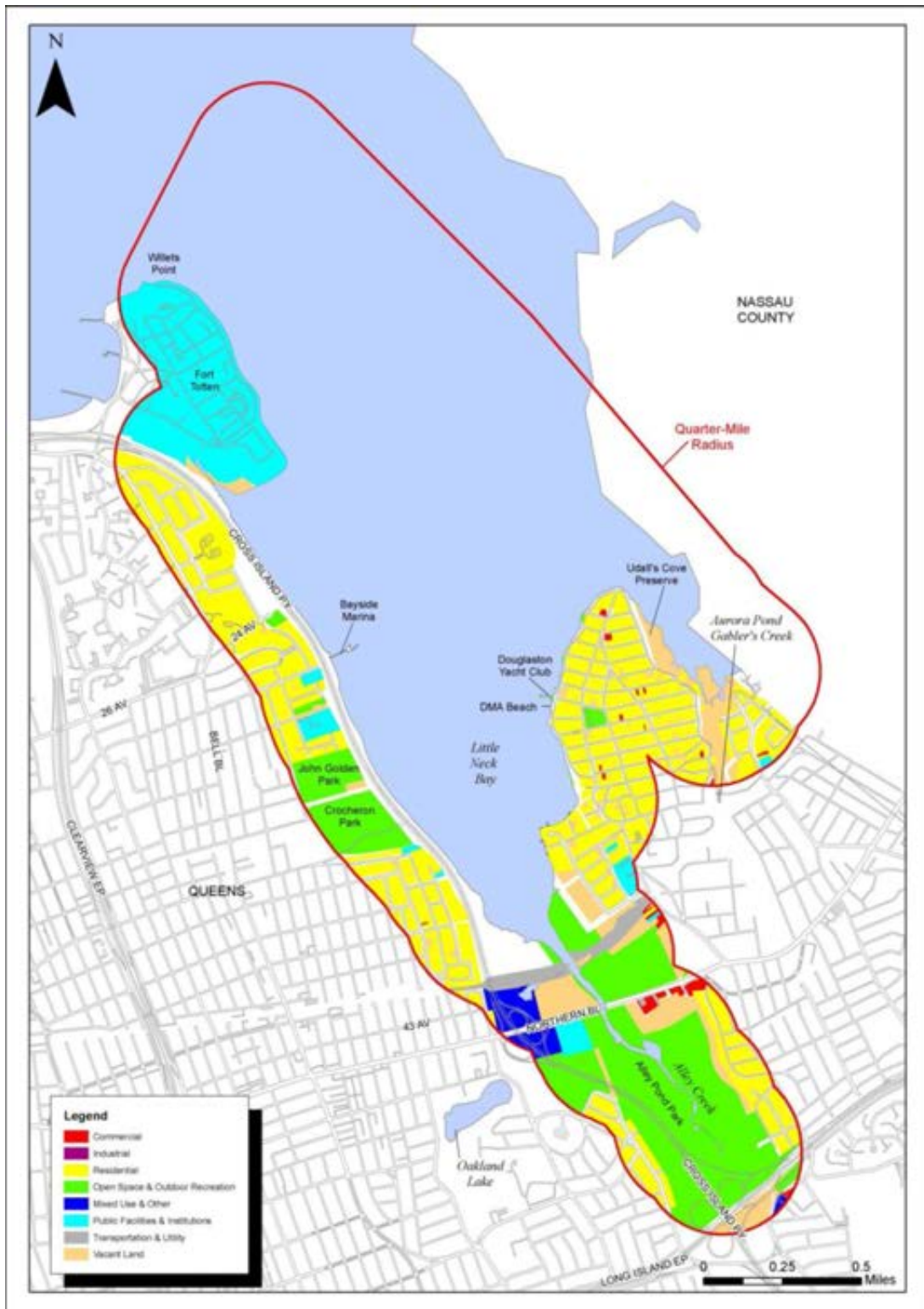


Figure 2-4. ¼ Mile Land Use in Alley Creek and Little Neck Bay

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 34th Avenue 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 CSO and 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 (View NE)

2.1.a.3 Impervious Cover Analysis

Impervious surfaces within a watershed are those characterized by an artificial surface, such as concrete, asphalt, 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 NYC WWTPs combined area drainage models developed in 2007 to support the several WWTPs that were submitted to DEC in 2009. However, as described below, efforts to update the model and the impervious surface representation have been recently completed.

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, or 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 park may not contribute any runoff to the CSS and as such would not be considered to be directly connected.

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 Citywide 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 of 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 CSS tributary to the Tallman Island WWTP.

2.1.a.4 Population Growth and Projected Flows

The DEP Bureau of Environmental Planning and Analysis (BEPA) routinely develop water consumption and dry weather wastewater flow projections for DEP for 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 Update 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 that 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 Facility, 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 Facility for model simulations after May, 2007.
- Representation of the Alley Creek CSO Retention Facility for model simulations after March 10, 2011.
- Inclusion of the Bowery Bay drainage areas that contribute CSOs to the Flushing Creek CSO Retention Facility and to TI-010. Because the overflows from a portion of the Bowery Bay High Level sewershed conveyed to this tank through the Park Avenue outfall, this model update was performed to avoid the need to run the Bowery Bay model as a 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 DEP Bureau of Water and Sewer Operations (BWSO) have 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 citywide 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, hourly ET estimates obtained from four National Oceanic and Atmospheric Administration (NOAA) climate stations [John F. Kennedy (JFK), Newark (EWR), Central Park (NYC), and LaGuardia (LGA)] for an 11-year period were reviewed. 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, DEP recalibrated 13 of the City's landside models after the updates and enhancements were complete. This effort and calibration results are included in the IW Citywide Recalibration Report (DEP, 2012a) 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 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 Citywide Recalibration Report (DEP, 2012a).

2.1.b Review and Confirm Adequacy of Design Rainfall Year

DEP has been consistently applying the 1988 annual precipitation characteristics to the landside IW 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 EPA 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 2009 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 and sewershed are divided between two major political jurisdictions – the Borough of Queens (Queens County, within NYC), 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 served by private 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 WWTPs 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.

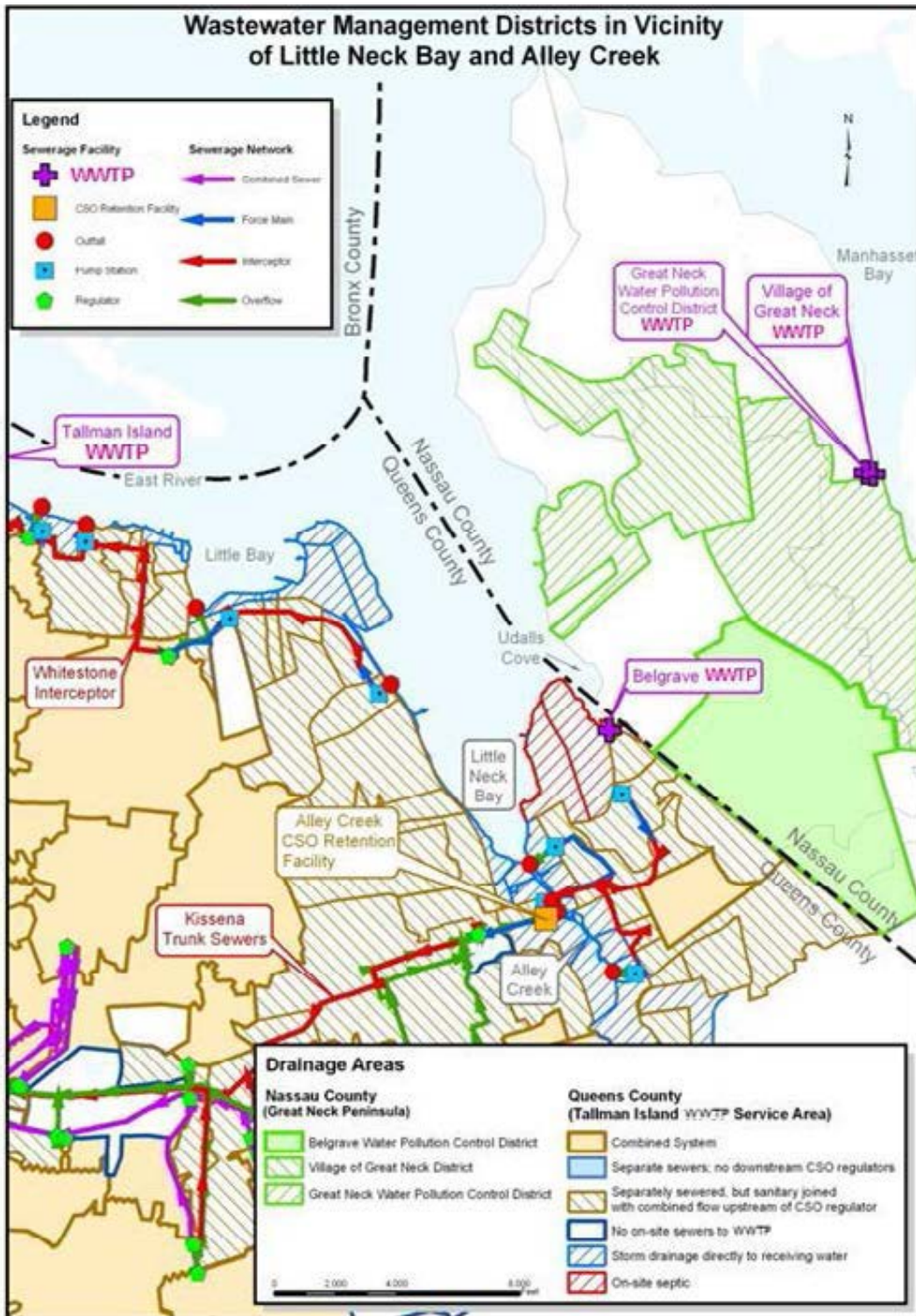


Figure 2-6. Alley Creek Wastewater Service Areas

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 both sanitary (SSS) and combined (CSS) sewersheds, as summarized in Table 2-3 and Appendix A. CSO outfalls that discharge to Alley Creek and Little Neck Bay are summarized in Table 2-4. The Tallman Island service area includes:

- 16 pumping stations, with five serving combined system areas;
- 49 combined sewer flow regulator structures; and
- 24 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	5,903
<ul style="list-style-type: none"> • 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 	(923) (4,980)
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. Alley Creek and Little Neck Bay Drainage Area: Acreage By Outfall/Regulator

Outfall	Outfall Drainage Area	Regulator	Regulator Drainage Area	Regulated Drainage Area Type	Receiving Water
East River					
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 CSO Retention Facility	1550.7	Combined and Separate	Alley Creek

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 2-1. The collection system is 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: Main, College Point, Flushing and Whitestone.

- 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 WWTP, then discharges in the Powell's Cove PS, 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 WWTP along the East River.

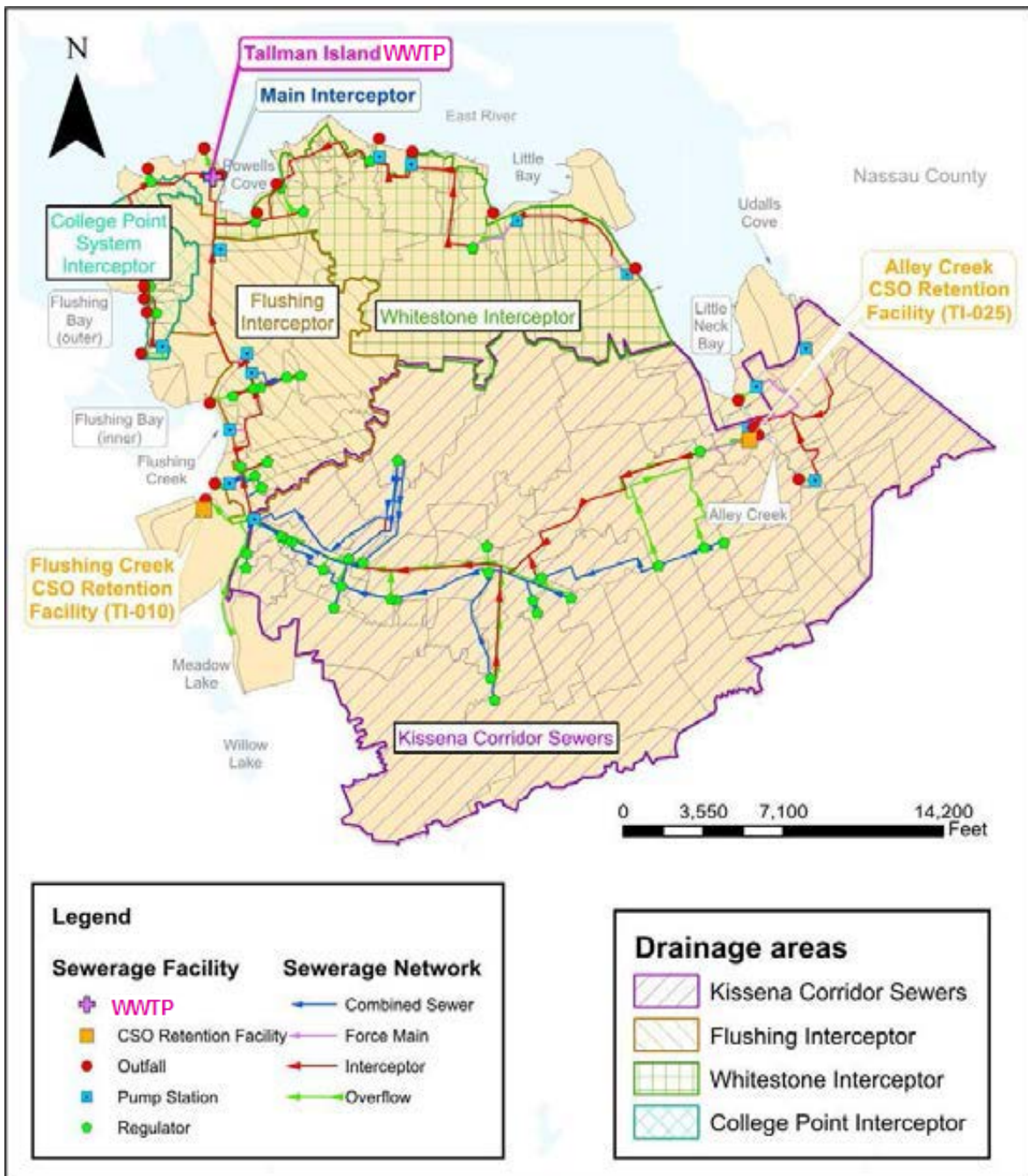


Figure 2-7. Tallman Island WWTP Service Area

This service area also includes two CSO retention facilities that were planned, designed and constructed based on the East River Facility Planning and WWFP. The first one is the Flushing Creek CSO Retention Facility, 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 CSO Retention Facility, which became operational as of March 11, 2011. This facility has an offline storage capacity of 5 MG. During wet weather, flows that reach the TI-008 CSO regulator are directed to the offline facility by the diversion weir in Chamber 6 of the Alley Creek CSO Retention Facility. When the storage facility reaches capacity, excess water overflows an effluent weir and is discharged to Alley Creek through Outfall TI-025, after receiving floatables control. The facility also provides some degree of primary settling. Post-event dewatering of this facility 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, 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 overland 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.

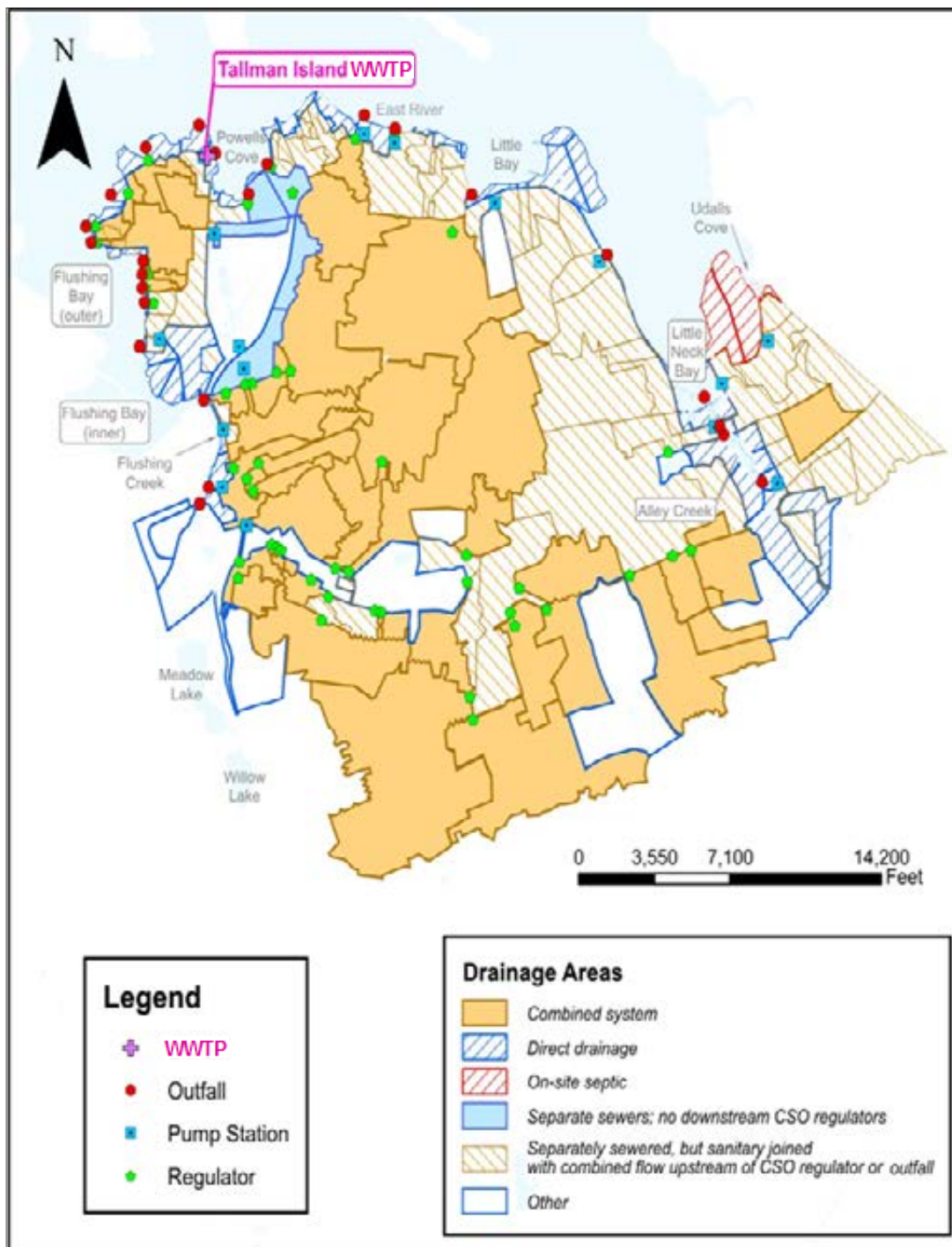


Figure 2-8. Tallman Island WWTP Drainage Area

Tallman Island Stormwater Outfalls

There are nine permitted stormwater outfalls discharging to Alley Creek and Little Neck Bay, as shown on Figure 2-9; 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 permitted 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. Note that TI-025 is the CSO outfall for the Alley Creek CSO Retention Facility, and 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 CSO discharges 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 is known as Douglas Manor. The neighborhood is predominantly composed of single family residences served by private 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.

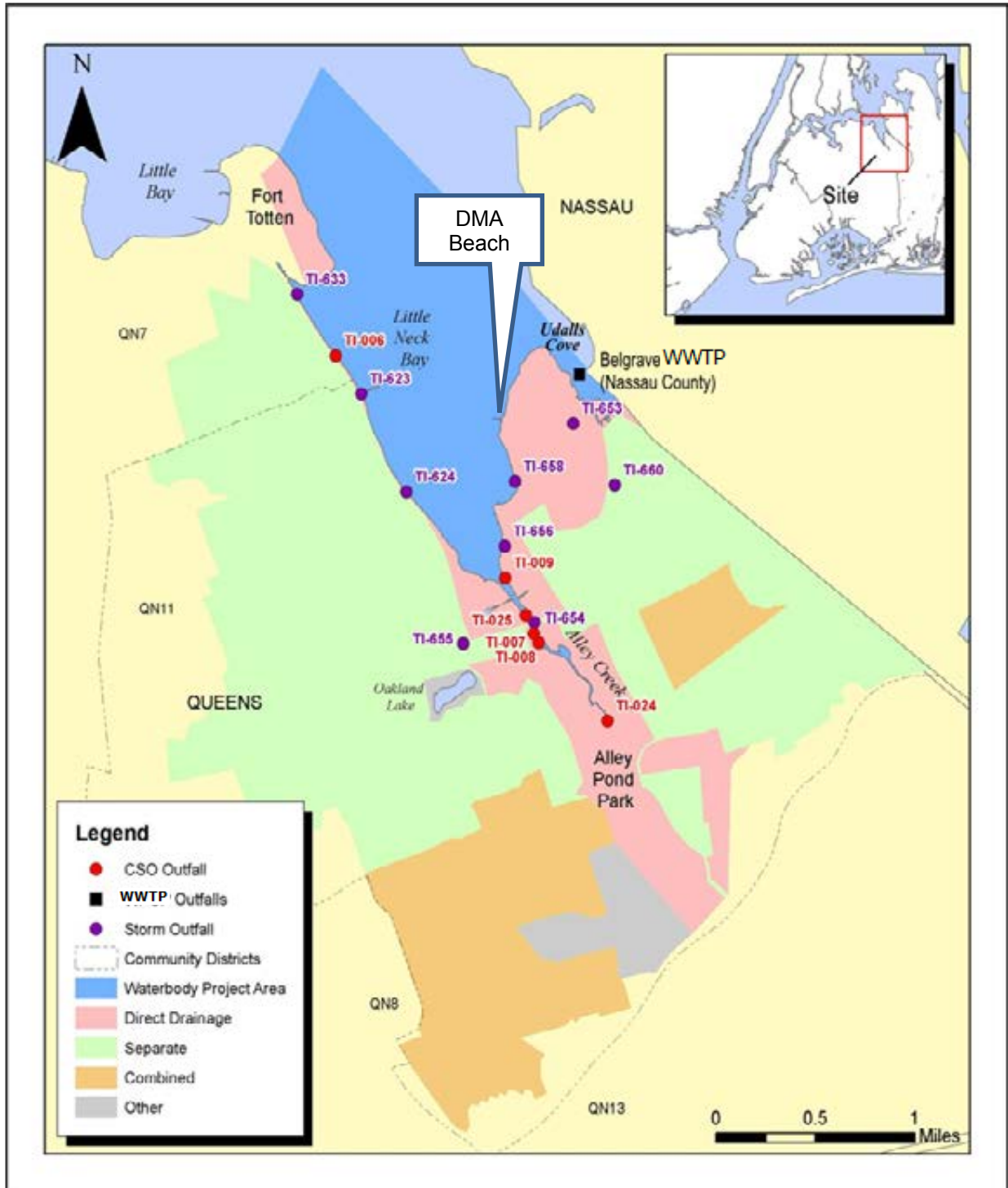


Figure 2-9. Alley Creek and Little Neck Bay SPDES Permitted Outfalls

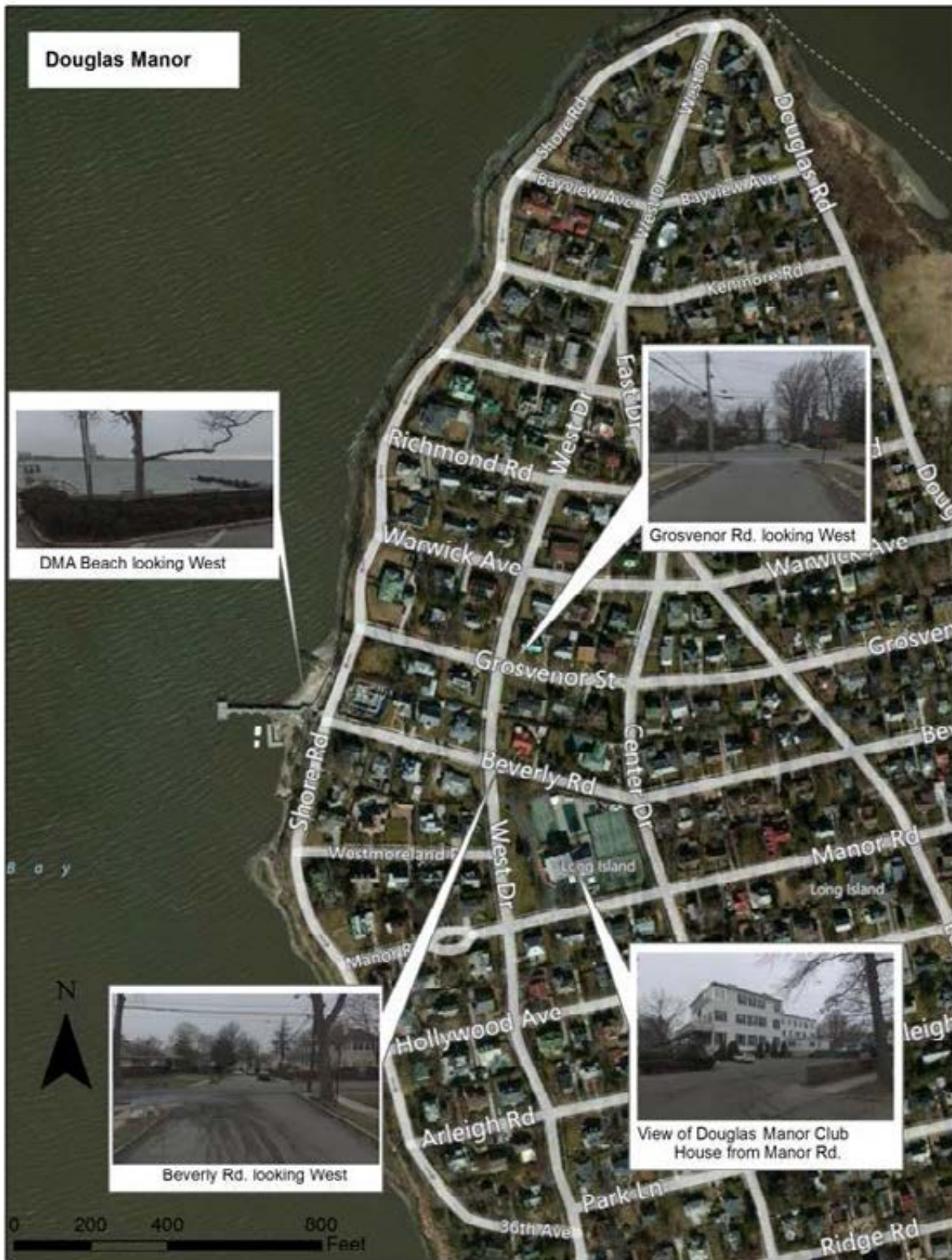


Figure 2-10. Douglas Manor Community

2.1.c.2 Stormwater and Wastewater Characteristics

Pollutant loadings for the sources identified and discussed in Section 2.1.c.1 were assessed for their impacts on water quality in Alley Creek and Little Neck Bay. 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 the two waterbodies.

Tallman Island Stormwater Outfalls: Stormwater overflow concentrations are assigned an Event Mean Concentrations (EMC) for inclusion in the water quality model calibration and LTCP baseline analyses. Historical information and data collected from sampling events were used to guide the selection of concentrations of BOD, TSS, total coliform, fecal coliform, and enterococci to use in calculating pollutant loadings from the various sources. Table 2-5 shows EMC stormwater concentrations for NYC stormwater discharges to Alley Creek and Little Neck Bay from the Tallman Island WWTP service area. Previously collected citywide sampling data from Inner Harbor Facility Planning Study (DEP, 1994) was combined with data for the EPA Harbor Estuary Program (HydroQual, 2005a) to develop these stormwater concentrations. The IW sewer system model (Section 2.1.a.5) is used to generate the flows from NYC storm sewer outfalls and concentrations noted in Table 2-5 are associated with the flows to develop pollutant loadings.

Tallman Island CSOs: CSO pollutant concentrations can be extremely variable and are a function of many factors. Generally, CSO concentrations are a function of local sanitary sewage and runoff entering the combined sewers. For the modeling analyses, CSO concentrations were calculated based on a mass balance of Tallman Island WWTP sanitary sewage concentrations and EMC stormwater runoff concentrations during each hour of each storm event. Influent dry-weather samples at the NYC WWTPs were used to model sanitary concentrations (DEP process control records; HydroQual, 2005b). These sanitary sewage influent concentrations are summarized in Table 2-5. Storm runoff concentrations entering the combined sewers was taken as those values shown in Table 2-5. The IW model is run in the water quality mode and traces the amount of sanitary sewage and the amount of stormwater at each location within the model. When there is a CSO discharge, its pollutant concentrations will have the calculated mix of sanitary sewage and storm runoff pollutants for each hour of overflow.

Alley Creek CSO Retention Facility Discharges: A different approach was taken for the calculation of the Alley Creek CSO Retention Facility effluent bacteria concentrations. The Alley Creek CSO Retention Facility bacteria concentrations were characterized by direct measurements from three storm events in 2013. These concentrations are as shown in Figure 2-11, a cumulative frequency distribution graphic. Both individual sample points are shown as well as the trend line that best fits the data distribution. Measured fecal coliform concentrations are log-normally distributed as is typical for this type of data and values range from 27,300 to 3,400,000 MPN/100mL. Similarly, enterococci concentrations are also log normally distributed and range from 24,000 to 580,000 MPN/100mL. These observed concentrations are beyond the range that DEP would expect from combined sewage which should be more highly reflective of stormwater runoff concentrations. In response to these elevated concentrations, and as discussed later in Section 8.0, DEP is evaluating disinfection of the Alley Creek CSO Retention Facility overflows as one of several potential LTCP control measures.

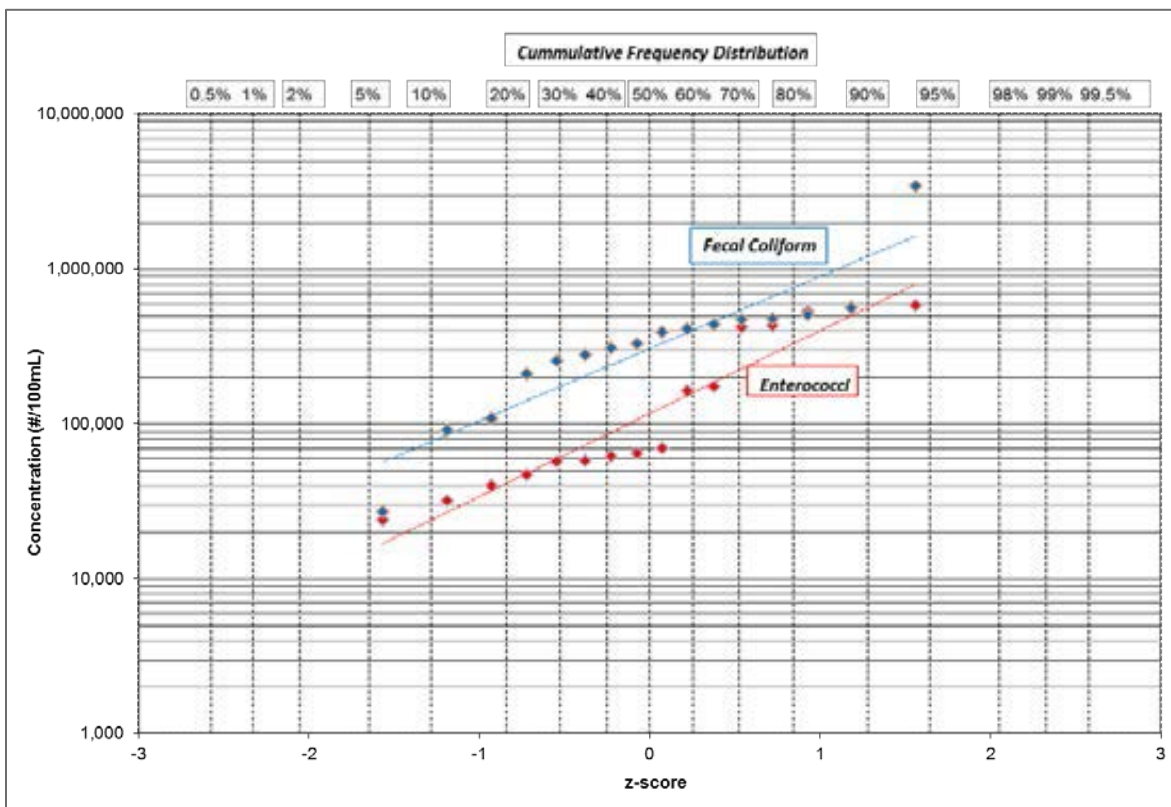


Figure 2-11. Alley Creek CSO Retention Facility Bacteria 2013 Sampling Data

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

Constituent	Sanitary Concentration	Stormwater Concentration
CBOD ₅ (mg/L) ⁽¹⁾	115	15
TSS (mg/L) ⁽¹⁾	140	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⁾ 2011, 2012, 2013 DEP Process Control TI WWTP operational records
⁽²⁾ Hydroqual Memo to DEP, 2005a.
⁽³⁾ Bacterial concentrations expressed as “most probable number” (MPN) of cells per 100 mL.

Nassau County Source Concentrations: Stormwater inflows to Little Neck Bay from Nassau County were assigned the concentrations presented in Table 2-6. Effluent quality data for the Belgrave WWTP, which discharges in to Little Neck Bay, were taken from DEC discharge monitoring reports (DMR) submitted by the Nassau County Department of Public Works, as shown on Table 2-7. The WWTP discharges an average of 1.3 MGD. Total coliform, fecal coliform, and enterococci are assumed to be negligible as the facility provides disinfection.

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.	

Other Sources: A sampling program targeting 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), named as the LIE Pond; 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. Sampling of the sources above was conducted to provide information to the water quality modeling tasks. The locations of these sources are depicted in Figure 2-12.

Six samples were collected from the Oakland Lake and LIE Pond outflows to characterize ambient bacteria concentrations. Samples were also collected for Microbial Source Tracking (MST) analysis at the Oakland Lake (outlet) and at LIE Pond. The MST method used sought the identification of species and genus of the enterococci and fecal coliform bacteria sampled that would allow a comparison with libraries of bacteria data to determine the most likely sources of the bacteria. The MST results and the lack of a suitable bacteria database, however, did not support a conclusive determination of the sources for any of the locations sampled. Flows were measured for both of these locations. The fecal coliform and enterococci data for both ponds are presented in Table 2-8. Oakland Lake concentrations were based on dry-weather samples collected at the lake outlet during 2012 and 2014. The LIE Pond concentrations were based on the dry-weather GM of samples collected during February 2013 and late 2013/early 2014. Oakland Lake flows were determined based on monitoring of the lake outflow in the storm sewer that bypasses Chamber 6 upstream of the Alley Creek CSO Retention Facility in 2012 and 2014. The LIE Pond flows were based on a few discrete measurements in 2012 and continuous flow monitoring in 2014. The Oakland Lake and LIE Pond sources of flow and pollutants were used in the

water quality model calibrations for 2011 and 2012 and included as part of the LTCP baseline analysis. Further discussion of the MST testing is found in Section 2.2.a.6 and summarized in Table 2-21.

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 (variable)	130	150	15
LIE Pond	1.5 (variable)	75	75	0
See Figures 2-9 and 2-12 for source locations.				

These results suggest that the concentrations of bacteria are from non-human sources as they do not exhibit the high concentrations of bacteria found when illicit discharges are present. Although they are not noted as significant sources of bacteria, these other sources provide a continuous source of bacteria to Alley Creek and are therefore carried forward through the baseline analyses presented in Section 6.0.

Illicit Sources: As later discussed in Section 2.2.a.6, elevated bacteria concentrations in Alley Creek indicated the potential presence of illicit discharges. As required by the DEC SPDES permits, DEPs illicit sewer connection tracking and removal enforcement program had traced and eliminated 11 illegal connections to the storm sewers that discharged through outfall TI-024 in 2011. However, during the LTCP development, review of additional data indicated that potential illicit discharges still existed somewhere along Alley Creek. As a result, sampling was conducted in 2014 as part of the LTCP development to track these potential illicit discharges to their source. As noted above sampling was conducted on the Oakland Lake and LIE Pond outflows, which found that although there were low levels of bacteria present, there were no signs of illicit discharges. Douglaston PS records were also reviewed and staff interviewed, again indicating that this was not a source of bacteria in dry weather. Further, sampling and visual inspections were made of storm sewers and of the CSO regulators and outfalls (TI-007, TI-008, TI-024 and TI-025) in 2013 and 2014, all of which indicated that the only remaining source of potential illicit discharges was outfall TI-024.

DEP is continuing to inspect the TI-024 system and locate the source of the illicit connections. As sources are found, appropriate corrective actions will be taken in accordance with DEP's standard procedures for these investigations. Illicit connections to this outfall, although apparently low in flow, discharge elevated concentrations of bacteria, thereby impacting bacteria levels in Alley Creek near the mouth of the creek where DEP conducts routine sampling (Station AC1). Based on sampling data and calibration of the water quality model, bacteria concentrations and flows associated with outfall TI-024 were developed as provided in Table 2-9.

Table 2-9. Upper Alley Creek Source Loadings Characteristics

Source	Flow (MGD)	Enterococci (org./100mL)	Fecal Coliform (cfu/100mL)	BOD-5 (mg/L)
TI-024 Illicit Connections	0.003 to 0.04	1,000,000	4,000,000	15
TI-024 Infiltration	0.2	0	0	6.3
See Figures 2-9 and 2-11 for source locations				



Figure 2-12. Upper Alley Creek Point – Source Locations

At TI-024, estimated groundwater infiltration was developed from short-term continuous metering of a 96 inch by 72-inch diameter storm sewer discharging through TI-024 during 2012 and 2013. Suspected illicit connections were detected through visual observations and four bacteria samples collected in February 2014 with fecal coliform concentrations that ranged from 29,000 to 50,000 cfu/100mL. The final concentrations for use in model calibrations were estimated as part of the calibration process. These loads were subsequently removed for the water quality model baseline analysis, assuming that illicit discharges would be abated outside of the LTCP process.

DMA Local Sources: The DMA Beach area has historically exhibited elevated bacteria concentrations. These local sources and other remote bacteria sources result in frequent closures of this bathing area (Figure 2-24). Receiving water sampling conducted in 2012 showed bathing area waterfront enterococci GM concentrations of about 151 cfu/100mL. Sampling in the receiving water at locations just offshore from DMA Beach in deeper water revealed a GM concentration of 37 cfu/100mL. The former elevated concentration right on the beach being so much higher than the sample collected slightly off shore suggests local bacteria sources rather than the source being remote from the beach.

At DMA, runoff from 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 as shown in Figure 2-13. Most of the runoff is conveyed as surface sheet-flow 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 2-13.

During dry weather, near surface groundwater flows downslope toward Little Neck Bay from DMA, likely carrying bacteria 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 baseline analysis, assuming that this source would be abated outside of the LTCP process.

The characteristics, summarized in Table 2-10, associated with the dry and wet weather sources of pollutants suspected to be associated with the on-site septic systems in the DMA area were developed through the process of calibrating the water quality model.

Table 2-10. 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

NYCDOT Capital Project HWQ-985 is currently progressing to redirect some of this sheet-flow with the primary intention of protecting the concrete retaining wall from static force loads that compromise its stability. This project 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 is as shown in Figure 2-14. This project is expected to be completed in 2016.



Figure 2-13. Little Neck Bay and DMA Beach Overland Drainage Characteristics

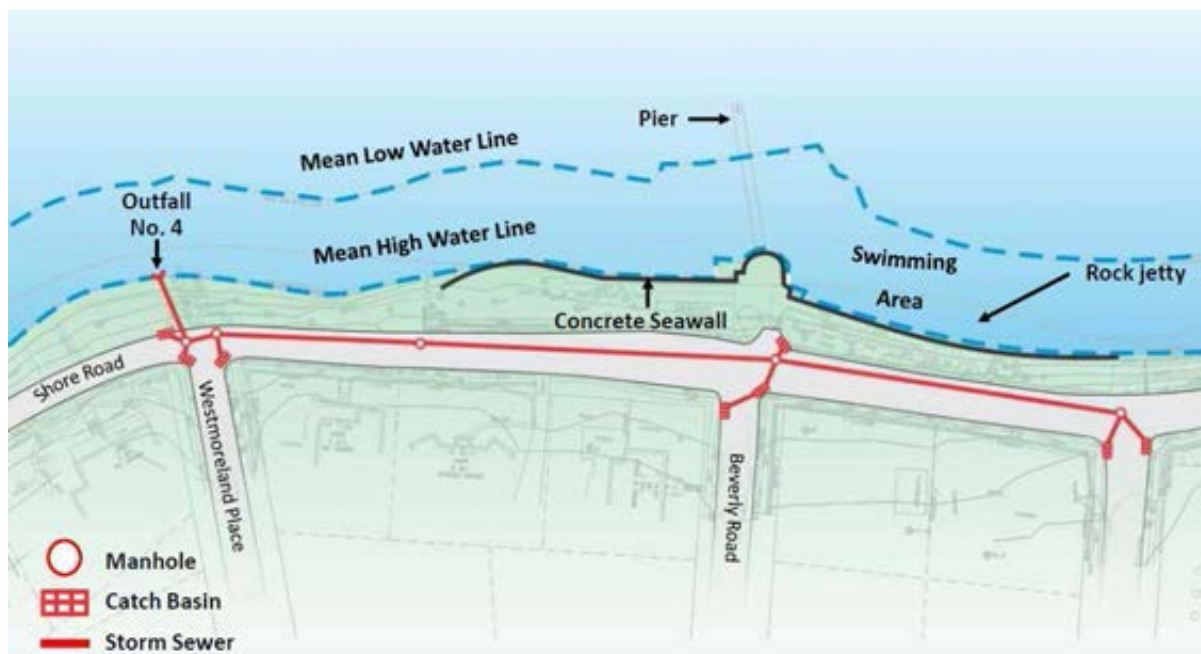


Figure 2-14. DMA Planned Drainage Improvements

2.1.c.3 Hydraulic Analysis of Sewer System

A citywide 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. 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. Thus, 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. 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 2xDDWF for rainfall year 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.

Detailed presentations of the data were contained in the Citywide Hydraulic Analysis Report (DEP, 2012b) 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 the re-calibrated model conditions as described in the June 2012 IW Citywide Recalibration Report. For the simulation, 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.

For this simulation the Tallman Island service area included the two CSO retention facilities, the new Whitestone Interceptor extension and associated sewer/regulator improvements. The simulation of the 2008 annual rainfall year resulted in a prediction that the Tallman Island WWTP would operate at its 2xDDWF capacity for 99 hours up from the very limited number of hours (generally less than 10 hours a year) that the plant reached that capacity historically.

Estimation of Peak Conduit/Pipe Flow Rates

Model output tables containing information on several pipe characteristics were prepared, coupled with calculation of the theoretical, non-surcharged, 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 WWFP 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 non-surcharged, 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 non-surcharged 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.

- Between 78 and 93 percent (by length) of the interceptors were predicted to flow at full depth or higher. Between 56 and 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 WWFP improvements showed that the overall peak plant inflow and HGL near the plant improved, in comparison to the non-WWFP 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 WWFP 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 historical flooding along Springfield Boulevard in Queens. These drainage system improvements, which took place from December 2002 through December 2006, consisted of installation of larger combined sewers in certain segments of the sewershed to increase conveyance capacity; construction of 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 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) corresponds 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 2-15 illustrates the interceptors that were cleaned within the Alley Creek sewershed.

DEP 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. 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



Figure 2-15. Alley Creek Interceptor Inspection Cleaning Extents

estimate the sediment levels as a percentage of overall sewer cross sectional area. Table 2-11 shows the sediment depths for the interceptors in the Alley Creek sewershed.

DEP will continue implementing it's programmatic interceptor cleaning program to ensure conveyance of 2xDDWF to the treatment plant.

Table 2-11. 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. DEP is currently upgrading the Tallman Island WWTP for Biological Nutrient Removal (BNR) as well as improvements that will enhance the collection system and treatment facility to convey, accept, and treat influent at twice the plant's design dry weather flow capacity during storm events. With respect to conveyance capacity to the WWTP, the status of the project work as of May 2014 is as follows.

- The majority of the new Whitestone Interceptor and turning chambers have been constructed.
- The connection of the interceptor (Connection Chamber) to the Tallman Island WWTP is complete, but not activated.
- The connection of the interceptor to the existing Whitestone Interceptor (Diversion Chamber) is ongoing.
- The work on the regulator modifications is to be initiated.

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. 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 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 2-12. DEP conducted water quality assessments where the data is represented by % attainment with pathogen

targets. For this LTCP, in accordance with guidance from DEC, 95 percent attainment of applicable water quality criteria constitutes compliance with the existing WQS or the Section 101(a) (2) goals.

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 2-13, these narrative criteria apply to all five classes of marine waters.

Table 2-12. 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.	$\geq 4.8^{(1)} \geq 3.0^{(2)}$	$\leq 70^{(3)}$	N/A	-----
SB	Primary and secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.	$\geq 4.8^{(1)} \geq 3.0^{(2)}$	$\leq 2,400^{(4)} \leq 5,000^{(5)}$	$\leq 200^{(6)}$	≤ 35
SC	Limited primary and secondary contact recreation, fishing. Suitable for fish, shellfish and wildlife propagation and survival.	$\geq 4.8^{(1)} \geq 3.0^{(2)}$	$\leq 2,400^{(4)} \leq 5,000^{(5)}$	$\leq 200^{(6)}$	N/A
I	Secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥ 4.0	$\leq 10,000^{(6)}$	$\leq 2,000^{(6)}$	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

(1) 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.

Note that the enterococci criterion of 35 MNP/100 mL listed in Table 2-12, 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. According to the DEC interpretation of the BEACH Act of 2000, the criterion applies on a 30-day moving GM basis during recreational season (May 1st to October 31st). Furthermore, DEC interprets that this criterion is not applicable to the tributaries of the Long Island Sound and the East River tributaries.

Currently, DEC is conducting its federally-mandated "triennial review" of the NYS WQS, in which States are required to review their water quality standards every three years. DEC is in the pre-public proposal phase of this rule, and staff is considering a wide-range of revisions/additions to water quality standards regulations.

Table 2-13. 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 2-14, while narrative criteria are shown in Table 2-15.

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 provide for an exact spatial overlap.

Table 2-14. 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 2-15. 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 100mL during the bathing season (Memorial Day to Labor Day). If the GM exceeds that value, the beach is closed pending additional analysis. Enterococci of 104 cfu/100mL are an advisory upper limit used by DOHMH. If beach enterococci data are greater than 104 cfu/100mL, 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 501 cfu/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 Recreational Water Quality Criteria (RWQC) recommendations in December 2012 (2012 EPA RWQC) which are designed to protect human health in coastal and non-coastal waters designated 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 bacteria found in water with fecal contamination. However, the BEACH Act of 2000 directs coastal states to adopt and submit to EPA revised recreational WQS for bathing waters by December 2015.

The 2012 EPA RWQC offers two sets of numeric concentration thresholds, as listed in Table 2-16, and includes limits for both the GM (30-day) and a statistical threshold value (STV). The STV is intended to be a value that should not be exceeded by more than 10 percent of the samples taken.

Table 2-16. 2012 EPA RWQC Recommendations

Criteria Elements	Recommendation 1 (estimated illness Rate 36/1,000)		Recommendation 2 (estimated illness Rate 32/1,000)	
	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

It is not known at this time how DEC will implement the 2012 EPA RWQC. Recent input from DEC has stated that Recommendation 2 will be used to update water quality criteria. The LTCP analyses were based on the enterococci numerical criteria associated with Recommendation 1.

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 consists of 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 2-16, 2-17 and 2-18 show shoreline typical for the regions of the study area. Figure 2-16 shows the rip-rap that typically fortifies much of the western shoreline of Little Neck Bay. Figure 2-17 shows the varied types of bulkheading, rip-rap and natural shoreline found along the eastern shoreline of Little Neck Bay. Figure 2-18 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 2-19.

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 2-20.



Figure 2-16. Western Shoreline of Little Neck Bay Near 27th Ave. (Looking West)



Figure 2-17. Eastern Shoreline of Little Neck Bay Near Shorecliff Place (Looking West)



Figure 2-18. Shoreline of Alley Creek (Looking North)

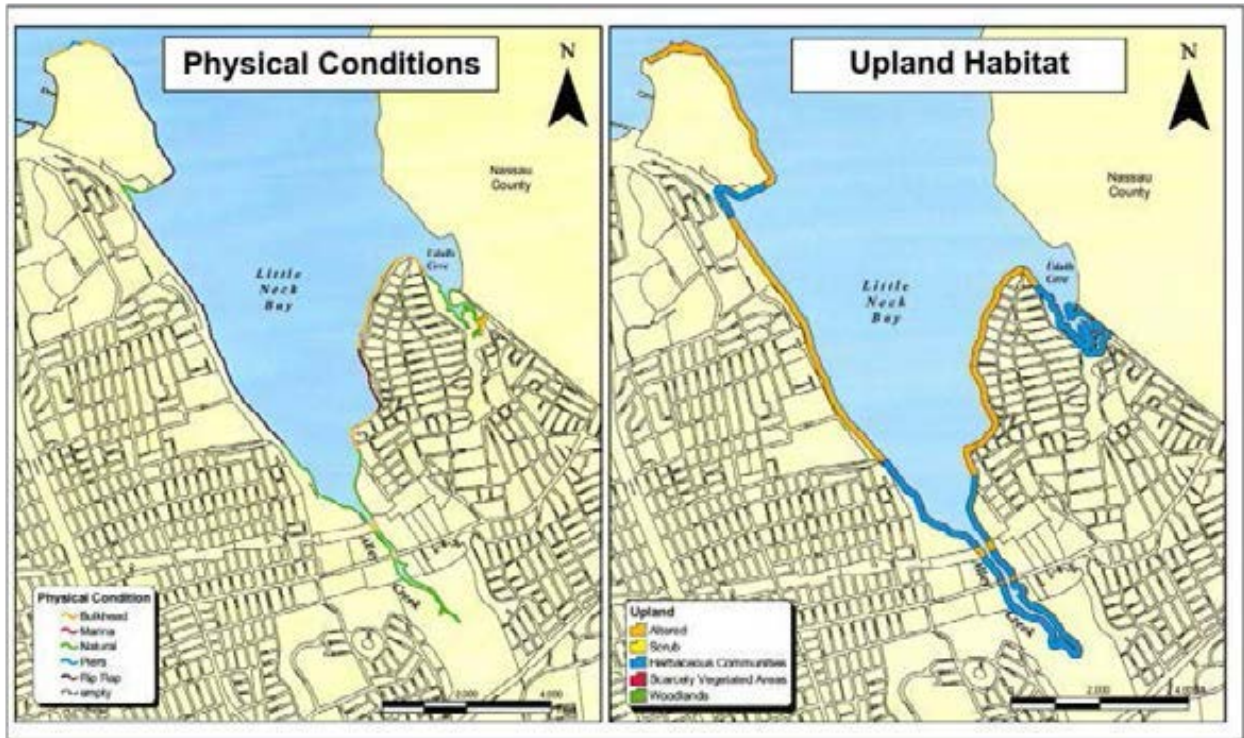


Figure 2-19. Shoreline Physical Conditions and Upland Habitat

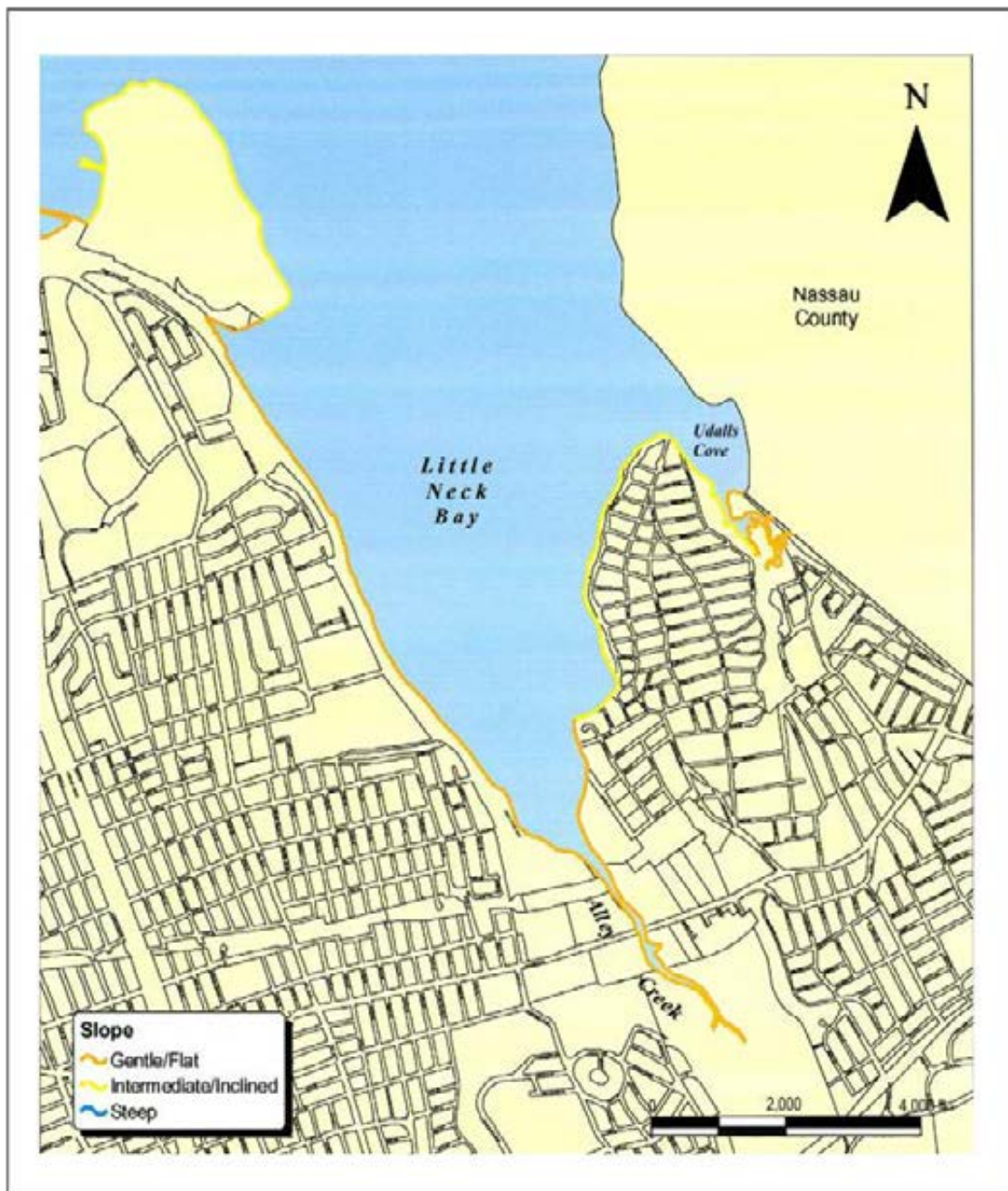


Figure 2-20. Alley Creek Existing Shoreline Slope

Waterbody Sediment Surficial Geology/Substrata

The bottom of Little Neck Bay is generally characterized as sand. The 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 Cove 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 as shown in Figure 2-21 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.

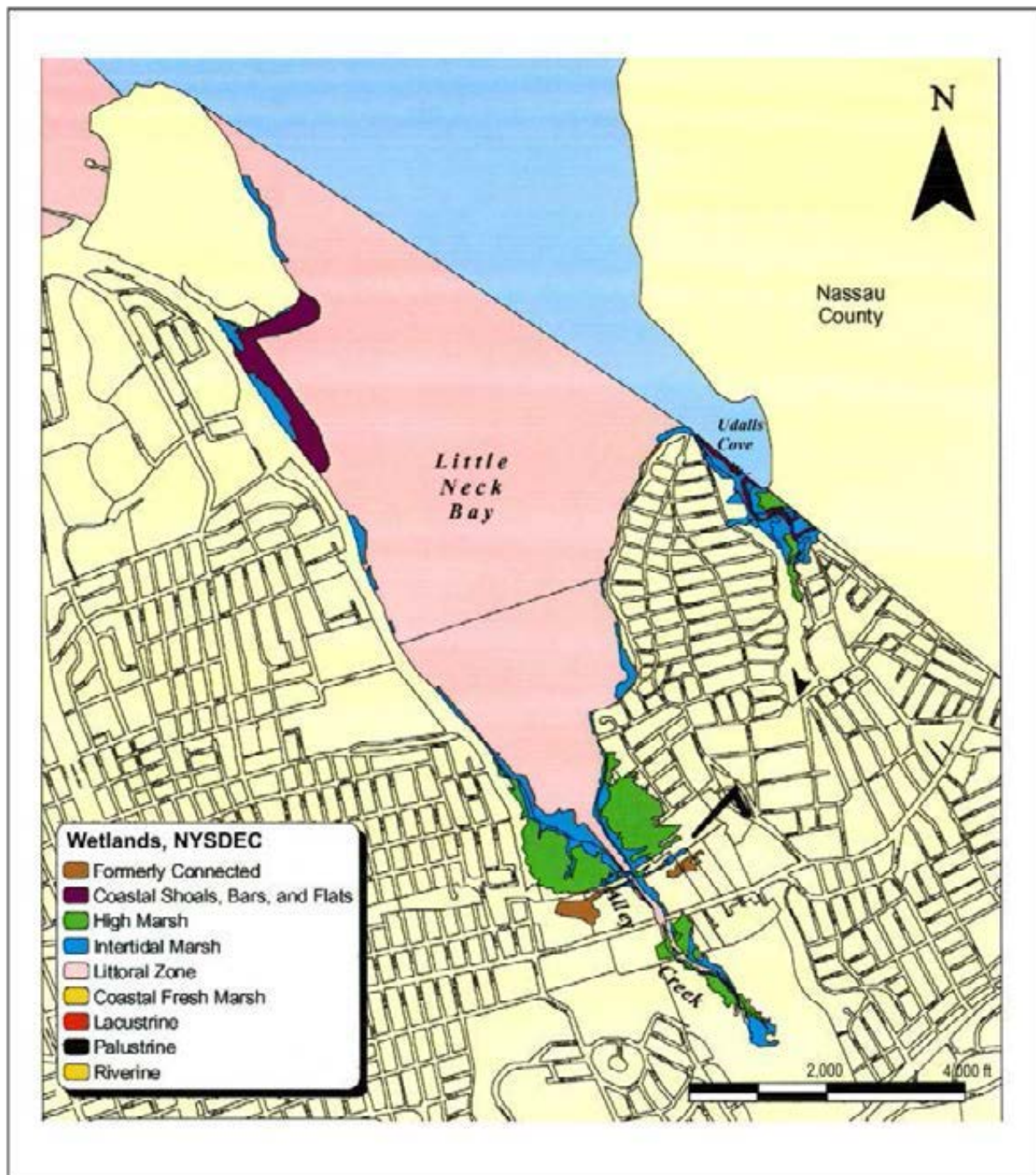


Figure 2-21. DEC Existing Mapped Wetlands. Source: WWFP, June 2009

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 NYC 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 as shown in Figure 2-22, and Table 2-17 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.

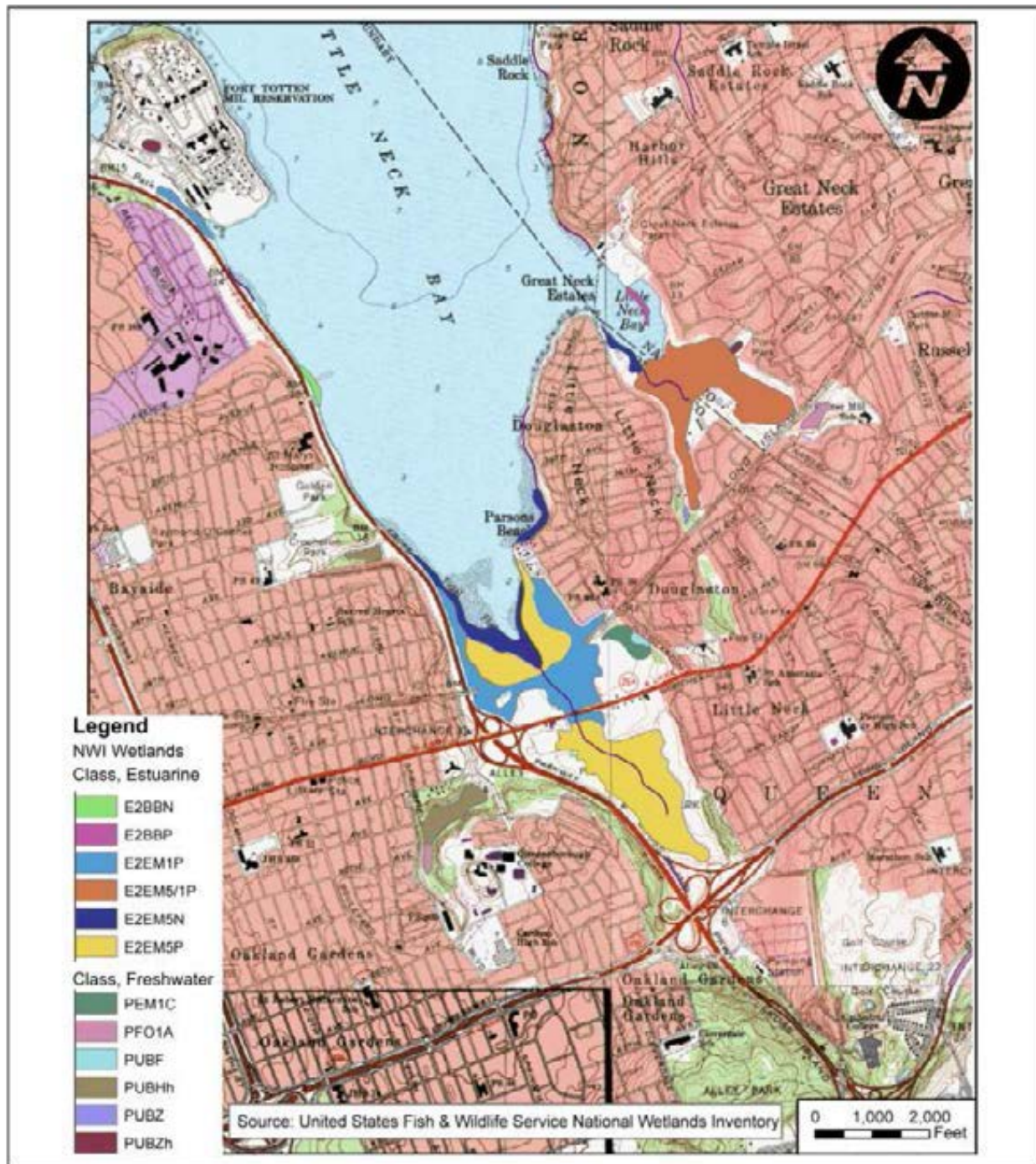


Figure 2-22. National Wetlands Inventory (NWI) Source: WWFP, June 2009

Table 2-17. 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 E1OWL. 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 2-21 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 the creek; 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 2-22. 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 bacteria monitoring is conducted weekly during the bathing season from Memorial Day through Labor Day. 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 1st and October 31st, 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.

2.2.a.4 Identification of Sensitive Areas

The Federal EPA CSO Control 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 EPA CSO Control Policy was conducted and is summarized in Table 2-18.

Table 2-18. 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.sactuarries.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). Its presence is due to the relatively large protected wetlands in Alley Pond Park rather than 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 the EPA CSO Control 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, impacted 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 enterococci and 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 2-23 shows the location of Stations E11, LN1, and AC1 of the HSM program.

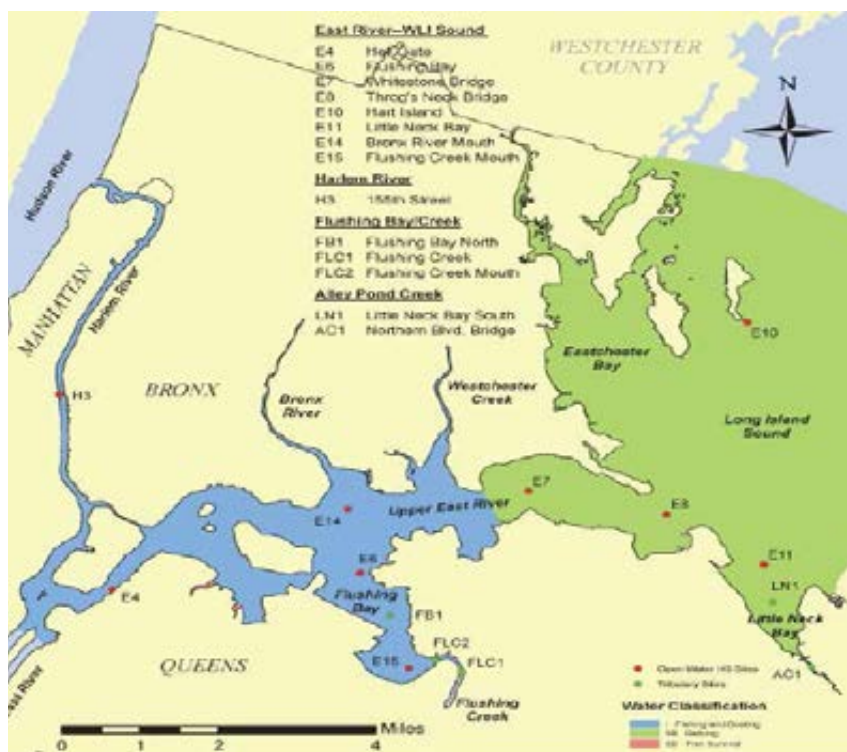


Figure 2-23. Harbor Survey UER-WLIS Region

The following sections provide an overview of the bacteria quality and DO levels of the Alley Creek and Little Neck Bay based on data collected by DEP as part of the HSM Program and as part of this LTCP. Additional information from the HSM program can be found at the following location.

http://www.nyc.gov/html/dep/html/harborwater/harborwater_quality_survey.shtml

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

DEP Harbor Survey Data and Department of Health and Mental Hygiene Data

Recent data collected within Alley Creek and Little Neck Bay are available from sampling conducted by DEP Harbor Survey and from the Department of Health and Mental Hygiene (DOHMH) between 2009 and 2013. DEP Harbor Survey routinely samples locations in Alley Creek and Little Neck Bay, while the DOHMH sampling the DMA Beach. Figure 2-24 provides a summary of the amount of time that DOHMH has measured the bathing area to be in compliance with the 30-day rolling average GM enterococci criterion that they use to open and close the area to bathers. As noted in this graphic, the bathing area only exhibited bathing water quality five percent of the time in the summer of 2011 while in the summer of 2012, it was open nearly 67 percent of the time.

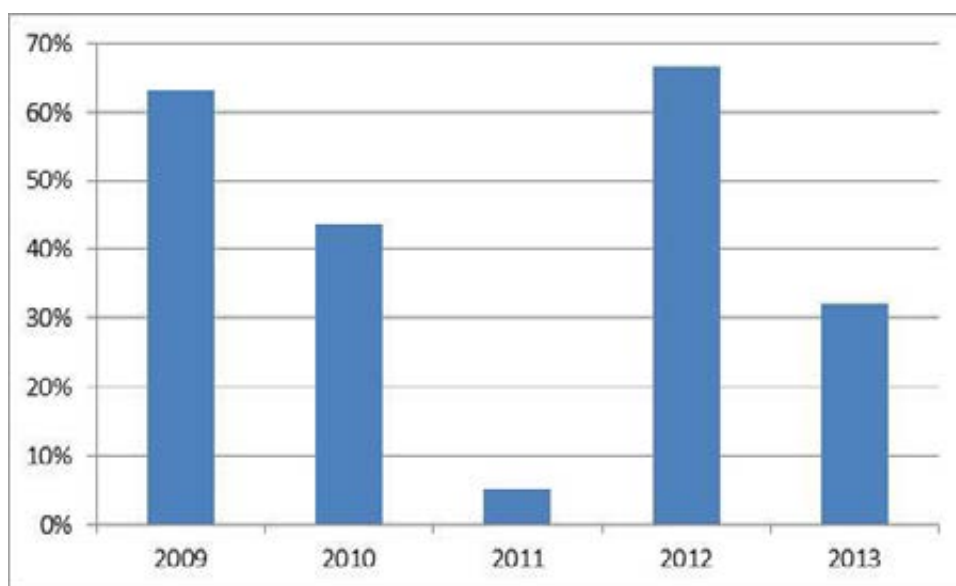


Figure 2-24. Douglaston Manor Association Bathing Area Openings

Percent of Enterococci Samples with 30-day GM < 35 cfu/100mL

Figures 2-25 and 2-26 present a number of statistical parameters of the DEP Harbor Survey data set over the same period. Shown on these figures are the site GMs over the noted period, along with data ranges (minimum to maximum and 25th percentile to 75th percentile). For reference purposes, the monthly GM water quality criterion for fecal coliform is also shown.

Figures 2-25 and 2-26 present fecal coliform bacteria data collected at Stations AC1, LN1 and E11, in Alley Creek, Little Neck Bay and at the DMA Beach. The data in Figure 2-25 represent the period of January 2009 through March 2011, prior to when the Alley Creek CSO Retention Facility came on-line, whereas Figure 2-26 shows the data collected at those stations for the period post Alley Creek CSO Retention Facility. Similarly, Figures 2-27 and 2-28 present enterococci data collected at the same locations for the same time periods.

The data indicate that the bacteria concentrations within Alley Creek are elevated within 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.

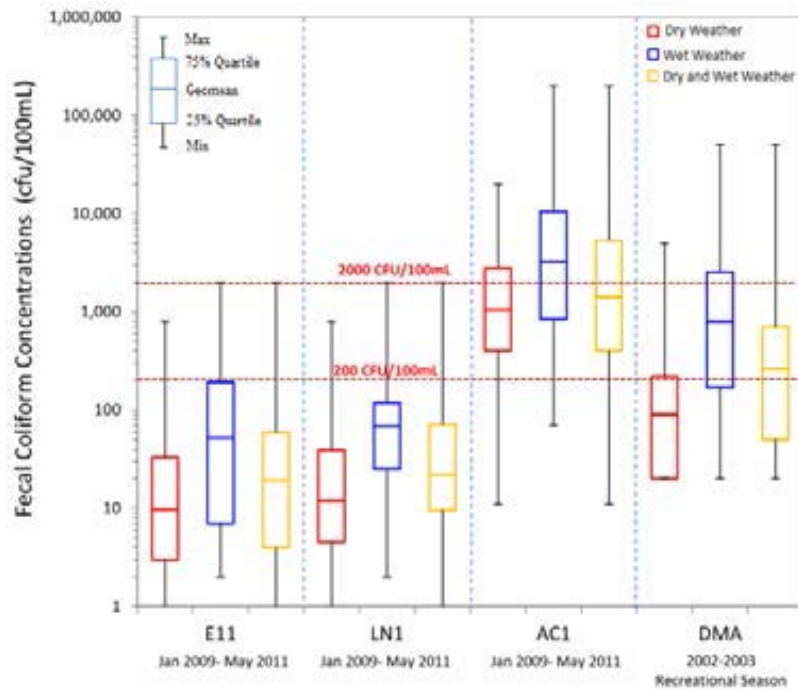


Figure 2-25. Fecal Coliform Data – Prior to Alley Creek CSO Retention Facility

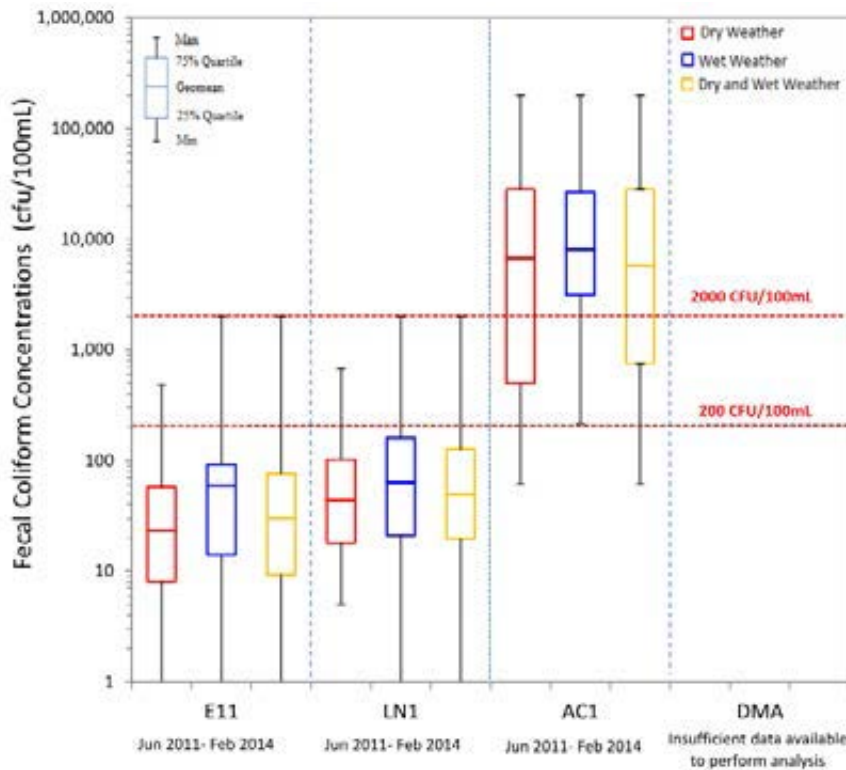


Figure 2-26. Fecal Coliform Data – Post Alley Creek CSO Retention Facility

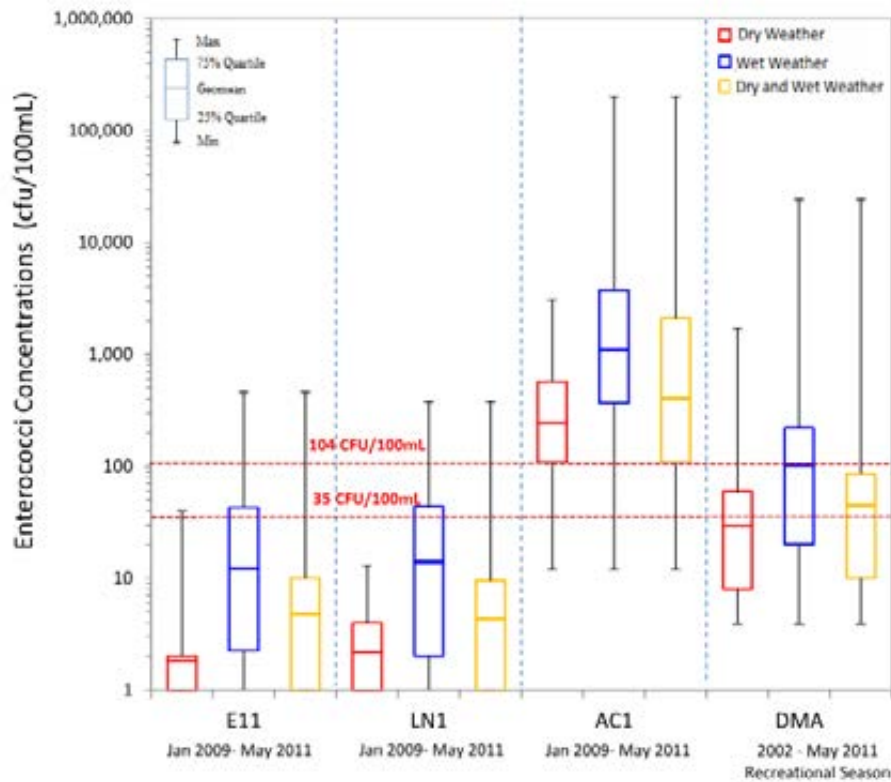


Figure 2-27. Enterococci Data – Prior to Alley Creek CSO Retention Facility

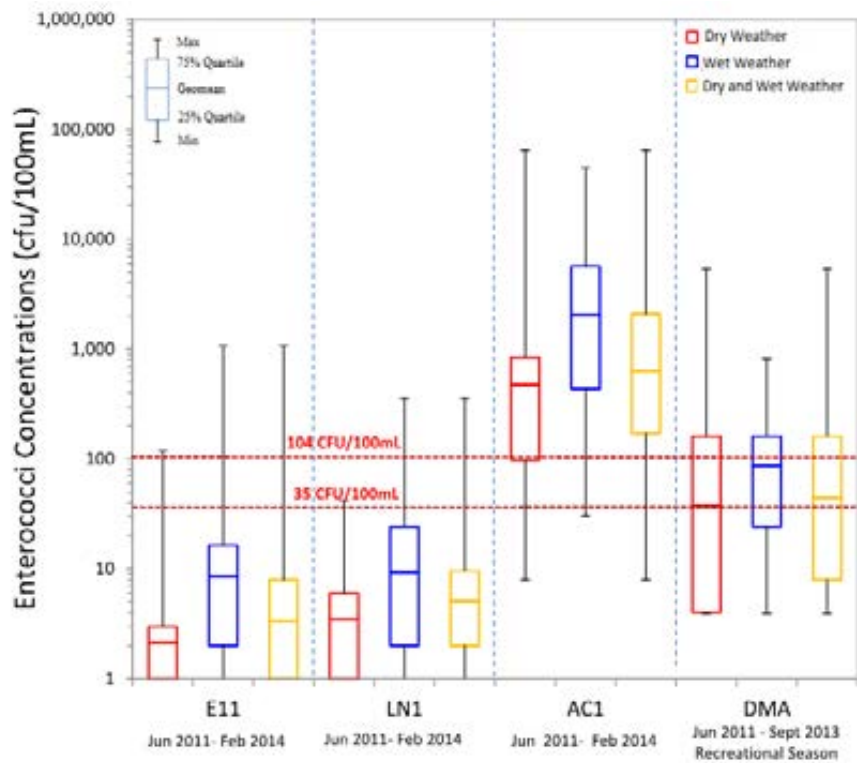


Figure 2-28. Enterococci Data – Post Alley Creek CSO Retention Facility

While it is apparent that the GMs increased slightly from pre- to post-retention Alley Creek CSO Retention Facility conditions, this appears in-part to be due to the extreme amount of rainfall in 2011 (Table 2-19). However, the data also indicate the possible presence of illicit dry weather sources during the period of record as many of the dry weather samples were elevated above expected background levels but still were not as high as those found in the wet weather samples. As noted in these graphics, dry weather fecal coliform concentrations had a GM of near 7,000 cfu/100mL for the post-construction period, with excursions as high as 200,000 cfu/100mL. Enterococci concentrations were lower with a GM of close to 500 cfu/100mL and excursions of up to over 50,000 cfu/100mL.

Table 2-19. LaGuardia Airport Summer Rainfall

Monthly Total Volume (in)			
	<i>June</i>	<i>July</i>	<i>August</i>
<i>2009</i>	8.46	6.62	2.66
<i>2010</i>	1.67	2.52	2.36
<i>2011</i>	3.85	2.94	17.32
<i>2012</i>	4.19	3.77	2.95
<i>2013</i>	8.16	2.8	1.97

The period GM summary of the bacteria data collected at Station AC1, presented in Table 2-20, shows that the post-construction concentrations increase in both wet and dry weather after the Alley Creek CSO Retention Facility came online. Since, the concentrations of bacteria at this location are elevated above expected background levels and increase during certain periods (particularly 2013), it can be deduced that this location is influenced by the presence of dry weather discharges. A temporal presentation of the data (Figure 2-29) demonstrates this issue by the large increase in bacteria concentrations in the middle of 2013. The data then return to pre-elevated lower levels in late 2013 and early 2014. The data then return to pre-elevated lower levels in late 2013 and early 2014. Accordingly, as discussed in Section 2.1.c.2, DEP conducted extensive investigations to locate the sources of the illicit connections. A previous illicit connection track-down investigation in 2011 located and eliminated 11 illicit connections within the Alley Creek drainage area. DEP believed they had found and abated all sources of illicit connections by late 2012 and reported as such to the DEC. However, as indicated by the bacteria data, it appears that there were additional sources not found and as such DEP initiated another track-down effort in late 2013. The results of this renewed track-down effort will be reported to DEC quarterly moving forward until concentrations at Station AC1 are reduced.

Table 2-20. Bacteria Data Summary – AC1 – Period GM

	Pre-Construction (January 2009 to March 2011)		Post-Construction (April 2011 to March 2014)	
	Dry	Wet	Dry	Wet
	Fecal Coliform (#/100mL)	1,047	3,283	6,722
Enterococci (#/100mL)	240	1,091	468	2,036

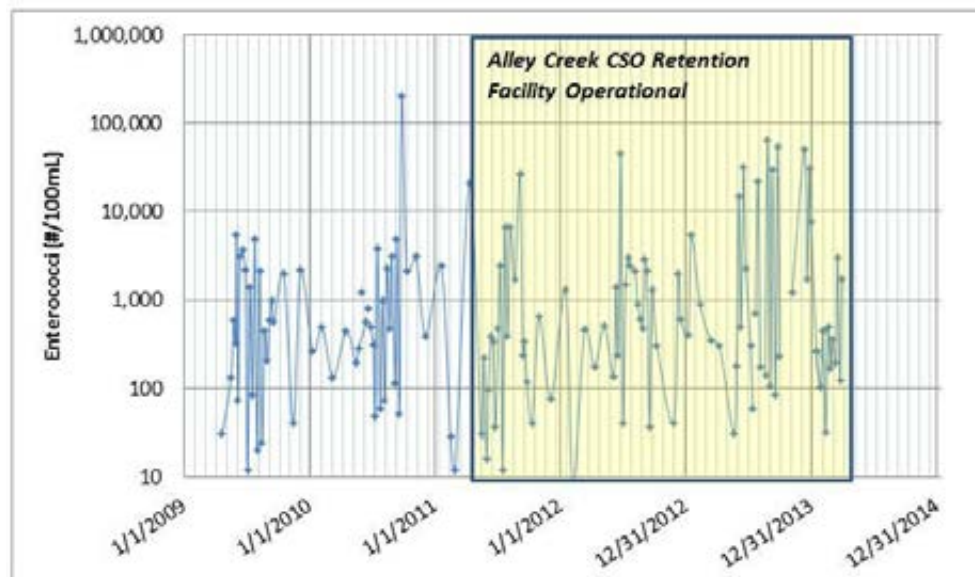
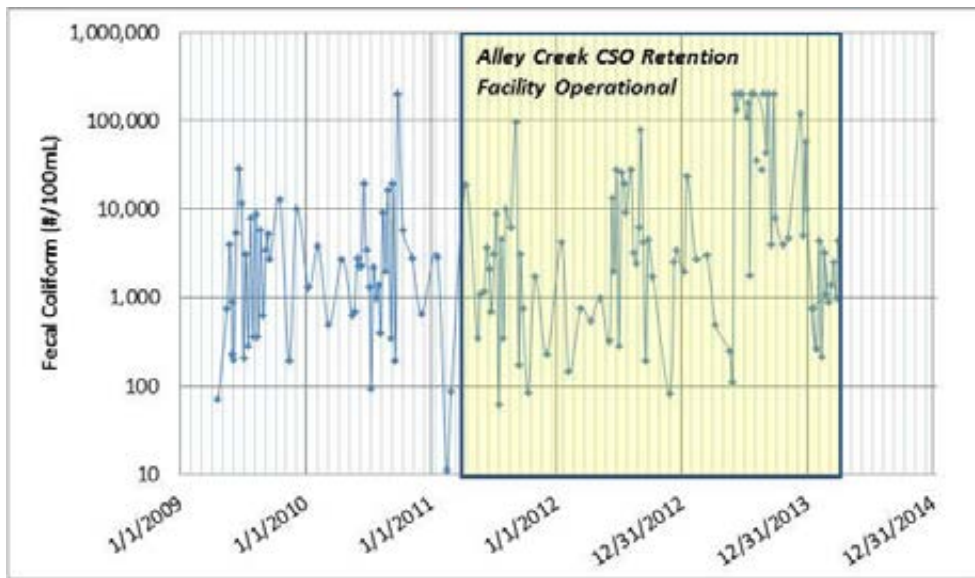


Figure 2-29. Bacteria Concentrations – AC1 Sampling Station

Microbial Source Tracking

Because of a large resident population of waterfowl in both impoundments, it was speculated that the observed elevated bacteria in Alley Creek might be from a source other than humans. To test this, MST was performed to attempt to determine the host (bird, dog, or human) that contributed the observed fecal pollution to the waterbodies. Fecal pollution can originate from point sources such as sewage, effluent from wastewater treatment plants and stormwater, and from non-point sources such as leaking septic systems, agriculture or wildlife runoff where the entry point of contamination to surface waters is not obvious. In either case, mammalian sources leave genetic tracers that can be detected in the laboratory.

Detection and quantification of gene biomarkers for human, bird, and dog sources were performed by Source Molecular Laboratory, based in Florida, using quantitative Polymerase Chain Reaction (qPCR) DNA analytical technology proprietary to the laboratory. A general marker was quantified as copy numbers per mL, which is roughly analogous to bacteria concentrations (although not related). Then two human markers, one bird marker, and one dog marker were targeted for presence/absence, and if found to be present, quantified in the same manner as the general marker. Those results that were below the detection limits of the associated genetic assay were classified as negative. A negative result is not definitive of the absence of fecal contamination. As previously noted, due to the low bacteria levels in the samples, the results cannot be considered to be absolute. The results for the five sampling events are summarized in Table 2-21.

Table 2-21. TOC MST Sampling Results

Date	1/3/2014		1/11/2014		2/1/2014		2/12/2014		2/25/2014	
<u>Location</u>	Hum 1	Hum 2	Hum 1	Hum 2	Hum 1	Hum 2	Hum 1	Hum 2	Hum 1	Hum 2
Oakland Lake Outlet	-	-	-	-	-	Positive	-	-	-	-
Oakland Lake main Inflow (OL6)	Positive	Positive	-	-	-	-	-	-	-	-
LIE Pond	-	-	-	-	-	-	-	-	-	-
<u>Location</u>	Bird		Bird		Bird		Bird		Bird	
Oakland Lake	Positive (t)		Positive (d)		Positive (t)		-		-	
Oakland Lake main Inflow (OL6)	Positive		-		-		-		-	
LIE Pond	Positive		-		-		Positive (t)		-	
<u>Location</u>	Dog		Dog		Dog		Dog		Dog	

Date	1/3/2014		1/11/2014		2/1/2014		2/12/2014		2/25/2014	
Location	Hum 1	Hum 2	Hum 1	Hum 2	Hum 1	Hum 2	Hum 1	Hum 2	Hum 1	Hum 2
Oakland Lake	-		-		-		-		-	
Oakland Lake main Inflow (OL6)	Positive		-		-		-		-	
LIE Pond	-		-		-		-		-	

(t): trace; (d) detected in duplicate sample

Bird markers were found to be positive in three of five Oakland Lake samples and two of five LIE Pond samples. The single positive for dog marker detection coincided with positives for all other markers for that event at the QCC outfall, suggesting a higher level of contamination. The dog marker can have a false-positive when human markers are abundant. Only one of two human markers was detected in a single event, suggesting a limited human contribution to the fecal contamination observed.

Source Molecular Laboratory indicated that the results showed trends typical of other projects. However, a set of five measurements at one location may not be statistically significant to make an appropriate interpretation of the overall results, especially considering the relatively infrequent positives in the results. Due to the low bacteria levels, further sampling was not performed. The frequency of positive results is the most important parameter when ranking sites with respect to the contribution of a particular host to the contamination.

Alley Creek LTCP Sampling

To supplement the water quality sampling information that is available from DEP and DOHMH, a sampling program was conducted during the development of this LTCP. This sampling was targeted at developing a better understanding of the spatial variability of the water quality trends within Little Neck Bay especially in the vicinity of DMA Beach. An array of sampling locations, as shown on Figure 2-30, was developed to fill in the areas between the DEP and DOHMH sampling locations. Samples were collected at these locations in both dry and wet weather in November and December 2012. The emphasis of the sampling program was on bacteria indicators although data were developed for other water quality indicators such as DO.

As noted previously in Section 2.1.c.2, MST samples were also collected at DMA Beach. The results obtained did not provide a conclusive determination of the most likely source of the bacteria sampled for the reasons presented in that earlier discussion.

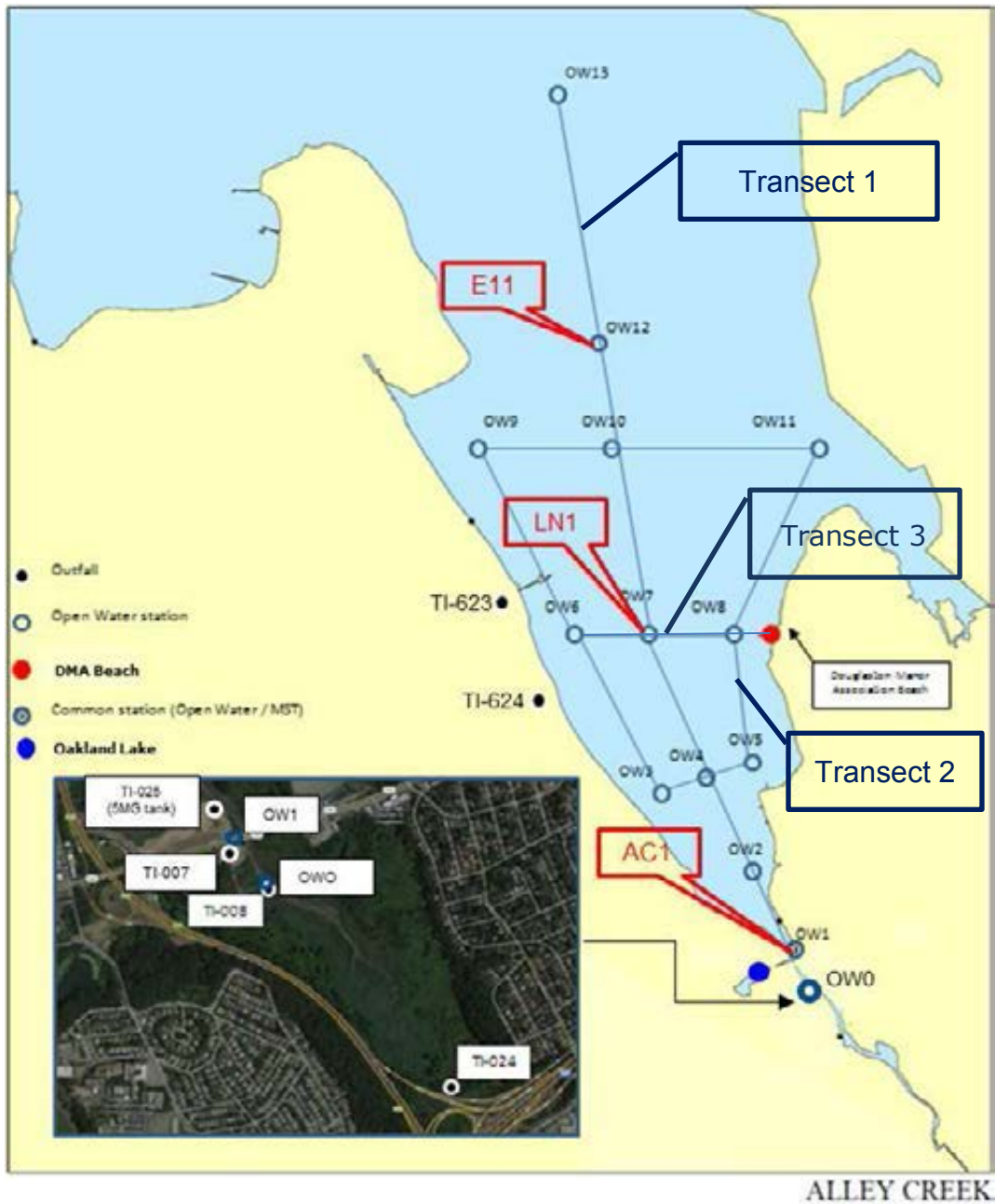


Figure 2-30. 2012 Intensive Sampling and HSM Locations

The results of this sampling effort are provided in Figures 2-31 and 2-32 for enterococci and fecal coliform in wet weather, and Figures 2-33 and 2-34 present these results for dry weather. As shown in Figures 2-31 and 2-32, there appears to be a gradient of bacteria from Alley Creek to the center portion of Little Neck Bay along the Bay centerline (Stations OW2, OW4 and OW7), along the eastern shoreline (Stations OW2, OW5 and OW8), and along the western shoreline (Stations OW2, OW3 and OW6). That gradient has the elevated bacteria concentrations at the locations in Alley Creek, and they decrease from the Creek towards the Upper East River. Locations further removed from Alley Creek (Stations OW9 through OW13) seem to have bacteria concentrations that are almost equal, and appear to be more related to

East River sources then they are related to Alley Creek sources. The lack of a relationship between the values at these outer stations and the inner stations indicates that the bacteria concentrations at these locations are likely associated with other sources of bacteria to the system that are impacting the greater East River and western Long Island Sound.

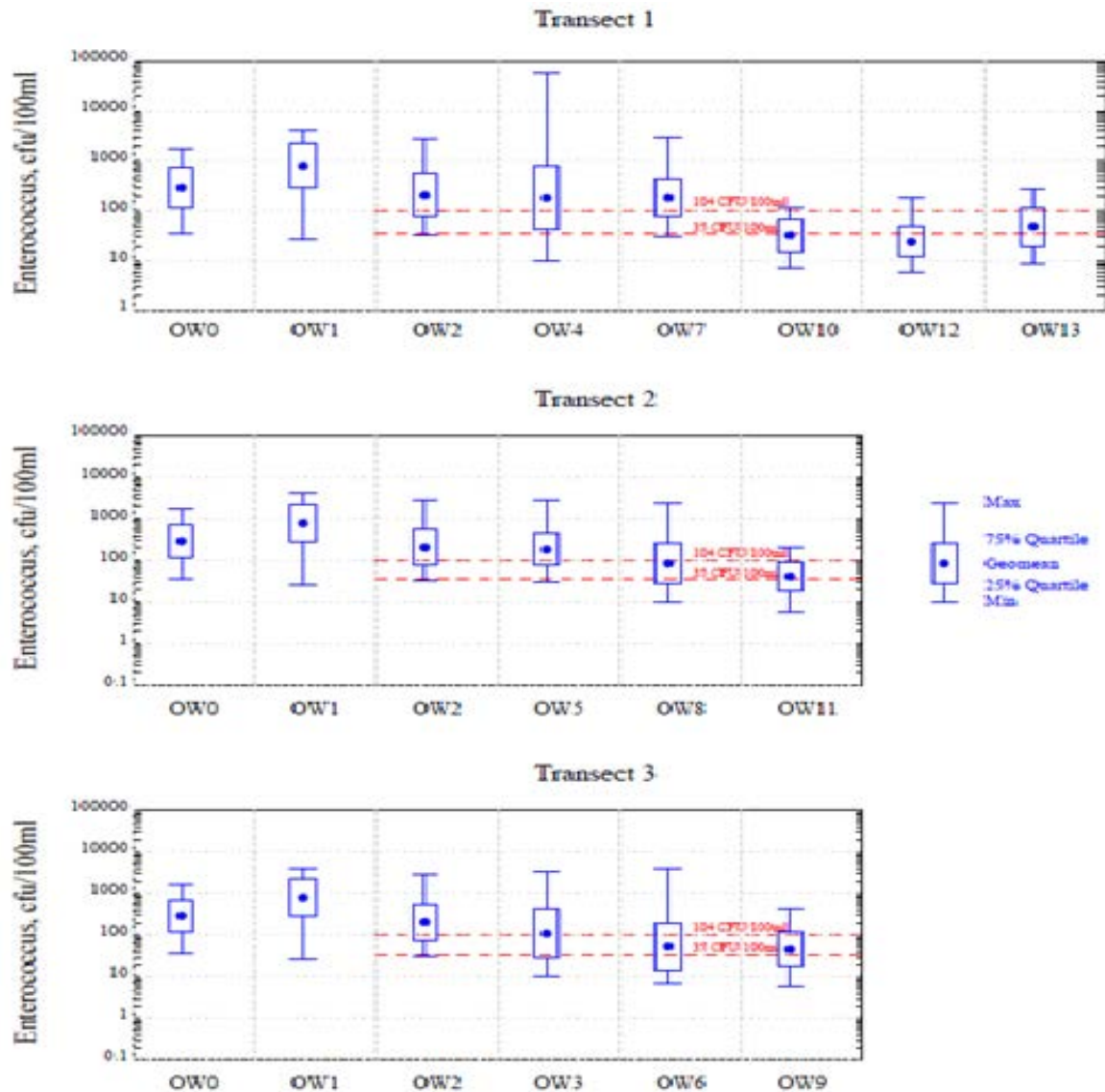


Figure 2-31. FSAP Wet Weather Enterococci Concentrations

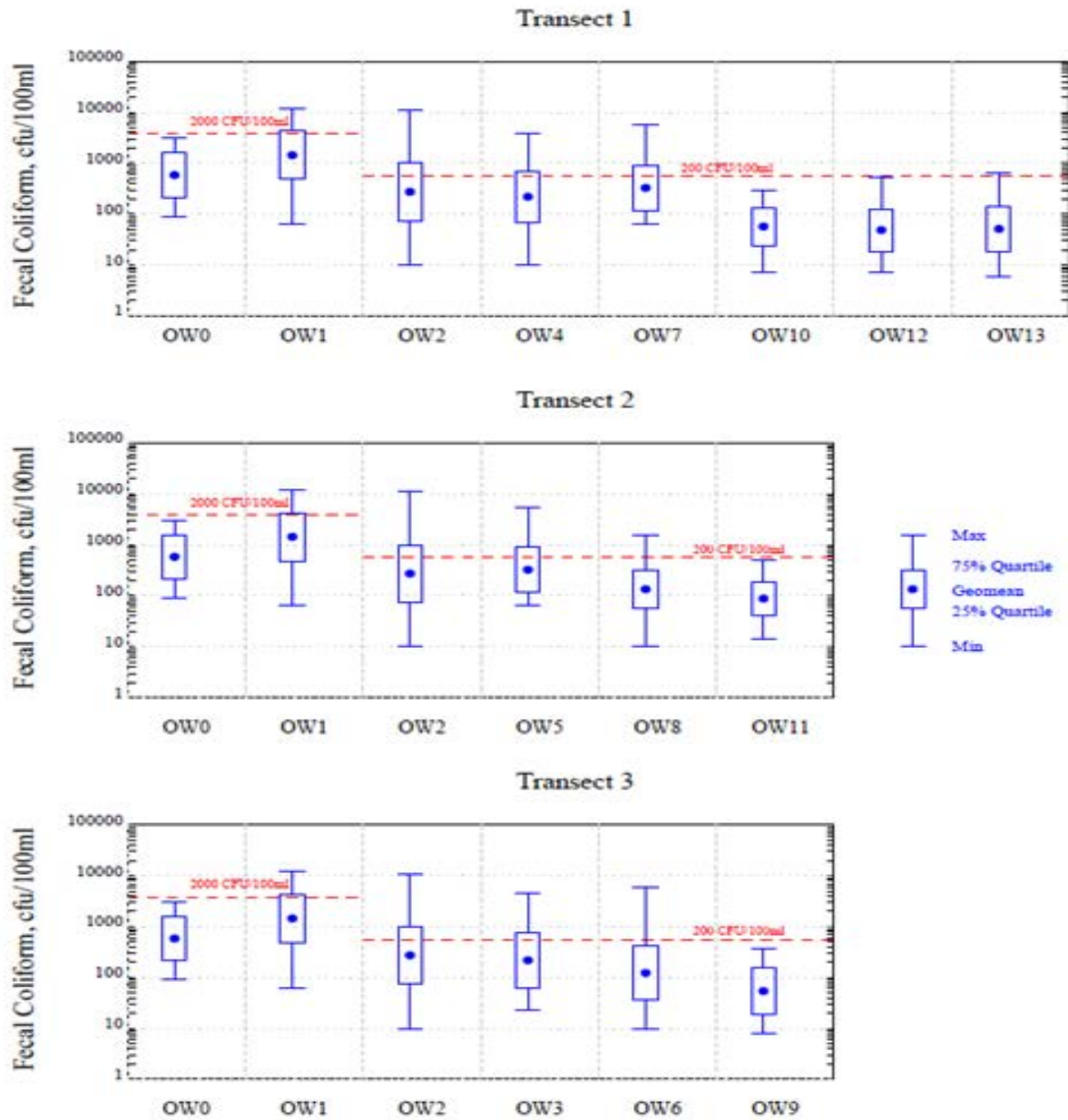


Figure 2-32. FSAP Wet Weather Fecal Coliform Concentrations

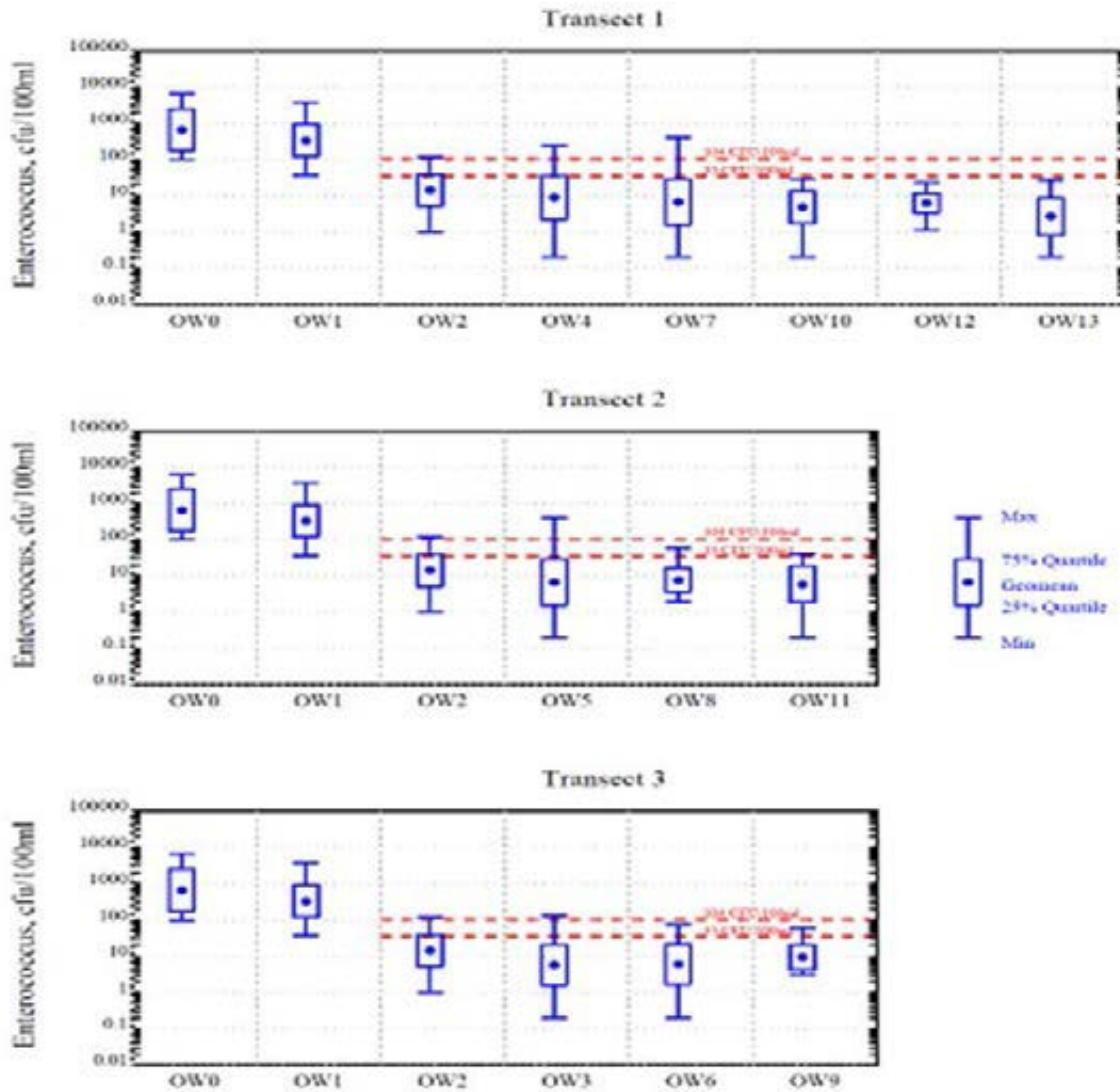


Figure 2-33. FSAP Dry Weather Enterococci Concentrations

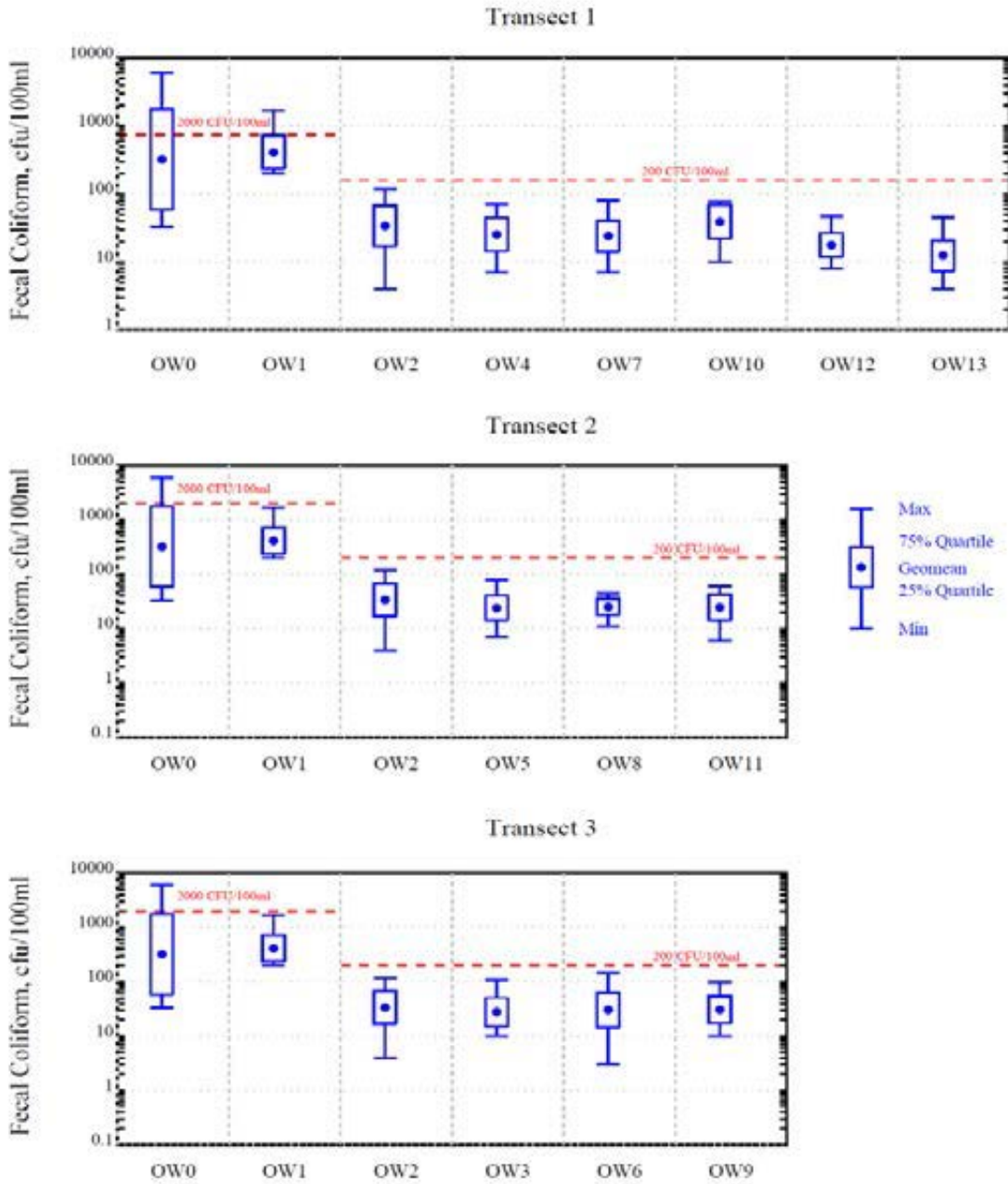


Figure 2-34. FSAP Dry Weather Fecal Coliform Concentrations

Similarly, the concentrations of bacteria 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 2-35. 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.

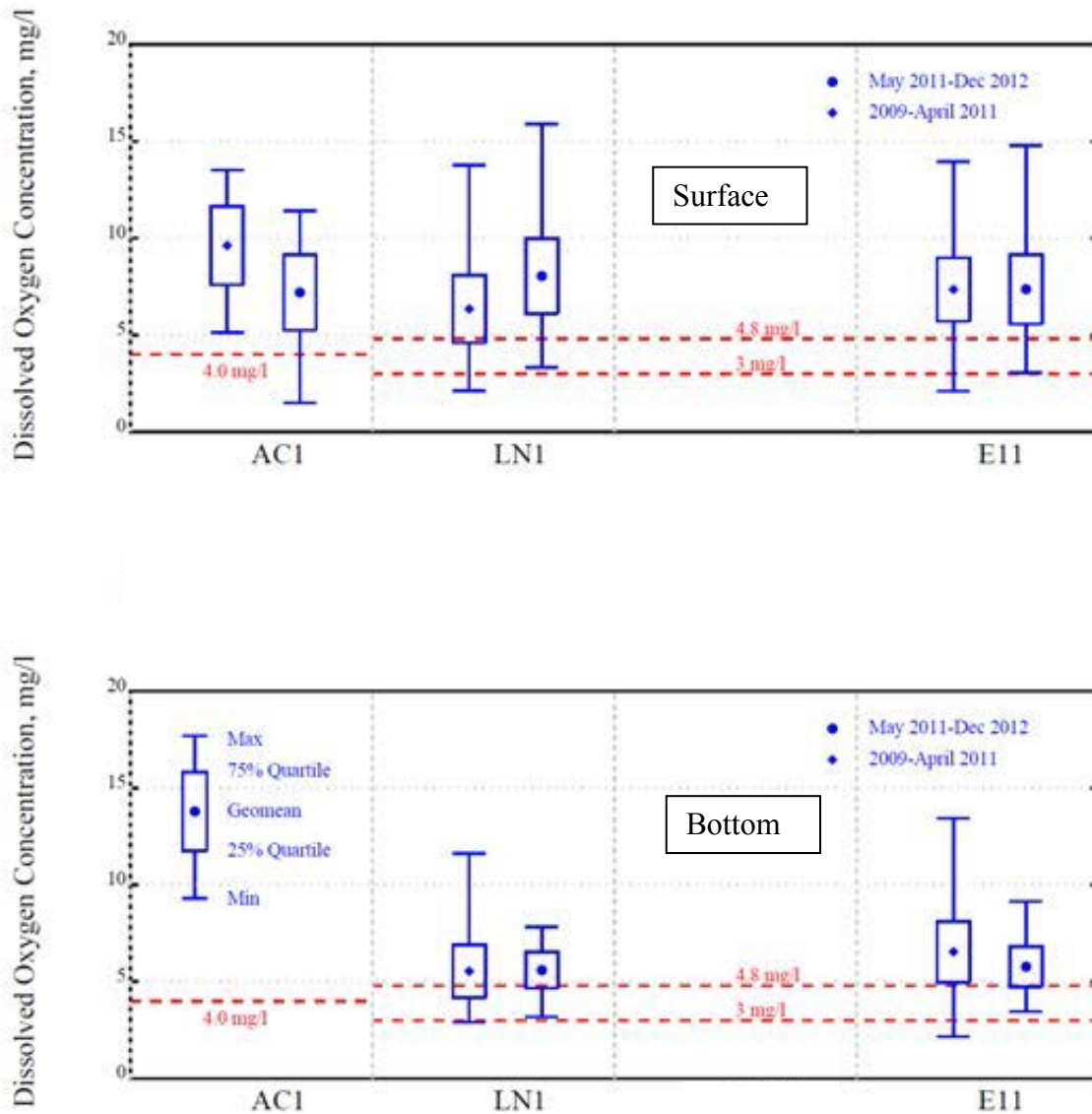


Figure 2-35. Dissolved Oxygen Concentrations

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 2013 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

EPA Nine Minimum Controls	SPDES Permit Best Management Practices
	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 combined sewer system (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 inspections of the CSO regulator structures 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;
- Telemetry 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 WWTP must be physically capable of receiving a minimum of two times design dry weather flow (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 per their DEC-approved Wet Weather Operating Plans. The maximum flow that can reach a particular WWTP, however, 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 2013 BMP report indicate that DEP's WWTPs generally complied with this BMP during 2013.

On May 8, 2014, DEC and DEP entered into an administrative consent order that includes an enforceable compliance schedule to ensure that DEP maximizes flow to and through the WWTP during wet weather events

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 it has always been a DEP goal to 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 2013. That being said, some instream monitoring data collected by DEP showed the potential for a bypass in 2013, but to date DEP has been unable to determine the cause and in late 2013 and early 2014 the instream data no longer show evidence of this potential bypass.

Although dry weather discharges were found in the Tallman Island WWTP drainage area, they were located in storm sewers. Some were corrected and one is still being tracked down (see Section 2.0). Illicit connections to the storm sewer system are not part of the CSO BMP reporting but something that DEP continually tracks down as appropriate. In the Tallman Island sewershed, there was one bypass reported at the Clearview pump station due to electrical equipment problems, and there were two bypasses at the WWTP. As noted above, none of these bypasses impacted Alley Creek or Little Neck Bay.

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 2013 BMP Annual Report, the average total metals discharged by all regulated industries to the WWTPs was 13.9 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 2013 (DEP, 2013a).

3.7 Control of Floatables 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:** 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. There are no reported projects for the Tallman Island WWTP service area in the Best Management Practices 2013 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 2013 Annual Report, although no combined sewer extension projects were completed during that year.

3.10 Sewer Connection & 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 2013, 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 2013 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. DEP has posted signs on all CSO outfalls in the Alley Creek drainage area and hosts a web site that notifies the public is there is a potential for elevated pathogen levels associated with wet weather events (www.nyc.gov/html/dep/html/harborwater/nyc_waterbody_advisory_program.shtml). In accordance with this BMP the NYC Department of Health and Mental Hygiene implements and manages a notification program that provides the public with information about bathing water quality. Accordingly, the Wet Weather Advisories, Pollution Advisories and Closures are tabulated for all NYC public and private beaches. Douglas Manor Association (DMA) Beach, a private beach on Little Neck Bay, was closed a

total of 63 days and had Pollution Advisories posted for a further 34 days during the 2013 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 Monitoring 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 eleven annual reports to date, covering calendar years 2003 through 2013. 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.

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 Alley Creek CSO Retention Facility 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 CSO Retention Facility 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 Facility and to provide tank bypass to TI-008
- New CSO Retention Facility (5 MG Alley Creek CSO Retention Facility)
- 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 CSO Retention Facility
- Fixed baffle at TI-025 for floatables retention, minimizing release of floatables to Alley Creek
- Expansion and upgrade of Old Douglaston PS to empty the storage tank and convey flow to Tallman Island WWTP after the end of the storm

As described in Section 3.0, a major sewer upgrade project is underway to construct an extension of Whitestone Interceptor. This project is aimed at improving the wet weather conveyance capacity to the Tallman Island WWTP. When this project is completed, it is projected to significantly increase the hours that the Tallman Island WWTP will reach 2xDDWF.

In addition to the grey infrastructure listed above, as part of the construction of the Alley Creek CSO Retention Facility and new outfall, DEP made a significant environmental investment in the creation of a large wet wetland adjacent to the outfall. In 2011, DEP completed a \$20M environmental restoration of the northern portion of Alley Pond Park in Bayside, Queens. DEP constructed 8 acres of tidal wetlands and 8 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 the receiving waters as well as parts of the sewer system during wet weather events.

Currently, DEP is about to embark on additional work in the area that will be undertaken as part of the resolution of an enforcement matter brought by NYS for the applicable violation(s). The proposed project involves the restoration of approximately 1 to 1.5 acres of wetlands, located near the 8 acres of tidal wetland restoration described above. This Environmental Benefit Project would provide additional

ecological benefit by removing anthropogenic fill material to re-establish tidal flushing and proper hydrology to support a tidal wetland community. The work includes the removal of fill material, disposal, new planting soil, plants, a goose exclusion fence and a 2-year maintenance and guarantee period at a cost of just under \$1M.

4.1.a Completed Projects

The five million gallon Alley Creek CSO Retention Facility and Old Douglaston Pump Station were 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 with the exception of recommendations that are made in this LTCP as described later.

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 Facility, providing data for model validation, feedback to facility operations, and an assessment metric for the effectiveness of the facility. Each year's data set is being compiled and evaluated to refine the understanding of the interaction between Alley Creek, Little Neck Bay, and the Alley Creek CSO Retention Facility, with the ultimate goal of fully attaining compliance with current WQS or for supporting a UAA to revise such standards. The PCM program contains three basic components:

1. The Alley Creek CSO Retention Facility 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 citywide program takes form. Any further modifications to the PCM program will be submitted to DEC for review and approval.

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

While Section 2.0 discussed water quality data within Alley Creek and Little Neck Bay in general, this section describes PCM sampling specifically for the purpose of quantifying the effects of the Alley Creek CSO Retention Facility. PCM for the Alley Creek CSO Retention Facility 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, as DEP collected water quality samples at two other locations in the immediate vicinity of the PCM location AC1 (LTCP FSAP Stations OW0 and OW1), and in Little Neck Bay south of HSM Station LN1 (Station OW2) are also presented herein. Figure 4-1 presents a map of the PCM and HSM Stations E8, EW11, LN1, and AC1 as well as the sampling locations OW0 and OW1 which were sampled as part of this LTCP.



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

The Alley Creek and Little Neck Bay monitoring results that were associated with the DEP PCM program for 2012 are presented on Figures 4-2 through 4-5. The results are shown for dissolved oxygen (DO), fecal coliform bacteria, enterococci bacteria, and total suspended solids (TSS), respectively. Additional data collected at Station AC1 between 2009 and 2014 is contained in Section 2.2.a.6. 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 Facility 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. It should be noted that in the middle of 2013, pathogen concentrations in Alley Creek, increased for reasons that DEP has not been able to resolve despite extensive investigations. It returned to pre-elevated levels later in the year.

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.

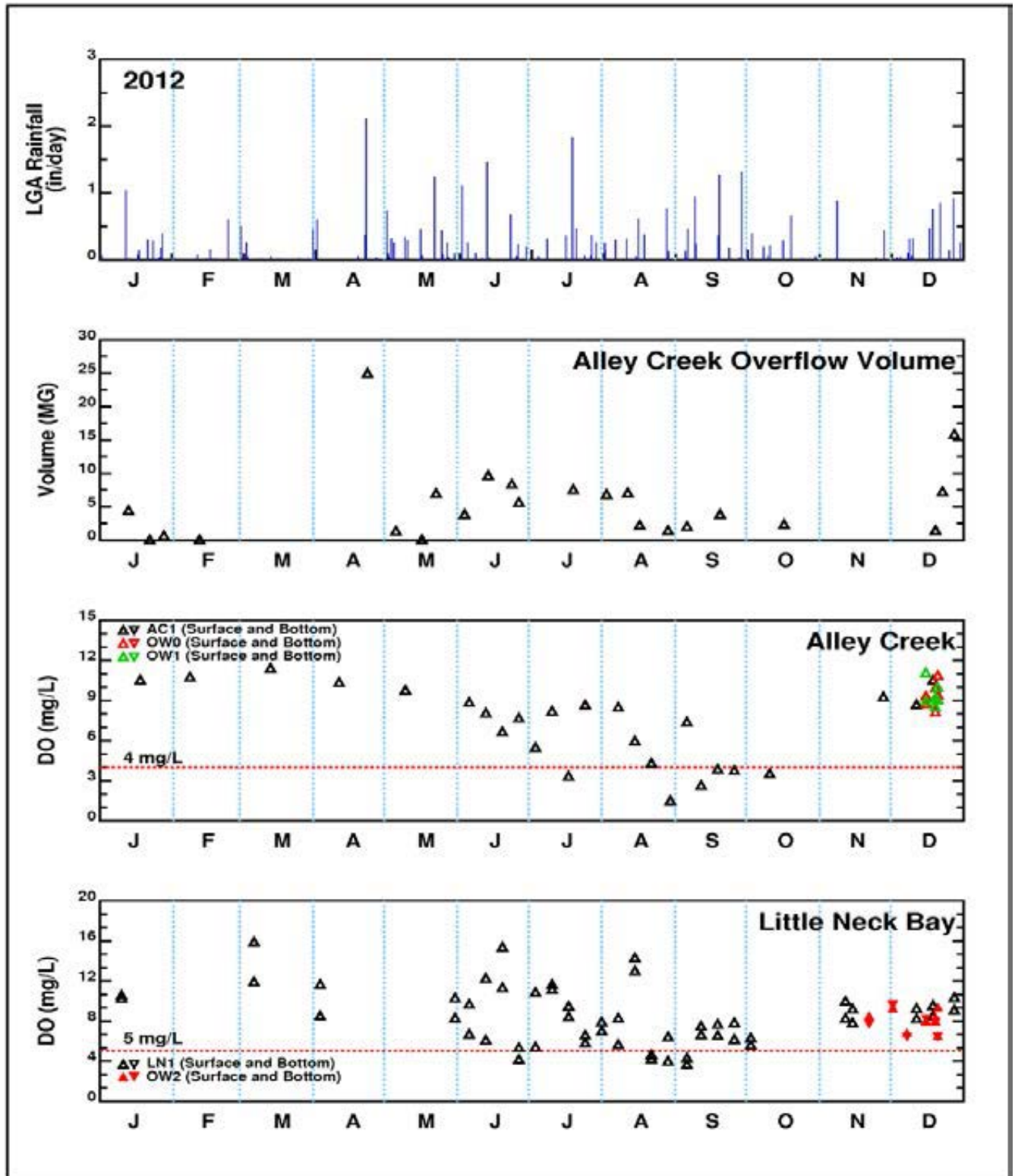


Figure 4-2. Alley Creek CSO Retention Facility
 Ambient Water-Quality Monitoring – Dissolved Oxygen, 2012

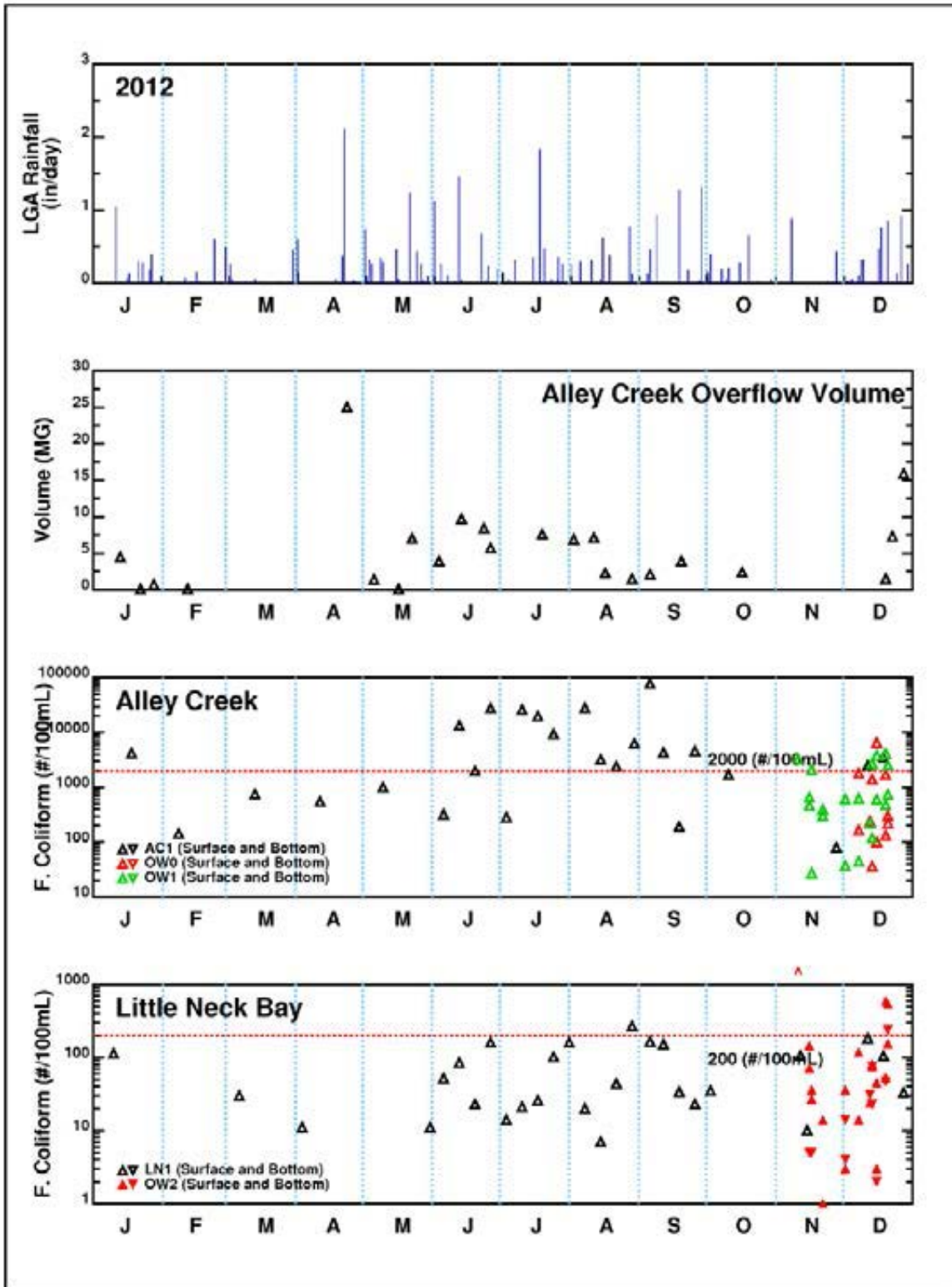


Figure 4-3. Alley Creek CSO Retention Facility - Ambient Water-Quality Monitoring – Fecal Coliform Bacteria, 2012

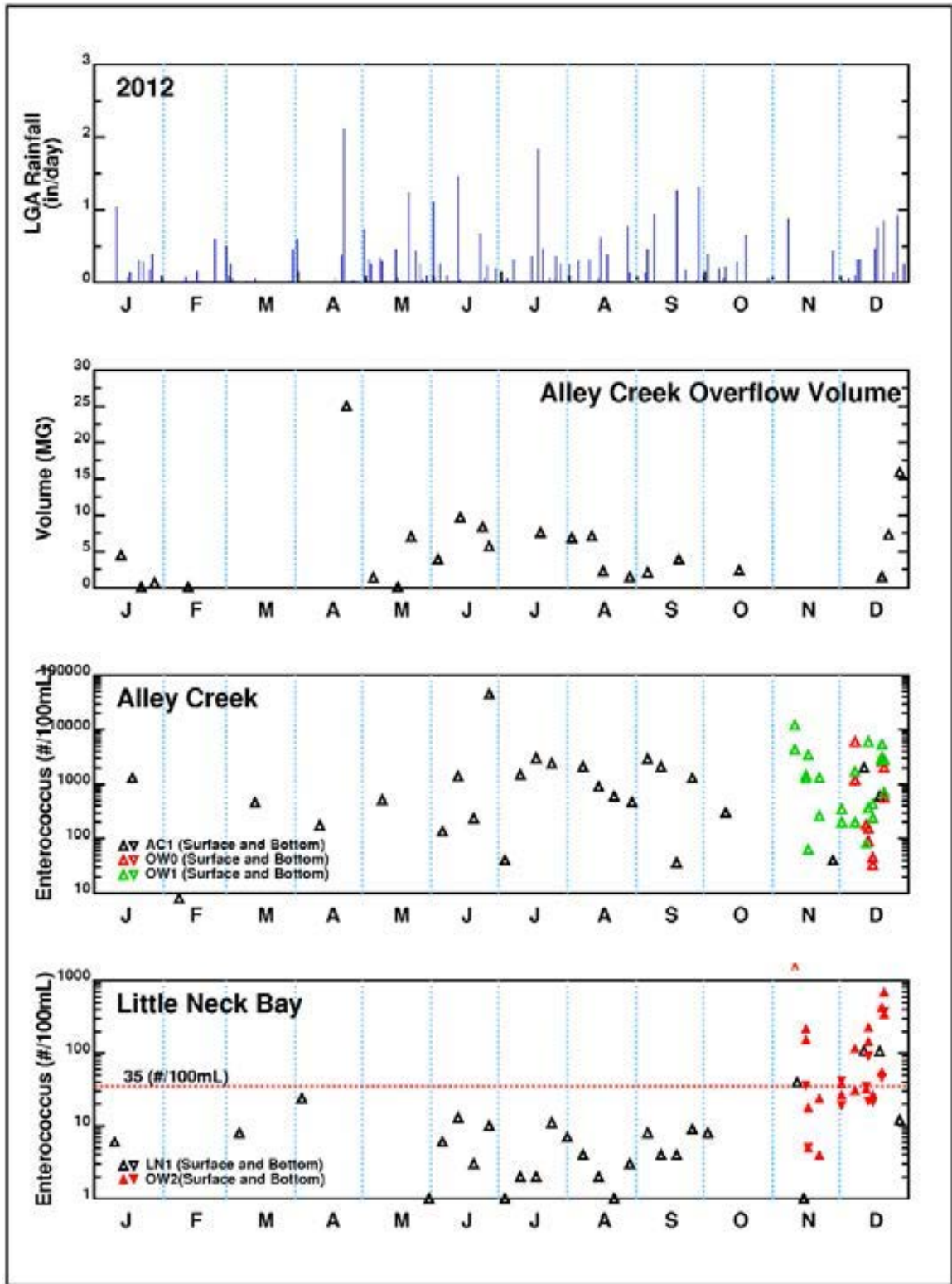


Figure 4-4. Alley Creek CSO Retention Facility
 Ambient Water-Quality Monitoring – Enterococci Bacteria, 2012

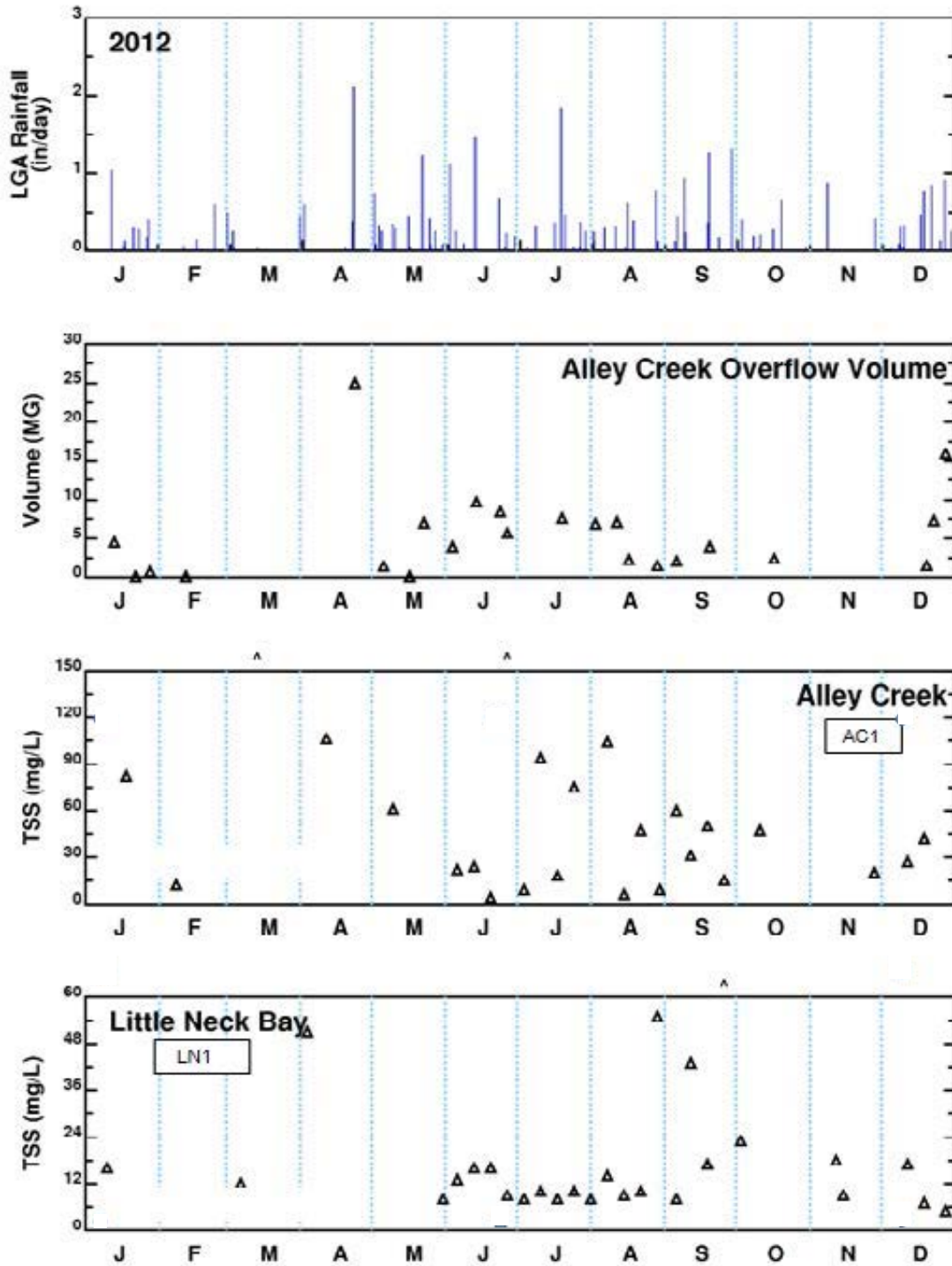


Figure 4-5. Alley Creek CSO Retention Facility Ambient Water-Quality Monitoring – TSS, 2012

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

Flow Monitoring

DEP monitors water-surface elevations and pumped volumes over time at the Alley Creek CSO Retention Facility. Based on these measurements and other information, DEP estimates daily inflow and infiltration (I/I), wet weather retained volume, pump-back volume, and overflow periods and overflow volumes. Table 4-1 presents a summary of the monthly overflow estimates, respectively.

Analysis¹ 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 NYC. Monthly rainfall ranged from 0.91 to 5.06 inches. Analysis of the rainfall that fell on the Alley Creek watershed was developed using NOAA archived rainfall radar imagery and calibration techniques that compare the radar imagery to land-based point rainfall gauges including the LaGuardia gauge. This technique resulted in a total rainfall of 41.7 inches with monthly totals ranging from 1.37 inches to 7.2 inches.

As summarized in Table 4-1, the Alley Creek CSO Retention Facility monitoring data showed that the facility overflowed during 25 storm events in 2012, or about twice a month, meaning that the Alley Creek CSO Retention Facility fully captured flow generated during the other 100 rainfall events (80 percent). DEP reported that the tank retained a total of 256 MG of combined sewage for pump-back 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 recently completed 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 CSO Retention Facility relies on depth measurements and weir equations that have inherent weaknesses due to the use of indirect measurements of overflows. One result of the CSO Flow Monitoring Pilot Study was that direct flow measurements were found to be the most accurate, and that they are more accurate than the depth and weir calculation approach used previously. DEP is currently working with the firm that completed the pilot program to improve this measurement approach and apply what is learned in the pilot study to more accurately measure the overflow from the Alley Creek CSO Retention Facility. The plan is to inspect the Alley Creek CSO Retention Facility and evaluate improved monitoring approaches.

Table 4-1 also summarizes the model-predicted 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 overflow volumes are consistently higher than the monitoring-based volumes. These modeling results differ and result in a larger overflow volume than those results provided in the *Post Construction Compliance Monitoring (PCM) and CSO Retention Facility Overflow Summary for Calendar Year 2012* (August 2013, NYC DEP) report in the following ways:

- Rainfall Radar Data – Rainfall radar data was used in this LTCP to get a better representation of the rainfall on the watershed. These data resulted in a total of 41.6 inches of rainfall on the

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.

watershed, which is 15 percent greater than the 36.2 inches of rainfall observed at the LaGuardia Airport point rain gauge used in the PCM reporting.

- IW model Improvements – Recent inspections of the regulators and a review of the sewer system connectivity resulted in a number of updates to the IW model that were not available when the PCM report was completed.
- Alley Creek CSO Retention Facility Operations – During 2012, a valve that opens to drain the retained water was discovered to intermittently stick in a closed position, while giving the operators a signal that it was open. Upon discovering this faulty valve, it was repaired and the facility operated as designed. This faulty valve resulted in a certain number of storms occurring before the tank was completely drained down. The IW modeling contained herein was conducted with this knowledge which was not discovered when the PCM report was developed. As such, results provided to the DEC in the PCM report underestimated overflows from the facility.

As discussed above, DEP will be evaluating its measurement approach for flows retained and discharged from the Alley Creek CSO Retention Facility and determining whether improved methods of monitoring overflows are feasible. When this evaluation is completed, DEP will have information on the accuracy of flow measurements made to date. Thus, variations between model-predicted performance and monitored data are expected.

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

Month	Rain at LGA (in)	Rain Near Alley Creek Tank – from rainfall radar (in)	Monthly Recorded Data	IW Model Data
			Overflow Volume (MG)	Overflow Volume (MG)
January	2.51	2.41	5	2
February	1.43	1.37	0	0
March	0.91	1.27	0	0
April	3.18	3.67	25	25
May	4.67	5.34	9	15
June	4.19	7.2	28	54
July	3.77	3.11	8	9
August	2.95	4.02	18	19
September	5.06	3.81	6	9
October	1.86	3.12	2	4
November	1.35	1.68	0	4
December	4.30	4.70	25	14
Totals:	36.18	41.70	125	157
Number of Overflow Events			24	22
⁽¹⁾ From Monthly Operation Reports				

Even during dry weather, the Alley Creek CSO Retention Facility 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 Alley Creek CSO Retention Facility cells and estimates² the overall I/I on a daily and monthly basis. The I/I estimates are summarized in the Alley Creek CSO Retention 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 CSO Retention Facility is operated such that I/I volumes are pumped back to the WWTP prior to anticipated wet weather events to maximize the rate of capture of combined sewage at the facility. This minor inflow is contained in the IW modeling assumptions.

Effluent Quality

Because Alley Creek CSO Retention Facility is an unmanned facility, overflow effluent quality was not measured during 2012. Limited effluent quality data were, however, sampled as part of the development

² For the Alley Creek CSO Retention 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.)".

of the LTCP in an attempt to better quantify the loadings to the Alley Creek CSO Retention Facility. Overflow events were sampled in both January and December 2013. Samples were collected from the effluent during one event and from the influent during two other events. The influent samples were collected as a surrogate to the effluent because the Alley Creek CSO Retention Facility overflows so infrequently. Bacteria data from the sampling events was presented in Section 2.0.

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 Facility. 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 coliform bacteria in Alley Creek by reducing the volume of CSOs discharged. At the time of the Facilities Plan, the primary parameter of concern was DO, as CSO control alone was not deemed 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 meeting existing WQS and assesses the possibility of attainment of primary contact WQ criteria (see Section 6.0).

CSO Storage

Analysis³ 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 Facility). Based on this information and the operational records in the monthly operating reports, the Alley Creek CSO Retention Facility fully captured combined sewage generated in 100 of the 125 storms, or 80 percent of all storms in 2012. Review of the rainfall radar data record showed higher rainfalls over the watershed. Rainfall from this data set exceeded the 0.46 inch threshold a total of 28 times in 2012. In total there were 131 occurrences when rainfall exceeded 0.01 inches (trace). Using this data set, the tank would have fully captured 81 percent of all storms.

Rainfall at LGA exceeded the 0.46-inch design capacity of the Alley Creek CSO Retention Facility during 15 of these 25 overflow events, and inspection of the rainfall radar information indicates that 0.46 inches or more likely occurred over the service area during another four overflow events (January 21, February 11, August 10, and October 15). Another six 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 Alley Creek CSO Retention 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 Facility reduced the number of CSO events 82 percent, which is above the annual-average target of 70 percent established in the DEC approved Alley Creek CSO Retention Facility Plan (June 2003). In terms of CSO volume, operation of the Alley Creek CSO Retention Facility is calculated to have reduced discharge volume by 63 percent from what would have been 418 MG/yr to 157 MG/yr (Table 4-1), which exceeds the annual-average volume reduction target of 54 percent.

CSO Pollutant-Load Reduction

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

Based upon the IW modeling analyses, the operation of the Alley Creek CSO Retention Facility reduced 2012 pollutant loadings of both TSS and BOD by 73 percent, versus the condition before the Alley Creek CSO Retention Facility was constructed, thereby exceeding the annual-average target reductions of 70 and 66 percent, respectively, developed in the approved Alley Creek CSO Facility Plan.

As noted above, the Alley Creek CSO Retention Facility fully captured the influent flow and associated floatables for 100 of the 131 rainfall events in 2012. During the 25 events in 2012 when the Alley Creek CSO Retention Facility did overflow, floatables removal at the facility was enhanced by means of an underflow baffle. Further, the retained floatables were removed either at trash racks at the Old Douglaston PS or the influent screens at the Tallman Island WWTP. Overall, the Alley Creek CSO Retention Facility reduced overflow floatables substantially.

5.0 GREEN INFRASTRUCTURE

By controlling stormwater runoff through the processes of infiltration, evapotranspiration, and capture and reuse (rainwater harvesting), green infrastructure (GI) can help keep stormwater out of combined sewer systems or detain its entry into the system and allowing more flow to reach the WWTPs.¹ As noted in Section 1.0, through its 2010 GI Plan DEP has embraced this approach and the use of GI has been incorporated into the 2012 Order on Consent with DEC.

The 2012 Order on Consent requires DEP to manage the equivalent of stormwater generated by one-inch of runoff from 10 percent of impervious surfaces in combined sewer areas citywide by 2030. In the near term, DEP is required to implement the equivalent GI to attain an application rate of 1.5 percent by December 31, 2015. If this 1.5 percent goal is not met, DEP must certify that it has encumbered \$187M for implementation of GI and submit a contingency plan to DEC by June 20, 2016. Over the next 20 years, DEP is planning for \$2.4 billion in public and private funding for targeted GI installations and \$2.9 billion in cost-effective grey infrastructure upgrades in order to reduce CSOs and gain the co-benefits of GI. An overview of the DEP GI Plan, including citywide and watershed-based implementation, is described below. Pursuant to the Order on Consent, DEP also publishes a “Green Infrastructure Annual Report” every April 30th in order to provide updates on all GI related efforts and the status of implementation. These reports can be found at:

http://www.nyc.gov/html/dep/html/stormwater/nyc_green_infrastructure_plan.shtml

5.1 NYC Green Infrastructure Plan (GI Plan)

The City published the GI Plan in September 2010, which presents 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 GI Plan will yield co-benefits, which include but are not limited to, improved air quality, urban heat island mitigation, carbon sequestration, increased shade, and increased urban habitat for pollinators and wildlife.

In January 2011, DEP created the Office of Green Infrastructure (OGI) to implement the goals of the GI Plan, and budgeted over \$730M including \$5M in Environmental Benefits Project (EBP) funds,² through FY 2023 for GI projects. OGI, and in partnership with other DEP bureaus and City agencies, is leading the design and construction of 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 standard designs for right-of-way bioswales (ROWBs) and designed other projects that include pervious pavement, rain gardens, and green and blue roofs. The Areawide Strategy and other implementation activities initiated by OGI to achieve the milestones in the 2012 Order on Consent are described in more detail below and in the most recent Green Infrastructure Annual Report available on the DEP website.

¹ U.S. EPA, March 2014. Greening CSO Plans: Planning and Modeling Green Infrastructure for Combined Sewer Overflow (CSO) Control.

² 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.

5.2 City-wide Coordination and Implementation

To meet the GI goals of the 2012 Order on Consent, DEP has been identifying Priority CSO Tributary Areas (“Priority Areas”) as shown in Figure 5-1, for GI implementation based on several criteria. DEP looks closely at the annual CSO volume, frequency of CSO events, as well as outfalls that may be affected by WWFPs or other system improvements in the future. DEP also notes outfalls in close proximity to existing and future public access locations. DEP will continue to review and expand the number of Priority Areas to ensure sufficient GI implementation toward the Order milestones.

The identification of Priority Areas enables DEP to focus resources on specific outfall tributary areas, analyze potential opportunities, saturate these areas with GI as much as possible, and to achieve efficiencies in design and construction. This Areawide strategy is made possible by DEP’s standardized designs and procedures which enable systematic implementation of GI. It also provides an opportunity to measure and evaluate the CSO-related benefits of area-wide GI implementation at the outfall level.

DEP utilizes the Areawide strategy for all public property retrofits as well, as described in more detail in the Green Infrastructure Annual Reports. DEP works directly with its partner agencies on retrofit projects at public schools, public housing, parkland, and other city-owned property within the Priority Areas. DEP coordinates on a regular basis with partner agencies to review designs for new projects and to gather current capital plan information to identify opportunities to integrate GI into planned public projects.

In addition to DEP managing its own design and construction contracts through OGI and the Bureau of Engineering Design & Construction (BEDC), the NYC Economic Development Corporation (EDC), Department of Parks and Recreation (DPR), and Department of Design and Construction (DDC) also manage several of these areawide contracts on behalf of DEP.



Figure 5-1. Priority CSO Tributary Areas for GI 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.

As part of the DEP website update in 2013, DEP reorganized and added new content to the GI pages at www.nyc.gov/dep/greeninfrastructure. Users can now easily access more information on the GI Program, including the types of GI practices most often employed, and DEP's research and development program. Users can also view a map of the Priority CSO Tributary Areas to learn if GI is coming to their neighborhood.

DEP also created an educational video on the GI Program. Posted to DEP's YouTube page, the video gives a brief explanation of the environmental challenges caused by combined sewer overflows while featuring GI technologies such as green roofs, rain gardens and permeable pavers. The video is available at DEP's YouTube page.

In order to provide more information about the GI Program, DEP developed an informational brochure that describes the site-selection and construction process for projects in the right-of-way. The brochure also includes frequently asked questions and answers, and explains the co-benefits of GI.

In addition, DEP will distribute door hangers to notify abutting property owners in advance of GI right-of-way construction projects. During construction in each contract area, DEP and its partner agencies will provide construction liaison staff to be present during construction and to distribute the door hangers to the adjacent property owners. The contact information for the construction liaison will be affixed to the door hangers for owners' use if they find a need to alert the City to a problem during construction.

DEP continues to make presentations to elected officials and their staff, community boards, and other civic and environmental organizations about the GI Program, upcoming construction schedules, and final GI locations as an ongoing part of its outreach efforts. DEP's Quarterly Progress Reports posted on the DEP LTCP webpage also report on the community engagement activities that take place on a quarterly basis.

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

The Green Infrastructure Annual Report contains the most up to date information on completed projects and can be found on the DEP website. Reporting on completed projects on a citywide and watershed basis by April 30th is required as part of the report documents, and the reports are posted on DEP's GI website. In addition, Quarterly Progress Reports are posted on the DEP LTCP webpage:

http://www.nyc.gov/html/dep/html/cso_long_term_control_plan/index.shtml

5.3.a Green Infrastructure Demonstration and Pilot Projects

The GI Program applies an adaptive management approach, based on information collected and assessed for demonstration projects and on pilot monitoring results. In particular, accumulated

information will be used to develop a GI performance metrics report by 2016, relating the benefits of CSO reduction to 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). Since 2010, more than thirty pilot GI source controls, or GI installations, have been constructed and monitored as part of the pilot program for GI. These practices include right-of-way GI such as enhanced tree pits, rooftop practices like blue roofs and green roofs, subsurface detention systems with open bottoms for infiltration, porous pavement, and bioretention facilities. 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 Order outlines design, construction, and monitoring milestones for three Neighborhood Demonstration Area Projects (“Demonstration Projects”), which DEP met in 2012 and 2013. DEP has completed construction of GI within a total of 63 acres of tributary area in the Newtown Creek, Hutchinson River and Jamaica Bay CSO tributary areas, and is currently monitoring these practices to study the benefits of GI application on a neighborhood scale and from a variety of techniques. The Demonstration Projects will culminate in the submission of the Post-Construction Monitoring (PCM) report in August 2014. These results will be incorporated into the 2016 Performance Metrics report, which will model the CSO reductions facilitated by GI projects. Pre-construction monitoring for all three Demonstration Projects started in fall 2011, and post-construction monitoring continued throughout 2013.

Construction of ROWBs as part of the Hutchinson River Green Infrastructure Demonstration Area was completed in April 2013 by DPR. There were 22 ROWBs installed within the 24 acre tributary area, and the design and construction costs were approximately \$545,000. In the 23 acre Jamaica Bay Green Infrastructure Demonstration Area, DEP completed 31 right-of-way GI installations in 2012 and the permeable pavement retrofit projects at NYCHA’s Seth Low Houses in 2013. The total design and construction costs were approximately \$1.3M. In the 16 acre Newtown Creek Green Infrastructure Demonstration Area, DEP constructed 19 ROWBs, two rain gardens, and a subsurface storm chamber system on the site of NYCHA’s Hope Gardens Houses. The projects were completed in 2013, and costs were approximately \$1.4M for design and construction. For more information on the Neighborhood Demonstration Areas, see the *2012 Green Infrastructure Annual Report*.

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

See Section 5.2, “Citywide Coordination and Implementation” in the Green Infrastructure Annual Reports for up-to-date information on completed projects.

5.3.c Performance Standard for New Development

DEP’s stormwater performance standard (Stormwater Rule), enables the City to manage stormwater runoff more effectively, and to reduce the rate of runoff into the City’s combined sewer systems from new development or major site expansions. Promulgated in July 2012,³ the Stormwater Rule requires any new house or site connections to the City’s combined sewer system to comply with stricter stormwater release rates, effectively requiring greater onsite detention. DEP’s companion document, Guidelines for the Design and Construction of Stormwater Management Systems,⁴ assists the development community and licensed professionals in the selection, planning, design, and construction of onsite source controls that comply with the Stormwater Rule.

The Stormwater Rule applies to new development or the alteration of an existing development in combined sewer areas of the City. For a new development, the stormwater release rate⁵ is required to be 0.25 cfs or 10 percent of the drainage plan allowable flow, whichever is greater.⁶ If the allowable flow is less than 0.25 cfs, then the stormwater release rate shall be equal to the allowable flow. For alterations, the stormwater release rate for the altered area will be directly proportional to the ratio of the altered area to the total site area, and no new points of discharge are permitted.⁷

5.3.d Other Private Projects (Grant Program)

Green Infrastructure Grant Program

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. The Order requires the Green Infrastructure Grant Program to commit \$3M of Environmental Benefits Program (EBP) funds⁸ to projects by 2015.

All private property owners served by combined sewers in NYC are eligible to apply for a GI grant. Grant funding is provided for the design and construction of projects that will reduce or manage a minimum of one inch of stormwater that falls on the selected properties. If selected, DEP will reimburse up to 100 percent of the design and construction costs for the GI project. Preference is given to projects that are

³ See Chapter 31 of Title 15 of the Rules of the City of New York Governing House/Site Connections to the Sewer System. (New York City, N.Y., Rules, Tit. 15, § 31)

⁴ The Guidelines are available at DEP’s website, at http://www.nyc.gov/html/dep/pdf/green_infrastructure/stormwater_guidelines_2012_final.pdf

⁵ New York City, N.Y., Rules, Tit. 15, § 31-01(b)

⁶ Allowable flow is defined as the storm flow from developments based on existing sewer design criteria that can be released into an existing storm or combined sewer.

⁷ New York City, N.Y., Rules, Tit. 15, § 31-03(a)(2)

⁸ EBP Projects are undertaken by DEP in connection with the settlement of an enforcement action taken by New York State and the New York State Department of Environmental Conservation for violations of New York State law and DEC regulations.

located in priority watersheds, are cost-effective, provide matching funds or other contributions, and include ancillary environmental and community benefits such as increased shade, decreased energy use for cooling buildings, increased awareness about stormwater management, and green jobs development.

See the Green Infrastructure Annual Report for up-to-date information on the Green Infrastructure Grant Program.

Green Roof Tax Abatement

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. Additionally, DEP funded 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.

The tax abatement includes an increase to the value of the abatement from \$4.50 to \$5.23 per square foot, to continue offsetting construction costs by roughly the same value as the original tax abatement. And given that rooftop farms tend to be larger than typical green roofs (generally around one acre in size), the abatement value cap was also increased from \$100,000 to \$200,000 to allow such applicants to receive the full value of the abatement. Finally, based on the amount allocated for this abatement, the total annual amount available for applicants (i.e., in the aggregate) is \$750,000 in the first year, and \$1,000,000 in each subsequent year through March 15, 2018. The aggregate amount of abatements will be allocated by the New York City Department of Finance on a pro rata basis. See the Green Infrastructure Annual Report for up to date information on the Green Roof Tax Abatement.

5.3.e Projected vs. Monitoring Results

Pilot Monitoring Program

As mentioned above, more than 30 pilot GI source controls, or GI installations, have been constructed and monitored as part of the pilot program for GI. 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.

Monitoring efforts focused on the functionality of the GI and their impact on runoff rates and volumes, along with water and soil quality and typical maintenance requirements. Monitoring activities largely

involved remote monitoring equipment that measured water level or flows at a regular interval, supporting analysis of numerous storms throughout at each site.

Monitoring analyses through 2013 demonstrated that all pilot GI types are providing effective stormwater management, particularly for storms with depths of one inch or less. All GI practices have provided benefits for storms greater than one inch, with specific impacts varying based upon location and the type. In many cases, bioretention practices have fully retained the volume of one inch storms they receive.

Monitoring activities will be discontinued at several sites that have multiple years of performance data and have exhibited relatively consistent performance throughout that period. Further monitoring at these locations may be resumed in the future to further examine long-term performance. Monitoring data for these locations is included in the *2012 Pilot Monitoring Report*. In addition, up to date information on the Pilot Monitoring Program can be found in the 2013 Green Infrastructure Annual Report.

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 re-calibrate the IW computer model to the monitored GI 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.

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 the GI Plan have been refined over time to better characterize the retention and detention functions.

As reviewed in the existing system configuration, CSO discharges into Alley Creek emanate from outfall TI-025, the effluent chamber of the Alley Creek CSO Retention Facility. The periodic discharges from this outfall include both CSO and stormwater as both are conveyed to the Alley Creek CSO Retention Facility through chamber 6 and diverted to the tank. Therefore, the future GI opportunities will be evaluated in 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 or 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 Order. It is important to note, however, that a 50 percent application rate would require the construction of GI projects on 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 ROWBs). 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 is 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 include reconnaissance of the salt marshes, the ephemeral, perennial, and tidal stream reaches, and invasive plant extent in the upland forested areas. Issues identified during the field assessment such as dumping, invasive plants, and erosion, 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 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 be focused 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 former 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 incremental citywide GI application rates required by the 2012 on Consent, 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 with a footprint for ongoing GI implementation.

Watershed-specific implementation rates for GI are estimated based on the best available information from modeling efforts. Specific WWFPs, the Sustainable Stormwater Management Plan, the GI 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 GI 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, the characterization of Alley Creek and Little Neck Bay 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 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 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 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.

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 with applicable water quality standards 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 bacteria concentrations within the two waterbodies for a set of baseline conditions, as described in this section. The InfoWorks (IW) 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 bacteria levels and the WQS. A one-year (using average 2008 rainfall) simulation was performed for bacteria and dissolved oxygen (DO). This shorter term continuous simulation served as a basis for evaluation of control alternatives. A 10-year (2002-2011) simulation was performed for bacterias, to assess the baseline conditions, evaluate the performance gap, and analyze the impacts of the final alternative.

This section of the report describes the baseline conditions and the bacteria concentrations calculated by the ERTM water quality model. It further describes the gap between calculated baseline bacteria 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 are 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 provided by DEC to represent future conditions. Specifically, these conditions included the following assumptions:

- The design year was established as 2040
- The Tallman Island WWTP receives peak flows at 2xDDWF
- Grey infrastructure includes those recommended in the 2009 WWFP
- Waterbody specific GI application rates are 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 by comparing the baseline conditions with WQS. In addition, complete removal of CSO was evaluated. Further analyses were conducted for CSO control alternatives in Section 8.0.

The IW model was used to develop stormwater flows, conveyance system flows, and CSO volumes for a defined set of future or 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 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 were 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. On May 8, 2014, DEC and DEP entered into an administrative consent order that includes an enforceable compliance schedule to ensure that DEP maximizes flow to and through the WWTP during wet weather events.
- **Sewer conditions:** The IW model was developed to represent the sewer system on a macro scale that included 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 alternatives 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 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 3.0 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 bacteria water quality at the mouth of Alley Creek in dry weather to assess whether dry weather sewage discharges 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 remaining illegal connections on an as needed basis. Although illicit sources of bacteria were included in the water quality model calibration exercises to accurately simulate the observed ambient bacteria 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 Facility WWOP (BMP #4) is contained within the Tallman Island WWTP WWOP. This Plan establishes procedures for pumping down the Alley Creek CSO Retention Facility 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 the Alley Creek CSO Retention Facility became operational on March 11, 2011. Details of these projects are as follows:

- New 1,475-foot long multi-barrel outfall sewer extending to a new outfall on Alley Creek (TI-025).
- New 5 MG Alley Creek CSO Retention Facility:
 - New diversion chamber (Chamber 6) to direct CSO to the new Alley Creek CSO Retention Facility 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 5.0, the Alley Creek and Little Neck Bay watershed has one of the smallest total CSS impervious areas of all of the LTCP watersheds. DEP estimated that three 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 or separate storm sewer system. These areas are depicted as “Direct Drainage” or “Local Sources” in Figure 2-8 (Section 2.0), 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 was 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 separate stormwater collection systems to the receiving waters. The abovementioned areas are generally outside the Alley Creek and Little Neck Bay watershed, including Oakland Lake, Long Island Express (LIE) Pond 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 volumes for the baseline conditions; it included the Alley Creek CSO Retention Facility, which is operational, and assumed the implementation of three 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 bacteria 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 – Track-down work conducted in 2014 showed no obvious sources of contaminated stormwater being discharge into Oakland Lake or the LIE Pond. Additionally, bacteria samples collected within Oakland Lake and its outlet along with the LIE Pond outlet, showed bacteria concentrations that were well below levels that could be considered typical for such urban waterways. One location where illicit discharges were apparent was TI-024, where DEP did find dry weather flows with fecal coliform concentrations of 50,000/100mL. DEP has initiated a source track-down program for this area and will report to DEC quarterly on the progress made. As such, no illicit discharges are included in the baseline conditions, and 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 bacteria model calibrations, stormwater runoff from DMA was assigned higher than typical stormwater bacteria concentrations, which represented the impact of localized sources. Based on the assumption that improvements will be undertaken to address these localized sources, the additional bacteria 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 bacteria 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

<i>Pollutant Source</i>	<i>Enterococci (cfu/100mL)</i>	<i>Fecal Coliform (cfu/100mL)</i>	<i>BOD₅ (mg/L)</i>
Stormwater	15,000	35,000	15
Alley Creek CSO Retention Facility	Monte Carlo	Monte Carlo	140 ¹
Direct Drainage	15,000	35,000	15
Oakland Lake DW	130	150	15
LIE Pond DW	75	75	0
Note 1 – Sanitary sewage concentration. CSO concentrations calculated using IW model and by mass balance.			

Typical (2008) baseline volumes and loads of CSO, stormwater, direct drainage and localized dry weather sources of pollution to Alley Creek are summarized in Table 6-2. The specific SPDES permitted outfalls associated with these sources were shown in Figure 2-9. Additional tables can be found in Appendix A. The information in these tables is provided for the 2008 rainfall condition. CSO effluent concentrations were assigned based on a Monte Carlo analysis that was conducted to reproduce the range and distribution of the observed Alley Creek CSO Retention Facility fecal coliform and enterococci concentrations. As discussed in Section 2.0, the Alley Creek CSO Retention Facility overflow bacteria concentrations were determined by using the monitored tank concentrations, shown in Figure 2-11, and IW modeled overflow volumes. For 2008, the IW model calculates that a total of 132 MG discharges from the Alley Creek CSO Retention Facility

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

Totals by Source by Waterbody		Volume	Enterococci	Fecal Coliform	BOD
Waterbody	Source	Total Discharge (MG/yr)	Total Org (10¹²)	Total Org (10¹²)	Total Lbs
Alley Creek					
	CSO	132.1	789.3	2,170.9	18,507
	Stormwater*	334.9	189.3	1,023.8	42,873
	Local Sources	1,600	5.9	6.4	0
	Total	2,067	984.5	2,605	61,380
Little Neck Bay					
	CSO	0	0	0	0
	Stormwater*	450	255.5	596.1	64,855
	Local Sources	0	0	0	0
	Total	450	255.5	596.1	64,855

* Includes 47.6 MG/yr direct drainage runoff

6.3 Performance Gap

Concentrations of bacteria 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 bacteria concentrations in the Creek for the baseline conditions, using 2002-2011 data

and DO concentrations using 2008 data. Hourly model calculations were saved for post-processing for comparison with the existing and Future Primary Contact WQ Criteria with 2012 modification (RWQC) WQS as further discussed below in Section 6.3.c. The performance gap was then developed as the difference between the model-calculated baseline waterbody DO and bacteria concentrations and the applicable numerical WQS. Accordingly, the analysis is broken up into three sections:

- Existing WQ Criteria;
- Assessment of Alley Creek compliance with the Primary Contact WQ Criteria (Class SC); and
- Future Primary Contact WQ Criteria (2012 EPA RWQC).

The Existing WQ Criteria include Little Neck Bay as a Class SB waterbody and Alley Creek as a Class I waterbody, with the numeric criteria presented in Table 6-3. The enterococci criterion is applied as a rolling 30-day GM for the six-month recreational period from May 1st – October 31st. Existing conditions also consider DMA Beach as an officially recognized swimming beach; therefore the DOHMH criterion for enterococci is applied using a bathing season from Memorial Day to Labor Day rolling 30-day GM. A summary of the criteria that were applied is shown in Table 6-3.

Table 6-3. Classifications and Criteria Applied for Gap Analysis

Analysis	Numerical Criteria Applied		
	Alley Creek	Little Neck Bay	DMA Beach
Existing WQ Criteria	I (Fecal Monthly GM -2000 cfu/100 mL)	SB (Fecal Monthly GM – 200 cfu/100 mL) SB (Enterococci rolling 30-d recreational season GM - 35 cfu/100 mL)	SB (Fecal Monthly GM - 200 cfu/100 mL) SB (Enterococci rolling 30-d bathing season GM- 35 cfu/100 mL)
Primary Contact WQ Criteria	SC* (Fecal Monthly GM - 200 cfu/100 mL)	Same as above	Same as above
Future Primary Contact WQ Criteria	(Enterococci rolling 30-d recreational season GM – 35 cfu/100 mL+ STV – 130 cfu/100 mL)	(Enterococci rolling recreational season 30-d GM – 35 cfu/100 mL+ STV – 130 cfu/100 mL)	SB (Enterococci rolling bathing season 30-d GM – 35 cfu/100 mL+ STV – 130 cfu/100 mL)

Note: GM = Geometric Mean; STV = 90th Percentile Statistical Threshold Value; NYC DOHMH Bathing Season = Memorial Day to Labor Day; Recreational Season = May 1st to October 31st.

*This water quality criteria is not currently assigned to Alley Creek. For such criteria to take effect, DEC must first adopt the criteria in accordance with rulemaking and environmental review requirements.

** This Future Standard has not yet been proposed by DEC. For such standard to take effect, DEC must first adopt the standard in accordance with rulemaking and environmental review requirements. **In addition, DEC must follow the required regulatory procedures to reclassify Alley Creek from I to SC.**

It should be noted that because Alley Creek is considered a tributary, under the BEACH Act of 2000, the existing enterococci criterion for Class SC does not apply. Also, analyses in this LTCP are performed using the 30-day rolling GM of 35 cfu/100mL and the STV of 130 cfu/100mL for enterococci. In addition, DEC has recently advised DEP that it plans to adopt the 30-d rolling GM for enterococci of 30 cfu/100 ml, with a not to exceed the 90th percentile statistical threshold value (STV) of 110 cfu/100 ml, which is more stringent of the options presented by the 2012 EPA Recommended Recreational Water Quality Criteria.

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

2008 Rainfall Annual Simulation

Typical model results are shown in Figures 6-1 through 6-5, for Alley Creek (Station AC1) and Little Neck Bay (Stations OW2, LN1, DMA, E11), respectively, with 2008 rainfall conditions. As described in Section 2.0, 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 recreational season from May 1st – October 31st GM enterococci criterion. The fecal coliform panel 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. In the enterococci panel of each figure, the instantaneous (black line) and rolling 30-day GM (blue line) enterococci calculated concentrations are presented.

As illustrated by the figures, the modeling results indicate that at Station 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 and enterococci criteria during 2008 conditions with the exception of Station OW2, which is in non-attainment of fecal coliform during February. Non-attainment of the enterococci criterion does not occur during the recreational or bathing seasons under 2008 conditions.

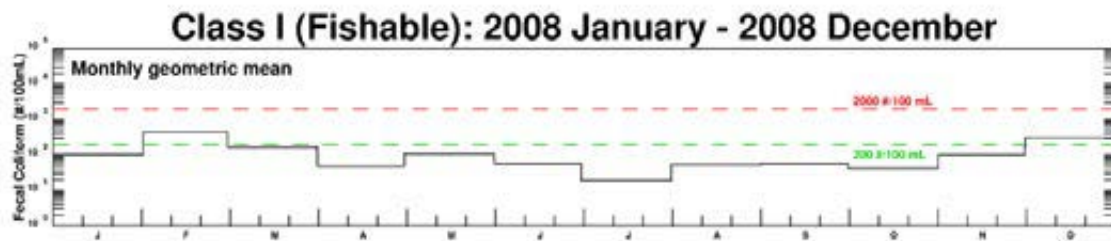


Figure 6-1. Calculated Baseline AC1 Bacteria Concentrations (2008 Rainfall)

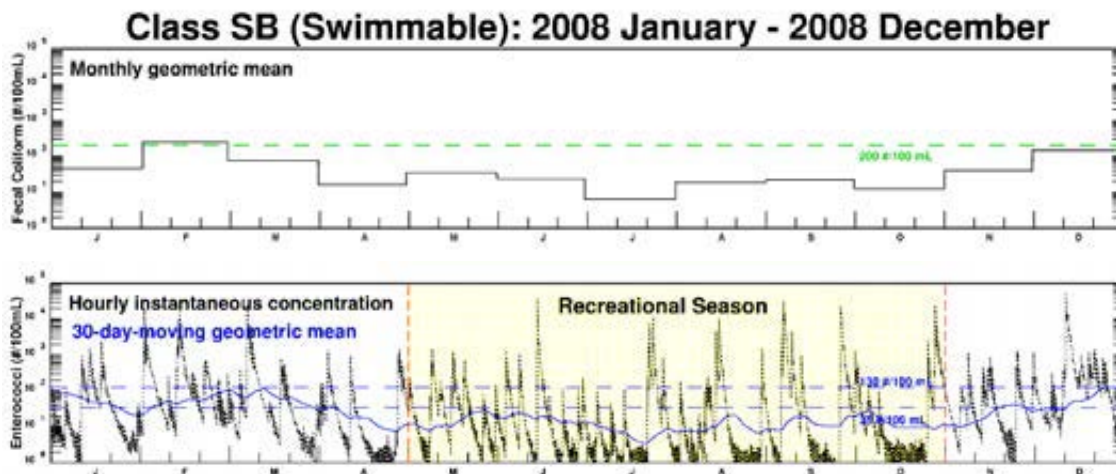


Figure 6-2. Calculated Baseline OW2 Bacteria Concentrations (2008 Rainfall)

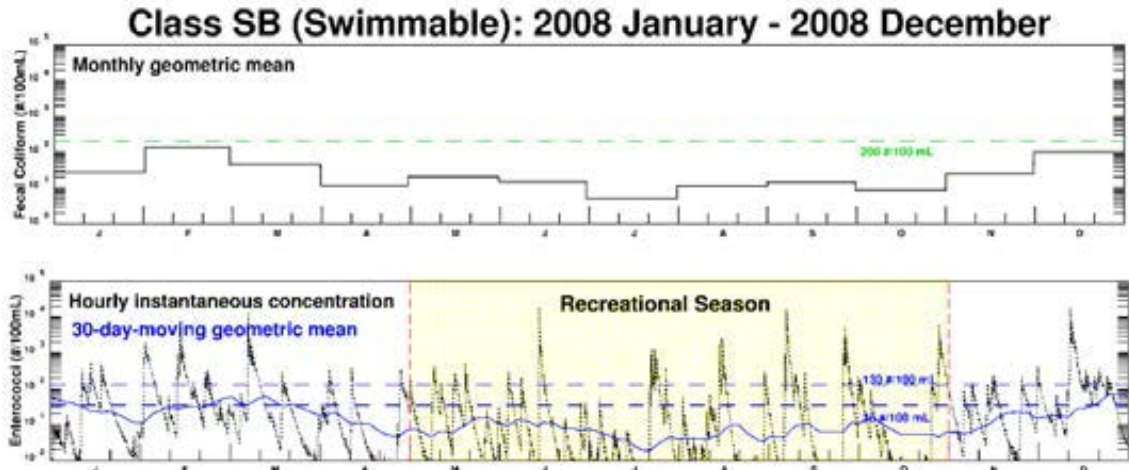


Figure 6-3. Calculated Baseline LN1 Bacteria Concentrations (2008 Rainfall)

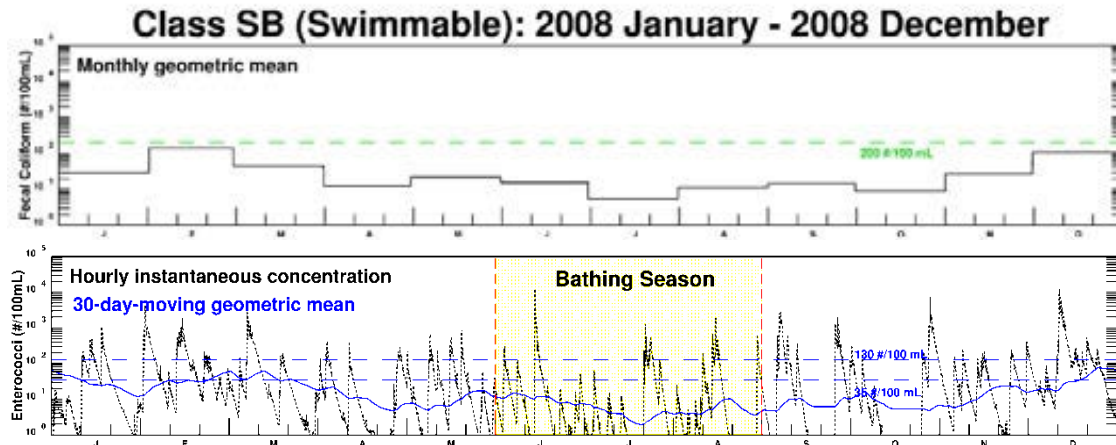


Figure 6-4. Calculated Baseline DMA Bacteria Concentrations (2008 Rainfall)

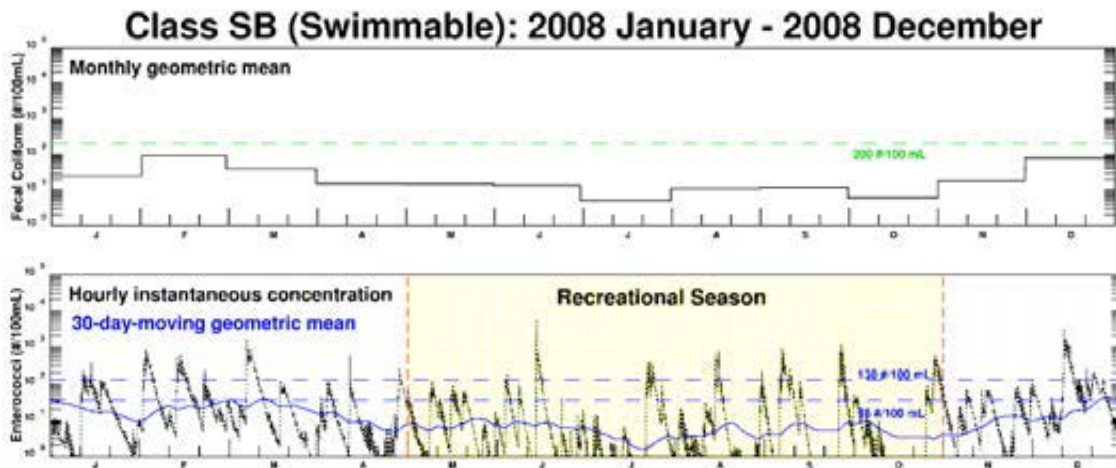


Figure 6-5. Calculated Baseline E11 Bacteria Concentrations (2008 Rainfall)

10-Year Long-Term Simulation

A 10-year baseline simulation of bacteria 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 Figures 6-6 and 6-7 and Tables 6-4 and 6-5. Figure 6-6 shows that the calculated 10-year long-term attainment of the existing fecal coliform criterion under baseline conditions is quite high. Most areas achieve 100 percent attainment, while a small area in lower Little Neck Bay has between 96 and 100 percent attainment of the fecal coliform criterion. Table 6-4 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 2008, 2009 and 2011 for Station OW2, and 2009 for Station LN1, which each have one month of non-attainment.

Modeling indicates that the 10-year percent attainment with the enterococci recreational season rolling 30-day GM criterion is not quite as high as the attainment with the fecal coliform criterion, as shown in Figure 6-7. The majority of Little Neck Bay has greater than 92 percent attainment with the enterococci criterion. The lower portion of Little Neck Bay has attainment ranging from approximately 68 percent to 92 percent. Table 6-5 presents the calculated rolling 30-day recreational period GM for enterococci at each station for the 10-year period, with the exception of DMA, where the bathing season from Memorial Day to Labor Day attainment is presented. The criterion is not applicable at Station AC1, as Alley Creek is an inland waterway. Attainment at all of the stations is quite high with the exception of OW2 where single year attainment is as low as 76 percent.

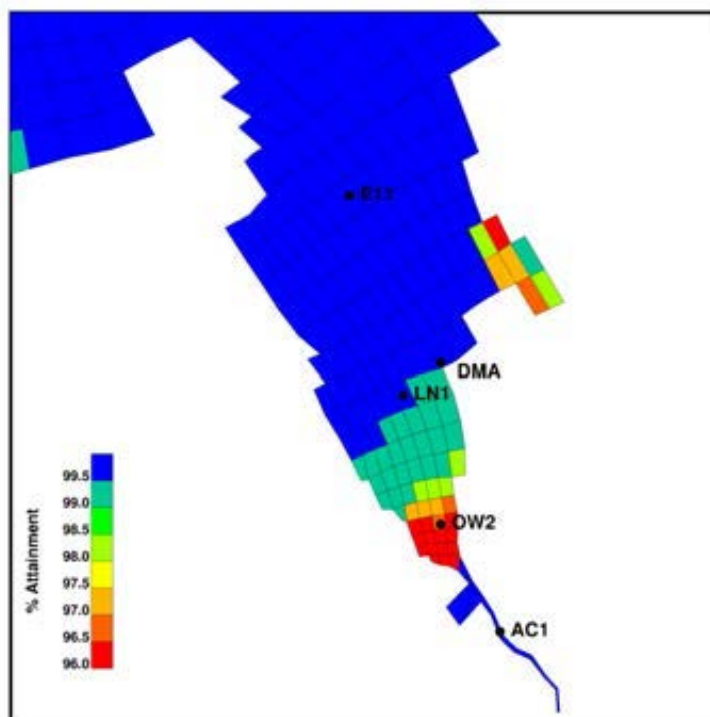


Figure 6-6. 10-Year Attainment of Existing Fecal Coliform Criteria

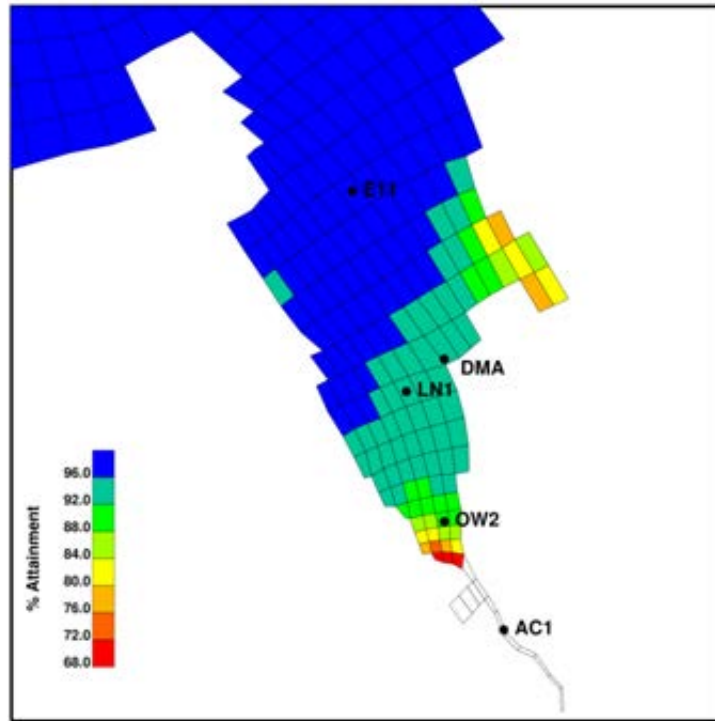


Figure 6-7. 10-Year Attainment of Existing Enterococci Recreational Period Criterion

Table 6-4. Calculated 10-Year Baseline Fecal Coliform* Attainment of Existing Criteria - Percent of Months in Attainment

Station	Projection Year										Percent Attainment	
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
AC1	100	100	100	100	100	100	100	100	100	100	100	100
OW2	100	100	100	100	100	100	92	92	100	92	98	98
LN1	100	100	100	100	100	100	100	92	100	100	99	99
DMA	100	100	100	100	100	100	100	100	100	100	100	100
E11	100	100	100	100	100	100	100	100	100	100	100	100

*Monthly GM of 2000 cfu/100 ml for AC1 and GM of 200 cfu/100 ml for OW2, LN1, E11 and DMA

Table 6-5. Calculated 10-Year Baseline Enterococci* Recreational Period Attainment (Percent)

Station	Projection Year										Percent Attainment	
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
AC1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OW2	98	83	97	96	92	91	100	76	100	76	91	
LN1	100	88	100	97	99	92	100	88	100	85	95	
DMA ⁽¹⁾	100	75	100	100	97	100	100	91	100	89	95	
E11	100	97	100	100	100	95	100	100	100	97	99	

1 - DMA Attainment Percent based on Bathing Season
 *30 day rolling GM of 35 cfu/100 ml

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 6-6. Water quality calculations indicate that the overall attainment with the Class I criterion of 4 mg/L is 98 percent for the year at Station AC1. Under the baseline conditions the calculated DO concentrations tend to be somewhat higher in Little Neck Bay. 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 6-6, annual DO attainment is between 96 and 99 percent, depending on the area of the Bay.

Table 6-6. Model Calculated DO Attainment (2008 Rainfall)

Station	Critical Month Average (mg/L)	Minimum Monthly Attainment (%)	Annual Attainment (%)
AC1	5.1	89	98
OW2	6.3	99	99
LN1	5.6	66	96
E11	6.0	80	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 bacteria and DO using existing criteria.

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

Bacteria

The DEC is required to periodically review whether or not a waterbody can be reclassified to its Primary Contact WQ Criteria. This LTCP assessed the level of attainment for Alley Creek, which is a Class I waterbody, if DEC were to re-classify it to Class SC (limited primary contact recreation).

Model calculations presented in Figure 6-1 show that under the baseline conditions, Station AC1 does not meet the Class SC criterion for fecal coliform for two months during 2008 conditions. Figure 6-8 presents a spatial depiction of the calculated 10-year attainment for Class SC fecal coliform annually (monthly GM

of 200 cfu/100 ml) under baseline conditions. Overall; the attainment of the fecal coliform criterion at Station AC1 is 87 percent for the 10-year period. Table 6-7 presents the annual fecal percent attainment at Station AC1. In all, 15 out of 120 months, or 12.5 percent, do not attain the Class SC fecal coliform criterion.

Because Alley Creek would not meet Class SC criteria under baseline conditions, an analysis was conducted to determine how much of the gap between projected water quality and the Class SC criteria was due to CSO discharges, the focus of the LTCP. Figure 6-9 presents the 10-year attainment of the Class SB/SC fecal coliform criterion with 100 percent CSO control. For the discussion that follows, 100 percent CSO control can be taken as either 100 percent volumetric control or disinfection as both would produce similar levels of bacteria attainment according to the model. The 10-year attainment at Station AC1 would improve from 87 percent to 94 percent under the 100 percent CSO control scenario. Table 6-7 presents the annual fecal percent attainment at Station AC1 during the 10-year assessment period with 100 percent CSO control. Seven months would be in non-attainment of the Class SC criterion for fecal coliform under the 100 percent CSO control scenario conditions - representing an improvement of eight months over 10 years or just less than one month per year. Within Little Neck Bay, the area calculated to be in full attainment with the primary contact standard with 100 percent CSO control would increase by 128 acres (9.5 percent improvement). The majority of the improvement occurred within inner Little Neck Bay.

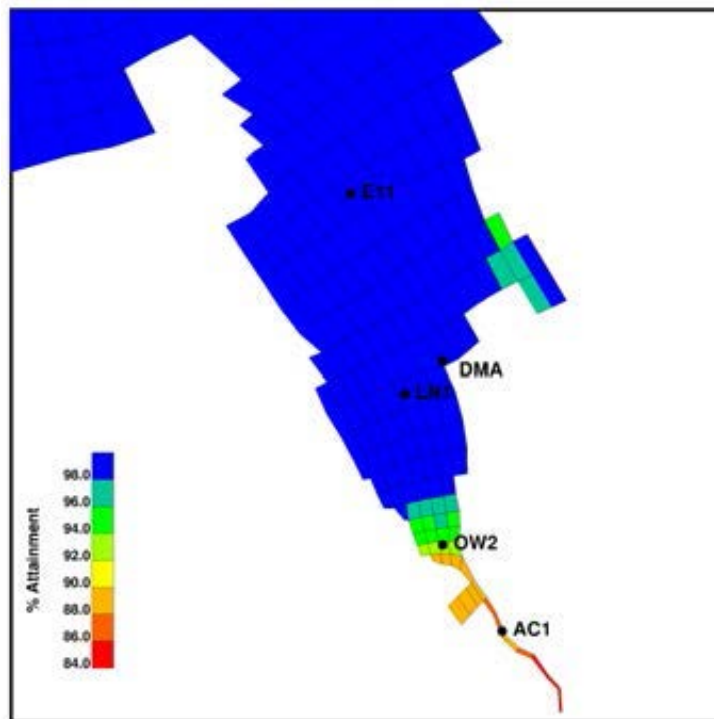


Figure 6-8. 10-Year Attainment of Class SB/SC Fecal Coliform Criterion – Baseline Conditions

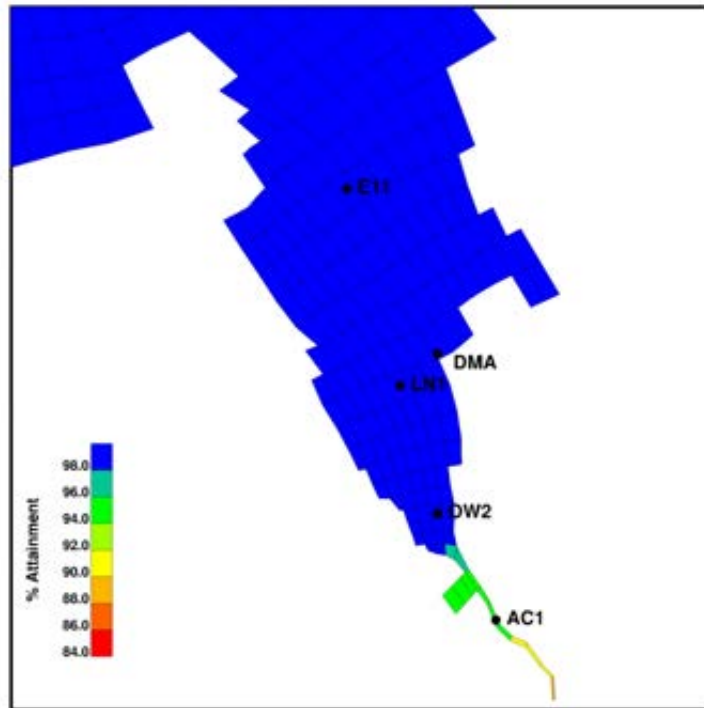


Figure 6-9. 10-Year Attainment of Class SB/SC Fecal Coliform Criterion- 100 Percent CSO Control

Table 6-7. Fecal Coliform Geometric Mean Class SC Attainment Baseline and 100 Percent CSO Control – Station AC1 (10-Year)

Year	Annual Attainment (%)		Recreational Season Attainment (%)	
	Baseline	100% CSO Control	Baseline	100% CSO Control
2002	100	100	100	100
2003	92	100	83	100
2004	100	100	100	100
2005	83	100	83	100
2006	83	92	100	100
2007	83	92	100	100
2008	83	83	100	100
2009	83	83	83	83
2010	83	100	100	100
2011	83	92	83	100
Total	87	94	93	98

The level of attainment of the enterococci criterion when the Alley Creek CSO Retention Facility is 100 percent controlled is presented in Figure 6-10. Overall, the spatial extent of the area with greater than 92 percent attainment in Little Neck Bay is increased. A small section of the southern portion of Little Neck Bay remains with attainment between 80 and 92 percent.

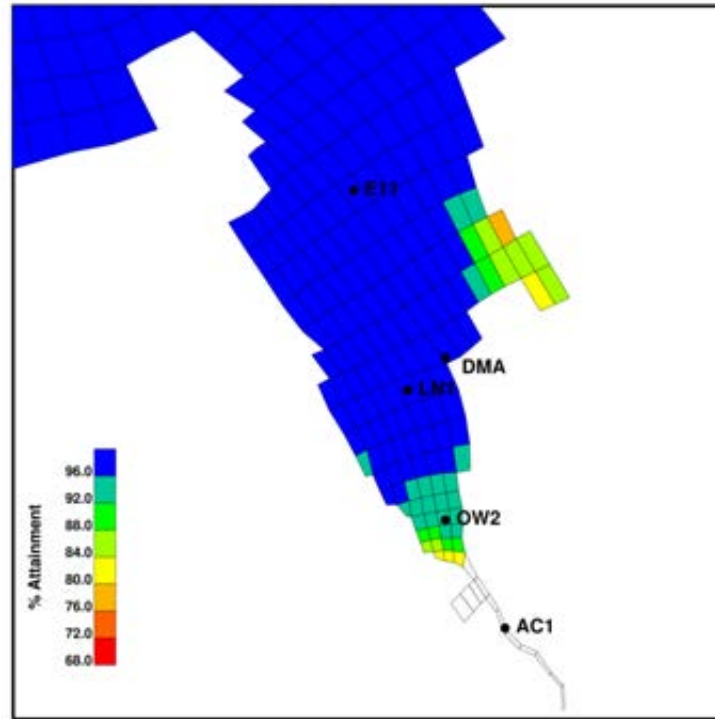


Figure 6-10. 10-Year Attainment with Class SB Recreational Season Enterococci Criterion under the 100 Percent CSO Control

Dissolved Oxygen

Upgrading Alley Creek to Class SC would require that it meet the DO chronic 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, as well as a an acute criterion of never less than 3.0 mg/L. Table 6-8 presents annual attainment with Class SC DO criteria at Station AC1, the location to have the lowest DO concentrations.. Annual attainment of the chronic criteria is reached 95 percent of the time under baseline conditions.

Table 6-8. Model Calculated DO Results for Class SC Criterion at AC1 – Baseline and 100 Percent CSO Control Conditions (10-Year)

Station	Annual Attainment (%)	
	Chronic	Acute
AC1 (Baseline)	95	99
AC1 (100 Percent CSO Control)	96	99

The 100 percent CSO control scenario was evaluated 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. For the discussion that follows, 100 percent CSO control is 100 percent volumetric control. The attainment of the Class SC criteria for DO at Station AC1 with complete CSO control is also presented in Table 6-8. The annual attainment would increase to 96 percent for the chronic criterion.

6.3.c Future Primary Contact WQ Criteria

As noted in Section 2.0, EPA released its Recreational Water Quality Criteria (RWQC) recommendations in December 2012. These included recommendations for recreational water quality criteria for protecting human health in all coastal and non-coastal waters designated for primary contact recreation use. The criteria 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 Future Primary Contact WQ Criteria. As noted earlier, DEC has recently advised DEP that it plans to adopt the 30-d rolling GM for enterococci of 30 cfu/100 ml, with a not to exceed the 90th percentile statistical threshold value (STV) of 110 cfu/100 ml, which is more stringent of the options presented by the 2012 EPA RWQC.

10-Year Long-Term Simulation

Figure 6-11 presents the calculated model results for baseline conditions when compared to the Future Primary Contact WQ Criteria of a rolling 30-day GM of 35 cfu/100mL. The figure shows that the 10-year long term recreational season enterococci percent attainment calculated for the baseline within Little Neck Bay are divided into three areas – one area that is in attainment with the future primary contact enterococci criterion a high percentage of the time (outer Little Neck Bay); another zone (inner Little Neck Bay) where attainment with the criterion is predicted as 91%; and Alley Creek, where very low (53 percent) attainment is achieved. Table 6-9 presents the attainment at the five chosen stations with the Future Primary Contact WQ 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.

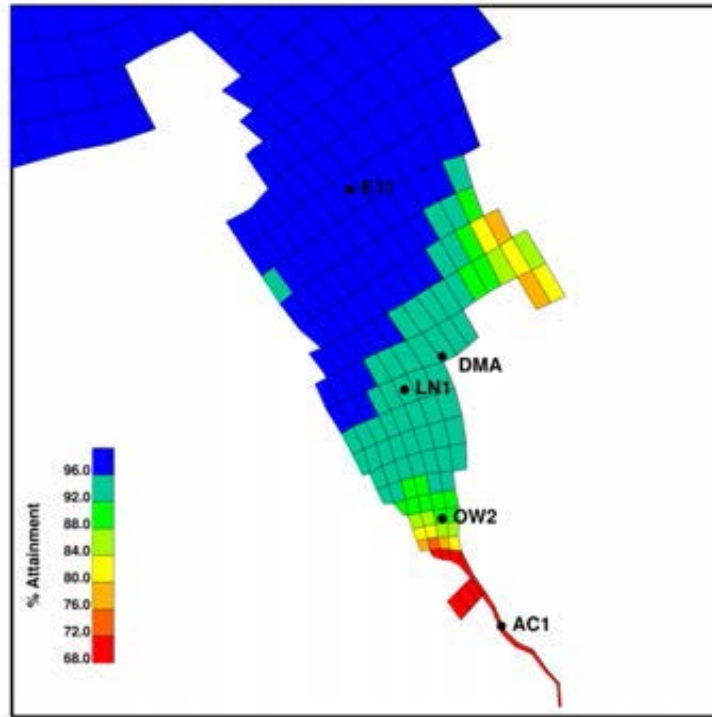


Figure 6-11. Enterococci Recreation Season Attainment (10-Yr Simulation) with 30-day Rolling Geometric Mean of 35 cfu/100mL

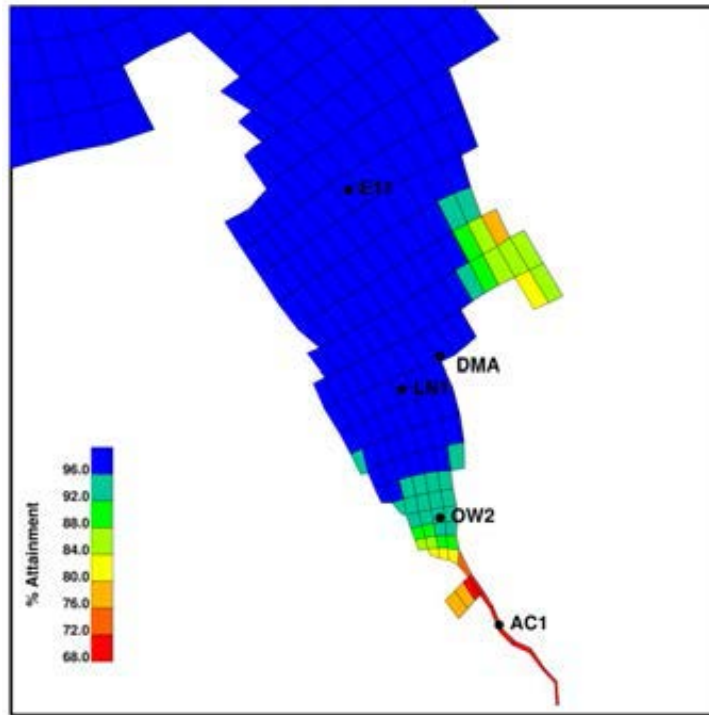


Figure 6-12. Enterococci Recreation Season Attainment (10-Yr Simulation) with 30-day Rolling Geometric Mean of 35 cfu/100mL with 100 Percent CSO Control

Table 6-9. Recreational Season Attainment (10-Year) with Future Primary Contact WQ Criteria

Station	Enterococci Percent Attainment							
	Baseline				100% CSO Control*			
	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	53	44	9	7	64	54	10	8
OW2	91	87	25	22	95	93	31	26
LN1	95	94	51	43	99	97	73	60
E11	99	98	75	69	100	99	85	80
DMA	95	93	49	40	99	97	69	58

*Approximately equivalent to disinfection

Figure 6-12 presents the 10-year recreational season attainment of the future enterococci criterion for the 100 percent CSO control. Minor improvements are calculated over the baseline condition. Table 6-9 also presents the attainment of future enterococci criteria for the 100 percent CSO control scenario. Some improvement is calculated nearest the Alley Creek CSO Retention Facility at Stations AC1 and OW2, on the order of 11 percent; lower levels of improvement are predicted at Stations LN1 and DMA. Overall, the 90th percent STV criterion attainment is still low, with only nine percent annual attainment calculated at Station AC1. During the bathing season from Memorial Day to Labor Day, the model predicts DMA Beach would attain the primary contact SB enterococci criterion 99 percent of the time, however STV attainment would be only 69 percent.

6.3.d CSO Volumes and Loadings Needed to Attain Future Primary Contact WQ Criteria

These analyses indicate that complete control of CSOs alone will not close the gap between the predicted baseline enterococci concentrations and the future primary contact criteria 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 fecal coliform and enterococci concentrations in Alley Creek and Little Neck Bay. The source types include the East River at the mouth of Little Neck Bay, local source inputs (Oakland Lake and LIE Pond), Nassau County stormwater, NYC stormwater, and CSOs. The analysis was completed at Stations AC1, OW2, LN1, E11 and DMA using the ERTM model. The analysis for fecal coliform included annual GM, the maximum winter month (February) GM, and the maximum summer month (June) GM. The results of the fecal coliform component analysis are presented in Table 6-10. The analysis for enterococci included the calculation of enterococci GMs for the maximum 30-day period during the year and the maximum 30-day period during the bathing season from Memorial Day to Labor Day, as well as the 90th percentile STV values during these periods. 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 partial results of the enterococci component analysis are presented in Table 6-11. A full table of enterococci results is included in Appendix A.

The fecal component analysis shows that both Stations AC1 and OW2 would not be in attainment of the Class SB/SC criterion for the maximum winter month condition. In both cases, CSO contribute approximately one-third of the total GM. In the case of Station AC1, stormwater from direct drainage runoff and stormwater outfalls contributes enough fecal coliform to cause non-attainment of the criterion.

Table 6-10. Fecal Coliform GM Source Components

Source	Station	Fecal Coliform Contribution, cfu/100mL		
		Annual GM	Maximum Winter Month	Maximum Summer Month
East River	AC1	2	6	-
Local Sources	AC1	14	20	12
Nassau County Stormwater	AC1	2	6	-
NYC Stormwater	AC1	79	269	46
CSO	AC1	14	156	6
Total	AC1	111	457	66
East River	OW2	3	13	2
Local Sources	OW2	-	4	-
Nassau County Stormwater	OW2	3	13	-
NYC Stormwater	OW2	23	116	15
CSO	OW2	6	83	4
Total	OW2	36	229	23
East River	LN1	4	20	3
Local Sources	LN1	0	0	0
Nassau County Stormwater	LN1	4	22	2
NYC Stormwater	LN1	9	50	6
CSO	LN1	3	36	2
Total	LN1	20	128	13
East River	E11	10	45	6
Local Sources	E11	0	0	0
Nassau County Stormwater	E11	3	16	3
NYC Stormwater	E11	3	15	2
CSO	E11	-	9	-
Total	E11	17	85	12
East River	DMA	4	22	3
Local Sources	DMA	0	0	0
Nassau County Stormwater	DMA	6	27	3
NYC Stormwater	DMA	8	45	6
CSO	DMA	3	35	-
Total	DMA	21	128	13

The assessment of the enterococci GM components on an annual and bathing season (Memorial Day to Labor Day) basis does not have regulatory implications, but it is instructive in showing the relative contribution of the various sources to the GM during these periods. **The component assessment indicates that NYC stormwater is the largest contributor to the enterococci GM, followed by the CSO.** The CSO source contributes on the order of 20 percent to the enterococci GM during these periods. This

result is because stormwater is discharged during each rain event and the CSO discharges only once or twice per month. The use of the GM gives more weight to sources that discharge more frequently (e. g. stormwater) than those that discharge less frequently.

Table 6-11. Enterococci GM Source Components

Source	Station	Enterococci Contribution, cfu/100mL	
		Annual 30-day Max. GM	Bathing Season 30-day Max. GM
East River	AC1	4	1
Local Sources	AC1	18	11
Nassau County Stormwater	AC1	4	2
NYC Stormwater	AC1	254	43
CSO	AC1	53	14 ¹
Total	AC1	332	73
East River	OW2	6	2
Local Sources	OW2	4	1
Nassau County Stormwater	OW2	8	4
NYC Stormwater	OW2	86	9
CSO	OW2	25	6 ¹
Total	OW2	129	22
East River	LN1	8	2
Local Sources	LN1	1	0
Nassau County Stormwater	LN1	15	6
NYC Stormwater	LN1	36	0
CSO	LN1	11	2 ¹
Total	LN1	71	10
East River	E11	18	4
Local Sources	E11	0	0
Nassau County Stormwater	E11	12	3
NYC Stormwater	E11	9	0
CSO	E11	3	1 ¹
Total	E11	41	8
East River	DMA	9	2
Local Sources	DMA	1	0
Nassau County Stormwater	DMA	20	7
NYC Stormwater	DMA	36	0
CSO	DMA	12	1 ¹
Total	DMA	76	10

Note: 1 – not including CSO seasonal disinfection

CSO Contribution to Non-Attainment

Table 6-11 presents the calculated enterococci concentrations for all sources including CSOs. CSOs at all locations except within Alley Creek (AC1), are calculated for the annual and recreational season 30-day GMs to be less than the 2012 RWQC modification criterion of a GM of 35 cfu/100mL for the baseline conditions.

Further reductions in enterococci bacteria will only result from programs that focus on stormwater, if those programs could effectively reduce stormwater sources during the periods during which the maximum GMs are calculated to occur. As those sources are not part of this CSO LTCP with respect to the development of control measures, the alternatives that are the focus of the following sections of this report focus on reduction of the remaining CSOs discharges to Alley Creek and Little Neck Bay.

From NYS DOH

https://www.health.ny.gov/regulations/nycrr/title_10/part_6/subpart_6-2.htm

Operation and Supervision

6-2.15 Water quality monitoring

(a) No bathing beach shall be maintained ... to constitute a potential hazard to health if used for bathing. To determine if the water quality constitutes a potential hazard ... shall consider one or a combination of any of the following items: results of a sanitary survey; historical water quality model for rainfall and other factors; verified spill or discharge of contaminants affecting the bathing area; and water quality indicator levels specified in this section.

(1) Based on a single sample, the upper value for the density of bacteria shall be: (i) 1,000 fecal coliform bacteria per 100 ml; or ... (iii) 104 enterococci per 100 ml for marine water;

6.3.e Time to Recover

Another analysis that consisted of examining the calculated hourly fecal coliform and enterococci water quality model simulation results was performed to gain additional insight with respect to the impacts of CSO and MS4 stormwater on Alley Creek and Little Neck Bay water quality. Analyses provided above examine the longer term impacts of wet weather sources, as required by existing and proposed bacteria criterion (monthly GM and 30-day GM). Shorter term impacts are not brought out through these regulatory measures. To gain insight to the shorter term impacts of wet weather sources of bacteria, DEP has reviewed the New York State Department of Health guidelines relative to single sample maximum bacteria concentrations that they believe "constitute a potential hazard to health if used for bathing". The presumption being that if the bacteria concentrations are lower than these levels, then the water bodies do not pose potential hazardous if primary contact is practiced.

Basically fecal coliform concentrations that exceed 1,000 cfu/100mL and or enterococci concentrations exceeding 104 cfu/100mL are considered potential hazards by the State Department of Health and should be avoided. Water quality modeling analyses were conducted herein to assess

the amount time following the end of rainfall required for the outer portion of Alley Creek and Little Neck Bay to recover and return to concentrations less than 1,000 cfu/100 mL fecal coliform and 130 cfu/100mL enterococci. The value 130 was used instead of 104 as recent EPA guidance indicates that the 104 value will no longer be relevant.

The analyses performed consisted of examining the water quality model calculation for Alley Creek and Little Neck Bay bacteria concentrations for recreation periods (May 1st to October 31st) abstracted from 10-years of model simulations. The time it takes for wet weather elevated bacteria concentrations to return to 1,000 or 130 was then calculated for each storm with the various size categories and the median time after the end of rainfall was then calculated for each rainfall category.

The process began with an analysis of the LGA rainfall data for the period of 2002-2011. The SYNOP model was used to identify each individual storm and calculate the storm volume, duration and start and end times. Rainfall periods separated by four hours or more were considered separate storms. Statistical analysis of the individual rainfall events for the recreational seasons of the 10-year period calculated the 90th percentile rainfall event to be 1.09 in.

The rainfall event data was then compared against water quality model bacteria results for the 10 recreational periods to determine how long it took for the water column concentration to return to target threshold concentrations from the end of the rain event. Since the system is tidal, care was taken to capture the last time the concentration returned to the target threshold after each rain event. To be conservative, the hour in which the concentration reached the target threshold concentration was included, so the minimum time to recover is one hour. The chosen target threshold concentrations were 1,000 cfu/100mL for fecal coliform, and 130 cfu/100mL for enterococci. The various rainfall events were then placed into rain event size “bins” ranging from less than 0.1 in. to greater than 1.5 in., as shown in Table 6-12. Only rain events that reached the target threshold concentrations before the beginning of the next storm were included. The median time to recover for each bin at each water quality station was calculated. The results for the baseline and 100 percent CSO control scenarios are shown in Table 6-12.

The smaller rain event size bins show no difference between the baseline and 100 percent CSO control scenarios. This is because the existing Alley Creek CSO Retention Facility captures these smaller storms. The 1.0 to 1.5 in. rainfall bin is considered the key bin because it includes the 90th percentile rain event. At Station AC1, the time to recover to the fecal coliform target threshold in the 1.0 to 1.5 in. bin is 20 hours under baseline conditions. Complete CSO control reduces this time to 12 hours. The 1.0 to 1.5 in. bin time to recover at Station AC1 for the enterococci target threshold is 45 hours for the baseline conditions, and is reduced to 31 hours for 100 percent CSO control. The times to recover are progressively shorter with distance from Alley Creek to where the time to recover is the minimum one hour at Station E11 for the 1.0 to 1.5 in. bin.

Table 6-12. Time to Recover

Rain Event Size (in)	Station	Time to Recover (hours)			
		Fecal Coliform Threshold (1000 cfu/100mL)		Enterococci Threshold (130 cfu/100mL)	
		Baseline	100% CSO Control	Baseline	100% CSO Control
<0.1	AC1	-	-	-	-
0.1-0.4	AC1	5	5	10	10
0.4-0.8	AC1	8	8	21	21
0.8-1.0	AC1	18	12	33	26
1.0-1.5	AC1	20	12	45	31
>1.5	AC1	29	14	49	31*
<0.1	OW2	-	-	-	-
0.1-0.4	OW2	-	-	-	-
0.4-0.8	OW2	4	4	11	11
0.8-1.0	OW2	9	5	25	16
1.0-1.5	OW2	17	7	33	27
>1.5	OW2	29	12	46	29

CSO Long Term Control Plan II
Long Term Control Plan
Alley Creek and Little Neck Bay

Rain Event Size (in)	Station	Time to Recover (hours)			
		Fecal Coliform Threshold (1000 cfu/100mL)		Enterococci Threshold (130 cfu/100mL)	
		Baseline	100% CSO Control	Baseline	100% CSO Control
<0.1	LN1	-	-	-	-
0.1-0.4	LN1	-	-	-	-
0.4-0.8	LN1	-	-	-	-
0.8-1.0	LN1	-	-	-	-
1.0-1.5	LN1	2	-	7	7
>1.5	LN1	16	3	40	19
<0.1	E11	-	-	-	-
0.1-0.4	E11	-	-	-	-
0.4-0.8	E11	-	-	-	-
0.8-1.0	E11	-	-	-	-
1.0-1.5	E11	-	-	-	-
>1.5	E11	2	-	18	5
<0.1	DMA	-	-	-	-
0.1-0.4	DMA	-	-	-	-
0.4-0.8	DMA	-	-	-	-
0.8-1.0	DMA	-	-	2	2
1.0-1.5	DMA	-	-	4	4
>1.5	DMA	15	-	39	16

* - In one case the time to recover for the > 1.5 in. bin was greater than the 1.0 – 1.5 in. bin, so the time to recover was set equal to the time to recover of the 1.0 to 1.5 in. bin.