



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

Combined Sewer Overflow Long Term Control Plan for Gowanus Canal

Appendix C: Supplemental Documentation September 2015

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Department of Environmental Protection
Bureau of Wastewater Treatment**

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1. INTRODUCTION

1. Purpose

This Supplemental Documentation contains the New York City Department of Environmental Protection's (DEP's) responses to the New York State Department of Environmental Conservation's (DEC's) comment letter, dated August 5, 2015, on DEP's June 2015 Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP) for the Gowanus Canal. This Supplemental Documentation is now made part of the referenced LTCP as Appendix C.

As so supplemented, the LTCP sets forth DEP's plans for managing CSO discharges into the Gowanus Canal and its findings and recommendations to further improve water quality in the Canal.

2. Format

The document has been divided into sections including General Comments, Executive Summary, and the various sections of the LTCP on which DEC comments were received.

In addition to responses to specific comments, this document also includes: a revised Executive Summary as Attachment 1. Collectively, the Supplemental Documentation and attachments, plus the original June 2015 submittal, constitute the overall revised Gowanus Canal LTCP.

2. RESPONSE TO COMMENTS

DEC COMMENT No. 1:

Dissolved Oxygen Standards. In various sections of the LTCP, such as on pg. ES-13 and in Table ES-6, the City incorrectly refers to the Class I/SC dissolved oxygen standards as “primary contact recreation” standards. The D.O. standards are not related to the contact recreation, they are associated with the supporting aquatic species, either for survival or propagation, and may include single “never less than” standards or acute and chronic standards. As such, any references to dissolved oxygen standards should be revised to clarify they are not related to contact recreation.

DEP Response:

The table below outlines the proposed revisions associated with references to the Dissolved Oxygen standards.

Type	Language
Executive Summary Page ES-2, ES-3	The bacteria criteria assessed in this LTCP include Existing WQ Criteria (Class SD and I for the Gowanus Canal). Also assessed is the attainment of Primary Contact WQ Criteria and Potential Future Primary Contact WQ Criteria. Therefore, water quality assessments associated with current Primary Contact WQ Criteria within the Gowanus Canal considered fecal coliform and dissolved oxygen (DO) eriteria exclusively (Table ES-1). <u>Additionally, dissolved oxygen (DO) attainment was evaluated for designated and next higher use classifications.</u> As described above, the 2012 EPA RWQC recommended certain changes to the bacteria water quality criteria for primary contact. Although not currently applicable to this waterbody, the Gowanus Canal LTCP includes attainment analyses of the 2012 EPA RWQC (referred to hereinafter as the “Potential Future Primary Contact WQ Criteria”).
Executive Summary Page ES-14	The DO attainment levels were met for the Existing WQ Criteria as shown in Table ES-5. As shown in Table ES-6, the Primary-Contact Class SC/SB WQ Criteria for the 2008 baseline simulation are met at all locations except Stations GC-6 and GC-8 where the attainment levels are 94 percent and 87 percent, respectively.
Executive Summary Page ES-15	Potential Future Primary Contact WQ Criteria are essentially met both annually and for the recreational season (May 1 st through October 31 st). WQS attainment does not meet or exceed 95 percent at four stations in which the STV component of the Potential Future WQ Criteria ranges from 91 to 93 percent and two others, at which the chronic standard of the primary-contact Class SC/SB DO criteria ranges between <u>87</u> and <u>94</u> percent.

<p>Executive Summary Page ES-20</p>	<p>The 2008 simulation for DO is presented below in Table ES-13. It shows the DO water quality criteria are met for the Existing WQ Criteria and Primary Contact WQ Class SC/SB DO Criteria, except at two water quality stations in which the chronic standard of the Primary Contact WQ Class SC/SB DO Criteria ranges from 87 to 94 percent. In summary, the 10 year simulation shows the Gowanus Canal is meeting Existing WQ Criteria and will meet bacteria Primary Contact WQ Criteria. DO water quality criteria are met except at two water quality stations in which the chronic standard of the Primary Contact WQ Class SC/SB DO Criteria ranges from 87 to 94 percent. Additional improvements CSO reductions would have little or no impact on projected attainment of water quality criteria.</p>
<p>Executive Summary Page ES-22</p>	<p>The analyses contained in this LTCP demonstrate that the Gowanus Canal is projected to fully attain the existing bBacterial Primary Contact WQ Criteria. DO levels largely comply with the primary contact-Class SC/SB standards except at Stations GC-6 and GC-8 at which attainment with the chronic standard ranges from 87 to 94 percent. As a result, a UAA is not required.</p>
<p>Executive Summary Page ES-26</p>	<p>Table ES-21 compares compliance with the water quality classifications for the 2008 and 10 year model simulation for the Existing WQ Criteria, Primary Contact WQ Criteria for bacteria, next higher use Class SC/SB Criteria for DO, and the Potential Primary Contact WQ Criteria for bacteria achieved by Alternatives 1, 2 and 3.</p>
<p>Section 6 Page 6-1</p>	<p>Continuous water quality simulations were performed to evaluate the gap between calculated baseline bacteria and DO levels and for the Existing Water Quality Standards and next higher use classifications including Class I and Class SC/SB .both the Existing WQ Criteria and Potential Future Primary Contact WQ Criteria. As detailed below, a one-year (using average 2008 rainfall) simulation was performed for bacteria and DO. This simulation served as a basis for evaluating the control alternatives presented in Section 8.</p>
<p>Section 6 Page 6-8</p>	<p>Hourly model calculations were saved for post-processing and comparison with the Existing WQ Criteria, Primary Contact Criteria, Class I, Class SC/SB and Potential Future Primary Contact WQ Criteria for bacteria and DO. As discussed 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 versus 100% CSO reduction. The analysis is developed to address the following three sets of criteria:</p> <ul style="list-style-type: none"> • Existing WQ Criteria (Upstream of Hamilton Ave – Class SD, Downstream of Hamilton Ave – Class I); • Bacteria Primary Contact WQ Criteria and DO next higher use classifications; and • Bacteria Potential Future Primary Contact Recreational WQ

	Criteria (EPA RWQC, 2012).
Section 6 Page 6-12	The calculated attainment results for the Primary Contact WQ Class SC/SB DO Criteria are presented in Table 6-9 for the 2008 baseline conditions. Greater than 98 percent attainment is calculated for the acute portion of the Primary Contact WQ Class SC/SB DO Criteria. For the chronic portion of the Primary Contact WQ Class SC/SB DO Criteria, the calculated attainment is greater than 95 percent for eight out of ten stations, with two stations having calculated attainment of 94 percent and 87 percent, respectively. A gap analysis was performed to determine the effect of 100% CSO controls on attainment of the chronic portion of the Primary Contact WQ Class SC/SB DO Criteria. Gap analysis results are presented in Table 6-9. Calculations indicate that 100% CSO controls would result in greater than 99 percent attainment for the acute portion of the Primary Contact WQ Class SC/SB DO Criteria as compared to 98 percent attainment for baseline conditions. This gap analysis shows a small improvement in DO concentrations with 100% removal of the Gowanus Canal CSOs. Calculations indicate that 100% CSO controls would result in greater than 95 percent attainment for the chronic portion of the Primary Contact WQ Class SC/SB DO Criteria at nine stations as compared to eight stations for baseline conditions. Calculations indicate that attainment for the chronic portion of Primary Contact WQ Class SC/SB DO Criteria at the worst station with 100% CSO controls would be 89 percent as compared to 87 percent for baseline conditions.
Section 8 Page 8-50	The data reflected in these tables demonstrates that, with the exception of the primary contact Class SC/SB chronic standard for DO, whose attainment level ranges from 87 percent to 94 percent at two of the water quality stations, full compliance with existing <u>bacteria and DO standards</u> and Primary Contact WQ Criteria <u>for bacteria</u> is achieved.
Section 8 Page 8-53	DEP will implement additional CSO controls as are required in the EPA ROD, which will result in further reductions in CSO overflows. These additional CSO controls will <u>slightly</u> improve the level of compliance with primary contact Class SC/SB DO WQS as described later in this section.
Section 8 Page 8-54	Because the analyses developed herein indicate that the Gowanus Canal is projected to fully attain primary contact bacteria water quality criteria, fully attain the Existing DO Criteria and largely attain the primary contact Class SC/SB DO criteria, a UAA is not required under the 2012 CSO Order on Consent.

Table ES-1. Classifications and Standards Applied

Analysis	Numerical Criteria Applied	
Existing WQ Criteria Fish Survival (Class SD) and Boating/Fishing (Class I)	Gowanus Canal Above Hamilton Ave (Class SD)	Fecal - None; DO never < 3.0 mg/L
	Gowanus Bay Below Hamilton Ave (Class I)	Fecal Monthly GM ≤ 2,000 DO never < 4.0 mg/L
<u>Bacteria</u> Primary Contact WQ Criteria ⁽¹⁾ / <u>DO Class</u> <u>SC/SB</u>	Saline Water	Fecal Monthly GM ≤ 200 Daily Average DO ≥ 4.8 mg/L ⁽³⁾ DO never < 3.0 mg/L
Potential Future Primary Contact WQ Criteria ⁽²⁾	Enterococci: rolling 30-d GM – 30 cfu/100mL Enterococci: STV – 110 cfu/100mL	

Notes:

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

- (1) This water quality standard is not currently assigned to the Gowanus Canal or Gowanus Bay.
- (2) The Potential Future Primary Contact WQ Criteria have not yet been adopted by DEC.
- (3) The daily average DO concentration may fall below 4.8 mg/L for a limited number of days [in accordance with NYSDEC TOGs 1.1.6. See Section 2 for the equation and calculation description.](#)

**Table ES-6. Model Calculated DO Attainment for
Primary Contact Class SC/SB WQ Criteria (2008)**

Station	Annual Attainment Percent Attainment			
	Baseline		100% Gowanus CSO Control	
	Chronic ⁽¹⁾	Acute ⁽²⁾	Chronic ⁽¹⁾	Acute ⁽²⁾
GC-1	100	100	100	100
GC-2	100	100	100	100
GC-3	100	100	100	100
GC-4	100	100	100	100
GC-5	100	100	100	100
GC-6	94	98	95	99
GC-7	95	99	96	100
GC-8	87	100	89	100
GC-9	99	100	100	100
GC-10	100	100	100	100

Notes:

- (1) ~~24-hr~~ Daily Average DO ≥ 4.8 mg/L with allowable excursions to ≥ 3.0 mg/L for certain periods of time [in accordance with NYSDEC TOGs 1.1.6.](#)
- (2) Acute Criteria: DO ≥ 3.0 mg/L.

Table ES-13. Calculated 2008 DO Attainment Baseline Conditions - Annual

Station	Existing WQ Criteria		Primary Contact Class SC/SB WQ Criteria			
	Criterion	Attainment (%)	Criterion ⁽¹⁾	Attainment (%)	Criterion ⁽²⁾	Attainment (%)
GC-1	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-2	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-3	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-4	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-5	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-6	≥3.0 mg/L	100 <u>98</u>	≥4.8 mg/L	94	≥3.0 mg/L	98
GC-7	≥3.0 mg/L	100 <u>99</u>	≥4.8 mg/L	95	≥3.0 mg/L	99
GC-8	≥4.0 mg/L	100 <u>95</u>	≥4.8 mg/L	87	≥3.0 mg/L	100
GC-9	≥4.0 mg/L	100	≥4.8 mg/L	99	≥3.0 mg/L	100
GC-10	≥4.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100

Notes:

- (1) Chronic standard.
- (2) Acute standard.

**Table ES-21. Alternatives 1, 2 and 3 – Compliance with Classifications and Standards
 - 2008 Model Simulation for Alternative 1 and 10 Year Model Simulations
 for Alternatives 2 and 3**

Analysis	Numerical Criteria Applied		Compliance
Existing WQ Criteria Fish Survival (Class SD) and Boating/Fishing (Class I)	Gowanus Canal Above Hamilton Ave (Class SD)	Fecal - None	Yes
		DO never < 3.0 mg/L ⁽⁴⁾	Yes
	Gowanus Bay Below Hamilton Ave (Class I)	Fecal Monthly GM ≤ 2,000	Yes
		DO never < 4.0 mg/L ⁽⁴⁾	Yes
<u>Bacteria</u> Primary Contact WQ Criteria ⁽¹⁾ / <u>DO Class</u> <u>SC/SB</u>	Saline Water	Fecal Monthly GM ≤ 200	Yes
		Daily Average DO ≥ 4.8 mg/L ^(3,4)	No ⁽⁵⁾
		DO never < 3.0 mg/L ⁽⁴⁾	Yes
Potential Future Primary Contact WQ Criteria ⁽²⁾	Enterococci: rolling 30-d GM – 30 cfu/100mL		Yes
	Enterococci: STV – 110 cfu/100mL		No

Notes:

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

- (1) This water quality standard is not currently assigned to the Gowanus Canal or Gowanus Bay.
- (2) The Potential Future Primary Contact WQ Criteria have not yet been adopted by DEC.
- (3) The daily average DO concentration may fall below 4.8 mg/L for a limited number of days in accordance with NYSDEC TOGs 1.1.6. See Section 2 for the equation and calculation description.
- (4) DO based on 2008 typical year model simulations.
- (5) DO Attainment is 88 percent at Station GC-8.

Table 6-4. Classifications and Standards Applied

Analysis	Numerical Criteria Applied	
Existing WQ Criteria Fish Survival (Class SD) and Boating/Fishing (Class I)	Gowanus Canal Above Hamilton Ave (Class SD)	Fecal - None; DO never < 3.0 mg/L
	Gowanus Bay Below Hamilton Ave (Class I)	Fecal Monthly GM ≤ 2,000 DO never < 4.0 mg/L
Bacteria Primary Contact WQ Criteria ⁽¹⁾ / DO Class SC/SB	Saline Water	Fecal Monthly GM ≤ 200 Daily Average DO ≥ 4.8 mg/L ⁽³⁾ DO never < 3.0 mg/L
Potential Future Primary Contact WQ Criteria ⁽²⁾	Enterococci: rolling 30-d GM – 30 cfu/100mL Enterococci: STV – 110 cfu/100mL	

Notes:

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

(1) This water quality standard is not currently assigned to the Gowanus Canal or Gowanus Bay.

(2) The Potential Future Primary Contact WQ Criteria have not yet been adopted by DEC.

(3) The daily average DO concentration may fall below 4.8 mg/L for a limited number of days. See Section 2 for the equation and calculation description.

**Table 6-9. Model Calculated DO Attainment for
Primary Contact WQ Criteria Class SC/SB (2008)**

Station	Annual Attainment Percent Attainment			
	Baseline		100% Gowanus CSO Control	
	Chronic ⁽¹⁾	Acute ⁽²⁾	Chronic ⁽¹⁾	Acute ⁽²⁾
GC-1	100	100	100	100
GC-2	100	100	100	100
GC-3	100	100	100	100
GC-4	100	100	100	100
GC-5	100	100	100	100
GC-6	94	98	95	99
GC-7	95	99	96	100
GC-8	87	100	89	100
GC-9	99	100	100	100
GC-10	100	100	100	100

Notes:

(1) ~~24-hr~~ **Daily Average** DO ≥ 4.8 mg/L with allowable excursions to ≥ 3.0 mg/L for certain periods of time in accordance with TOGs 1.1.6.

(2) Acute Criteria: DO ≥ 3.0 mg/L.

Table 8-18. Calculated 2008 DO Attainment Baseline Conditions - Annual

Station	Existing WQ Criteria		Primary Contact WQ Class SC/SB DO Criteria			
	Criterion	Attainment (%)	Criterion ⁽¹⁾	Attainment (%)	Criterion ⁽²⁾	Attainment (%)
GC-1	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-2	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-3	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-4	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-5	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-6	≥3.0 mg/L	100 98	≥4.8 mg/L	94	≥3.0 mg/L	98
GC-7	≥3.0 mg/L	100 99	≥4.8 mg/L	95	≥3.0 mg/L	99
GC-8	≥4.0 mg/L	100 95	≥4.8 mg/L	87	≥3.0 mg/L	100
GC-9	≥4.0 mg/L	100	≥4.8 mg/L	99	≥3.0 mg/L	100
GC-10	≥4.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100

Notes:

- (1) Chronic standard.
- (2) Acute standard.

**Table 8-19. LTCP Baseline Compliance with Classifications and Standards –
 10 Year Model Simulation**

Analysis	Numerical Criteria Applied		Compliance
Existing WQ Criteria Fish Survival (Class SD) and Boating/Fishing (Class I)	Gowanus Canal Above Hamilton Ave (Class SD)	Fecal - None	Yes
		DO never < 3.0 mg/L ⁽⁴⁾	Yes
	Gowanus Bay Below Hamilton Ave (Class I)	Fecal Monthly GM ≤ 2,000	Yes
		DO never < 4.0 mg/L ⁽⁴⁾	Yes
<u>Bacteria</u> Primary Contact WQ Criteria ⁽¹⁾ / <u>DO Class</u> <u>SC/SB</u>	Saline Water	Fecal Monthly GM ≤ 200	Yes
		Daily Average DO ≥ 4.8 mg/L ^(3,4)	No ⁽⁵⁾
		DO never < 3.0 mg/L ⁽⁴⁾	Yes
Potential Future Primary Contact WQ Criteria ⁽²⁾	Enterococci: rolling 30-d GM – 30 cfu/100mL		Yes
	Enterococci: STV – 110 cfu/100mL		No

Notes:

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

- (1) This water quality standard is not currently assigned to the Gowanus Canal or Gowanus Bay.
- (2) The Potential Future Primary Contact WQ Criteria have not yet been adopted by DEC.
- (3) ~~24-hr~~ Daily average DO ≥ 4.8 mg/L with allowable excursions to ≥ 3.0 mg/L for certain periods of time in accordance with NYSDEC TOGs 1.1.6. See Section 2.0 for the equation and calculation description.
- (4) DO based on 2008 typical year model simulations.
- (5) DO Attainment ranges from 87 percent to 94 percent at Stations GC-8 and GC-6.

DEC COMMENT No. 2:

Water Quality Sampling Results. Figure 2-19 indicate an increase in fecal coliform and enterococci concentrations around sampling location GC-7. The Department recommends that the City conduct additional site investigation to determine if illicit discharges are contributing to the high concentrations.

DEP Response:

Illicit connections would be expected to result in significantly elevated bacteria concentrations during dry weather. The box plots in Figure 2-19 (included below) show the dry-weather geomean and 75th quartile values for fecal coliform at Station GC-7 to be well under 200 cfu/100mL. The data in the box plots are from the period of July to September 2014. The individual data points for fecal coliform for the July to September 2014 period, along with additional dry-weather data collected by DEP from December 2014 to June 2015, are presented below in the figure titled “LTCP2 GC7 Raw Data – Dry Weather Events”. Review of these data points showed one sample value above 200 cfu/100mL (the value was 2,900 cfu/100mL). Sentinel Monitoring data from Station S68, which is the same location as LTCP2 sampling location GC7, are presented below in the figure titled “2013 to 2015 Sentinel Monitoring Data, Station S68”. From this data set, only two points were above 200 cfu/100mL, and none were above 2,000 cfu/100mL. The Sentinel Monitoring data are therefore consistent with the LTCP2 dry-weather data at Station GC-7. For Enterococcus, Figure 2-20 (included below) showed the dry-weather geomean at Station GC-7 to be well under 30 cfu/100mL, and the 75th quartile value to be about 30 cfu/100mL. Collectively, these data would not be indicative of the presence of a sustained source of dry-weather bacteria in the vicinity of Station GC-7. However, DEP will consider whether additional Sentinel Monitoring is warranted at that location.

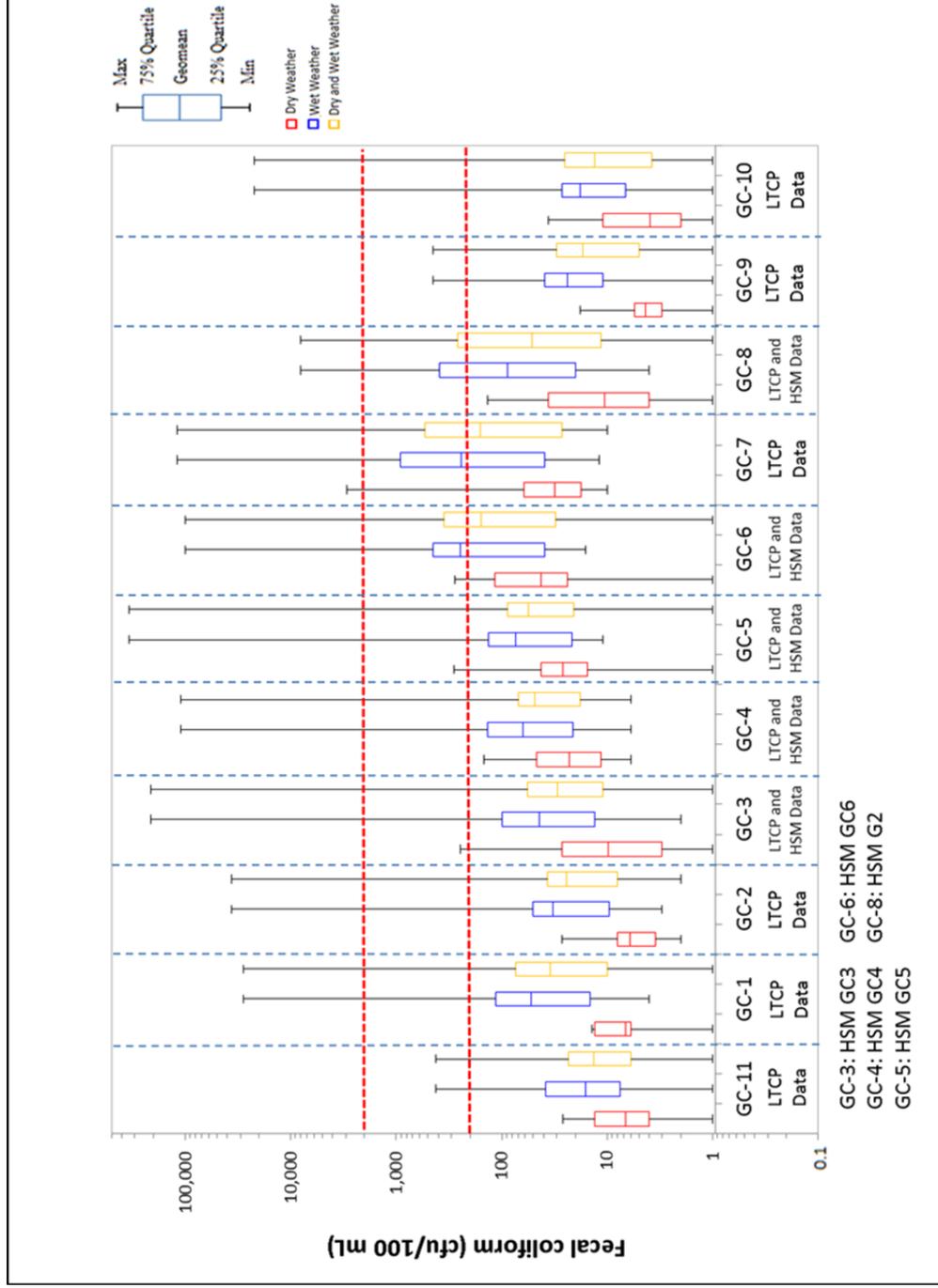
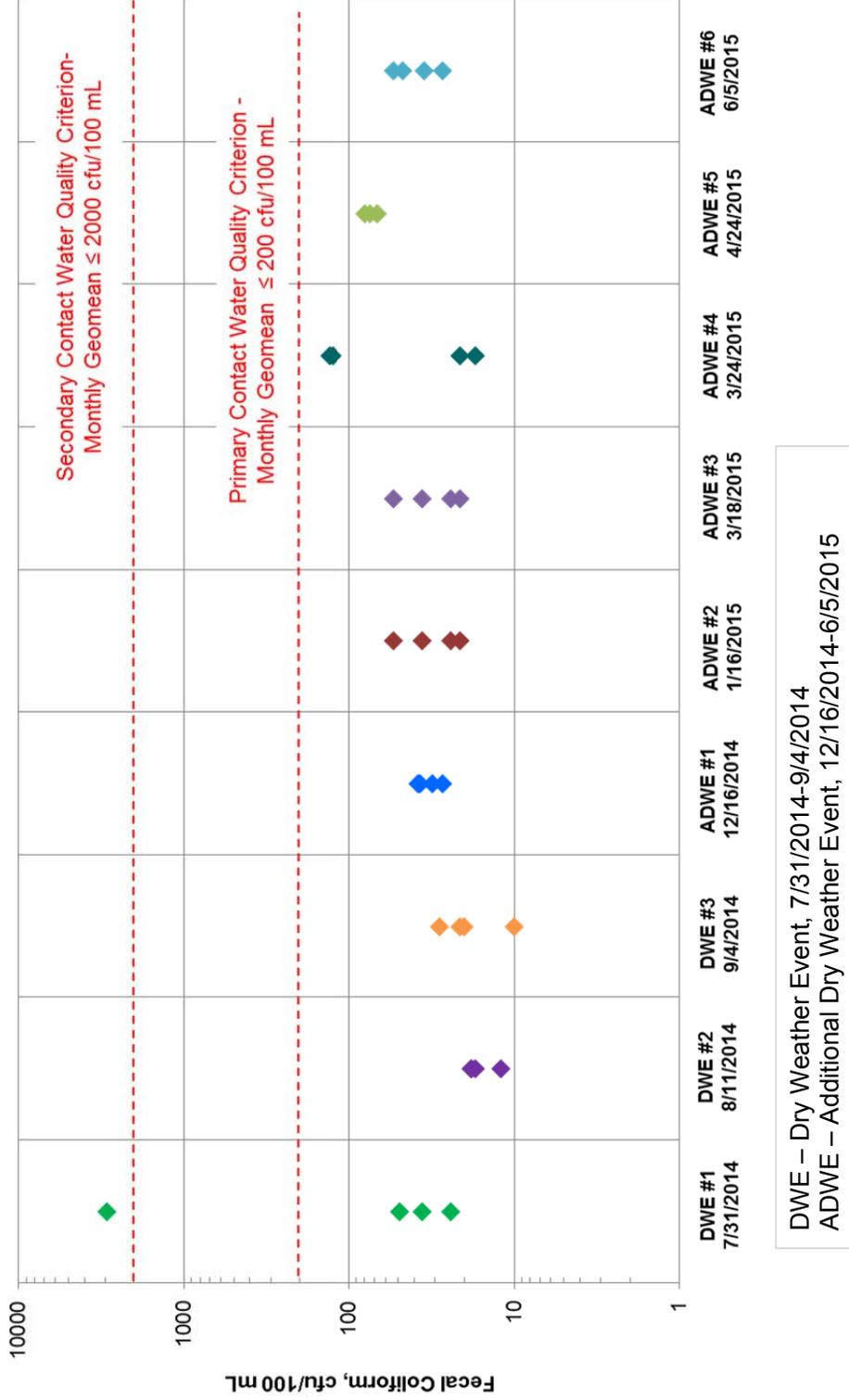
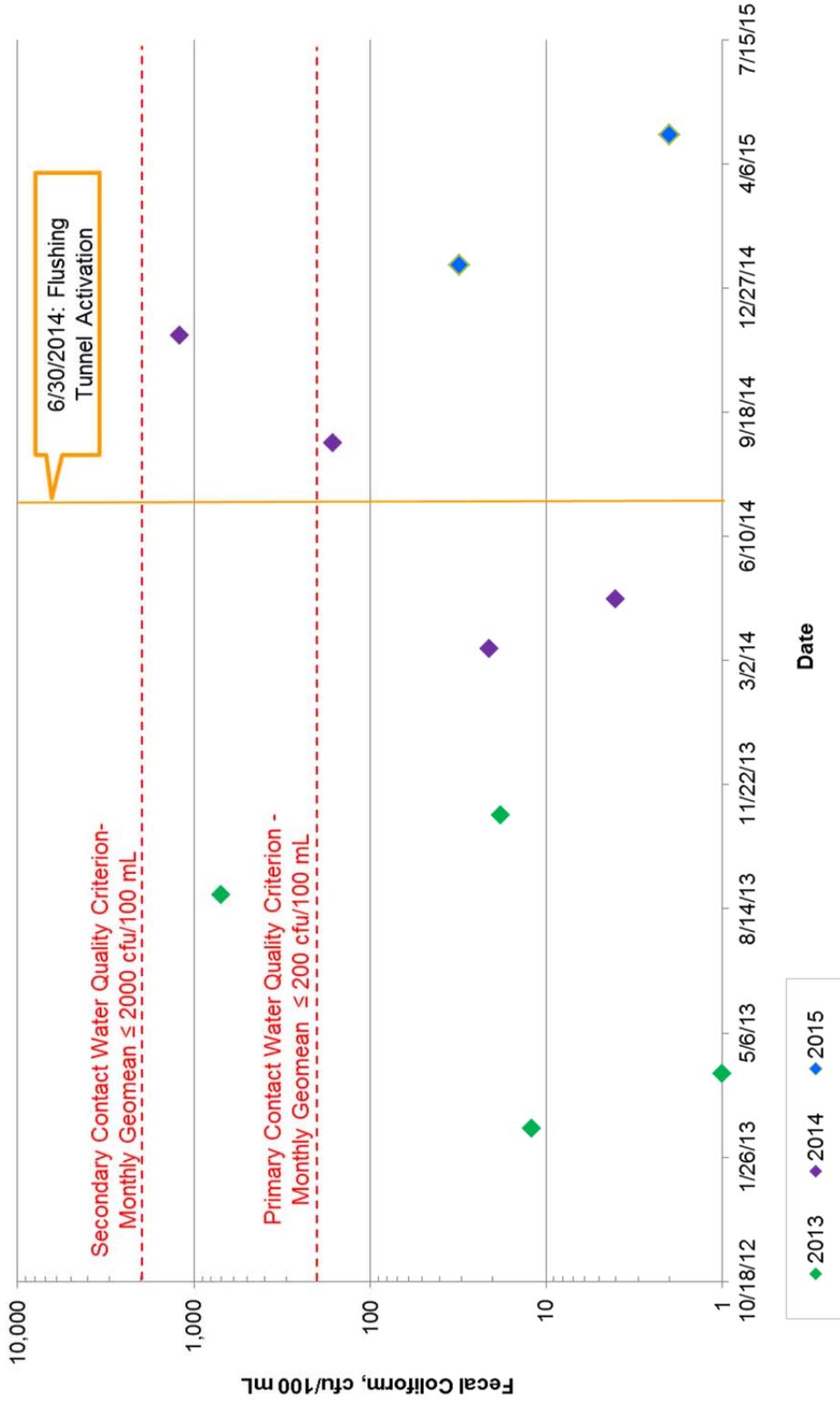


Figure 2-19. Fecal Coliform Data from LTCP and HSM - Gowanus Canal (July – September 2014)

LTCP2 GC7 Raw Data - Dry Weather Events



2013-2015 Sentinel Monitoring Data, Station S68



Note: Sentinel Monitoring Station S68 is the same location as LTCP2 Station GC7; No HSM sampling at GC7 location.

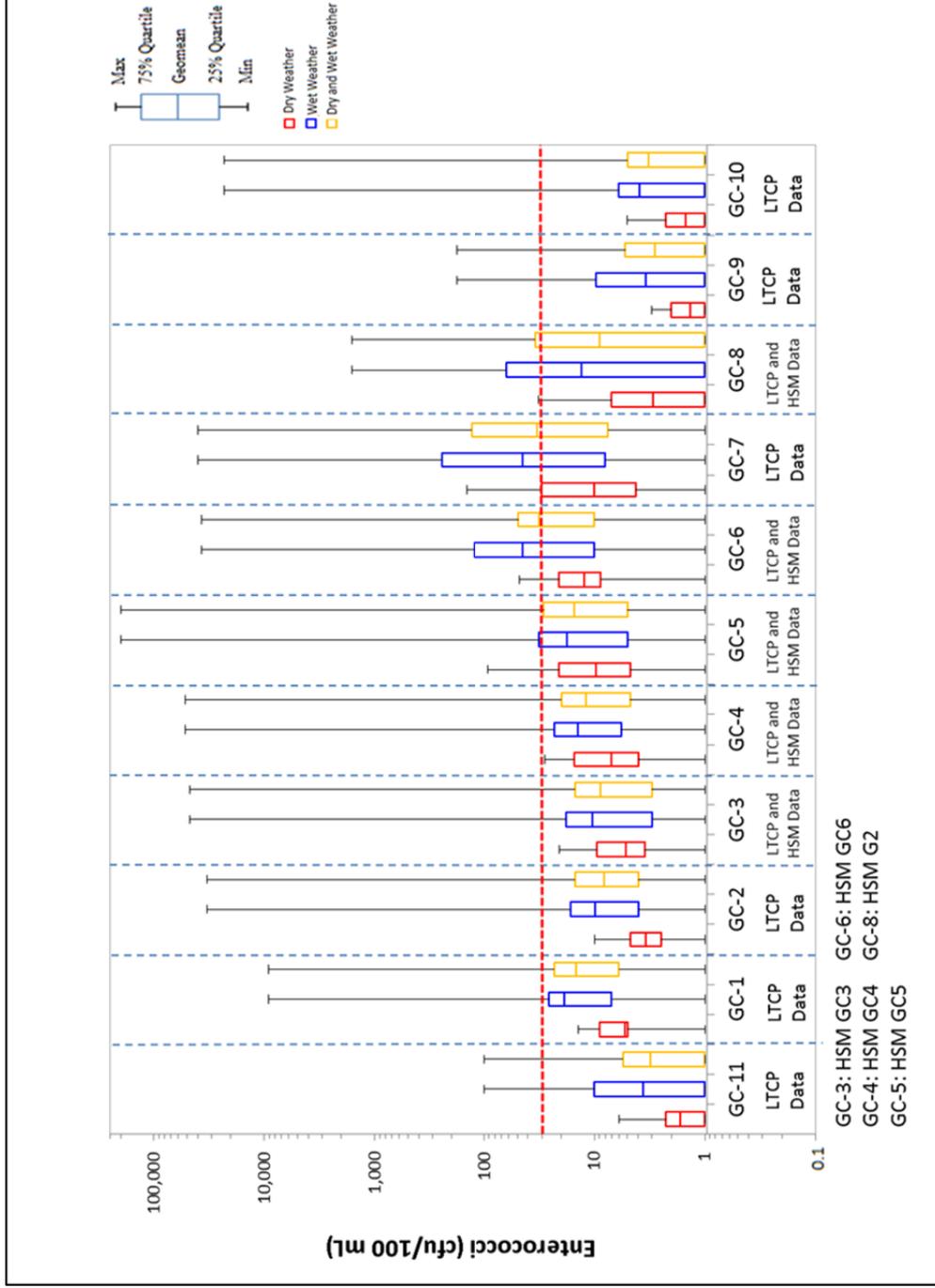


Figure 2-20. Enterococci Data from LTCP and HSM - Gowanus Canal (July – September 2014)

DEC COMMENT No. 3:

Cost Estimates for Alternatives. Additional information is requested on the cost estimate provided for the alternatives. In particular, provide:

- a. A detailed breakdown of the costs for the tank alternatives, including planning and design costs, construction costs, and operations and maintenance costs.
- b. A table summarizing the uncertainties associated with each cost estimate (e.g. – 50 percent / +100 percent for Class 5 estimates) for all retained alternatives.

The City may also consider updating Figures 8-13 to 8-15 with a “box and whiskers” format for each cost estimate to illustrate the range of uncertainty.

DEP Response:

The City notes it has provided detailed cost estimates for the planning, design, construction, and operation and maintenance of CSO tank alternatives at Gowanus Canal in:

- *Preliminary Remedial Design Report for the CSO Facility at Owl’s Head Outfall OH-007, dated June 2015*
- *CSO Facility Site Recommendation Report for Owl’s Head Outfall OH-007, dated June 2015*
- *Preliminary Remedial Design Report for the CSO Facility at Red Hook Outfall RH-034, dated June 2015*
- *CSO Facility Site Recommendation Report for Red Hook Outfall RH-034, dated June 2015*

In accordance with the Association for the Advancement of Cost Engineering (AACE) International criteria, these reports support a Class 4 estimate. This set of criteria define a Class 4 estimate as a Planning Level or Design Technical Feasibility Estimate. Typically, engineering is from 1 percent to 15 percent complete. Class 4 estimates are used to prepare planning-level cost scopes, or to evaluate alternatives in design conditions, and form the base work for the Class 3 Project Budget or Funding Estimate. Expected accuracy for Class 4 estimates typically ranges from minus 30 percent to plus 50 percent, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. A 20 percent contingency was added to the gross cost estimate, which is typical and appropriate for a Class 4 estimate. According to the same set of criteria, the expected accuracy for Class 5 estimates typically ranges from minus 50 percent to plus 100 percent.

A “box and whiskers plot” will not effectively depict the nature of the uncertainty surrounding the Gowanus LTCP cost estimates. Box and whisker plots are best for analyzing variability and outliers of known data, while the provided cost estimate is forecast for a most probable design and construction cost around a known level of uncertainty. However, given the differences in the sources of cost estimates for the tank and non-tank alternatives, a column has been added to Table 8-15 indicating the uncertainty range associated with the estimates for each alternative (see below).

Symbols were added to Figures 8-13 through 8-15 to differentiate classes of cost estimates for each alternative evaluated.

Table 8-15. Summary of Retained Alternatives Costs

Alternative	Capital/PBC ⁽²⁾ (\$ Million)	Annual O&M Cost ⁽²⁾ (\$ Million)	Total Present Worth (\$ Million)	Accuracy Range of Cost Estimate
1. EPA ROD Tanks (8 MG Tank at Outfall RH-034 and 4 MG Tank at Outfall OH-007)	801 ⁽¹⁾	1.9	829	AAEC Class 4 -30% to +50%
2. 5.7 MG Tank at Outfall RH-034 and 2.5 MG Tank at Outfall OH-007	663	1.4	683	AAEC Class 5 -50% to +100% ⁽³⁾
3. 3.5 MG Tank at Outfall RH-034 and 1.4 MG Tank at Outfall OH-007	493	0.9	507	See Note 4
4. 3.5 MG Tank at RH-034 and Weir Modifications at Outfalls OH-006, OH-007 and OH-024	389	0.8	401	See Note 4
5. Bond-Lorraine Sewer Reconstruction and Weir Modifications at Outfalls OH-006, OH-007 and OH-024	334	1.4	355	AAEC Class 5 -50% to +100%
6. 75% CSO Control Tunnel	680	1.0	695	AAEC Class 5 -50% to +100%
7. 100% CSO Control Tunnel	846	1.8	873	AAEC Class 5 -50% to +100%

Notes:

- (1) EPA estimate for same tanks is \$77M.
- (2) Tank costs presented as capital costs based on Superfund estimates. Non-tank alternatives presented as Probable Bid Costs (PBCs). Annual O&M costs estimated from historical costs of equivalent CSO control projects implemented or previously evaluated within NYC.
- (3) Tank costs based on interpolation/extrapolation of Superfund estimates.
- (4) 3.5 MG tank at RH-034 based on AAEC Class 4 estimate; 1.4 MG tank at OH-007 based on extrapolation of Superfund estimates; weir modifications based on AAEC Class 5 estimate.

In addition, to clarify the differences in the sources of cost estimates, the following revisions to Section 8 will be inserted:

Section 8.1.c, first paragraph and bullets:

For the purpose of this LTCP, three sources/methods of estimating the construction costs of CSO control alternatives were used to determine their PBC, namely:

- Preliminary estimation based on historical construction costs of equivalent projects.
- Costs estimates used in the Superfund evaluations. These estimates provide Association for the Advancement of Cost Engineering (AACE) Class 4 estimate (accuracy range of minus 30 percent to plus 50 percent); Class 4 estimates were provided for the 8 MG and 3.5 MG tank alternatives at RH-034, and for the 4 MG tank alternative at OH-007. Cost estimates for the 5.7 MG tank at RH-034, and the 2.5 MG and 1.4 MG tank alternatives at OH-007 were interpolated/extrapolated from the Superfund cost estimates. In addition, the cost estimates that were provided by Superfund or were based on the Superfund estimates included soft costs, and are considered capital costs.
- Typical LTCP methodology using a costing tool based on parametric costing data. This approach provides an Association for the Advancement of Cost Engineering (AACE) Class 5 estimate (accuracy range of minus 20 to 50 percent to plus 30 to 100 percent), which is typical and appropriate for this type of planning evaluation. For purposes of this LTCP, all costs are reported in 2015 dollars. LTCP costs are presented as probable bid costs (PBC), and do not include soft costs, consistent with the approach taken in previous LTCPs submitted to DEC.

Section 8.4 first paragraph:

Evaluation of the retained alternatives requires cost estimation. The methodology for developing these costs is dependent upon the type of technology or control measure under consideration, its annual O&M requirements, and, unique to this LTCP, cost data made available from the DEP Superfund analysis. As described in Section 8.1.c, the cost estimates for the tank alternatives based on the Superfund analysis are presented as capital costs, including soft costs. The cost estimates for the non-tank alternatives developed by LTCP are presented as PBCs. The total net present worth costs were determined using the estimated capital or PBC as appropriate, and then adding the NPW of the projected annual O&M costs at an assumed interest rate of 3 percent over a 20-year life cycle. O&M costs were derived from similar projects evaluated within NYC. All costs are reported in 2015 dollars.

Table 8-12: *Second row, replace “Capital Costs” with “Capital/PBC Costs”*

Table 8-13: *Second row, replace “Capital Costs” with “PBC”*

Current Figures:

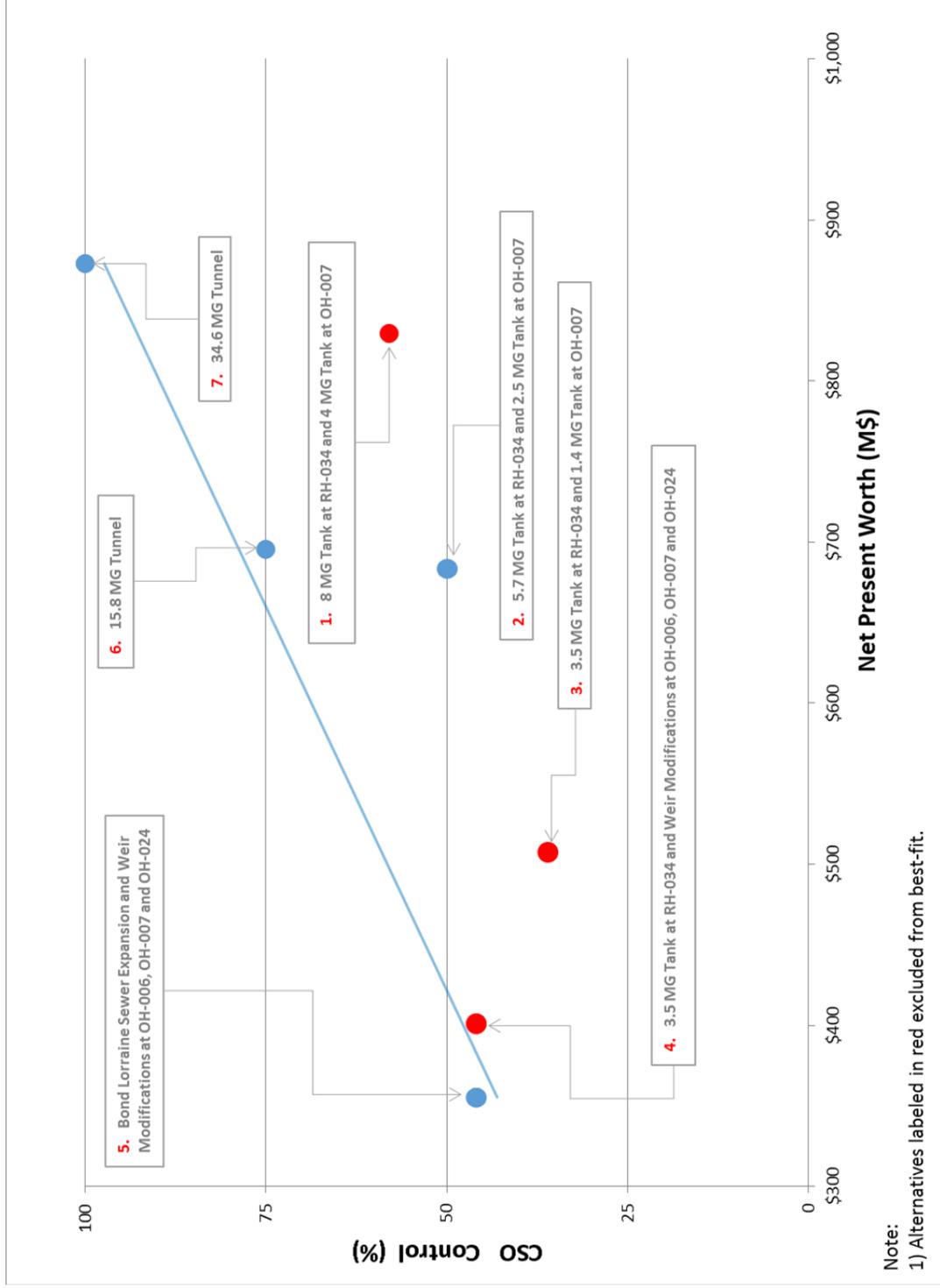


Figure 8-13. Cost vs. CSO Control (2008 Rainfall)

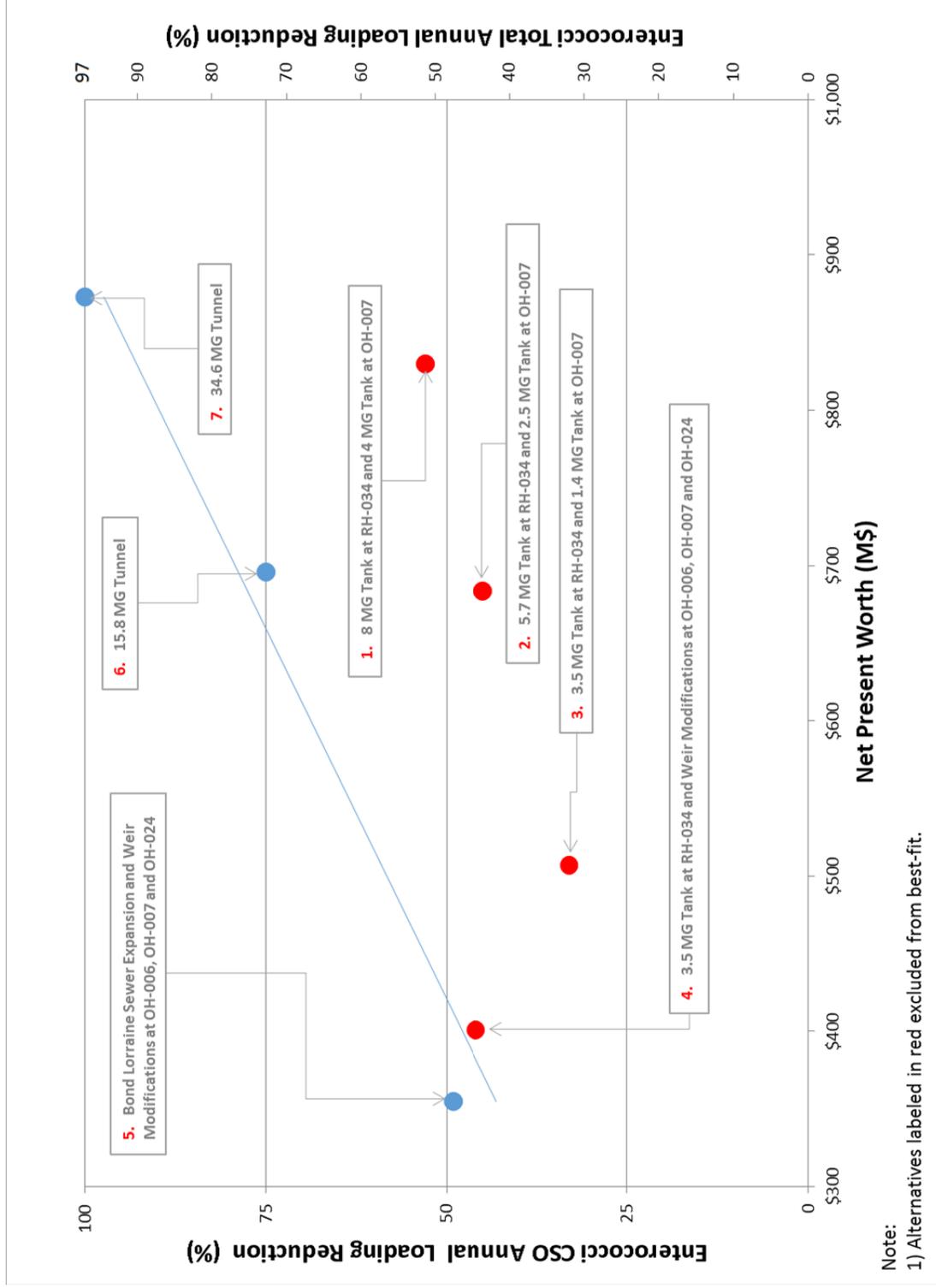


Figure 8-14. Cost vs. Enteroococi Loading Reduction (2008 Rainfall)

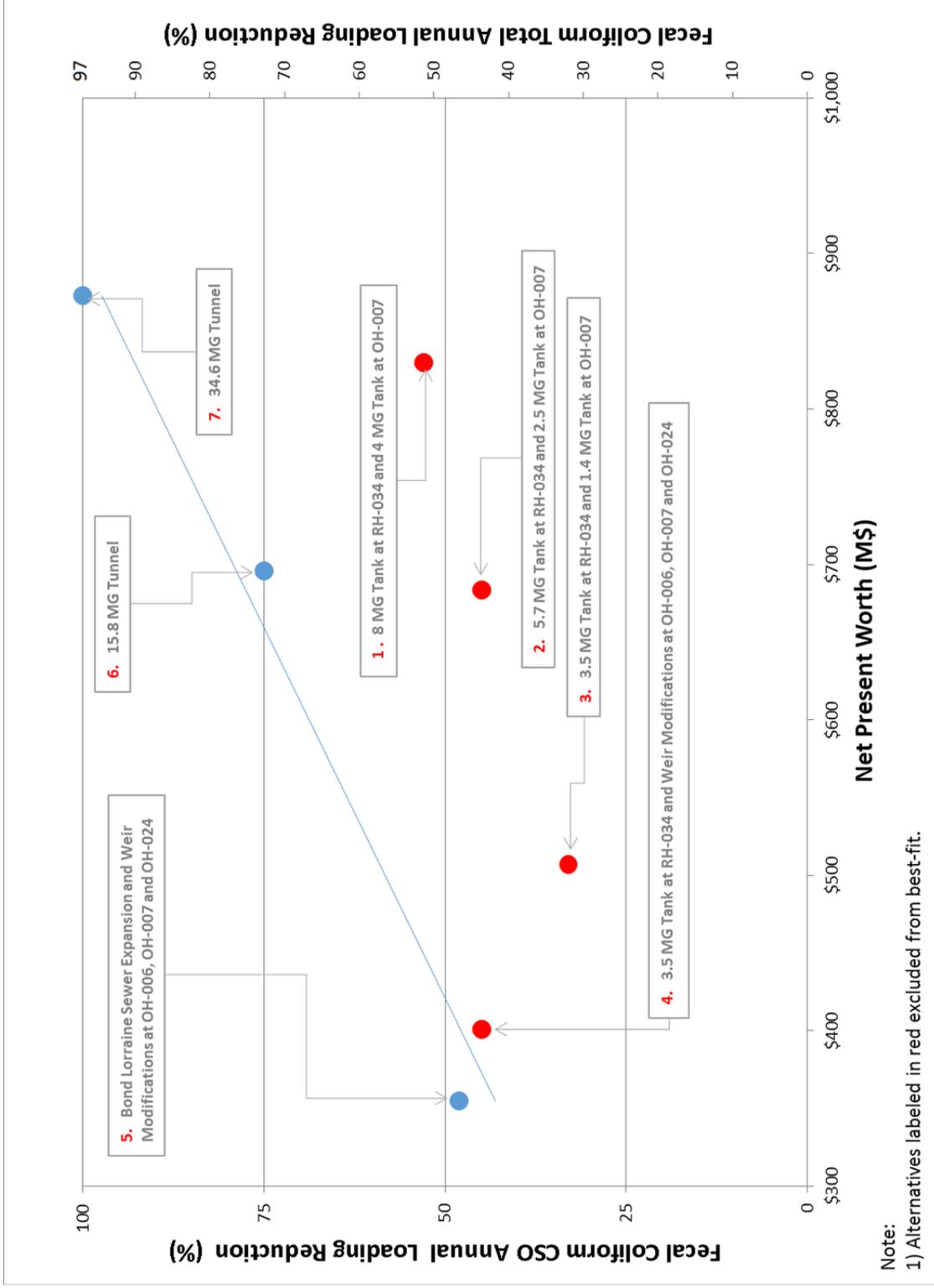


Figure 8-15. Cost vs. Fecal Coliform Loading Reduction (2008 Rainfall)

Proposed Figures:

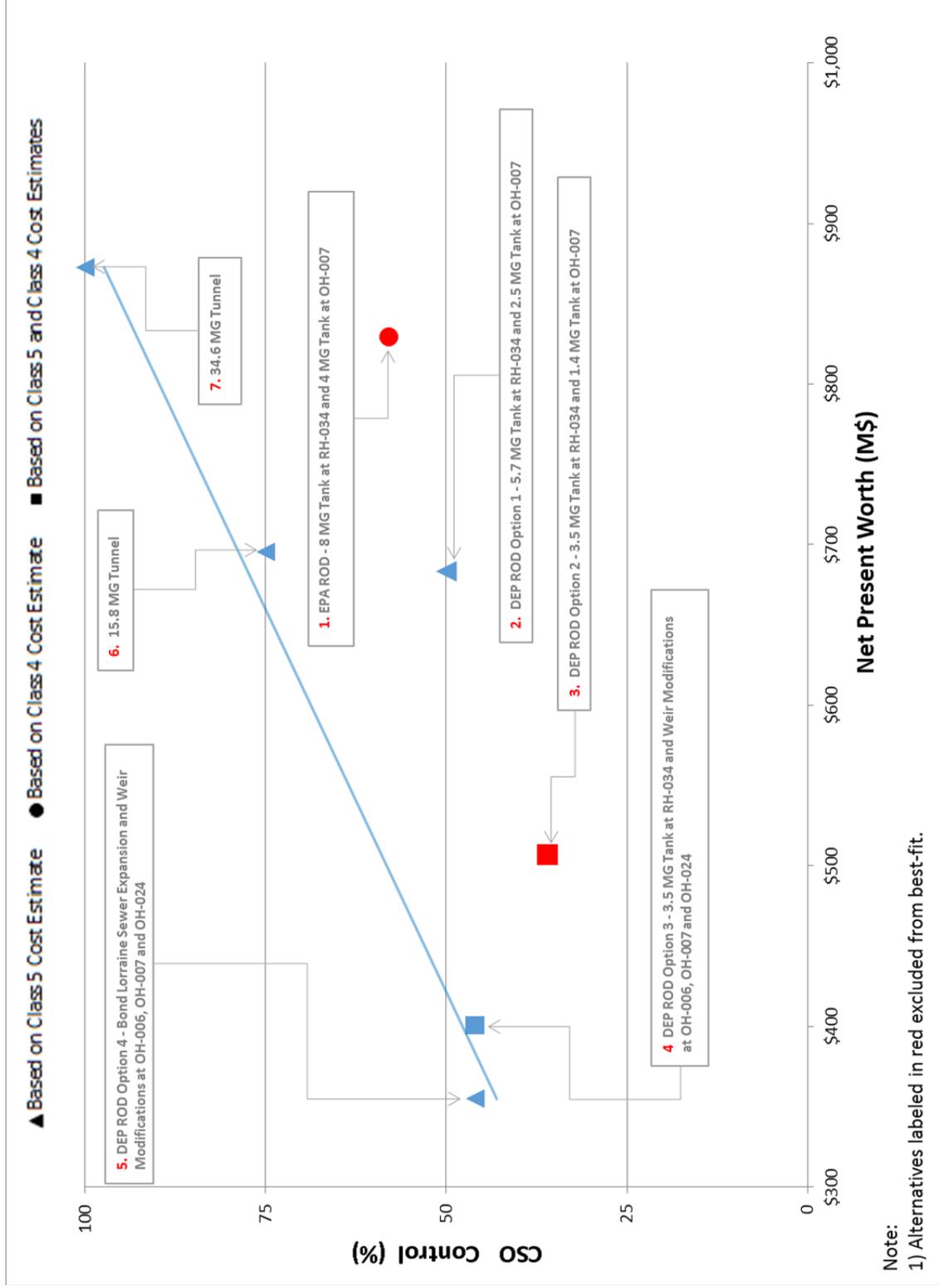


Figure 8-13. Cost vs. CSO Control (2008 Rainfall)

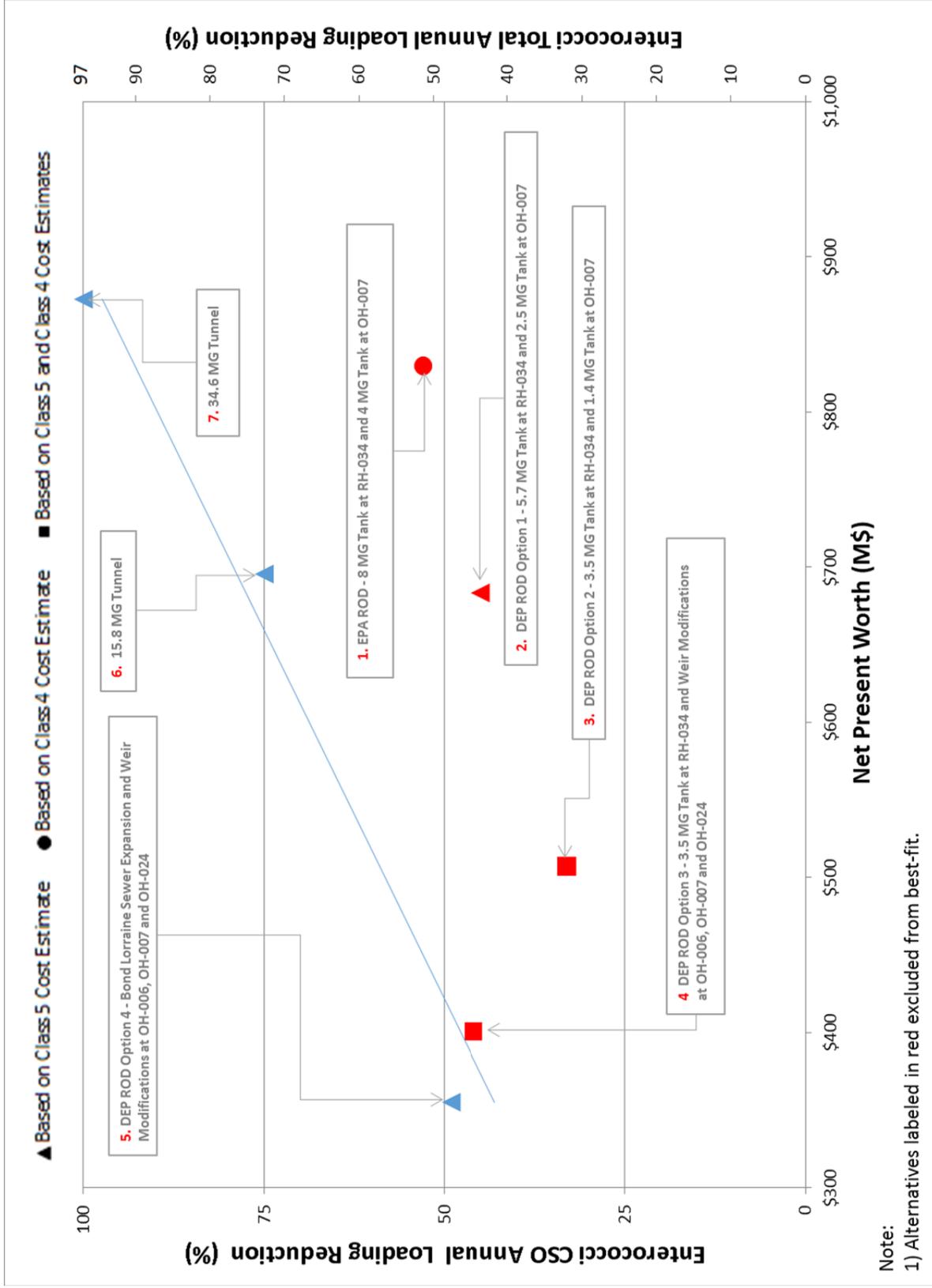


Figure 8-14. Cost vs. Enterococci Loading Reduction (2008 Rainfall)

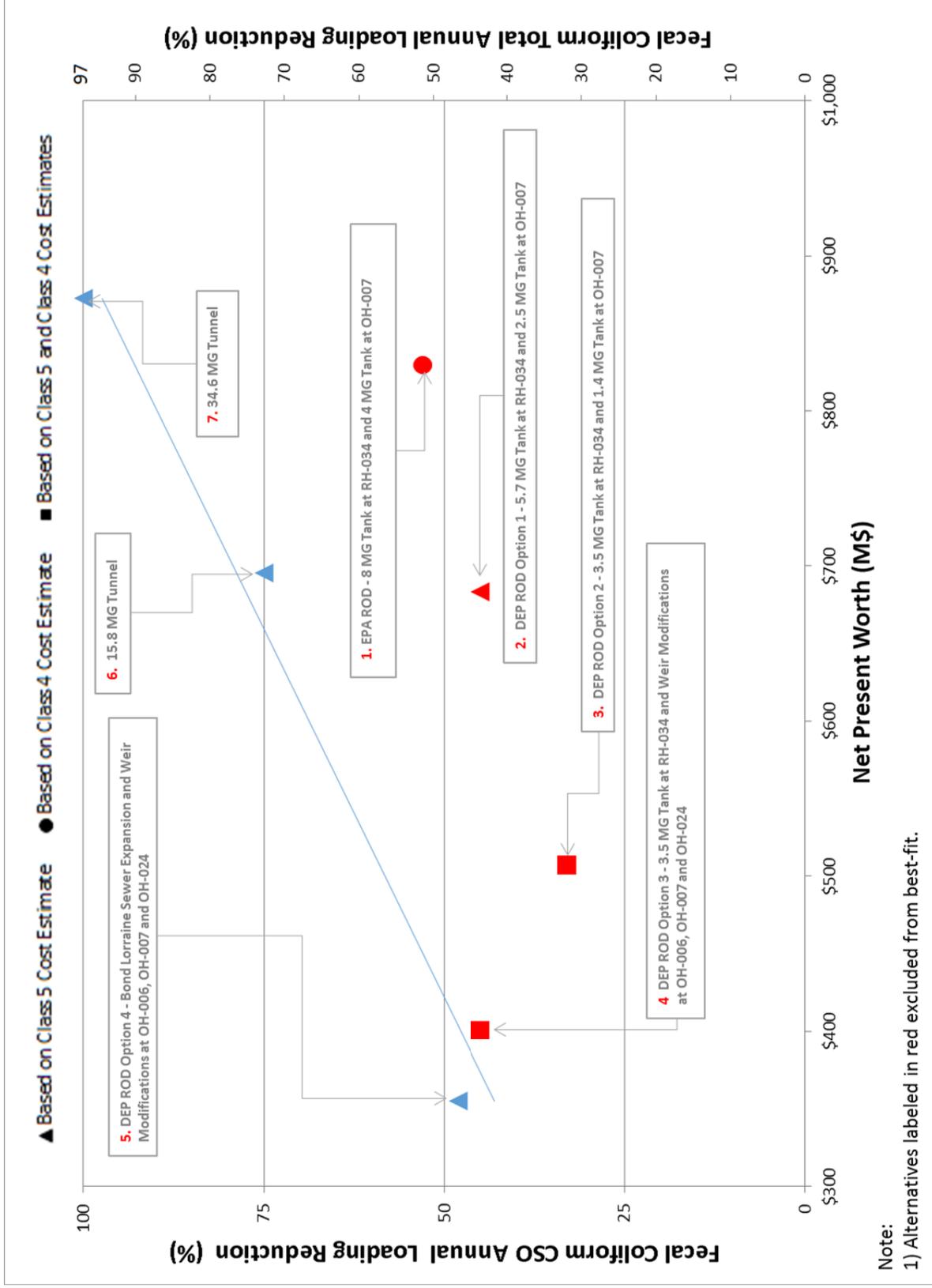


Figure 8-15. Cost vs. Fecal Coliform Loading Reduction (2008 Rainfall)

DEC COMMENT No. 4:

Cost Attainment Curves. Clarify why only some of Figures 8-16 to 8-25 include attainment information for Primary Contact WQ Criteria Annually (FC).

DEP Response:

For Figures 8-16, 8-17, 8-21 and 8-22, separate plots are presented for annual (green dots) and seasonal (orange squares) compliance with Primary Contact WQ Criteria, because seasonal compliance was 100% for all alternatives, while annual compliance was less than 100% for some alternatives. For Figures 8-18, 8-19, 8-20, 8-23, 8-24 and 8-25, annual compliance with Primary Contact WQ Criteria was 100% for all alternatives. For these plots, the orange squares represent annual compliance. Because 100% compliance on an annual basis means that there would also be 100% compliance in the recreational season, a separate plot for recreational season compliance was not provided.

DEC COMMENT No. 5:

Tank Operation and SPDES 2A Permit Application. The Department has conferred with USEPA, and the two agencies have reached the following understandings. The proposed CSO storage tanks discussed in the LTCP are not being constructed pursuant to the Clean Water Act. Instead, the tanks are part of the Superfund remedy selected by EPA. EPA has authority to oversee the design, construction and operation of the tanks as part of the remedy. Under Superfund law, the tanks must comply with all substantive New York State permitting requirements.

Once completed, the tanks will be a major modification to the City's wastewater collection system, and pursuant to the State law and regulation, must be operated pursuant to the SPDES permits for the two WWTPs to which the tanks will pump stored combined sewage. The LTCP failed to discuss the long-term operation of the tanks nor future treatment of stored CSO. The Department and EPA have determined that the process should include the City submitting SPDES 2A permit applications to DEC for the inclusion of the tanks into the Red Hook and Owls Head WWTPs at the time the final design documents are submitted to EPA. The Department will coordinate with the City and EPA on public notice and approval of the SPDES permit modifications, and require the DEP to develop modified Red Hook and Owls Head WPCPs Wet Weather Operating Plans to include the CSO storage tanks at the time. Therefore, the Department requests that the LTCP addresses the necessity for modifying the WWTPs SPDES permit and the Wet Weather Operating Plans to allow the tanks to operate under the Clean Water Act.

DEP Response:

The City agrees that construction and operation of storage tanks would necessitate a revision of the Red Hook and Owl's Head Wet Weather Operating Plans and a revision to associated SPDES permits. As detailed design proceeds, the selected design engineer

will collaborate with DEP and other stakeholders on the specifics of the design, which will then inform the necessary revisions to WWOPs and SPDES permits as pertinent details become available. It is anticipated that the SPDES 2A permit applications would be submitted at the 90-percent design level.

DEP asks for clarification on DEC's statement that EPA has authority to oversee the operations of the tanks as part of the Superfund remedy. It is DEP's understanding that EPA has oversight authority under the Superfund statute to require and oversee the project during planning, design, and construction but that upon construction completion, DEC will have oversight for operations through the SPDES permit process.

DEC COMMENT No. 6:

Gowanus Canal Dredging Project. Given the extensive contamination of the CSO sediments in the Gowanus Canal, and the fact the sediments will be addressed by EPA's Superfund remedy, the Department concurs with the City's previous proposal to eliminate the project as discussed in the City's letter dated February 19, 2014. Therefore, the project will be removed from the CSO Order, and the LTCP can be revised to reflect this change. The Department looks forward to reviewing the proposed Superfund remedy for addressing the sediments.

DEP Response:

Acknowledged.

ATTACHMENT 1

Revised Executive Summary

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 (WQ) data analyses and WQ modeling simulations.
- Evaluations and Conclusion — Evaluations, recommendations and conclusion consistent with the Federal Combined Sewer Overflow (CSO) Control Policy and the Clean Water Act (CWA).

1. BACKGROUND

The New York City (NYC) Department of Environmental Protection (DEP) prepared this Long Term Control Plan (LTCP) for the Gowanus Canal pursuant to a CSO Order on Consent (Department of Environmental Conservation [DEC] Case No. CO2-20110512-25), dated March 8, 2012 (2012 CSO Order on Consent). The 2012 CSO Order on Consent is a modification of a 2005 CSO Order on Consent (DEC Case No. CO2-20000107-8). Under the 2012 CSO Order on Consent, DEP is required to submit to DEC 11 waterbody-specific LTCPs by December 2017. The Gowanus Canal LTCP is the sixth of those LTCPs.

As described in the LTCP Goal Statement in the 2012 CSO Order on Consent, the goal of each LTCP is to identify, with public input, appropriate CSO controls necessary to achieve waterbody-specific water quality standards (WQS), consistent with the Federal 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 pathogen targets and associated recovery times. Consistent 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 conditioned on verification through rigorous post-construction compliance monitoring (PCM).

Regulatory Requirements

The waters of NYC are subject to Federal and New York State (NYS or State) laws and regulations. Particularly relevant to this LTCP is the United States Environmental Protection Agency’s (EPA) CSO Control Policy, which provides guidance on the development and implementation of LTCPs, and the setting of WQS. In NYS, CWA regulatory and permitting authority has been delegated to DEC.

DEC has designated the Gowanus Canal Class SD above Hamilton Avenue, and Class I below Hamilton Avenue. The best usage of Class SD waters is fishing and of Class I, secondary contact recreation and fishing (6 New York Code of Rules and Regulations [NYCRR] 701.14). Figure ES-1 shows the area of the Gowanus Canal at Hamilton Avenue, below the Gowanus Expressway.

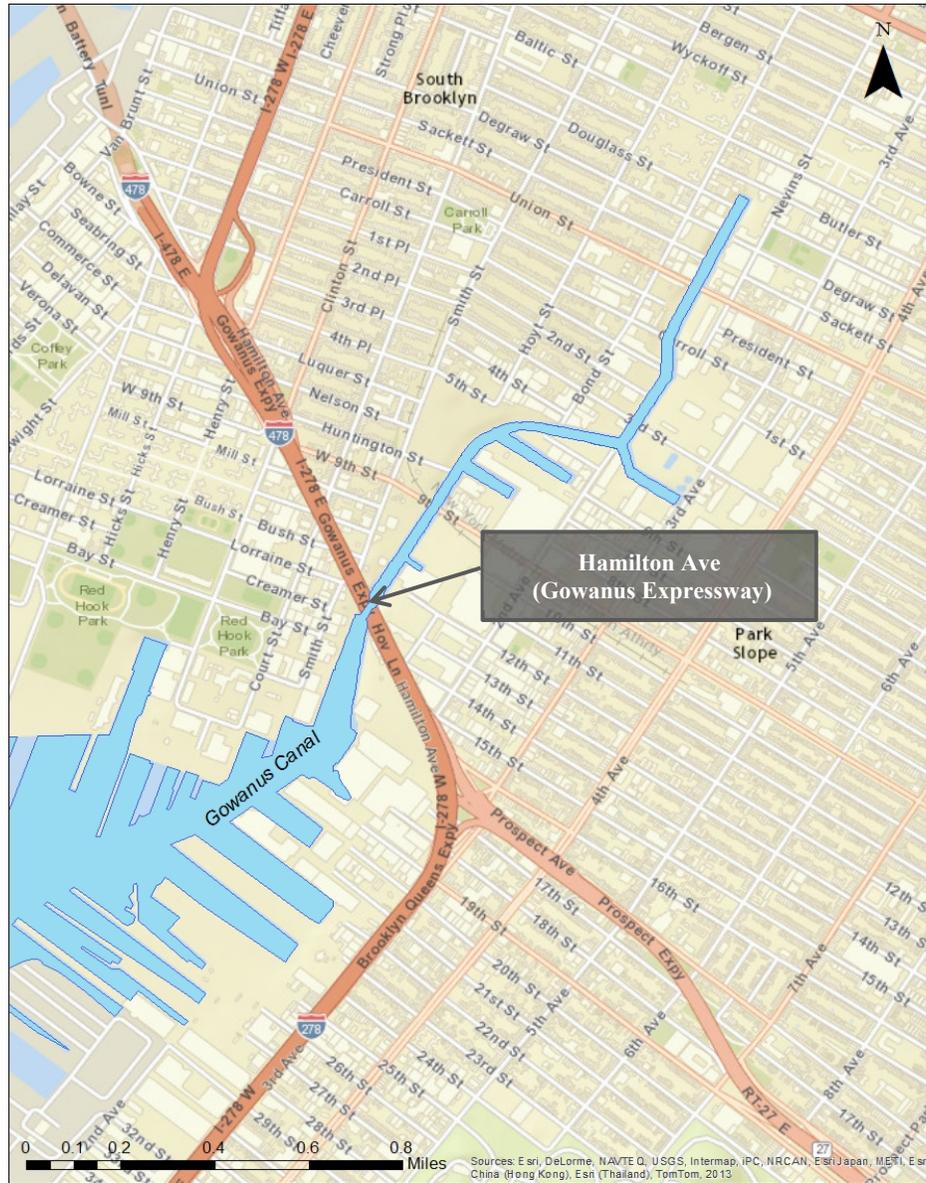


Figure ES-1. Gowanus Canal Area Map

DEC has publicly noticed a proposed rulemaking to amend 6 NYCRR Parts 701 and 703. The proposed total and fecal coliform bacteria criteria of 200 cfu/100mL would be the same for Classes SD, I and SC waters. In addition, DEC has advised DEP that it will soon adopt the 30-day rolling geometric mean (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). It is not expected that the recommendations herein will be altered by the new criteria.

The bacteria criteria assessed in this LTCP include Existing WQ Criteria (Class SD and I for the Gowanus Canal). Also assessed is the attainment of Primary Contact WQ Criteria and Potential Future Primary Contact WQ Criteria. Therefore, water quality assessments associated with current Primary Contact WQ Criteria within the Gowanus Canal considered fecal coliform exclusively (Table ES-1). Additionally, dissolved oxygen (DO) attainment was evaluated for designated and next higher use classifications. As described above, the 2012 EPA RWQC recommended certain changes to the bacteria water quality criteria for primary contact. Although not currently applicable to this waterbody, the Gowanus Canal LTCP includes attainment analyses of the 2012 EPA RWQC (referred to hereinafter as the “Potential Future Primary Contact WQ Criteria”).

Table ES-1 summarizes the Existing WQ Criteria, Primary Contact WQ Criteria and Potential Future Primary Contact WQ Criteria applied in this LTCP.

Table ES-1. Classifications and Standards Applied

Analysis	Numerical Criteria Applied	
Existing WQ Criteria Fish Survival (Class SD) and Boating/Fishing (Class I)	Gowanus Canal Above Hamilton Ave (Class SD)	Fecal - None; DO never < 3.0 mg/L
	Gowanus Bay Below Hamilton Ave (Class I)	Fecal Monthly GM ≤ 2,000 DO never < 4.0 mg/L
Bacteria Primary Contact WQ Criteria ⁽¹⁾ / DO Class SC/SB	Saline Water	Fecal Monthly GM ≤ 200 Daily Average DO ≥ 4.8 mg/L ⁽³⁾ DO never < 3.0 mg/L
Potential Future Primary Contact WQ Criteria ⁽²⁾	Enterococci: rolling 30-d GM – 30 cfu/100mL Enterococci: STV – 110 cfu/100mL	

Notes:

GM = Geometric Mean; STV = 90th Percentile Statistical Threshold Value

- (1) This water quality standard is not currently assigned to the Gowanus Canal or Gowanus Bay.
- (2) The Potential Future Primary Contact WQ Criteria have not yet been adopted by DEC.
- (3) The daily average DO concentration may fall below 4.8 mg/L for a limited number of days in accordance with NYSDEC TOGs 1.1.6. See Section 2 for the equation and calculation description.

The Gowanus Canal is also the focus of an EPA Superfund program that has a CSO mitigation component. This CSO program is being conducted under the Comprehensive Environmental Response, Compensation and Liability Act (“CERCLA” or “Superfund”) through an EPA Administrative Order for Remedial Design, Index No. CERCLA 02-2014-2019, issued to NYC in advance of, and independent of, this LTCP.

In September 2013, the EPA issued its Record of Decision (ROD) for the Gowanus Canal Superfund Site. The ROD requires the siting, design, construction, and operation of two CSO retention tanks to control discharges of solids to the Gowanus Canal, unless other technically viable alternatives are identified.¹ The ROD preliminarily estimated that an 8-million-gallon (MG) tank would be necessary at Outfall

¹ See United States Environmental Protection Agency. Record of Decision, Gowanus Canal Superfund Site: Summary of Remedial Alternatives, page 55.

RH-034, and a 4 MG tank at Outfall OH-007. This LTCP evaluated several alternatives including the ROD alternatives for water quality impacts.

Gowanus Canal Watershed

The Gowanus Canal watershed is highly urbanized, comprised primarily of residential areas, with some commercial, industrial, institutional and open space/outdoor recreation areas. The largest outdoor recreation area within this watershed is the Prospect Park in Brooklyn, located next to the area served by the Owls Head Wastewater Treatment Plant (WWTP). Other, smaller parks are located throughout the watershed.

The Gowanus Canal watershed comprises approximately 1,758 acres located on the northwestern shore of the Borough of Brooklyn. The majority of land immediately surrounding the shores of the Gowanus Canal is primarily industrial and commercial. The area is served by a complex collection system comprised of combined and separate storm sewers, interceptor sewers and pump stations, several CSO and stormwater outfalls, and the Flushing Tunnel. The Flushing Tunnel is the major source of flow to the Gowanus Canal, with a rated pumping capacity of 250 million gallons per day (MGD). The watershed is served by both the Red Hook and Owls Head WWTPs.

The Gowanus Canal outfalls and watershed characteristics are shown in Figures ES-2 and ES-3.

DEP activated the upgraded Gowanus Pump Station (PS) on June 20, 2014, and the refurbished Flushing Tunnel on May 3, 2014. The Flushing Tunnel introduces water from the Buttermilk Channel in the East River to the head end of the Gowanus Canal. Water is drawn at an average rate of 215 MGD to the Gowanus Canal PS. The water then flows to the mouth of the Gowanus Canal into Gowanus Bay. The introduction of the East River water has improved the water quality in the Gowanus Canal significantly. The cost of these improvements was \$190M.

The Gowanus PS, located on Douglass Street at the head of the Gowanus Canal, is designed to convey sewage flow to the Columbia Street Interceptor via a force main in the Flushing Tunnel. It serves a drainage area of approximately 657 acres. The station was built in 1908 and was last upgraded in 2014. The Gowanus PS has a capacity of 30 MGD with excess flows discharged to the Gowanus Canal via CSO Outfall RH-034. During wet weather, the station receives unregulated combined sewage flow from most of its drainage area, as well as regulated combined sewage flow from the Nevins Street Pump Station.

Green Infrastructure

DEP has determined that the Gowanus Canal watershed is a target area for its Green Infrastructure (GI) Program. The Gowanus Canal has a total tributary combined sewer impervious area of 1,387 acres. DEP projects that GI penetration rates would manage 12 percent of the impervious surfaces within the Gowanus Canal combined sewer service area by 2030. This accounts for right-of-way (ROW) practices, public property retrofits, GI implementation on private properties, and for conservatively estimated new development trends. The model has predicted a reduction in annual overflow volume of 41 MG from this GI implementation based on the 2008 baseline rainfall condition.



Figure ES-2. Gowanus Canal Outfalls

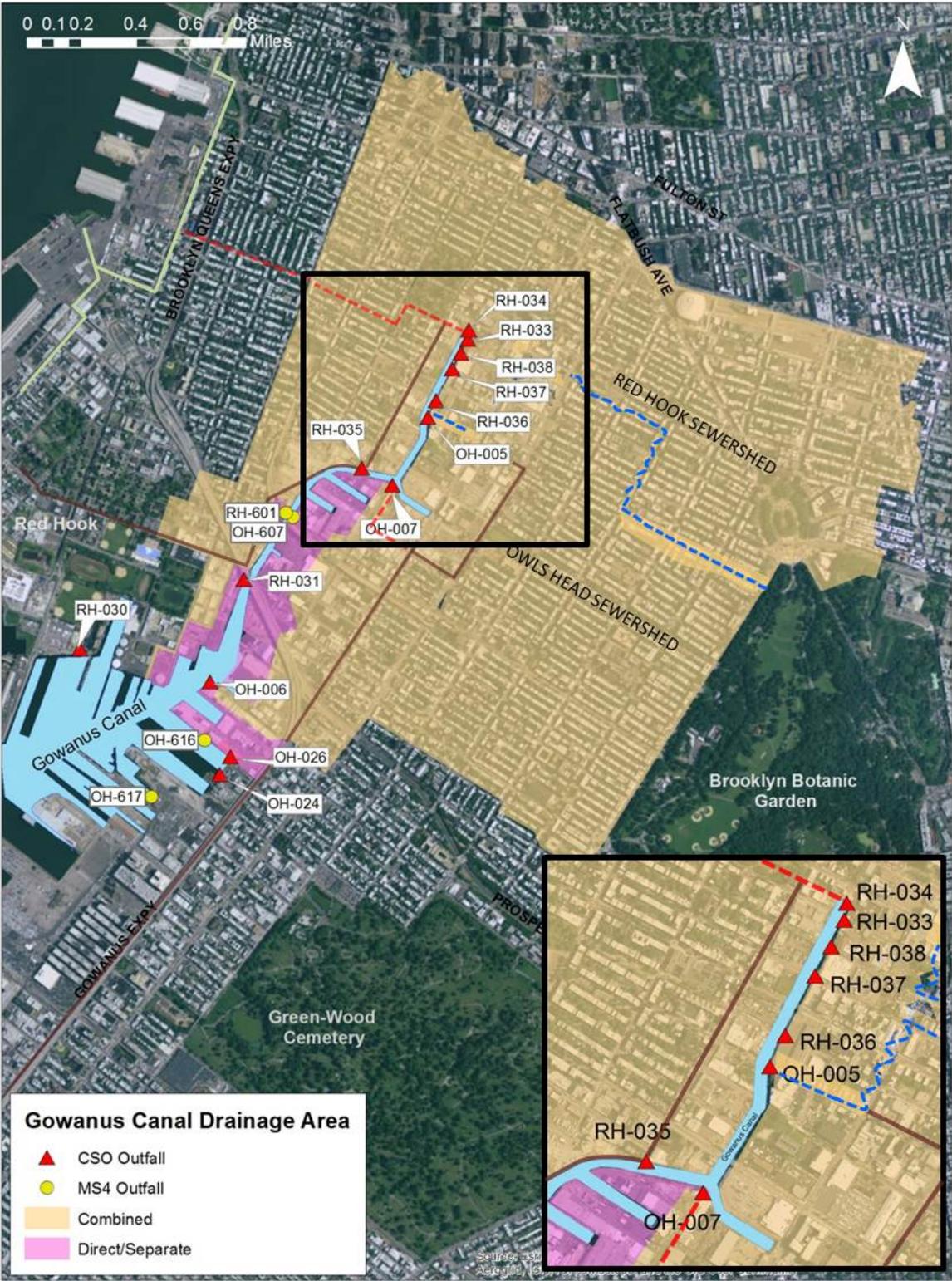


Figure ES-3. Gowanus Canal Watershed and Associated WWTP Service Areas

2. FINDINGS

Current Water Quality Conditions

Analysis of water quality in the Gowanus Canal was based on data collected from July to September 2014, during the development of the Gowanus Canal LTCP. The sampling stations are shown in Figure ES-4. A second data collection effort that further corroborated the data collected earlier was conducted from November 2014 to June 2015.

Figure ES-5 presents fecal coliform bacteria data collected at Stations GC-1 to GC-11, and Figure ES-6 presents the enterococci data at these same stations for the sampling period of July to September 2014. The plots represent data collected from the LTCP and Harbor Survey Monitoring (HSM) programs.

Overall, the water quality data recently collected within the Gowanus Canal indicates significant improvements over those collected prior to the of the Flushing Tunnel and pump station. The fecal coliform and enterococci dry-weather GMs for the sampling period are below 200 cfu/100mL and 30 cfu/100mL, the bacteria numerical thresholds of the Primary Contact WQ Criteria and GM component of the Potential Future Primary Contact WQ Criteria, respectively.

As shown in these graphics, dry-weather fecal coliform concentrations are lower than those for wet weather conditions. Overall, the water quality reflects the significant improvements achieved by the 2008 Waterbody/Watershed Facility Plan (WWFP) recommended plan (i.e. operation of the refurbished Flushing Tunnel and upgraded Gowanus PS). As demonstrated by the sampling results and projected LTCP baseline attainment, the water quality in the Gowanus Canal has improved from the concentrations and attainment of WQS documented in prior CSO planning efforts.

Baseline Conditions, 100% CSO Control and Performance Gap

Computer models were used to assess attainment with Existing WQ Criteria (Class SD and I), Primary Contact WQ Criteria (Class SC), including the 200 cfu/100mL fecal coliform criterion and Potential Future Primary Contact WQ Criteria. The analyses focused on two primary objectives:

1. Determine the baseline levels of compliance with water quality criteria with all sources being discharged at existing levels to the waterbody. These sources would primarily be direct drainage runoff, stormwater and CSO. This analysis is presented for Existing WQ Criteria, Primary Contact WQ Criteria and Potential Future Primary Contact WQ Criteria.
2. Determine potential attainment levels with 100% of CSO controlled or no discharge of CSO to the waterbody, keeping the remaining non-CSO sources. This analysis is presented for the classifications and standards criteria shown in Table ES-1.

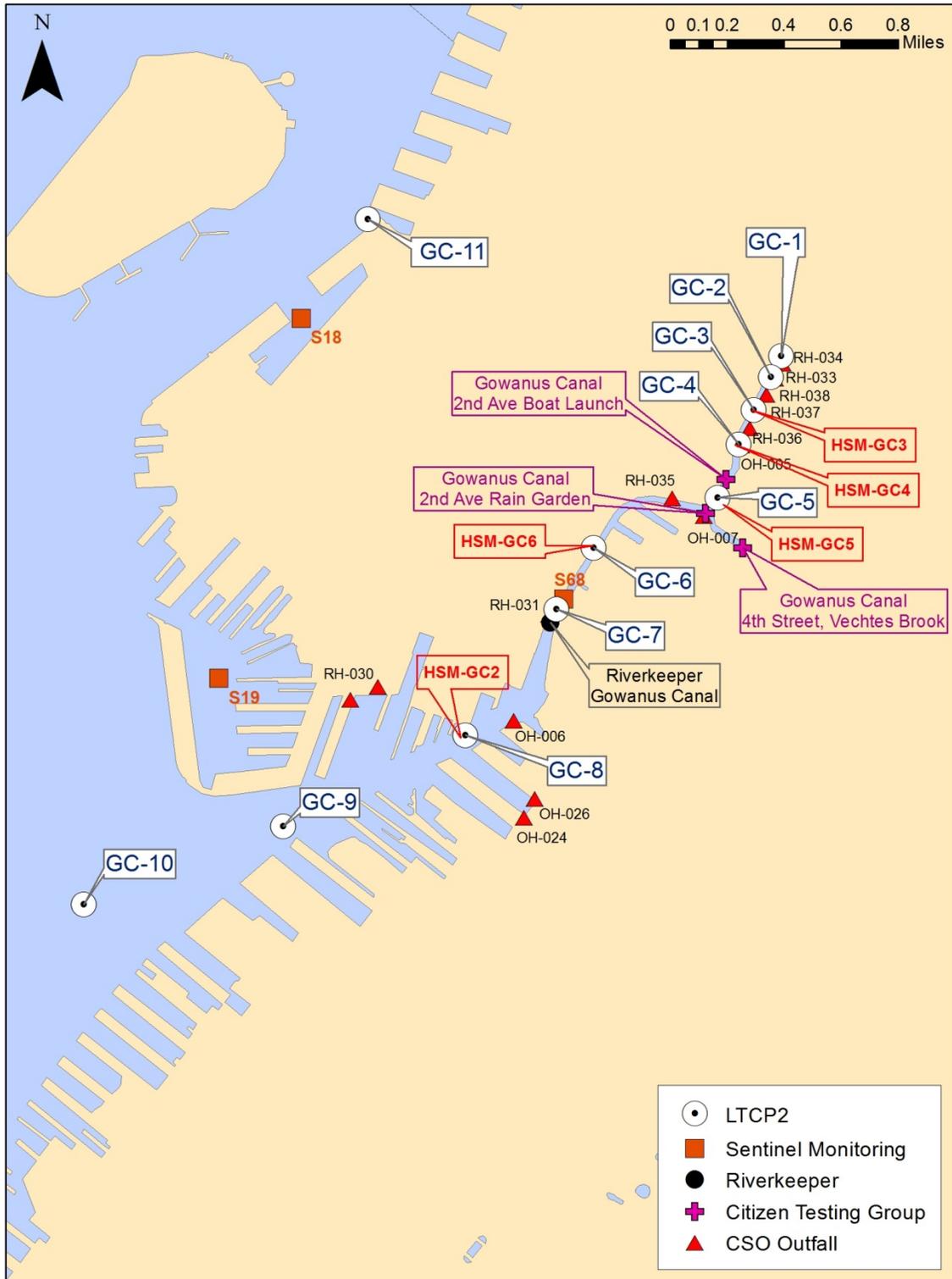


Figure ES-4. Sampling Stations of Various Sampling Programs at Gowanus Canal

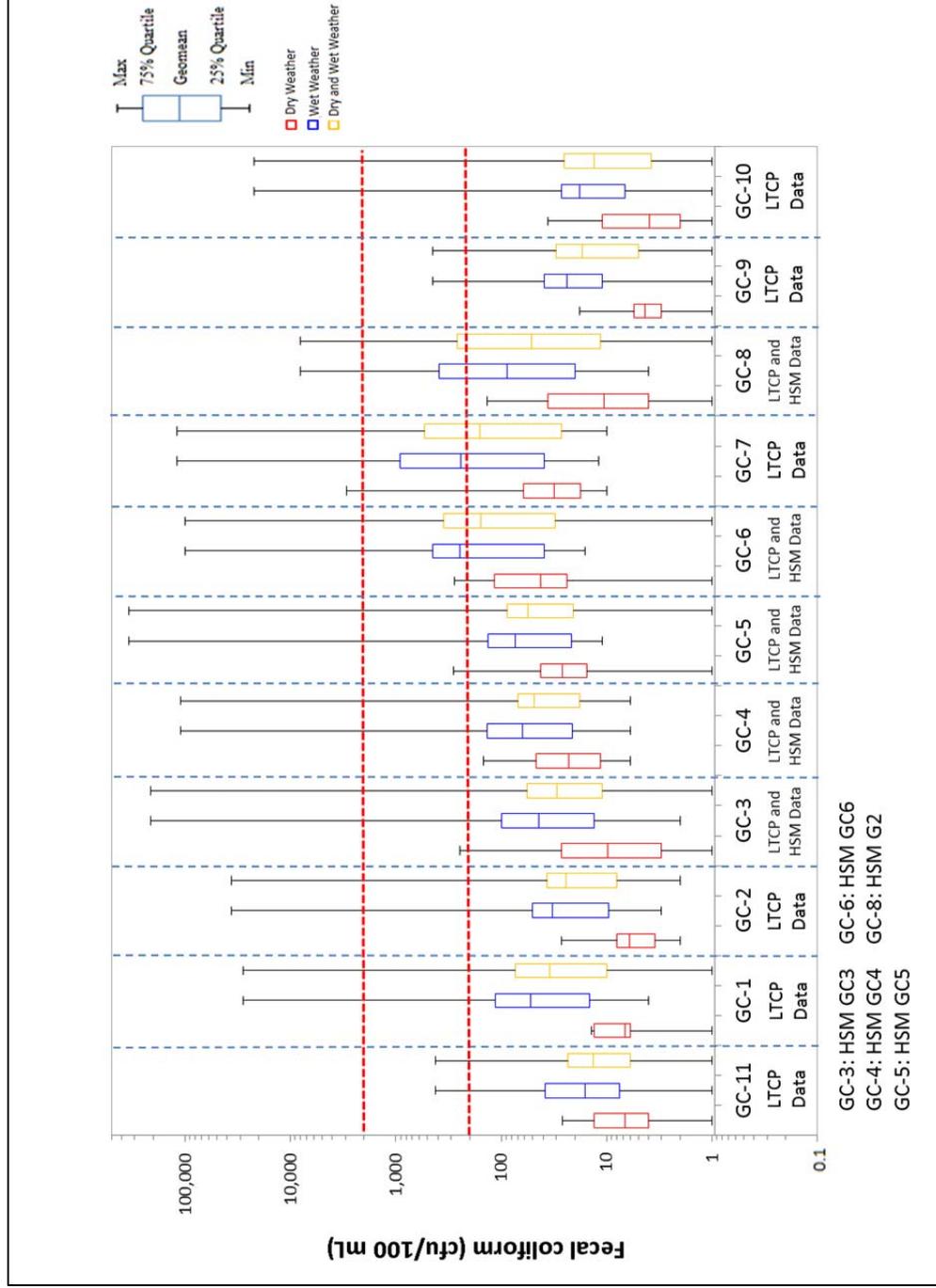


Figure ES-5. Fecal Coliform Data from LTCP and HSM - Gowanus Canal (July – September 2014)

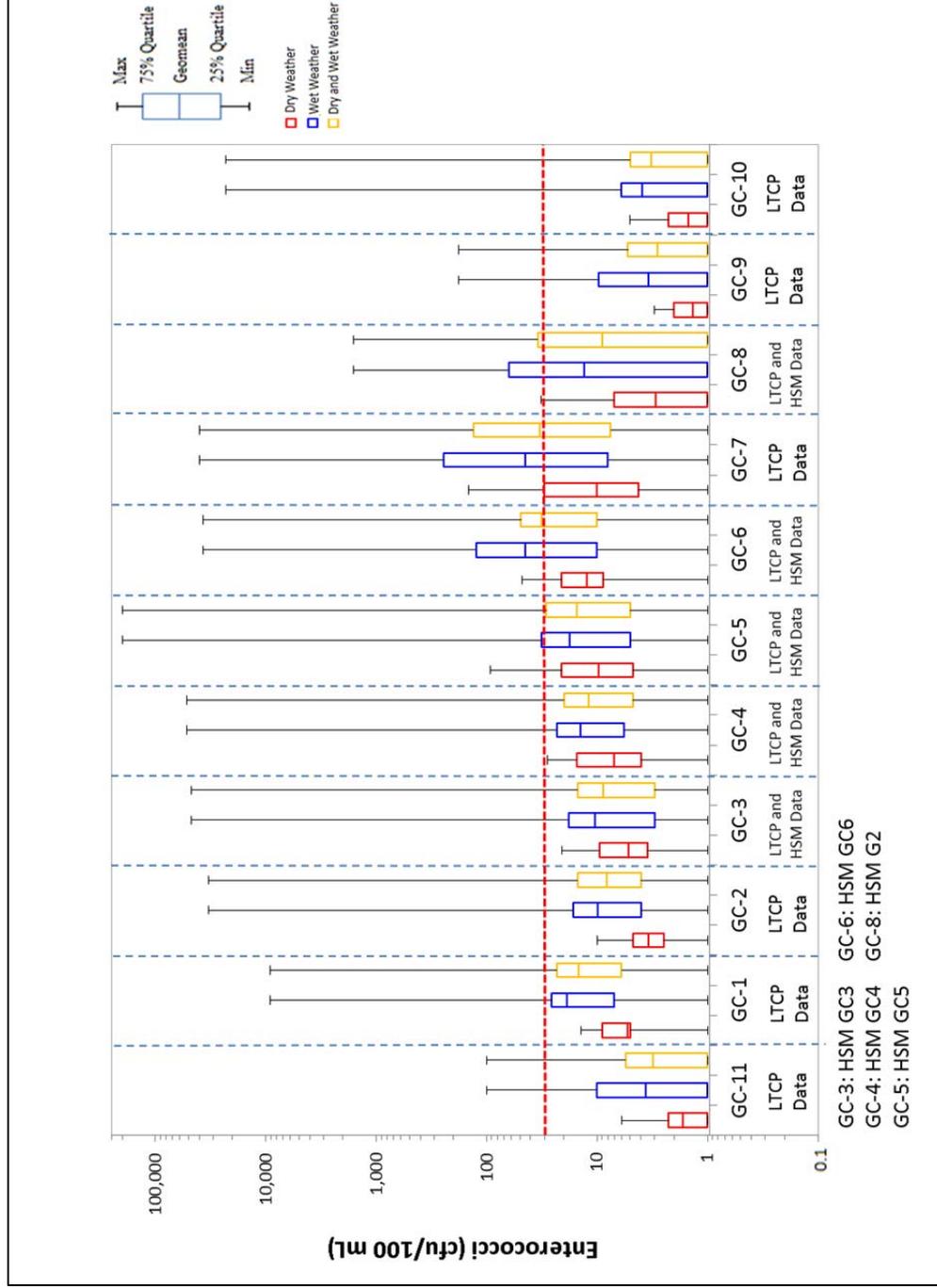


Figure ES-6. Enterococci Data from LTCP and HSM - Gowanus Canal (July – September 2014)

Given the importance of the water quality modeling, the Gowanus Canal Water Quality Model (GCWQM) was updated and peer-reviewed by independent experts to confirm that the modeling was both up-to-date and accurate. The modeling was conducted using a higher resolution computational grid and hydrodynamic framework than was used in the 2008 Gowanus Canal WWFP modeling simulations. The water quality model was used to calculate ambient bacteria and DO concentrations within the waterbody for a set of baseline conditions, as described in Section 6.0.

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; Owls Head and Red Hook WWTPs would receive combined peak flows at two times design dry-weather flow (2xDDWF) or wet weather capacity of 240 and 120 MGD, respectively; grey infrastructure would include those elements recommended in the 2008 WWFP; and waterbody-specific GI application rates would be based on the best available information. In the case of the Gowanus Canal, the GI application rate was assumed to be 12 percent coverage. The water quality assessments were conducted using continuous water quality simulations – a typical year (2008 rainfall) simulation for bacteria and DO assessment to support the alternatives evaluation. For baseline conditions, Alternatives 1, 2 and 3, the LTCP analysis used the 10-year (2002 to 2011 rainfall) simulation for further analysis of bacteria criteria attainment.

Table ES-2 shows that for the 2008 baseline criteria, the Gowanus Canal meets Existing WQ Criteria for fecal coliform 100% of the time.

Table ES-2. Calculated 2008 Baseline Fecal Coliform Maximum Monthly GM and Attainment of Existing Criteria for the Class (I) Boating/Fishing WQ Criteria

Station	Class	Maximum Monthly Geometric Means (cfu/100mL)		% Attainment with Existing Criteria		% Attainment with Class I Criteria	
		Annual	Recreation Period	Annual GM ≤2000 #/100mL	Recreation Period GM ≤2000 #/100mL	Annual GM ≤2000 #/100mL	Recreation Period GM ≤2000 #/100mL
GC-1	SD	213	45	NA	NA	100	100
GC-2	SD	201	43	NA	NA	100	100
GC-3	SD	199	42	NA	NA	100	100
GC-4	SD	197	40	NA	NA	100	100
GC-5	SD	199	39	NA	NA	100	100
GC-6	SD	216	37	NA	NA	100	100
GC-7	SD	215	36	NA	NA	100	100
GC-8	I	181	23	100	100	100	100
GC-9	I	164	24	100	100	100	100
GC-10	I	170	31	100	100	100	100

The Primary Contact WQ Criteria for the 2008 year baseline attainment levels are shown in Table ES-3. The recreational season (May 1st through October 31st) attainment levels are met. The annual attainment levels are met at all locations with the exception of Stations GC-1, GC-2, GC-6 and GC-7 where attainment levels are 92 percent. A 92 percent attainment level means that one month out of 12 was out

of attainment. However, when the baseline attainment is evaluated under the more extensive 10-year water quality simulations, as described later in this section, the baseline annual attainment of the primary contact fecal coliform criterion exceeds DEC's prescribed 95 percent attainment target for the corresponding water quality criterion.

**Table ES-3. Calculated 2008 Baseline Fecal Coliform
Maximum Monthly GM and Attainment of Primary Contact WQ Criteria**

Station	Maximum Monthly Geometric Means (cfu/100mL)		% Attainment	
	Annual	Recreation Period	Annual GM ≤ 200 #/100mL	Recreation Period GM ≤ 200 #/100mL
GC-1	213	45	92	100
GC-2	201	43	92	100
GC-3	199	42	100	100
GC-4	197	40	100	100
GC-5	199	39	100	100
GC-6	216	37	92	100
GC-7	215	36	92	100
GC-8	181	23	100	100
GC-9	164	24	100	100
GC-10	170	31	100	100

The attainment levels with Primary Contact WQ Criteria under the 100% CSO control scenario are shown in Table ES-4. The projected level of attainment following 100% control of the CSO discharges is the same as that for existing baseline conditions. This indicates that little improvement in water quality attainment can be achieved with additional CSO controls.

**Table ES-4. Calculated 2008 100% CSO Control Fecal Coliform
Maximum Monthly GM and Attainment of Primary Contact WQ Criteria**

Station	Maximum Monthly Geometric Means (cfu/100mL)	% Attainment
	Annual	Annual GM ≤ 200 #/100mL
GC-1	107	100
GC-2	108	100
GC-3	108	100
GC-4	105	100
GC-5	105	100
GC-6	105	100
GC-7	105	100
GC-8	80	100
GC-9	84	100
GC-10	102	100

The DO attainment levels were met for the Existing WQ Criteria as shown in Table ES-5. As shown in Table ES-6, the Class SC/SB WQ Criteria for the 2008 baseline simulation are met at all locations except Stations GC-6 and GC-8 where the attainment levels are 94 percent and 87 percent, respectively.

Table ES-5. Model Calculated DO Attainment – Existing WQ Criteria (2008)

Station	Class	DO Criteria (≥ mg/L)	% Annual Attainment 2008
GC-1	SD	3	100
GC-2	SD	3	100
GC-3	SD	3	100
GC-4	SD	3	100
GC-5	SD	3	100
GC-6	SD	3	98
GC-7	SD	3	99
GC-8	I	4	95
GC-9	I	4	100
GC-10	I	4	100

Table ES-6. Model Calculated DO Attainment for Class SC/SB WQ Criteria (2008)

Station	Annual Attainment Percent Attainment			
	Baseline		100% Gowanus CSO Control	
	Chronic ⁽¹⁾	Acute ⁽²⁾	Chronic ⁽¹⁾	Acute ⁽²⁾
GC-1	100	100	100	100
GC-2	100	100	100	100
GC-3	100	100	100	100
GC-4	100	100	100	100
GC-5	100	100	100	100
GC-6	94	98	95	99
GC-7	95	99	96	100
GC-8	87	100	89	100
GC-9	99	100	100	100
GC-10	100	100	100	100

Notes:

- (1) Daily Average DO ≥ 4.8 mg/L with allowable excursions to ≥ 3.0 mg/L for certain periods of time in accordance with NYSDEC TOGs 1.1.6.
- (2) Acute Criteria: DO ≥ 3.0 mg/L.

The Potential Future Primary Contact WQ Criteria attainment is shown below in Table ES-7. The table shows that the 30-day GM of 30 cfu/100mL is met at all stations, and the 110 cfu/100mL STV criterion is met at six of the ten stations.

Table ES-7. Calculated 2008 100% CSO Control Enterococci Maximum Monthly GM and Attainment of Potential Future Primary Contact WQ Criteria

Station	Maximum Recreational Period 30-day Enterococci (cfu/100mL)		% Attainment	
	GM	90th Percentile STV	Recreation Period GM ≤ 30 #/100mL	Recreation Period STV ≤ 110 #/100mL
GC-1	17	127	100	91
GC-2	17	132	100	91
GC-3	17	130	100	91
GC-4	17	123	100	93
GC-5	16	116	100	95
GC-6	16	100	100	100
GC-7	16	99	100	100
GC-8	11	46	100	100
GC-9	12	59	100	100
GC-10	15	104	100	100

The baseline conditions modeling shows that the Existing WQ Criteria (Class SD and Class I) are met 100% of the time. Similarly, the attainment levels with the Primary Contact WQ Criteria and the Potential Future Primary Contact WQ Criteria are essentially met both annually and for the recreational season (May 1st through October 31st). WQS attainment does not meet or exceed 95 percent at four stations in which the STV component of the Potential Future WQ Criteria ranges from 91 to 93 percent and two others, at which the chronic standard of the Class SC/SB DO criteria ranges between 87 and 94 percent.

Public Outreach

DEP's comprehensive public participation plan ensured that interested stakeholders were involved in the LTCP process. Stakeholders included both citywide and regional groups, some of whom offered comments at two public meetings. DEP will continue to solicit comments on the public's use of the waterbody, and, at the third public meeting, will present its preferred plan for the Gowanus Canal.

Evaluation of Alternatives

DEP used a multi-step process to evaluate control measures and CSO control alternatives. The evaluation process considered: environmental benefits; community and societal impacts; and implementation and operation and maintenance (O&M). After considering comments generated by detailed technical workshops, the retained alternatives were subjected to cost-performance and cost-attainment evaluations, where economic factors were considered, resulting in the seven retained alternatives presented in Table ES-8.

Table ES-8. Retained Alternatives

Alternative	Description
1	<ul style="list-style-type: none"> • 8 MG Tank at Outfall RH-034 • 4 MG Tank at Outfall OH-007
2	<ul style="list-style-type: none"> • 5.7 MG Tank at Outfall RH-034 • 2.5 MG Tank at Outfall OH-007
3	<ul style="list-style-type: none"> • 3.5 MG Tank at Outfall RH-034 • 1.4 MG Tank at Outfall OH-007
4	<ul style="list-style-type: none"> • 3.5 MG Tank at Outfall RH-034 • Weir Modifications at Outfalls OH-006, OH-007 and OH-024
5	<ul style="list-style-type: none"> • Bond-Lorraine Sewer Reconstruction • Weir Modifications at Outfalls OH-006, OH-007 and OH-024
6	<ul style="list-style-type: none"> • 8,400 LF-long, 18 ft-diameter tunnel • 15.8 MG storage
7	<ul style="list-style-type: none"> • 8,400 LF-long, 27 ft-diameter tunnel • 34.6 MG storage

The retained alternatives with CSO volume and bacteria load reductions are presented below in Table ES-9. The reductions range from 36 to 100%.

Table ES-9. Gowanus Canal Projected Annual CSO Volume and Bacteria Reductions for the Retained Alternatives (2008 Rainfall)

Basin-Wide Alternative	Annual CSO Volume to Gowanus Canal (MGY)	Increase in Annual CSO Volume Discharged to Other Waterbodies (MGY)	Net Change in Flow to both WWTPs (MGY)	Annual CSO Volume Reduction to Gowanus Canal (%)	Annual Fecal Coliform Reduction to Gowanus Canal (%)	Annual Enterococci Reduction to Gowanus Canal (%)	Frequency of Annual CSO Overflows to Gowanus Canal
Baseline Conditions	263	---	---	---	---	---	44
1. EPA ROD Tanks (8 MG Tank at Outfall RH-034 and 4 MG Tank at Outfall OH-007)	110	0	153	58	53	53	35
2. 5.7 MG Tank at Outfall RH-034 and 2.5 MG Tank at Outfall OH-007	133	0	130	50	45	45	35
3. 3.5 MG Tank at Outfall RH-034 and 1.4 MG Tank at Outfall OH-007	168	0	96	36	33	33	35
4. 3.5 MG Tank at Outfall RH-034 and Weir Modifications at Outfalls OH-006, OH-007 and OH-024	142	59	62	46	45	46	17
5. Bond-Lorraine Sewer Reconstruction and Weir Modifications at Outfall OH-006, OH-007 and OH-024	143	117	2	46	48	49	31
6. Tunnel (75% CSO Control)	65	0	198	75	75	75	6
7. Tunnel (100% CSO Control)	0	0	263	100	100	100	0

Costs of LTCP Alternatives

The retained alternative estimated costs for Probable Bid Costs (PBC), O&M and present worth are shown below in Table ES-10. The total present worth ranges from \$355M to \$873M. The PBCs range from \$334M to \$846M.

Table ES-10. Cost of Retained Alternatives

Alternative	Capital Cost/PBC ⁽²⁾ (\$ Million)	Annual O&M Cost ⁽²⁾ (\$ Million)	Total Present Worth (\$ Million)	Accuracy Range of Cost Estimate
1. EPA ROD Tanks (8 MG Tank at Outfall RH-034 and 4 MG Tank at Outfall OH-007)	801 ⁽¹⁾	1.9	829	AACE Class 4 - 30% to +50%
2. 5.7 MG Tank at Outfall RH-034 and 2.5 MG Tank at Outfall OH-007	663	1.4	683	AACE Class 5 - 50% to +100% ⁽³⁾
3. 3.5 MG Tank at Outfall RH-034 and 1.4 MG Tank at Outfall OH-007	493	0.9	507	See Note 4
4. 3.5 MG Tank at Outfall RH-034 and Weir Modifications at Outfalls OH-006, OH-007 and OH-024	389	0.8	401	See Note 4
5. Bond-Lorraine Sewer Reconstruction and Weir Modifications at Outfalls OH-006, OH-007 and OH-024	334	1.4	355	AACE Class 5 - 50% to +100%
6. 75% CSO Control Tunnel	680	1.0	695	AACE Class 5 - 50% to +100%
7. 100% CSO Control Tunnel	846	1.8	873	AACE Class 5 - 50% to +100%

Notes:

- (1) EPA ROD estimate for same tanks is \$77M.
- (2) Tank costs presented as capital costs based on Superfund estimates. Non-tank alternatives presented as Probable Bid Costs (PBCs). Annual O&M costs estimated from historical costs of equivalent CSO control projects implemented or previously evaluated within NYC.
- (3) Tank costs based on interpolation/extrapolation of Superfund estimates.
- (4) 3.5 MG tank at RH-034 based on AACE Class 4 estimate; 1.4 MG tank at OH-007 based on extrapolation of Superfund estimates; weir modifications based on AACE Class 5 estimate..

3. EVALUATIONS AND CONCLUSION

DEP will implement the plan elements identified in this section upon DEC's approval of this LTCP, which also recommends the continued implementation of WWFP recommendations.

LTCP analyses for the Gowanus Canal are summarized here for the following:

1. Water Quality Modeling Results
2. Use Attainability Analysis (UAA)

3. Recommendations
4. Conclusion

Water Quality Modeling Results

The bacteria simulations used a 10-year period and the typical year (2008) was used for DO. As would be expected, 10-year simulation results vary slightly from the 2008 simulations, which were used for the evaluation of alternatives which provide an effective uniform evaluation platform for multiple CSO control alternatives. The 10-year simulation is processed to confirm the water quality impacts of the LTCP baseline scenario over a longer period. For this particular LTCP, bacteria 10-year simulations were also conducted for retained alternatives that DEP is evaluating separately, consistent with the EPA’s ROD for the Gowanus Canal.

The Gowanus Canal 10-year bacteria attainment results for the baseline annual and recreational season (May 1st through October 31st) are shown in Tables ES-11 and ES-12. The tables show that water quality at all sampling stations complies with the bacteria Existing WQ Criteria and Primary Contact WQ Criteria, i.e., attainment above 95 percent. Attainment of the enterococci Potential Future Primary Contact WQ Criteria ranges from 95 to 100% for the 30 cfu/100mL criterion and 34 to 86 percent for the 110 cfu/100mL STV criterion.

**Table ES-11. Calculated 10-Year Bacteria Attainment
Baseline Conditions – Annual**

Station	Existing WQ Criteria (Class I) ⁽¹⁾		Primary Contact WQ Criteria	
	Criterion (cfu/100mL)	Attainment (%)	Criterion (cfu/100mL)	Attainment (%)
GC-1	Fecal ≤ 2,000	100	Fecal ≤ 200	98
GC-2	Fecal ≤ 2,000	100	Fecal ≤ 200	99
GC-3	Fecal ≤ 2,000	100	Fecal ≤ 200	100
GC-4	Fecal ≤ 2,000	100	Fecal ≤ 200	100
GC-5	Fecal ≤ 2,000	100	Fecal ≤ 200	100
GC-6	Fecal ≤ 2,000	100	Fecal ≤ 200	98
GC-7	Fecal ≤ 2,000	100	Fecal ≤ 200	98
GC-8	Fecal ≤ 2,000	100	Fecal ≤ 200	99
GC-9	Fecal ≤ 2,000	100	Fecal ≤ 200	100
GC-10	Fecal ≤ 2,000	100	Fecal ≤ 200	100

Notes:

(1) Not currently designated to Stations GC-1 through GC-7.

Table ES-12. Calculated 10-Year Bacteria Attainment Baseline Conditions - Recreational Season (May 1st through October 31st)

Station	Existing WQ Criteria (Class I)		Primary Contact WQ Criteria		Potential Future Primary Contact WQ Criteria			
	Criterion ⁽¹⁾ (cfu/100mL)	Attainment (%)	Criterion (cfu/100mL)	Attainment (%)	Criterion (cfu/100mL)	Attainment (%)	Criterion (cfu/100mL)	Attainment (%)
GC-1	Fecal ≤ 2,000	100	Fecal ≤ 200	100	Enterococci ≤ 30	99	Enterococci STV ≤ 110	70
GC-2	Fecal ≤ 2,000	100	Fecal ≤ 200	100	Enterococci ≤ 30	99	Enterococci STV ≤ 110	73
GC-3	Fecal ≤ 2,000	100	Fecal ≤ 200	100	Enterococci ≤ 30	99	Enterococci STV ≤ 110	73
GC-4	Fecal ≤ 2,000	100	Fecal ≤ 200	100	Enterococci ≤ 30	99	Enterococci STV ≤ 110	74
GC-5	Fecal ≤ 2,000	100	Fecal ≤ 200	100	Enterococci ≤ 30	99	Enterococci STV ≤ 110	66
GC-6	Fecal ≤ 2,000	100	Fecal ≤ 200	100	Enterococci ≤ 30	95	Enterococci STV ≤ 110	34
GC-7	Fecal ≤ 2,000	100	Fecal ≤ 200	100	Enterococci ≤ 30	95	Enterococci STV ≤ 110	35
GC-8	Fecal ≤ 2,000	100	Fecal ≤ 200	100	Enterococci ≤ 30	97	Enterococci STV ≤ 110	36
GC-9	Fecal ≤ 2,000	100	Fecal ≤ 200	100	Enterococci ≤ 30	99	Enterococci STV ≤ 110	59
GC-10	Fecal ≤ 2,000	100	Fecal ≤ 200	100	Enterococci ≤ 30	100	Enterococci STV ≤ 110	86

Notes:

(1) Not currently designated to Stations GC-1 through GC-7.

The 10-year simulation bacteria results show that the Gowanus Canal meets bacteria water quality criteria.

The 2008 simulation for DO is presented below in Table ES-13. It shows the DO water quality criteria are met for the Existing WQ Criteria and Class SC/SB DO Criteria, except at two water quality stations in which the chronic standard of the Class SC/SB DO Criteria ranges from 87 to 94 percent.

Table ES-13. Calculated 2008 DO Attainment Baseline Conditions - Annual

Station	Existing WQ Criteria		Class SC/SB WQ Criteria			
	Criterion	Attainment (%)	Criterion ⁽¹⁾	Attainment (%)	Criterion ⁽²⁾	Attainment (%)
GC-1	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-2	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-3	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-4	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-5	≥3.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100
GC-6	≥3.0 mg/L	98	≥4.8 mg/L	94	≥3.0 mg/L	98
GC-7	≥3.0 mg/L	99	≥4.8 mg/L	95	≥3.0 mg/L	99
GC-8	≥4.0 mg/L	95	≥4.8 mg/L	87	≥3.0 mg/L	100
GC-9	≥4.0 mg/L	100	≥4.8 mg/L	99	≥3.0 mg/L	100
GC-10	≥4.0 mg/L	100	≥4.8 mg/L	100	≥3.0 mg/L	100

Notes:

- (1) Chronic standard.
- (2) Acute standard.

In summary, the 10 year simulation shows the Gowanus Canal is meeting Existing WQ Criteria and will meet bacteria Primary Contact WQ Criteria. DO water quality criteria are met except at two water quality stations in which the chronic standard of the Class SC/SB DO Criteria ranges from 87 to 94 percent. Additional CSO reductions would have little or no impact on projected attainment of water quality criteria.

Table ES-14 presents an overview of the findings.

Table ES-14. Classifications and Standards Applied - 10 Year Model Simulation Results

Analysis	Numerical Criteria Applied		Compliance
Existing WQ Criteria Fish Survival (Class SD) and Boating/Fishing (Class I)	Gowanus Canal Above Hamilton Ave (Class SD)	Fecal - None	Yes
		DO never < 3.0 mg/L ⁽⁴⁾	Yes
	Gowanus Bay Below Hamilton Ave (Class I)	Fecal Monthly GM ≤ 2,000	Yes
		DO never <4.0 mg/L ⁽⁴⁾	Yes
Bacteria Primary Contact WQ Criteria ⁽¹⁾ / DO Class SC/SB	Saline Water	Fecal Monthly GM ≤ 200	Yes
		Daily Average DO ≥ 4.8 mg/L ^{(3) (4)}	No ⁽⁵⁾
		DO never < 3.0 mg/L ⁽⁴⁾	Yes
Potential Future Primary Contact WQ Criteria ⁽²⁾	Enterococci: rolling 30-d GM – 30 cfu/100mL Enterococci: STV – 110 cfu/100mL		Yes
			No

Notes:

- GM = Geometric Mean; STV = 90th Percentile Statistical Threshold Value
- (1) This water quality standard is not currently assigned to the Gowanus Canal or Gowanus Bay.
- (2) The Potential Future Primary Contact WQ Criteria have not yet been adopted by DEC.
- (3) The daily average DO concentration may fall below 4.8 mg/L for a limited number of days in accordance with NYSDEC TOGs 1.1.6. See Section 2 for the equation and calculation description.
- (4) DO based on 2008 typical year model simulations.
- (5) DO Attainment ranges from 87 percent to 94 percent at Stations GC-8 and GC-6.

DEP determined the amount of time following the end of rainfall required for the Gowanus Canal to recover and return to concentrations of less than 1,000 cfu/100mL fecal coliform using analyses from the August 14-15, 2008, 90th percentile storm. Details on the selection of this storm are provided in Section 6.0. The time to return to 1,000 cfu/100mL was then tabulated for each water quality station.

The results of the analysis are summarized in Table ES-15. As noted, the period of time needed for bacteria concentrations to return to levels considered by the NYS Department of Health (DOH) to be safe for primary contact varies with location. Generally, approximately 14 hours is typical for the upper reach of the Gowanus Canal, between Stations GC-1 and GC-7.

Table ES-15. Time to Recovery in Gowanus Canal (August 14-15 2008 Storm)

Class	Stations	Baseline Projected Time to Recovery (hours)
SD	GC-1 to GC-7	8 – 14
I	GC-8 to GC-10	7 – 10

UAA

The analyses contained in this LTCP demonstrate that the Gowanus Canal is projected to fully attain the existing Bacterial Primary Contact WQ Criteria. DO levels comply with existing standards and largely comply with the Class SC/SB standards except at Stations GC-6 and GC-8, at which attainment with the chronic standard ranges from 87 to 94 percent. As a result, a UAA is not required.

Recommendations

The LTCP presents DEP's recommendations consistent with the CWA, the CSO Control Policy, and the 2012 CSO Order on Consent, with the goal of meeting DEC WQS. However, this LTCP additionally summarizes bacteria and DO attainment achieved by alternatives evaluated pursuant to the ROD.

LTCP Recommendations

Existing WQS are being met as a result of DEP's refurbishment of the Flushing Tunnel and upgrade of the Gowanus PS. Water quality will improve still further with the build-out of planned GI and construction of the planned high level storm sewers (HLSS), as part of the LTCP baseline. The LTCP evaluated alternatives to further reduce CSO loadings to the Gowanus Canal beyond baseline conditions and determined that additional control measures would have little or no impact on projected water quality criteria for primary contact recreation, as the Gowanus Canal meets WQS for the Primary Contact WQ Criteria and the Potential Future Primary Contact WQ Criteria, with the exception of the STV criterion of the Potential Future Primary Contact WQ Criteria (110 cfu/100mL).

Water Quality Projections – EPA Superfund Requirements

Roughly concurrent with its analyses supporting the Gowanus Canal LTCP recommendations, DEP undertook additional analyses consistent with the ROD and as directed by the EPA's May 28, 2014 Administrative Order for Remedial Design. The latter analyses resulted in four reports that DEP will submit to the EPA. Those reports consist of the following:

1. Preliminary Remedial Design Report for CSO Facility at Red Hook Outfall RH-034.
2. Preliminary Remedial Design Report for CSO Facility at Owls Head Outfall OH-007.
3. CSO Facility Site Recommendation Report for Red Hook Outfall RH-034.
4. CSO Facility Site Recommendation Report for Owls Head Outfall OH-007.

The facilities evaluated under and described in these reports will further reduce CSO discharges to the Gowanus Canal and will further improve water quality. DEP's analyses of the alternatives proposed pursuant to the ROD are presented in the tables below and discussed fully in Section 8 of this LTCP.

**Table ES-16. Performance of Storage Tank Combinations
 from LTCP Evaluations for Outfall RH-034**

Outfall RH-034	Pre-WWFP	LTCP Baseline	ROD Proposed	Volumetric Reduction	
				74%	58%
Tank Size	-	-	8 MG	5.7 MG	3.5 MG
% Reduction	-	25%	82%	74%	58%
Remaining CSO Volume	182 MG	137 MG	33 MG	47 MG	76 MG
Annual Overflow Frequency	45	40	6	7	12

**Table ES-17. Performance of Storage Tank Combinations
 from LTCP Evaluations for Outfall OH-007**

Outfall OH-007	Pre-WWFP	LTCP Baseline	ROD Proposed	Volumetric Reduction	
				74%	58%
Tank Size	-	-	4 MG	2.5 MG	1.4 MG
% Reduction	-	16%	87%	74%	58%
Remaining CSO Volume	69 MG	58 MG	9 MG	18 MG	28 MG
Annual Overflow Frequency	48	44	5	6	13

Three alternatives from Section 8, representing alternatives with various tank sizes, are shown below. These are Alternatives 1, 2 and 3 and the corresponding tank sizes are summarized in Table ES-18. The water quality attainment with the 2008 and 10-year model simulation for bacteria and the 2008 model simulation for DO are shown below in Tables ES-19 and ES-20.

Table ES-18. LTCP Evaluated Storage Tank Sizes

Alternative	Tank Size (MG)	
	Outfall RH-034	Outfall OH-007
1. EPA ROD Tanks	8	4
2.	5.7	2.5
3.	3.5	1.4

Table ES-19. Attainment of Primary Contact WQ and Potential Future Primary Contact WQ Criteria with Alternatives 1, 2 and 3 – 2008 Model Simulation for Alternative 1 and 10 Year Model Simulations for Alternatives 2 and 3

Station	Alternatives 1, 2 and 3 Attainment with Primary Contact WQ Criteria (200 cfu/100mL fecal coliform) (%)	Attainment with Potential Future Primary Contact WQ Criteria for Enterococci					
		GM (30 cfu/100mL)			STV (110 cfu/100mL)		
		Alternative 1 (%)	Alternative 2 (%)	Alternative 3 (%)	Alternative 1 ⁽¹⁾ (%)	Alternative 2 (%)	Alternative 3 (%)
GC-1	100	≥95	≥95	≥95	87	87	86
GC-2	100	≥95	≥95	≥95	87	87	87
GC-3	100	≥95	≥95	≥95	87	87	86
GC-4	100	≥95	≥95	≥95	87	87	87
GC-5	100	≥95	≥95	≥95	90	87	84
GC-6	100	≥95	≥95	≥95	86	71	68
GC-7	100	≥95	≥95	≥95	77	71	69
GC-8	100	≥95	≥95	≥95	74	74	62
GC-9	100	≥95	≥95	≥95	76	75	72
GC-10	100	≥95	≥95	≥95	90	90	87

Notes:

(1) Alternative 1 is based on the 2008 model simulation and Alternatives 2 and 3 are based on the 10 year model simulations.

Table ES-20. WQ Criteria Dissolved Oxygen Attainment with LTCP
 Alternatives 1, 2 and 3 – 2008 Model Simulation

Class	Stations	Criteria	Attainment		
			Alternative 1 (%)	Alternative 2 (%)	Alternative 3 (%)
SD	GC-1 to GC-7	≥ 3 mg/L	99	99	99
	GC-8 to GC-10	≥ 4 mg/L	96	96	96
SC/SB	GC-1 to GC-7	Designated	95	95	95
	GC-8 to GC-10		88	88	88
	GC-1 to GC-7	Next Higher Classification	99	99	99
	GC-8 to GC-10		100	100	100

Notes:

- (1) Chronic Standard.
- (2) Acute Standard.

Table ES–21 compares compliance with the water quality classifications for the 2008 and 10-year model simulation for the Existing WQ Criteria, Primary Contact WQ Criteria for bacteria, next higher use Class SC/SB Criteria for DO, and the Potential Primary Contact WQ Criteria for bacteria achieved by Alternatives 1, 2 and 3.

Table ES-21. Alternatives 1, 2 and 3 – Compliance with Classifications and Standards - 2008 Model Simulation for Alternative 1 and 10 Year Model Simulations for Alternatives 2 and 3

Analysis	Numerical Criteria Applied		Compliance
Existing WQ Criteria Fish Survival (Class SD) and Boating/Fishing (Class I)	Gowanus Canal Above Hamilton Ave (Class SD)	Fecal - None;	Yes
		DO never < 3.0 mg/L ⁽⁴⁾	Yes
	Gowanus Bay Below Hamilton Ave (Class I)	Fecal Monthly GM ≤ 2,000	Yes
		DO never <4.0 mg/L ⁽⁴⁾	Yes
Bacteria Primary Contact WQ Criteria ⁽¹⁾ / DO Class SC/SB	Saline Water	Fecal Monthly GM ≤ 200	Yes
		Daily Average DO ≥4.8 mg/L ^(3,4)	No ⁽⁵⁾
		DO never < 3.0 mg/L ⁽⁴⁾	Yes
Potential Future Primary Contact WQ Criteria ⁽²⁾	Enterococci: rolling 30-d GM – 30 cfu/100mL Enterococci: STV – 110 cfu/100mL		Yes
			No

Notes:

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

- (1) This water quality standard is not currently assigned to the Gowanus Canal or Gowanus Bay.
- (2) The Potential Future Primary Contact WQ Criteria have not yet been adopted by DEC.
- (3) The daily average DO concentration may fall below 4.8 mg/L for a limited number of days in accordance with NYSDEC TOGs 1.1.6. See Section 2 for the equation and calculation description.
- (4) DO based on 2008 typical year model simulations.
- (5) DO Attainment is 88 percent at Station GC-8.

The water quality benefits achieved with Alternatives 1, 2 and 3 include reductions in CSO discharges to the Gowanus Canal. However, the 10-year water quality model runs do not show an appreciable elevation in WQS attainment. In all instances, the primary benefit will be fewer overflows to the Gowanus Canal and a greater removal of floatables.

The estimated construction and O&M costs for Alternatives 1, 2 and 3, as well as the corresponding Net Present Worth (NPW), are shown in Table ES-22.

Table ES-22. Cost of Alternatives 1, 2 and 3

Alternative		Capital Cost (\$M)	Annual O&M (\$M)	NPW (\$M)
1	8 MG Tank at Outfall RH-034	490	1.2	508
	4 MG Tank at Outfall OH-007	311	0.7	321
	Total	801	1.9	829
2	5.7 MG Tank at Outfall RH-034	450	0.9	462
	2.5 MG Tank at Outfall OH-007	213	0.5	221
	Total	663	1.4	683
3	3.5 MG Tank at Outfall RH-034	369	0.6	378
	1.4 MG Tank at Outfall OH-007	124	0.3	129
	Total	493	0.9	507

Conclusion

DEC and DEP have achieved dramatic improvements in water quality in the Gowanus Canal through an effective process that resulted in significant infrastructure improvements in the sewershed. These improvements were proposed in the 2008 WWFP submitted by DEP to DEC that was approved by DEC in 2009. That work included:

- Gowanus PS upgrade – increase capacity from 20 to 30 MGD and add screening facility to outfall for floatables control.
- Flushing Tunnel upgrade – three new pumps increasing average design flow to 215 MGD, and making it possible for more continuous flushing even during periods of low tide, with additional screening.
- Total project capital cost – \$190M.

These WWFP projects, coupled with the planned GI build-out and the proposed HLSS, are projected to bring the Gowanus Canal into full compliance with designated WQS.

In accordance with EPA Superfund requirements to reduce total suspended solids (TSS) loadings to the Canal, DEP has evaluated a range of alternatives including various CSO storage tank sizes for Outfalls RH-034 and OH-007. Such tanks, while reducing TSS loadings, also significantly reduce the frequency of overflows from LTCP baseline conditions of over 40 per year to a maximum of approximately 12 to 13 per year. These tanks will, to a certain extent, improve the level of attainment with the potential future enterococci criteria. Schedules for construction of the two tanks would be established pursuant to the Superfund program.

As noted above, the baseline projects have led to projected full compliance with designated WQS. As a result, DEP is proposing upgrading the designated Class SD portion of the Gowanus Canal to a Class I. DEP plans to extend the period of PCM to assess the potential for even further upgrades to the waterbody classification (e.g., Class SC) as it appears, based on the monitoring to-date, that water quality might support the uses associated with this classification during the recreational period. The Gowanus Canal should be considered for further upgraded WQS upon completion of the Superfund remediation work and results of water quality conditions after a longer trend of data can be analyzed from further PCM.