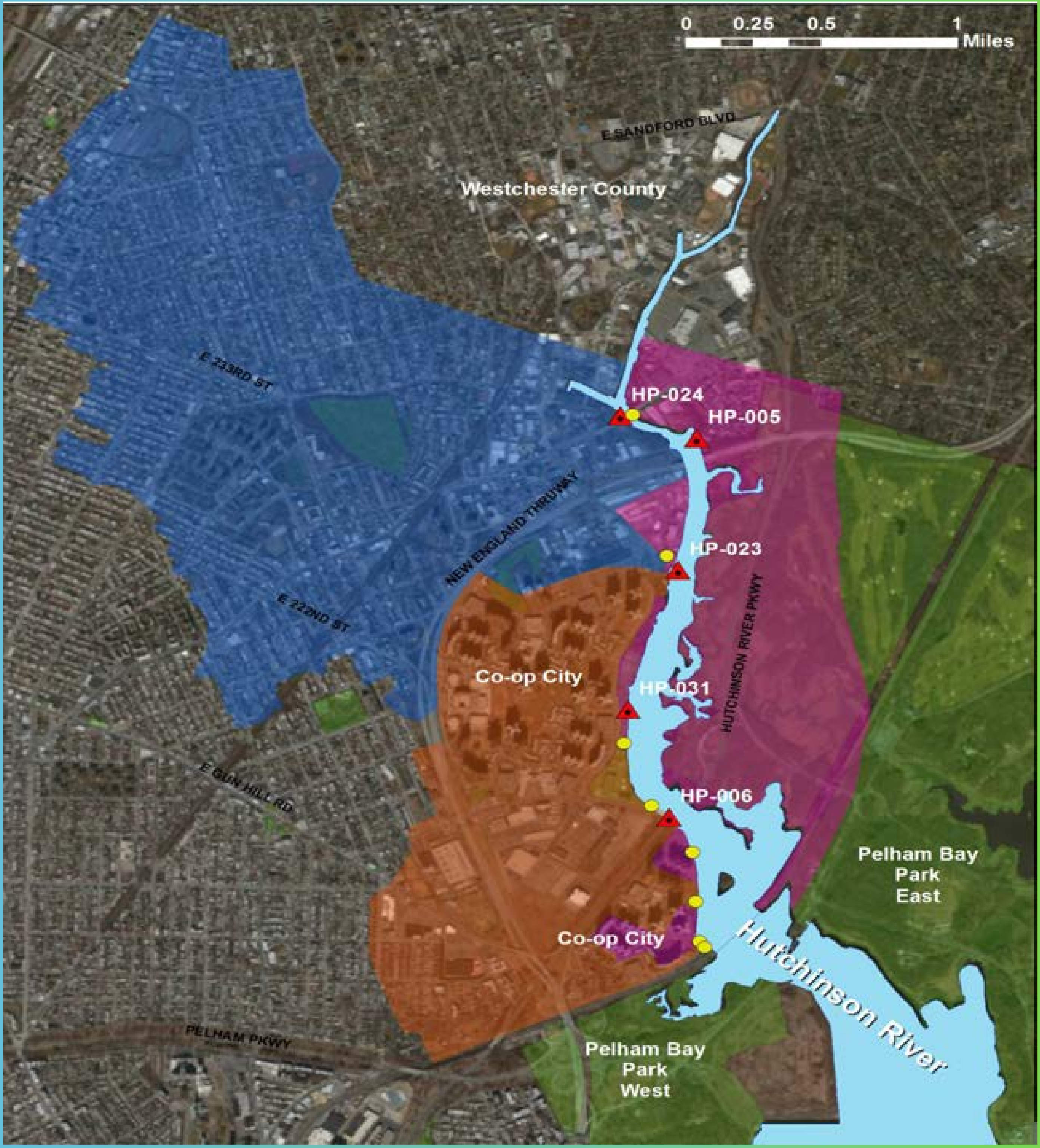
New York City Department of Environmental Protection

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

Combined Sewer Overflow Long Term Control Plan for Hutchinson River



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

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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 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 Hutchinson River waterbody are provided.

1. BACKGROUND

This Long Term Control Plan (LTCP) for Hutchinson River 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 Hutchinson River LTCP is the third of the LTCPs under the 2012 Order on Consent to be completed.

The goal of each LTCP, as described in the LTCP Goal Statement in the 2012 Order on Consent, is to identify, with public input, appropriate CSO controls necessary to achieve waterbody-specific water quality standards (WQS) consistent with the 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. For this LTCP, in accordance with guidance from DEC, 95 percent attainment of applicable water quality criteria constitutes compliance with the existing water quality standards or the Section 101(a)(2) goals conditioned on verification through rigorous post-construction compliance monitoring (PCM). The PCM will be reviewed for the Citywide LTCP and the percent attainment targets will be reviewed and, based upon the PCM results, 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.

DEC has designated the tidal Hutchinson River as a Class 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. Class SB waters include bacteria indicator criteria (fecal coliform) that are currently in the DEC WQS.

DEC has advised DEP that it plans to 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).

The criteria assessed in this LTCP include the applicable Existing WQ Criteria (Class SB – Primary Contact) (referred to hereinafter as Existing WQ Criteria) for Hutchinson River. It should also be noted that enterococci criteria do not apply to the tidal or freshwater sections of the Hutchinson River. They will apply to the tidal section of the river when adopted. 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 WQ Criteria and for the proposed 2012 EPA RWQC hereinafter referred to as the "Future Primary Contact WQ Criteria." Table ES-1 summarizes the Existing WQ Criteria and Future Primary Contact WQ Criteria applied in this LTCP.

Table ES-1. Classifications and Standards Applied

Analysis	Numerical Criteria Applied
Existing WQ Criteria – Primary Contact	SB: Fecal Monthly GM ≤ 200 cfu/100mL
Future Primary Contact WQ Criteria (1)	Entero: rolling 30-d GM – 30 cfu/100mL Entero: STV – 110 cfu/100mL

Notes:
GM = Geometric Mean; STV = 90 Percent Statistical Threshold Value.
(1) This Future Primary Contract WQ Criteria has not yet been proposed by DEC. For such criteria to take effect, DEC must first adopt the criteria in accordance with rulemaking and environmental review requirements. DEP reserves all rights with respect to any administrative and/or rulemaking process that DEC may engage in to revise WQS.

Through analyses described in this LTCP, DEP has determined that full attainment of both the Existing WQ Criteria and the Future Primary Contact WQ Criteria cannot be achieved in the Hutchinson River with 100 percent CSO control, due to the impact of non-CSO sources of bacteria, including sources which are not controlled by NYC in Westchester County. Therefore, gap analysis was also conducted using a waste load allocation (WLA) approach, as required by the 2012 Order on Consent, which examined the reductions needed from all sources in both Westchester County and NYC (CSO, separate stormwater system and direct drainage) to achieve attainment of WQS. The WLA analysis is described further below.

Because the preferred alternative would not result in attainment of bacteria WQS, a Use Attainability Analysis (UAA) is recommended for the New York City (NYC) tidal section.

Hutchinson River Watershed

Hutchinson River watershed characteristics and the NYC CSO outfalls are as shown in Figure ES-1. The NYC Municipal Stormwater Sewer Systems (MS4) outfalls are shown on Figure ES-2. Hutchinson River is a tributary of the Upper East River and is located in the eastern section of the Bronx. As further described below, the Hutchinson River LTCP Study Area comprises portions of Westchester County and NYC.

The NYC section of the watershed is bounded on the east by the Pelham Bay Park and on the west by industrial and residential areas. Industrial, manufacturing, transportation and utility uses exist along the western shore.

The Hutchinson River watershed includes portions of Westchester County and the Borough of the Bronx in NYC. The watershed in Westchester County is 5,770 acres. In NYC, the topographical watershed is 3,370 acres. Due to sewer system construction, urban development and other alterations to the watershed, the resulting watershed within NYC is now 2,552 acres with approximately 640 acres within Pelham Park. The Hutchinson River watershed has a total combined sewer impervious area of 1,128 acres out of a total NYC drainage area of 2,552 acres. This LTCP focuses on the portion of the river within NYC.

The majority of the NYC Hutchinson River watershed is served by the Hunts Point (HP) Waste Water Treatment Plant (WWTP). Sanitary flows and a portion of combined sanitary and stormwater flows are conveyed to the Hunts Point WWTP for treatment. Flows that exceed the capacity of the conveyance and treatment system are discharged into the waterbodies via permitted CSO outfalls. Limited portions of the drainage area along the shorelines discharge runoff directly to the Hutchinson River.

Green Infrastructure

DEP is planning to make significant investments in Green Infrastructure (GI) in the Hutchinson River watershed. DEP projects the following GI application rates by 2030:

- 111 acres (10 percent) to be managed using GI right-of-way-bioswales (ROWBs) and Stormwater Greenstreets;
- 32 acres (3 percent) to be managed in on-site private properties in Hutchinson River through new development and compliance with the Stormwater Performance Standard; and
- 15 acres (1 percent) to be managed in on-site public properties.

This acreage represents 14 percent of the total combined sewer impervious area in the watershed.

DEP conservatively estimated new development trends based on New York City Department of Buildings (DOB) building permit data from 2000 to 2011 and has projected that data for the 2012 to 2030 period to account for compliance with the stormwater performance standard.

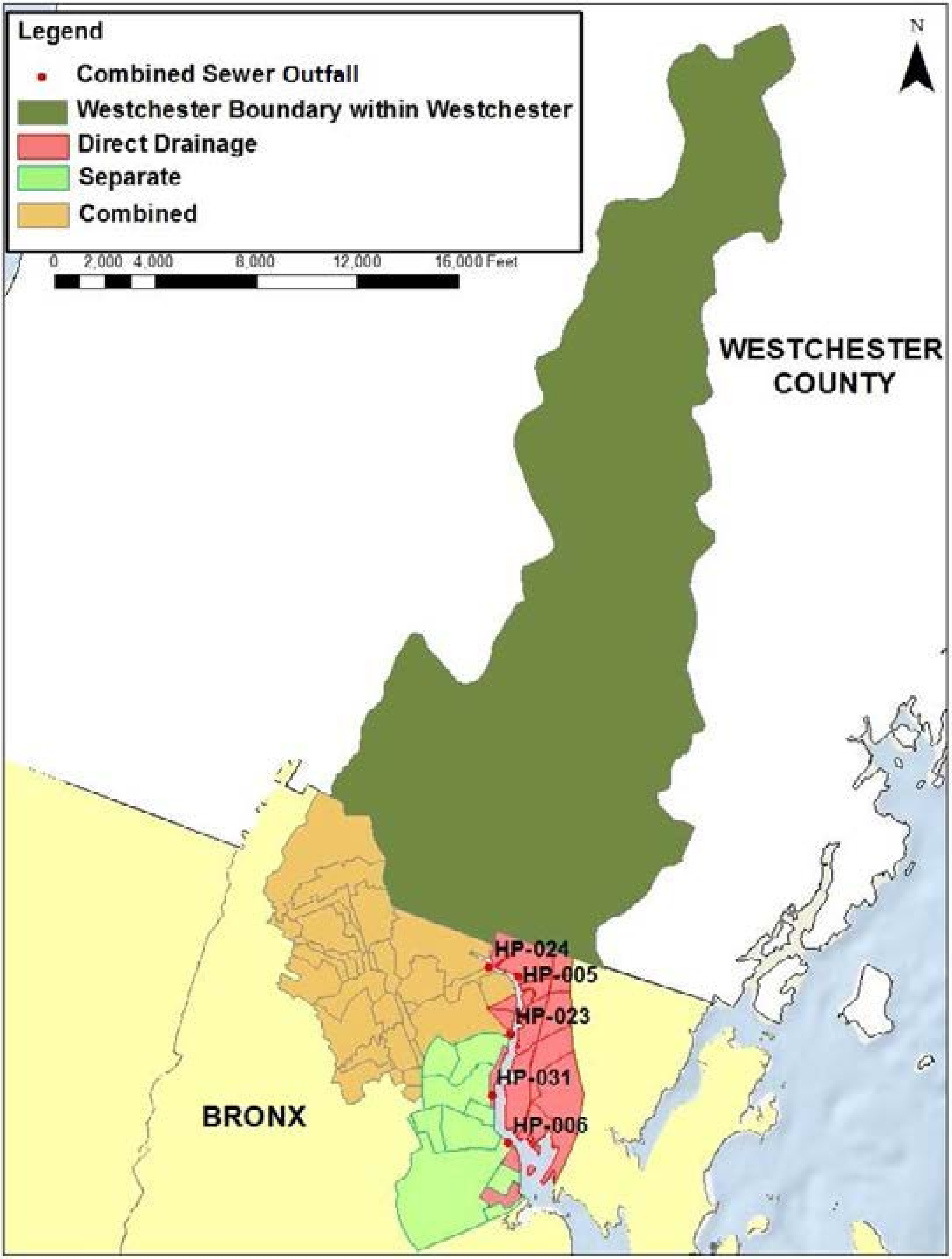

Figure ES-1. Hutchinson River Watershed Characteristics

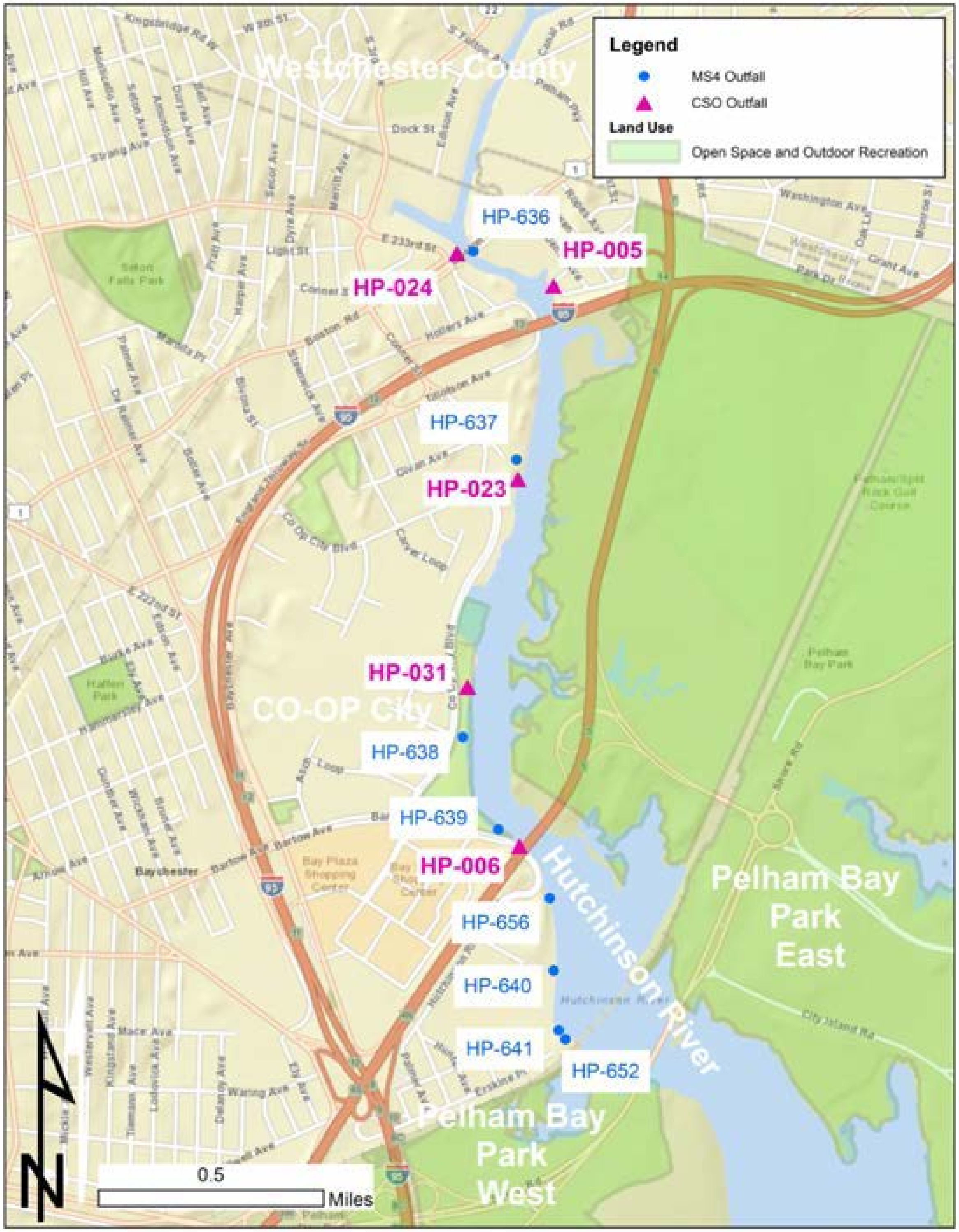

Figure ES-2. Hutchinson River CSO and DEP MS4 Discharge Locations

2. FINDINGS

Current Water Quality Conditions

Analysis of water quality in Hutchinson River was based on data collected from May 2012 to September 2012. The data was submitted to DEC in December 2012. Table ES-2 presents fecal coliform bacteria data collected at stations HR-01, HR-02, HR-03, HR-04, HR-05, HR-06, HR-07, HR-08 and HR-09 in Hutchinson River. The data in Table ES-2 shows the bacteria levels from the upstream (HR-09) to downstream (HR-01) locations. The Existing WQ Criteria for fecal coliform is exceeded at all locations except the most downstream location (HR-01). The Future Primary Contact WQ Criteria for enterococci is exceeded at all locations except HR-01.

Table ES-2. Geometric Means of In-stream Bacteria Samples

River Station	*Enterococci* (cfu/100mL)		Fecal Coliform (cfu/100mL)	
	Dry	Wet	Dry	Wet
HR-09	179	618	589	1,495
HR-08	7,606	4,964	12,253	10,132
HR-07	1,010	2,264	3,973	5,377
HR-06	55	313	140	1,134
HR-05	31	207	184	684
HR-04	34	112	467	521
HR-03	38	92	670	773
HR-02	26	58	381	516
HR-01	17	26	53	95

River stations HR-09 to HR-07 are in the freshwater reach of the river, while the stations below HR-07 are in the saltwater section. The boundary between Westchester County and NYC runs between river stations HR-06 and HR-05. Thus, the upstream freshwater section sources are primarily from Westchester County. The highest values for enterococci bacteria and fecal coliform were found in the freshwater section of the river and the lower values were observed in the tidal section.

Baseline Conditions, 100 Percent CSO Control and Performance Gap

Analyses utilizing computer models were conducted as part of this LTCP to assess attainment with Existing WQ Criteria (Class SB) and Future Primary Contact WQ Criteria for the Hutchinson River freshwater and tidal sections. 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 to the waterbody. These sources would primarily be direct drainage runoff, stormwater, CSO and Pelham Lake outflow. This analysis is presented for existing WQ criteria and Future Primary Contact WQ Criteria.

2. Determine attainment levels with 100 percent of CSO controlled or no discharge of CSO to the waterbody, keeping the remaining non-CSO 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). This model was updated and recalibrated using data from the 2012 sampling program in the Hutchinson River. Model outputs for fecal and enterococci bacteria as well as Dissolved Oxygen (DO) were compared with various monitored data sets during calibration in order to improve the accuracy and robustness of the models to adopt them for LTCP evaluations. The water quality model was then used to calculate ambient pathogen concentrations within the waterbody 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; Hunts Point Wastewater Treatment Plant (WWTP) would receive peak flows at two times design dry weather flow (2xDDWF), and waterbody-specific GI application rates would be based on the best available information. In the case of Hutchinson River, GI was assumed to have 14 percent coverage as noted above. Known dry weather sources of bacteria to the Hutchinson River in Westchester County were removed from the Baseline Conditions.

The water quality assessments were conducted using continuous water quality simulations – a one-year (2008 rainfall) simulation for bacteria and DO assessment to support alternatives evaluation, and a 10-year (2002 to 2011 rainfall) simulation for bacteria for attainment analysis for baseline, 100 percent CSO control and the preferred alternative.

The annual baseline loadings for 2008 are presented in Table ES-3.

Table ES-3. Annual CSO, Stormwater and Direct Drainage Volumes and Loads (2008 Rainfall)

Location	Outfall Type	Inflow (MG)	Enterococci (Organisms) x 10^{13}	Fecal Coliform (Organisms) x 10^{13}
NYC	CSO	322	173	512
	DEP Storm Outfall	176	33	23
	Direct Drainage	198	4.4	3
Westchester County	Wet Weather	923	175	350
	Pelham Lake Outflow	2,018	20	47

Tables ES-4 and ES-5 show the simulation results for the maximum monthly geometric mean for fecal coliform using a 10-year model simulation for the Baseline and 100 percent CSO Control. The tables present both the value of the maximum monthly geometric mean, and the percent attainment by year. The percent attainment improves from the NYC section (HR-05) to the East River (HR-01). Table ES-6 presents the 100 percent CSO control scenario for the Future Primary Contact WQ Criteria.

Table ES-4. Calculated 10-Year Fecal Coliform Maximum Monthly GM and Attainment of Existing WQ Criteria (Class SB) for Baseline

Location	(a) Monthly Maximum Fecal Coliform Geometric Mean (cfu/100mL)									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	March	March	March	October	January	December	February	June	February	August
HR-09	1077	1068	1074	1516	1289	1347	1247	2236	1148	1830
HR-08	1243	1199	1396	1765	1561	1794	1639	3178	1302	2060
HR-07	1307	1449	1853	1592	1652	2252	2038	3847	1255	2069
HR-06	301	297	170	260	387	751	623	587	281	439
HR-05	257	249	119	214	311	640	506	499	223	442
HR-04	200	193	79	156	244	485	399	348	165	345
HR-03	197	176	70	149	243	457	367	335	152	319
HR-02	151	130	52	118	186	310	277	236	116	243
HR-01	40	40	11	45	55	69	80	51	34	77
Location	(b) Fecal Coliform - Annual Attainment (Percent of Months)									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
HR-09	0	0	0	0	0	0	0	0	0	0
HR-08	0	0	0	0	0	0	0	0	0	0
HR-07	0	0	0	0	0	0	0	0	0	0
HR-06	83	58	83	75	75	83	75	67	83	58
HR-05	83	75	92	83	83	83	83	75	83	67
HR-04	100	83	100	92	83	83	83	83	100	83
HR-03	100	83	100	92	83	83	83	83	100	83
HR-02	100	100	100	92	100	83	92	83	100	83
HR-01	100	100	100	100	100	100	100	100	100	100

Table ES-5. Calculated 10-Year Fecal Coliform Maximum Monthly GM and Attainment of Existing Water Quality Criteria (Class SB) with 100% CSO Control

Location	(a) Monthly Maximum Fecal Coliform Geometric Mean (cfu/100mL)									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	March	March	March	October	January	December	February	June	February	August
HR-09	1077	1068	1074	1516	1289	1347	1247	2236	1148	1830
HR-08	1243	1199	1396	1765	1561	1794	1639	3178	1302	2060
HR-07	1307	1449	1853	1592	1652	2252	2038	3847	1255	2069
HR-06	225	238	170	192	313	557	464	468	245	283
HR-05	178	184	116	135	234	415	345	333	188	222
HR-04	130	131	76	88	173	284	257	207	133	162
HR-03	124	118	67	76	162	253	233	181	115	151
HR-02	99	91	51	64	131	184	184	142	88	118
HR-01	28	29	11	26	40	44	55	31	27	36
Location	**(b) Fecal Coliform - Annual Attainment (Percent of Months)**									
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
HR-09	0	0	0	0	0	0	0	0	0	0
HR-08	0	0	0	0	0	0	0	0	0	0
HR-07	0	0	0	0	0	0	0	0	0	0
HR-06	83	67	92	92	75	83	83	75	92	67
HR-05	100	100	100	92	92	92	83	83	100	83
HR-04	100	100	100	100	100	92	92	83	100	100
HR-03	100	100	100	100	100	92	92	92	100	100
HR-02	100	100	100	100	100	100	100	92	100	100
HR-01	100	100	100	100	100	100	100	100	100	100

Table ES-6. Calculated 10-Year Enterococci Maximum Monthly GM and Attainment of Future Primary Contact Water Quality Criteria (Class SB) with 100% CSO Control

Station		(a)Maximum 30-Day Enterococci Geometric Mean (cfu/100mL)									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
HR-09	Fresh water	562	1,069	426	734	815	492	391	914	530	829
HR-08		724	1,555	538	940	1,034	508	464	1455	604	1,033
HR-07		909	2,118	678	1,030	1,445	561	526	2,185	705	1,334
HR-06	Tidal	165	533	90	156	313	183	78	405	85	246
HR-05		145	469	75	122	272	177	64	343	72	226
HR-04		105	335	53	87	197	144	48	230	50	163
HR-03		97	302	50	81	180	135	45	201	44	144
HR-02		75	215	39	62	124	107	35	135	35	105
HR-01		19	53	11	20	29	36	9	29	12	29
Station		**(b) Enterococci - Recreational Season Attainment (Percent)**									
		2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
HR-09	Fresh water	0	0	0	0	0	0	0	0	0	0
HR-08		0	0	0	0	0	0	0	0	0	0
HR-07		0	0	0	0	0	0	0	0	0	0
HR-06	Tidal	44	39	24	65	17	39	55	28	69	19
HR-05		62	54	30	79	29	46	66	36	72	38
HR-04		75	63	52	90	46	58	80	44	84	59
HR-03		81	68	59	91	55	64	83	46	89	62
HR-02		89	76	73	92	73	78	96	66	93	67
HR-01		100	92	100	100	100	97	100	100	100	90

As shown in Table ES-5, even with 100 percent CSO control, full attainment of the existing fecal coliform standard would not be achieved in the 10-year period at river stations HR-09 to HR-06, while attainment would not be consistently achieved at river stations HR-05 to HR-02. For the Future Primary Contact WQ Criteria, the percent attainment with 100 percent CSO control is even less. The impact of non-CSO sources on attainment of WQS is evident in the data in Tables ES-5 and ES-6. Accordingly, the performance gap was assessed using a WLA process, as described below.

Waste Load Allocation Approach

The 2012 Order on Consent requires a WLA approach to be used for this LTCP. As noted above, the Hutchinson River has a freshwater and tidal water section. The freshwater section is primarily influenced by Westchester County loads and the tidal section is primarily influenced by NYC loads with some Westchester County loads included. Consistent with direction from DEC, DEP made the following major assumptions in the WLA:

- The freshwater section will meet the Existing WQ Criteria as it flows into the tidal section
- The tidal section bacteria loads are based on concentrations derived from sampling data, and CSO and stormwater flows from the InfoWorks CS™ (IW) collection system model
- WLA scenarios were evaluated for the tidal section to illustrate the bacteria load reductions needed to meet WQS assuming the freshwater section of the river was in compliance.

Freshwater Section Findings Using WLA

The load reductions needed to meet the Existing WQ Criteria in the freshwater section of the Hutchinson River range from 93 to 98 percent over the 10-year period of analysis are summarized in Table ES-7. The scope of work and timeline needed for Westchester County to meet the Existing WQ Criteria is unknown and not within DEP's control.

Table ES-7. Required Load Reductions to Attain Existing Fecal Coliform Criterion at End of Freshwater Section (Station HR-07)

Year	Pelham Lake Outflow	Westchester County Wet Weather
	Reduction %	Reduction %
2002	70.6	93.0
2003	74.9	95.2
2004	74.9	96.8
2005	67.0	96.0
2006	72.9	94.6
2007	73.5	97.4
2008	74.9	96.8
2009	75.4	98.0
2010	64.2	93.5
2011	73.7	95.1
Average	72.2	95.6

Tidal Section Findings Using WLA

Table ES-8 presents the maximum monthly fecal coliform concentrations for each year in the 10-year period, assuming the freshwater reach of the river is in compliance. As shown in Table ES-8, August 2011 represents the fourth highest month within the 10-year assessment period and, as such it was selected as the reference month to assess the WLA. Assuming the bacteria loads could be reduced such that the bacteria concentration at HR-05 could be reduced from 229 cfu/100mL to the Existing WQ Criteria, only three of 120 months in the 10-year period would remain out of compliance. The resulting percent attainment over the 10-year period would be 97.5 percent (117 out of 120 months). As noted above, in accordance with guidance from DEC, 95 percent attainment of applicable water quality criteria constitutes compliance with the existing WQ criteria. This level of protection for the WLA analysis in the tidal (salt water) reach of the Hutchinson River is consistent with the level of protection on other LTCPs. The 97.5 percent attainment level also provides a reasonable margin of safety which is commonly used in WLA assessments. Bringing August 2011 into compliance would also result in 100 percent compliance in the recreational season for the 10-year period, since the three months remaining out of compliance do not occur during the recreational season.

Table ES-8. Monthly Fecal Coliform Geometric Mean Concentrations at Station HR-05 during 2002-2011 with the Baseline and Freshwater Section in Attainment

Year	HR-05 Monthly Geo-Mean, with "HR-07" in Compliance											
ID	January	February	March	April	May	June	July	August	September	October	November	December
2002	35	10	124	40	27	39	6	8	16	27	87	55
2003	11	47	108	46	20	156	6	19	39	16	60	160
2004	15	30	27	68	62	19	53	13	19	7	80	69
2005	61	32	30	85	4	12	7	4	2	102	37	267
2006	128	53	8	58	37	52	31	11	9	73	147	41
2007	51	34	52	200	17	23	52	25	5	28	37	257
2008	51	196	64	27	31	24	6	22	25	14	58	137
2009	26	17	18	73	26	160	79	23	4	42	16	470
2010	18	74	131	23	18	7	7	4	8	23	19	44
2011	67	53	164	114	24	20	8	229	21	43	32	78

Table ES-9 summarizes the load reductions needed in the freshwater section to bring the freshwater section into compliance, and the load reductions in the tidal section needed to bring station HR-05 into compliance, assuming the freshwater load reductions are in place, for August 2011.

Table ES-9. Summary of WLA Reduction Requirements

Location	Load Sources	Existing Primary Contract Criteria - Fecal Coliform Load Reductions from Baseline Conditions (%)	Future Primary Contract Recreation Criteria – Enterococci Load Reductions from Baseline Conditions (%)
Freshwater Section	Pelham Lake Westchester County Wet Weather	73.7 95.1	88.4 98.7
Tidal Section	NYC CSO and Stormwater plus Westchester County Stormwater	14	69

Table ES-10 illustrates the reduction levels needed to meet the standards with different stormwater reduction scenarios. For example, in the tidal section a 14 percent CSO load reduction and 14 percent stormwater load reduction would be needed to achieve compliance for the August 2011 period. Alternatively, a 17 percent CSO load reduction is needed in the tidal section if zero percent reduction in stormwater loading (tidal Westchester County and NYC) is assumed.

Table ES-10. Summary of Tidal Section WLA Reduction Alternatives

Location	Criteria	WLA Reduction Requirement (%)	Source	Reduction Scenarios (%)		
Tidal Section	Existing Primary Contract Criteria - Fecal Coliform Load Reductions from Baseline Conditions	14	Municipal Stormwater	0	10	14
			CSO	17	15	14
	Future Primary Contract Recreation Criteria – Enterococci Load Reductions from Baseline Conditions	69	Municipal Stormwater	0	10	15
			CSO	94	90	88

In summary, achieving 97.5 percent annual compliance would provide a margin of safety above the 95 percent compliance level that has previously been accepted by DEC as equivalent to full attainment. 97.5 percent attainment would be achieved by bringing August 2011 into compliance with the Existing WQ Criteria assuming the freshwater reach is in compliance. CSO control alternatives that would achieve 17 percent CSO load reduction for the August 2011 period would bring August 2011 into compliance with the Existing WQ Criteria without any additional stormwater loading removal in the tidal section of the river. These parameters defined the compliance target for CSO control alternatives under the WLA scenario.

Public Outreach

DEP followed a comprehensive public participation plan in ensuring engagement of interested stakeholders in the LTCP process. Stakeholders included local residents, citywide and regional groups a number of whom offered comments at two 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 Hutchinson River Public Meeting. The third meeting will present the final identified preferred alternative to the public after DEC's review of the LTCP.

The public indicated there were some uses of the river for canoeing and kayaking. Those uses of the river are at sites that are not designated as launching locations.

Additional information on the public outreach activities is presented in Section 7 and Appendices B and C, Public Meeting Summaries and Appendix D, the UAA.

Evaluation of Alternatives

A multi-step process was used to evaluate control measures and CSO control alternatives. The evaluation process considered factors related to environmental benefits, community and societal impacts, and considerations related to implementation and Operation and Maintenance (O&M). Following the comments from technical workshops, the retained alternatives were subjected to cost performance and cost attainment evaluations where economic factors were introduced. Alternatives were also assessed against the WLA performance targets identified above. Table ES-11 presents the retained alternatives.

The Hutchinson River alternatives vary significantly in cost ranging in net present worth value from approximately $80M to over $800M. DEP's preferred alternative, Alternative 12 - 50 MGD Seasonal Disinfection in New Outfall HP-024, is valued at a construction cost of $90M and a present worth of $108M. The annual O&M costs for this alternative were estimated to be $1.25M. The LTCP cost estimates are considered Association for the Advancement of Cost Engineering (AACE) Class 5 estimates (accuracy range of -50% to +100%), which is typical and appropriate for this type of planning evaluation. Therefore, the construction cost of the preferred alternative could range from $45M to $180M. This alternative would achieve a fecal coliform load reduction of 23 percent for August 2011, which exceeds the WLA target for fecal coliform removal of 17 percent for August 2011, assuming no further stormwater load removals.

The cost-effectiveness of the alternatives was assessed by determining percent attainment of WQ criteria for 2008, assuming existing wet weather loads entering the freshwater section of the river. Figure ES-3 presents an example cost-performance curve at river station HR-05. The plot presents net present worth versus percent attainment for the Existing WQ Criteria, and the Future Primary Contact WQ Criteria. Alternative 12 is the third data point from the left axis. As indicated in Figure ES-3, alternatives with higher costs than Alternative 12 would not result in significant gains in attainment of WQ criteria. It should be noted that the percent attainment indicated in Figure ES-3 is lower than the 97.5 percent attainment referenced above under the WLA scenario because the values in Figure ES-3 include the impacts of baseline wet weather loads entering the freshwater section for 2008, while the 97.5 percent attainment was based on the WLA condition of the freshwater section being in attainment specifically for the August 2011 period.

Table ES-11. Summary of Retained Alternatives

Alternative	Description
1. Storage Tanks at HP-023 and HP-024 to provide 45% annual CSO control	2.9 MG storage tank at outfall HP-023 and 4.9 MG storage tank at outfall HP-024. Includes influent coarse screening, and facilities capable of dewatering the tanks in one day.
2. Storage Tanks at HP-023 and HP-024 to provide 25% annual CSO control	1.0 MG storage tank at outfall HP-023 and 1.7 MG storage tank at outfall HP-024. Includes influent coarse screening, and facilities capable of dewatering the tanks in one day.
3. Storage Tunnel for HP-023, HP-024 and HP-031 to provide 100% annual CSO control	39-ft. dia., 5,400 LF tunnel to capture CSO from outfalls HP-023, HP-024 and HP-031. Includes 22 MGD dewatering PS.
4. Storage Tunnel for HP-023, HP-024 and HP-031 to provide 76% annual CSO control	24-ft. dia., 5,400 LF tunnel to capture CSO from outfalls HP-023, HP-024 and HP-031. Includes 17 MGD dewatering PS.
5. Storage Tunnel for HP-023, HP-024 and HP-031 to provide 48% annual CSO control	16-ft. dia., 5,400 LF tunnel to capture CSO from outfalls HP-023, HP-024 and HP-031. Includes 8 MGD dewatering PS.
6. Individual RTB with disinfection facility at HP-024 to provide 40% seasonal CSO control	1.6 MG contact tank, with influent screens, 150 MGD effluent pumping, 1.6 MGD dewatering pumping, and disinfection chemical storage and feed equipment. Facilities located at outfall HP-024.
7. Individual RTB with disinfection facility at HP-023 to provide 50% seasonal CSO control	0.73 MG contact tank, with influent screens, 70 MGD effluent pumping, 0.73 MGD dewatering pumping, and disinfection chemical storage and feed equipment. Facilities located at outfall HP-023.
8. Consolidated HP-023/HP-024 RTB with disinfection facility at HP-023 to provide 88% seasonal CSO control	2.1 MG contact tank, with influent screens, 203 MGD effluent pumping, 2.1 MGD dewatering pumping, and disinfection chemical storage and feed equipment. Facilities sized for flows from outfalls HP-023 and HP-024, with consolidation conduit to carry flows from outfall HP-024 to facility located at outfall HP-023.
9. Consolidated HP-023/HP-024 RTB with disinfection facility at HP-023 to provide 78% seasonal CSO control	1.3 MG contact tank, with influent screens, 123 MGD effluent pumping, 1.3 MGD dewatering pumping, and disinfection chemical storage and feed equipment. Facilities sized for flows from outfalls HP-023 and HP-024, with consolidation conduit to carry flows from outfall HP-024 to facility located at outfall HP-023.
10. Consolidated HP-023/HP-024 RTB with disinfection facility at HP-023 to provide 62% seasonal CSO control	0.64 MG contact tank, with influent screens, 62 MGD effluent pumping, 0.64 MGD dewatering pumping, and disinfection chemical storage and feed equipment. Facilities sized for flows from outfalls HP-023 and HP-024, with consolidation conduit to carry flows from outfall HP-024 to facility located at outfall HP-023.
11. 25 MGD Seasonal Disinfection in New Outfall HP-024	New 10-ft. diameter, 600 LF outfall pipe with 25 MGD disinfection facility for outfall HP-024. New outfall configured to provide 15 minutes detention time at 25 MGD. Floatables control to be provided for new outfall.
12. 50 MGD Seasonal Disinfection in New Outfall HP-024	New 10-ft. diameter, 1,200 LF outfall pipe with 50 MGD disinfection facility for outfall HP-024. New outfall configured to provide 15 minutes detention time at 50 MGD. Floatables control to be provided for new outfall.
13. 150 MGD Seasonal Disinfection in New Outfall HP-024	New 10-ft. diameter, 3,000 LF outfall pipe with 150 MGD disinfection facility for outfall HP-024. New outfall configured to provide 15 minutes detention time at 150 MGD. Floatables control to be provided for new outfall.

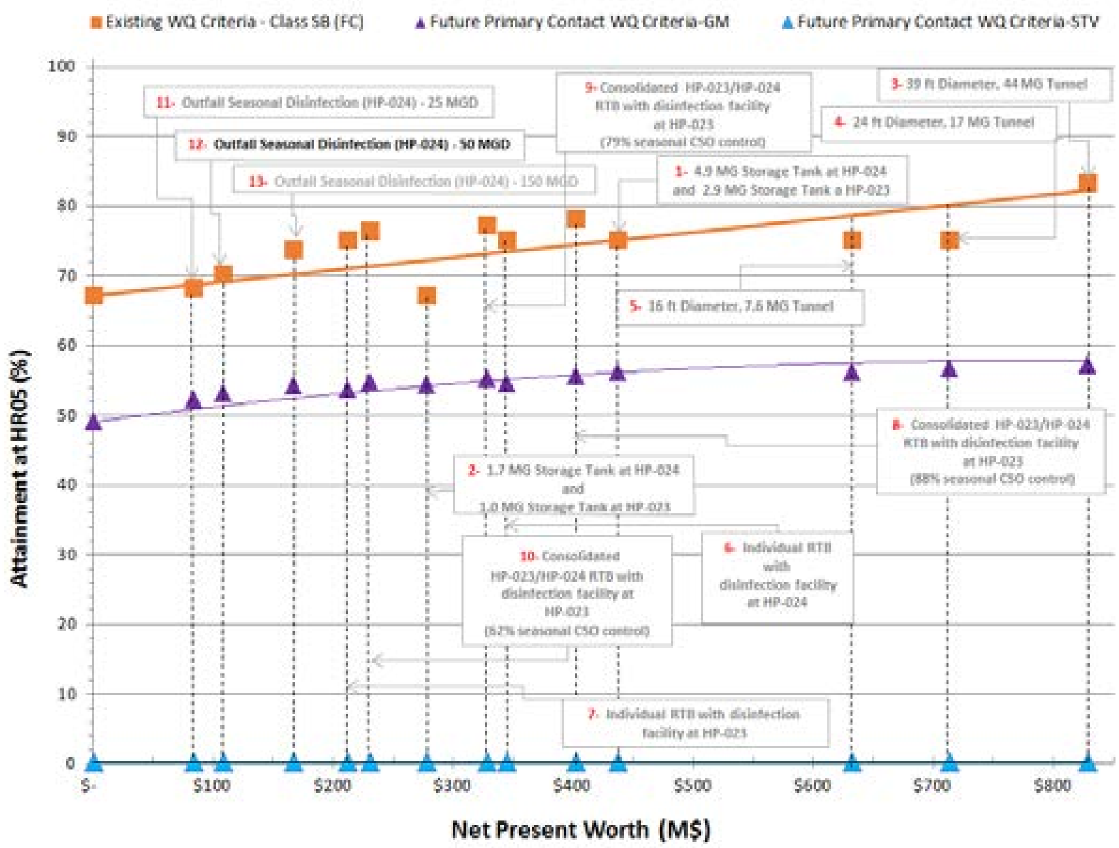

Figure ES-3. Cost vs. WQ Attainment at Station HR-05 (2008 Rainfall)

The preferred Alternative 12 consists of the following:

1. Disinfection of 50 mgd in a new 1200 foot, 10 foot diameter, pipe discharging to the river.
2. A 2-log kill (99 percent) is planned for the alternative for the recreational season (May 1st to October 31st).
3. Appropriate floatables control measures for the new outfall will be evaluated during design.
4. The estimated construction cost is $90M (Class 5 range $45M to $180M) and the present worth is $108M.
5. A preliminary site layout is shown in Figure ES-4 below.

Figure ES-4. Preferred Alternative – 50 MGD Seasonal Disinfection in New Outfall HP-024

3. RECOMMENDATIONS

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

The LTCP analyses and recommendations for Hutchinson River 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 calculated percent attainment for the recreational season for the Existing WQ Criteria and Future Primary Contact WQ Criteria for the preferred alternative are shown in Table ES-12. Annual attainment for the Existing WQ Criteria is shown in Table ES-13. The model runs that generated these results included baseline wet weather loads to the freshwater section of the river which result in the freshwater section being out of compliance. During the recreational season, the results show attainment that approaches (tidal section of the river) the DEC goal of 95 percent attainment for the Existing WQ Criteria but would be well below Future Primary Contact WQ Criteria.

Table ES-12. Calculated 10-year Bacteria Attainment for the Preferred Alternative - Recreational Season Only

Station	Existing WQ Criteria		Future Primary Contact WQ Criteria	
	Criterion	Attainment (%)	Criterion	Attainment (%)
HR-09	Fecal <= 200	0	Entero <=30	0
			STV <= 110	0
HR-08	Fecal <= 200	0	Entero <=30	0
			STV <= 110	0
HR-07	Fecal <= 200	0	Entero <=30	0
			STV <= 110	0
HR-06	Fecal <= 200	92	Entero <=30	41
			STV <= 110	3
HR-05	Fecal <= 200	95	Entero <=30	55
			STV <= 110	4
HR-04	Fecal <= 200	95	Entero <=30	68
			STV <= 110	8
HR-03	Fecal <= 200	97	Entero <=30	72
			STV <= 110	8
HR-02	Fecal <= 200	97	Entero <=30	83
			STV <= 110	13
HR-01	Fecal <= 200	100	Entero <=30	99
			STV <= 110	60

Table ES-13. Calculated 10-year Bacteria Attainment for the Identified Preferred Alternative-Annual Period

Station	Existing WQ Criteria	
	Criterion	Attainment (%)
HR-09	Fecal <=200	0
HR-08	Fecal <=200	0
HR-07	Fecal <=200	0
HR-06	Fecal <=200	77
HR-05	Fecal <=200	84
HR-04	Fecal <=200	90
HR-03	Fecal <=200	91
HR-02	Fecal <=200	94
HR-01	Fecal <=200	100

Attainment levels for the Existing WQ Criteria across the year are below the 95 percent attainment goal. Therefore a UAA will be required in all locations except HR-01. It should be noted that these levels of attainment differ from the 97.5 percent level of attainment discussed above for the WLA approach. This is because the WLA approach reduced the loads to bring the freshwater section into compliance.

Attainment of the STV upper 90th percentile values contained in the Future Primary Contact WQ Criteria is difficult if not impossible to achieve. Maximum enterococci concentrations achieved with the preferred alternative will not meet the EPA recommended Future Contact WQ Criteria STV concentration of 110 cfu/100mL.

Potential UAA Site-Specific Targets

Since the identified preferred alternative will not result in full compliance in Hutchinson River with the Existing WQ Criteria, due to sources which are beyond DEP's jurisdiction to control, DEP has prepared a UAA for Hutchinson River that identifies potential site-specific incremental targets.

These site-specific targets are based on water quality model simulations that account for CSO and stormwater sources. Under these conditions, the bacteria water quality indicators should be less than the identified targets the majority of the time.

The recommended recreational season site-specific targets are summarized in Table ES-14 along with the Existing WQ Criteria and Future Primary Contact WQ Criteria. Recommended targets for the non-recreational season are discussed in Section 8.

A time to recover analysis was also done for the tidal section of the river. Estimated times in hours are presented in Table ES-15 and described in Section 8. The longer times are associated with the higher rainfall intervals.

Table ES-14. Summary of Recreational Period Water Quality Targets for the Huchinson River – UAA

Location	Existing WQ Criteria	Future Primary Contact WQ Criteria	Site-Specific Targets with Disinfection (cfu/100mL)	Attainment with Site-Specific Targets (%)
Upper Tidal River	Fecal Coliform ≤ 200	Fecal Coliform No change	Fecal Coliform ≤ 400	96
	Enterococci N/A	Enterococci ≤ 30	Enterococci ≤ 150	95
Lower Tidal River	Fecal Coliform ≤ 200	Fecal Coliform No change	Fecal Coliform ≤ 200	95
	Enterococci N/A	Enterococci ≤ 30	Enterococci ≤ 100	95

Table ES-15. Summary of Estimated Time To Recover for Hutchinson River

	HR-05		HR-04		HR-03		HR-02		HR-01	
Rain Event Size (in)	Fecal	Entero	Fecal	Entero	Fecal	Entero	Fecal	Entero	Fecal	Entero
<0.1	-	-	-	-	-	-	-	-	-	-
0.1-0.4	-	-	-	-	-	-	-	-	-	-
0.4-0.8	20	46	11	41	14	38	5	28	-	-
0.8-1.0	27	54	25	49	23	49	14	41	-	-
1.0-1.5	36	60	30	55	25	54	21	49	-	-
>1.5	36*	60*	29	55	28	54	28	52	7	31

Summary of Recommendations

Water quality in Hutchinson River will be improved with the preferred alternative set forth and the implementation of the planned GI projects and recommendations made herein.

The actions identified in this LTCP include:

1. Alternative 12 - Disinfection of 50 MGD of CSO in a 1,200 foot long, 10 foot diameter pipe, including a new outfall to the river, has been identified as the preferred alternative. Appropriate floatables control measures for the new outfall will be evaluated during design. The estimated construction cost is $90M (Class 5 range $45M to $180M) and the annual O&M cost is $1.25M. The net present worth for the $90M construction cost and annual O&M costs is $108M. The new disinfection facility would be operational during the recreational season (May 1st to October 31st),

and would provide a 23 percent reduction in CSO bacteria loadings to the tidal section for the August 2011 period. Under the WLA approach, which assumes freshwater in compliance, a 17 percent CSO reduction with no stormwater reductions for the August 2011 model run would result in 97.5 percent attainment over the 10-year period of analysis. Therefore, no future stormwater reductions from NYC are required to meet the WLA load reduction target with this identified preferred alternative. Although this LTCP concerns CSOs, DEP believes this alternative is the most cost effective solution for both CSO and stormwater and is therefore going beyond the focus of this LTCP to address both wet weather sources.

2. Section 9.0 presents the implementation of the identified elements. Significant coordination, funding approvals, land acquisitions and permitting will be required for the design and construction.

3. A UAA is provided with site-specific targets for the NYC tidal section in Appendix D.

4. DEP will continue to invest in water quality improvements through the Green Infrastructure program.

DEP is committed to improving water quality in this waterbody, which will be advanced by the improvements and recommendations presented in this plan. These identified actions have been balanced with input from the public and awareness of the cost to the citizens of New York City.

1.0 INTRODUCTION

This Long Term Control Plan (LTCP) for Hutchinson River 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 ten waterbody-specific and one citywide LTCP to the New York State Department of Environmental Conservation (DEC) by December 2017. The Hutchinson River LTCP is the third of those 11 LTCPs to be completed.

1.1 Goal Statement

The following is the LTCP Introductory Goal Statement, which appears as Appendix C in the 2012 Order on Consent. It is generic in nature, so that waterbody-specific LTCPs will take into account, as appropriate, the fact that certain waterbodies or waterbody segments may be affected by New York City's (NYC) 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) goals of the Clean Water Act, or where the proposed alternative set forth in the LTCP will not achieve existing water quality standards or the Section 101(a)(2) goals, the LTCP will include a Use Attainability Analysis, examining whether applicable waterbody classifications, criteria, or standards should be adjusted by the State. The Use Attainability Analysis will assess the waterbody's highest attainable use, which the State will consider in adjusting water quality standards, classifications, or criteria and developing waterbody-specific criteria. Any alternative selected by a LTCP will be developed with public input to meet the goals listed above.*
>
> *On January 14, 2005, the NYC Department of Environmental Protection and the NYS Department of Environmental Conservation entered into a Memorandum of Understanding (MOU), which is a*

> *companion document to the 2005 CSO Order also executed by the parties and the City of New York. The MOU outlines a framework for coordinating CSO long-term planning with water quality standards reviews. We remain committed to this process outlined in the MOU, and understand that approval of this LTCP is contingent upon our State and Federal partners' satisfaction with the progress made in achieving water quality standards, reducing CSO impacts, and meeting our obligations under the CSO Orders on Consent."*

This Goal Statement has guided the development of the Hutchinson River LTCP and accompanying Use Attainability Analysis (UAA).

1.2 Regulatory Requirements (Federal, State, Local)

The waters of NYC are subject to Federal and New York State regulations. The following sections provide an overview of the regulatory issues relevant to long term CSO planning.

1.2.a Federal Regulatory Requirements

The 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 State 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 "303(d) List"). The 303(d) 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 WQS for the impaired waterbody.

The lower reach of Hutchinson River (the NYC reach) was considered as high priority for TMDL development and was included on the 2004 303(d) List for Depressed Dissolved Oxygen (DO) Levels. In 2006, the NYC reach was removed from the 303(d) List because of the 2005 CSO Order on Consent between DEC and DEP. As shown in Table 1-1, the Lower Hutchinson River remains delisted (updated February 2013) as a Category 4b waterbody for which required control measures other than a TMDL are expected to restore uses.

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

Waterbody	Pathogens	DO/Oxygen Demand	Floatables
Lower Hutchinson River (Bronx County)	N/A[(1)]	De-listed Category 4b Urban/Storm/CSOs	De-listed Category 4b CSOs, Urban/Storm

Notes:

(1) The Lower Hutchinson River is not on the 303(d) list for pathogens, and pathogens are not specifically identified as a cause of impairment for the Lower Hutchinson River under Category 4b. A footnote on the Category 4b list indicates that the Lower Hutchinson River is "being addressed through the NYC CSO Consent Order to meet pathogen standards..."

1.2.b Federal CSO Policy

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

1.2.c New York State Policies and Regulations

The State of New York (NYS) has established WQS for all navigable waters within its jurisdiction. Hutchinson River is classified as an SB waterbody. A Class SB waterbody is defined as "suitable for fish, shellfish and wildlife propagation and survival." The best usages of Class SB waters are "primary and secondary contact recreation and fishing" (6 NYCRR 701.11).

The States of New York, New Jersey and Connecticut are signatories to the Tri-State Compact which designated the Interstate Environmental District and created the Interstate Environmental Commission (IEC). The Interstate Environmental District includes all tidal waters of greater New York City, including Hutchinson River. The IEC has recently been incorporated into and is now part of the New England Interstate Water Pollution Control Commission (NEIWPCC), a similar multi-state compact of which NYS is a member. Hutchinson River is classified as Type A under the IEC system. Details of the IEC Classifications are presented in Section 2.2.

1.2.d Administrative Order on Consent

NYC 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 the LTCPs. The 2005 CSO Order on Consent requires 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 CSO 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 MOU to facilitate WQS reviews in accordance with the EPA CSO Control Policy. The last modification that occurred prior to 2012 was in 2009, which addressed the completion of the Flushing Bay CSO Retention Tank.

In March 2012, DEP and DEC amended the 2005 CSO Order on Consent to provide for incorporation of Green Infrastructure (GI) into the LTCP process, as proposed under NYC's Green Infrastructure Plan, and to update certain project plans and milestone dates. In doing so, some of the grey infrastructure projects noted in earlier Facility Plans or the Waterbody/Watershed Facility Plans (WWFP) were eliminated from the 2012 Order on Consent.

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 amount and frequency of wet weather discharges and improve water quality. DEP expects that alternatives will include a combination of green and grey infrastructure elements that are carefully evaluated using both the collection system and receiving water models. Following the analysis of alternatives, DEP will develop a recommended plan, along with an implementation schedule and strategy. 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 DEP's prior efforts by capturing the findings and recommendations from the previous facility planning documents for this watershed, including the WWFP. The LTCP integrates and builds on this existing body of work.

In June 2007, DEP issued the Hutchinson River WWFP. The WWFP, which was prepared pursuant to the 2005 CSO Order on Consent, includes an analysis and presentation of operational and structure modifications targeting the reduction of CSOs and improvement of the overall performance of the collection and treatment system within the watershed. The 2012 Order on Consent includes milestones for conducting water quality sampling and developing a report on the water quality and sewer system for the Hutchinson River. In addition, the 2012 Order on Consent deleted the requirement for construction of these CSO tanks and required a waste load allocation to better quantify the need for CSO controls. As such, no grey infrastructure projects were planned or implemented in the Hutchinson River as a result of the previous CSO facilities planning or the Order on Consent. The field sampling and sampling report were completed in 2012, and the Water Quality and Sewer System Report were submitted on July 1, 2013 in accordance with the 2012 Order on Consent milestones, and the revised submittal dated September 2014.

1.3.b Coordination with DEC

As part of the LTCP process, DEP attempted to work closely with DEC to share ideas, track progress, and work toward developing strategies and solutions to address wet weather challenges for the Hutchinson River LTCP.

During the early phases of the LTCP development, representatives from DEP and DEC technical staff, along with their technical consultants, conducted technical meetings on the Hutchinson River LTCP. The purpose of these early meetings was to discuss the plan components, including technical analysis and approach, 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 includes technical staff and representatives from DEP and DEC's legal departments and department chiefs who oversee the execution of the CSO program.

In addition to these meetings, DEC read a prepared statement at the first and second public meetings (see Section 7).

1.3.c Watershed Planning

DEP prepared its CSO WWFPs before the emergence of GI as an established method for reducing stormwater runoff. Consequently, the WWFPs did not include a full analysis of GI alternatives for controlling CSOs. In comments on DEP's CSO WWFPs, community and environmental groups voiced widespread support for GI, urging DEP to place greater reliance upon that sustainable strategy. In September 2010, NYC published the *NYC Green Infrastructure Plan*, hereinafter 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 Hutchinson LTCP planning process to involve 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 would reach interested stakeholders;
- Integrate the public outreach efforts with 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 related programs.

The public participation efforts for this Hutchinson LTCP are summarized in Section 7.0 in more detail.

2.0 WATERSHED/WATERBODY CHARACTERISTICS

This section summarizes the major characteristics of the Hutchinson River Watershed and Waterbody, building upon earlier documents that present a characterization of the area, most recently, the Waterbody/Watershed Facility Plan (WWFP) for Hutchinson River (DEP, 2007).

2.1 Watershed Characteristics

Hutchinson River (the river) begins in Westchester County, NY, flows through the Borough of the Bronx, and empties into Eastchester Bay. This system is a tributary of the Upper East River and lies immediately to the west of Long Island Sound. The Bay, in turn, empties into the Upper East River. The River is tidal throughout the Bronx but receives freshwater input in Westchester County, NY and from combined sewer overflow (CSO) and stormwater discharges. The Hutchinson River waterbody and watershed is largely urbanized and suburbanized. The watershed is bounded on the north by Westchester County, NY, the west by the Westchester Creek watershed, the east by Long Island Sound and the south by the Eastchester Bay. The Hutchinson River watershed is served by the Hunts Point Wastewater Treatment Plan (WWTP) which first came on-line in 1952 and which has been providing full secondary treatment since that time.

The Hutchinson River watershed is largely residential with a high percentage of open space and recreational area, thanks in part to Pelham Bay Park, the largest park within New York City (NYC). The watershed does, however, contain industrial, residential, commercial and parkland areas. There are several distinct regions within the watershed, each with their own character.

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 Hutchinson River, a tributary to the East River, runs 5 miles south from Scarsdale, through Westchester County and the Bronx, until it empties into Eastchester Bay. The Hutchinson River watershed includes portions of Westchester County and the Borough of the Bronx in NYC. The watershed area within Westchester County is 5,770 acres. In NYC, the topographical watershed of the Hutchinson River is 3,370 acres. Due to sewer system construction, urban development and other alterations to the watershed and runoff pathways, the resulting watershed within NYC that now drains to the Hutchinson River is approximately 2,552 acres with approximately 640 acres within Pelham Park. This Long Term Control Plan (LTCP) focuses on the portion of the river within NYC. The sewershed assessment area is shown in Figure 2-1.

The Hutchinson River boundary between fresh and saline surface waters occurs at Pelham Bridge. The Hutchinson River north of Pelham Bridge is classified as a minor river-freshwater source. South of Pelham Bridge the Hutchinson River is classified as a tidal tributary influenced by the waters of the East River.

Figure 2-1. Hutchinson River Assessment Area

The land surrounding the northern reaches of the river near the Bronx border is highly industrial with scrap metal plants and other industrial facilities surrounding its banks. The middle and southern portion of the river is bordered by the residential development Co-op City on the west bank and a more natural area, Pelham Bay Park, to the east and to the west on the southern end.

The urbanization of the Hutchinson River has led to the creation of combined sewer systems and stormwater systems that discharge to the river. Urbanization brought increased population, increased pollutants from sewage and industry, construction of sewer systems and physical changes affecting surface topography and imperviousness of the watershed. The urbanized condition also features additional sources of pollution from CSOs and industrial/commercial activities. Urbanization also reduces infiltration and natural subsurface transport and eliminated natural streams previously tributary to the Hutchinson River.

Several large and notable transportation corridors cross the watershed providing access between commercial and manufacturing areas and residential areas. Six bridges cross the navigable section (final 3 miles of the river) carrying rail and automobile traffic. From downstream heading upstream, these bridges include: Pelham Bridge (movable), Amtrak Pelham (movable), Hutchinson River Parkway (movable), Hutchinson River Parkway (movable), New England Thruway (fixed), Boston Post Road (fixed) and the Fulton Avenue Bridge (movable). The movable bridges still employ tenders and open daily for maritime traffic.

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

Land use throughout the Hutchinson River watershed is generally composed of parkland and residential areas with a few large pockets of commercial and industrial uses.

Pelham Bay Park, which spans the Hutchinson River, is the largest single feature of the watershed. A significant portion of the park is within the Hutchinson River watershed. The park is one of NYC's flagship parks and holds the distinction of being NYC's largest park at over 2,700 acres. Nearly a quarter of the area is underwater most of the time, providing a wetland environment to the park.

A small residential area is located north of Pelham Bay Park on the eastern bank of the Hutchinson River. North of the residential area on both the eastern and western banks of the river, and generally north of the Interstate 95 Bridge, there is an industrial region. The northwestern most portion of the watershed, west of New England Thruway (I-95), is primarily residential but does contain a small industrial sector and the watershed's only significant industrial user (SIU). Additionally, the area includes Seton Falls Park, a 35-acre woodland, wetland and bird sanctuary.

South of the industrial section on the eastern shore of the Hutchinson River, between I-95 and the Amtrak/Conrail river crossing, is Co-op City. This is a 330-acre medium density housing high rise cooperative. Co-op City overlooks the Hutchinson River, Pelham Park, two large shopping centers and an undeveloped strip of land along the shoreline. South of Co-op City lays the western portion of Pelham Park.

Figure 2-2 shows the overall zoning of the sewershed. Current land use for the watershed generally aligns with the established zoning. The northwestern portion of the watershed is zoned primarily residential (R4 and R5). An M1-1 industrial area is located in the northern portion of the sector and some small industrial areas in the southern portion of the sector are also M1-1. Some small commercial sections are also located along Boston Road (C8-1).

Figure 2-2. Zoning in the NYC Hutchinson River Watershed

The northernmost section of the watershed within NYC, adjacent to the Hutchinson River, just north and south of the New England Thruway (I-95), is the most industrially dense sector in the watershed. This region includes light, medium and heavy industrial zoning (M1-1, M2-1 and M3-1) and contains several scrap metal plants as well as both an asphalt and cement plant. This is also the location of outfalls HP-005, HP-024 and HP-023 of the combined sewer system.

South of this industrial region lies the housing cooperative Co-op City which also includes commercial and industrial zones. The housing units themselves are zoned R-6. The large mall located in the region (Bay Plaza Shopping Center) is zoned C4-3, C7 and C4-1. Some industries in the region on the west side of I-95 are zoned M1-1. The small area west of the interstate also includes some residential (R3-2) and commercial areas (C4-1). A small strip of public land runs between the river and Co-op City Boulevard. Another section of R-6 residential housing is located just south of the Bay Plaza Shopping Center and north of the Amtrak/Conrail railway.

South of Co-op City and the Amtrak/Conrail railway, lies the southernmost area in the Hutchinson River watershed. This area is primarily composed of the western portion of the Pelham Bay Park, north of the closed landfill. In addition to the parkland, the area is largely occupied by the interchange of I-95 and the Bronx and Pelham Parkway. The area also includes a small residential area (R3-2) just west of the intersection.

The eastern shoreline of the Hutchinson River is much more homogeneous in its zoning. With the exception of a small area north of I-95 along the river that is zoned industrial (M3-1, M1-1) and a small residential area (R3-2) to the east of that, the entire shoreline is taken up by Pelham Park Bay.

2.1.a.2 Permitted Discharges

In addition to the Hunts Point WWTP and several permitted stormwater discharge points discussed in more detail in Section 2.1.c.1, a number of other businesses/individuals hold State Pollutant Discharge Elimination System (SPDES) permits in the Hutchinson River watershed. It was determined that a total of nine state-significant SPDES permit holders are located in the watershed. These nine permit holders are located on the eastern and western shorelines of the river and encompass permitted discharges from facilities operated by Sprague, Exxon Mobil Oil Corp., Getty Petroleum Corporation, Mount Vernon Department of Public Works City Yard, West Vernon Petroleum Corporation and the Ball Chain Manufacturing Company. All but the Exxon Mobil Oil Corp. owned facilities are located in Westchester County.

None of these potential sources of contamination are associated with existing or previous CSOs. These sources, however, have the potential to affect water quality in the Hutchinson River by such means as contaminated site stormwater runoff.

2.1.a.3 Impervious Cover Analysis

Impervious surfaces within a watershed are those characterized by an artificial surface, such as concrete, asphalt, rock, or rooftop. Rainfall occurring on an impervious surface will experience a small initial loss through ponding and seasonal evaporation on that surface, with the remaining rainfall volume becoming overland runoff that directly flows into the combined sewer system and/or separate stormwater system. The impervious surface is important when characterizing a watershed and combined sewer system performance, as well as construction of hydraulic models used to simulate the performance of the combined sewer system (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 WWFPs that were submitted to New York State Department of Environmental Conservation (DEC) in 2009. However, as described below, efforts to update the model and the impervious surface representation have been recently completed.

As NYC started to focus attention on the use of Green Infrastructure to manage street runoff of stormwater 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 beneficial. In addition, NYC realized that it would be important to distinguish between impervious surfaces that directly introduce storm runoff to the sewer system [Directly Connected Impervious Areas, or DCIA] from those impervious surfaces that may not contribute runoff directly 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 impervious surface adjacent to parkland may not contribute storm runoff to the CSS and as such would not be considered to be directly connected.

In 2009 and 2010, New York City Department of Environmental Protection (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 InfoWorks CS™ (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 DEP with a better idea of where Green Infrastructure can be deployed to reduce the runoff contributions from impervious surfaces that contribute flow to the collection system.

2.1.a.4 Population Growth and Projected Flows

DEP’s Bureau of Environmental Planning and Analysis (BEPA) routinely develops water consumption and dry weather wastewater flow projections for DEP planning purposes. Water and wastewater demand projections were developed by BEPA in 2012; an average per capita water demand of 75 gallons per capita per day was determined to be representative of future uses. The year 2040 was established as the planning horizon, and populations for that time were developed by the New York City Department of Capital Planning 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 Hunts Point 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 outfall. 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 Hunts Point WWTP service area.

2.1.a.5 Update Landside Modeling

Within NYC, the Hutchinson River watershed is part of the overall Hunts Point WWTP system model (Hunts Point model). Several modifications to the collection system have occurred since the model was calibrated in 2007. Given that the Hunts Point model has been used for analyses associated with the annual reporting requirements of the SPDES permit best management practices (BMPs), 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:

- Updated representation of HP-009 (regulator R-13) via survey
- Updated hydrology upstream of HP-009 based on CSO Pilot Monitoring Program
- Removed demonstration inflatable dams (Metcalf, Lafayette)
- Updated hydrology in Hutchinson River drainage area
- Updated stormwater piping in Hutchinson River drainage area
- Removed regulator CSO 28 baffle, and raised weir 8 inches
- Included additional details for HP-011 and HP-013 outfall piping
- Updated Westchester County portion of model upstream of Hutchinson River
- Updated CSO regulator 29 and 29A improvements per "Engineering Design Services for Westchester Creek CSO Modifications"
- Updated Pugsley improvements per "Basis of Design Report for Pugsley Creek Relief Sewer"

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, DEP's Bureau of Water and Sewer Operations (BWSO) has been developing a Geographical Information System (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 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 NYC'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 (CPK), 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.

In 2012, thirteen of NYC's IW landside models underwent recalibration in addition to the updates and enhancements listed above. This effort is summarized with the calibration results in the IW Citywide Recalibration Report (DEP, 2012) required by the 2012 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 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 sets of coefficients that can be applied to other unmonitored areas of NYC. 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 Hunts Point WWTP basin. 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 U.S. Environmental Protection Agency (EPA) CSO Control 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 NYC have used the 2008 precipitation pattern to drive the runoff-conveyance processes, along with the 2008 tide observations; DEP believes 2008 to be more representative than 1988 conditions as it also includes some extreme storms.

While the WWFPs for the NYC waterbodies were based on 1988 rainfall conditions, future baseline conditions runs are now being performed using 2008 as the typical precipitation year. A comparison of these rainfall years, which led to the selection of 2008 as the typical year for this LTCP, is provided in Table 2-1. For 10-year simulations, the period of 2002-2011 is used (see Section 6).

Table 2-1. 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 Hutchinson River forms in Scarsdale, Westchester County, NY. It then flows 10 miles south through Westchester County, NY and into and through the Borough of the Bronx in NYC until it reaches Eastchester Bay. As such, the river is divided between two major political jurisdictions: (1) Westchester County, NY to the north and (2) the Borough of the Bronx within NYC, to the south. Figure 2-3 depicts the Hutchinson River watershed.

The watershed tributary to the Hutchinson River in NYC includes combined and separated sewer service areas within the Hunts Point collection system. The combined and separate service areas are located on the west side of the Hutchinson River extending from the western bank to the western boundary of the watershed. A large area of direct drainage acreage begins at the eastern shore of the river and extends eastward to the eastern boundary of the watershed. There are no combined sewers or Municipal Separate Storm Sewer Systems (MS4) storm sewers in the direct drainage areas. Rainfall that lands in direct drainage areas (typically coastal parks, undeveloped or underdeveloped areas) will flow over the land to the Hutchinson River. Figure 2-3 also depicts the locations of the various areas in the watershed.

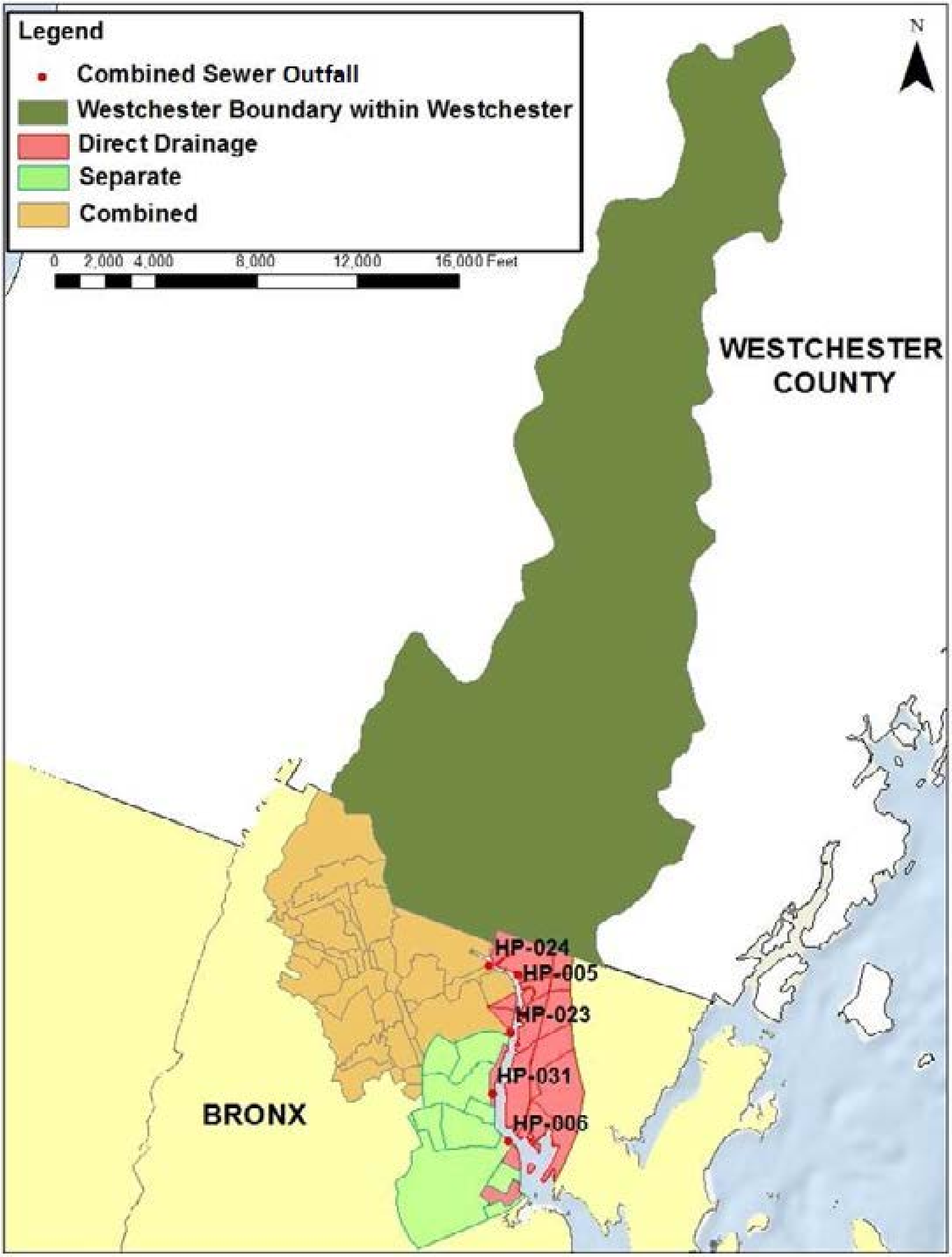

Figure 2-3. Hutchinson River Watershed

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

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

The Hunts Point 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 Hunts Point WWTP has a design dry weather flow (DDWF) capacity of 200 million gallons per day (MGD) and is designed to receive a maximum flow of 400 MGD (2xDDWF) with up to 260 MGD receiving secondary treatment (1.3 times DDWF to protect the BNR control processes). Flows over 260 MGD receive primary treatment and disinfection. A total of 15 pumping stations are located in the Hunts Point WWTP drainage area. Twelve handle combined sewage and three pump stormwater only. Five of the stations are located in the Hutchinson River drainage area. The developed areas in the Hutchinson River drainage area are all sewered.

Approximately 610 acres of Hutchinson River watershed are served by separate sanitary and storm sewers. These areas have separate sanitary sewer systems that ultimately convey flow to the interceptors to the Hunts Point WWTP. It should be noted that these separate sanitary lines convey flow into the combined system downstream of the separated area. Figure 2-4 presents the sewer system schematic for the Hunts Point drainage area. Table 2-2 presents acreage per type of drainage area.

Table 2-2. Hutchinson River Drainage Area: Acreage of Contributing Jurisdiction and System

Sewer Area Description	Area (acres)
Westchester County	5,770
NYC Combined	1,410
NYC Separate • Fully Separated • Watershed separately sewered, but with sanitary sewage subsequently flowing into a combined interceptor and stormwater either discharging directly to receiving water or into combined interceptor	610
NYC Direct Drainage • Overland Flow • Non-MS4 outfalls	532
TOTAL	8322

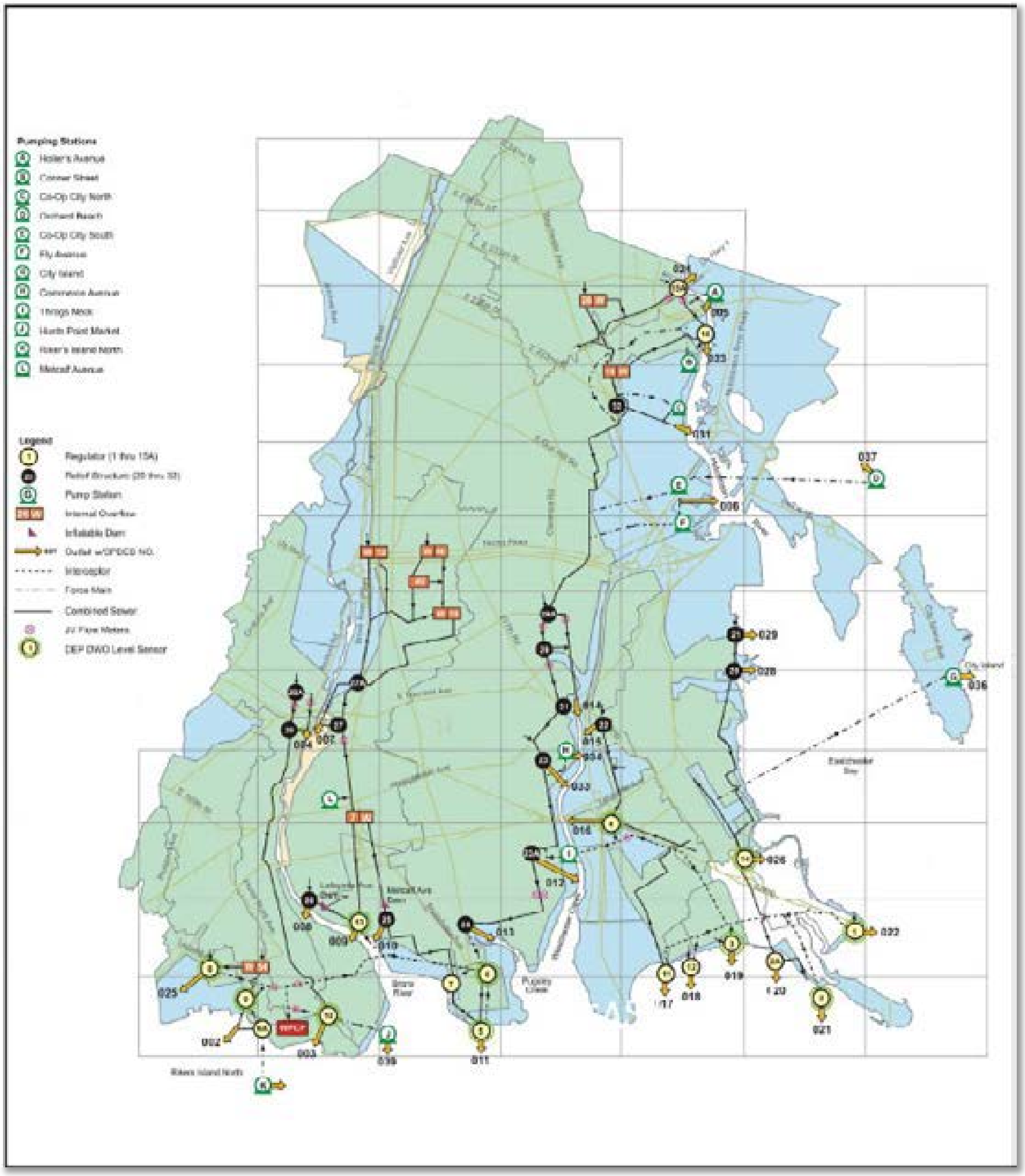

Figure 2-4. Sewer System Schematic for Hunts Point Drainage Area

Hunts Point Combined Sewer System

Combined sewers serve about 1,410 acres of the Hutchinson River drainage area. During wet weather events combined sewers may discharge to the river at three CSOs in the saline reach (HP-023, HP-024 and HP-031). HP-023 has a drainage area of 169 acres, HP-024 has a drainage area of 408 acres and HP-031 has a drainage area of 91 acres. Two pumping stations have emergency overflows at HP-005 and HP-006. In addition to the emergency overflow, HP-006 also has a drainage area of 288 acres of stormwater from nearby I-95.

The Hutchinson River drainage area includes two regulators, 15 and 15A upstream of outfalls HP-023 and HP-024, respectively. Part of the combined sewer drainage area flows into internal overflow (26W) and to Regulator 15A, which feeds HP-024. This flow can also divert to internal overflow 18 or to Regulator 15 from 15A, leading to outfall HP-023. Relief structure 32 drains a smaller defined area and is connected to outfall HP-031. Outfalls HP-005 and HP-006 provide emergency relief for Holler's Avenue and Ely Avenue Pumping Stations, respectively.

Hunts Point Stormwater Outfalls

A large area (610 acres) in the Hutchinson River sewershed is served by a separate stormwater system. The separately sewered area is located on the west side of the river, predominately in the southern portion of the sewershed at Co-op City. The total separately sewered area is 610 acres. Eight permitted MS4 stormwater outfalls are located in the Hutchinson River sewershed. One stormwater outfall is located on the eastern shore in the north (HP-636) and seven outfalls are on the eastern shore (HP-637, HP-638, HP-639, HP-640, HP-641, HP-652 and HP-656).

Examination of the population densities in the 14 NYC Sewer districts indicated that the sewer districts could be characterized and grouped into two categories of residential populations – "low density urban" and "high density urban." The Hunts Point drainage area including MS4 stormwater outfalls HP-639, HP-637, and HP-638 was classified as "high density urban" or a sewer district that has densities greater than 20,000 persons/mi^2. Figure 2-5 shows the Hutchinson River CSO and MS4 stormwater discharge locations.

2.1.c.2 Stormwater and Wastewater Characteristics

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

Data collected from sampling events were used to estimate concentrations for carbonaceous biochemical oxygen demand CBOD, total suspended solids (TSS), total coliform bacteria, fecal coliform bacteria and enterococci. Table 2-3 shows both the sanitary and stormwater concentrations for discharges to the Hutchinson River. Sanitary concentrations were developed based on sampling of WWTP influent during dry-weather periods (DEP, 2002). Stormwater concentrations were developed based on maximum likelihood estimator values based on waterbody-specific sampling results collected in 2012, as well as earlier sampling conducted citywide as part of the Inner Harbor Facility Planning Study (DEP, 1994), and sampling conducted citywide by the DEP for the USEPA Harbor Estuary Program (HydroQual, 2005).

This analysis is presented in the Hutchinson River CSO Waste Load Allocation Water Quality and Sewer System Report, submitted to DEC in June 2013 and resubmitted September 2014.

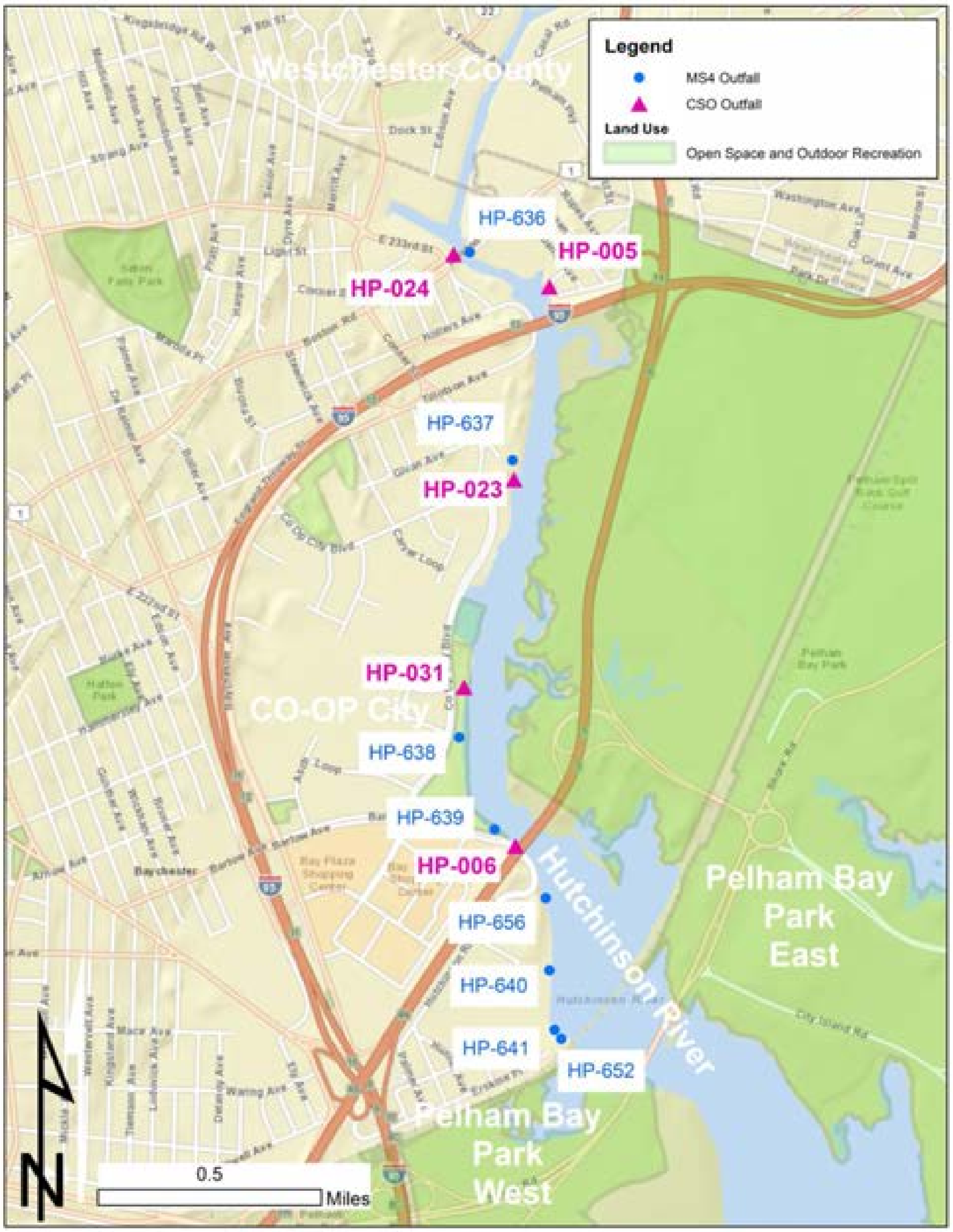

Figure 2-5. Hutchinson River CSO and MS4 Discharge Locations

Table 2-3. Sanitary and Stormwater Discharge Concentrations, Baseline Condition

<table>
<tr><th>Constituent</th><th>Sanitary Concentration [1]</th><th colspan="2">Stormwater Concentration[2, 3]</th></tr>
<tr><td>CBOD (mg/L)</td><td>110</td><td colspan="2">15</td></tr>
<tr><td>TSS (mg/L)</td><td>110</td><td colspan="2">15</td></tr>
<tr><td>Total Coliform Bacteria (cfu/100mL)[4]</td><td>25x10^6</td><td colspan="2">300,000</td></tr>
<tr><td rowspan="2">Fecal Coliform Bacteria (cfu/100mL)[4]</td><td rowspan="2">4x10^6</td><td>NYC[5]</td><td>Westchester County[5]</td></tr>
<tr><td>35,000</td><td>100,000</td></tr>
<tr><td rowspan="2">Enterococci (cfu/100mL)[4]</td><td rowspan="2">1x10^6</td><td>NYC[5]</td><td>Westchester County[5]</td></tr>
<tr><td>50,000</td><td>50,000</td></tr>
</table>

Notes:
(1) NYCDEP, 2002
(2) NYCDEP, 1994
(3) HydroQual, 2005
(4) Bacterial Concentrations expressed as “colonies forming units” per 100mL.
(5) NYCDEP, 2012

2.1.c.3 Hydraulic Analysis of Sewer System

A citywide hydraulic analysis was completed in December 2012 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 Hutchinson River drainage area after this effort was completed. Thus, the model results reported in this sub-section, while relevant for their intended use to document overall system-wide performance beyond the Hutchinson River 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 years 2008, and with projected 2040 DWFs; and

- Estimation of peak conduit/pipe flow rates that would result from a significant single event with projected 2040 DWFs.

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

Annual Hours at 2xDDWF for 2008 with Projected 2040 DWFs

Model simulations were conducted to estimate the annual number of hours that the Hunts Point WWTP would be expected to treat 2xDDWF for the 2008 precipitation year, which contained a total precipitation of 46.26 inches, as measured at JFK Airport. These simulations were conducted using projected 2040 DWFs for the re-calibrated model conditions as described in the December 2012 IW Citywide Recalibration Report. For these simulations, the primary input conditions applied were as follows:

- Projected 2040 DWF conditions.
- 2008 tides and precipitation data.

- WWTP at 2xDDWF capacity of 415 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 the Hunts Point service area, the simulation of the 2008 annual rainfall year resulted in a prediction that the Hunts Point WWTP would operate at or over its 2xDDWF capacity 59 hours throughout the year.

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 to 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.

- About 94 percent (by length) of the interceptors were predicted to flow at full depth or higher. Between 53 and 55 percent (by length) of the combined sewers were also predicted to flow at full depth, and 76 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 slightly, in comparison to the non-WWFP conditions in the Hunts Point WWTP service area.

- About 76 percent of the combined sewers (by length) reached a depth of at least 75 percent under the WWFP simulations. This indicates that limited additional potential exists for in-line storage capability in the Hunts Point system.

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

There are no known system bottlenecks and areas prone to flooding in the Hutchinson River watershed. DEP conducts regular sewer inspections and cleaning as reported in the SPDES BMP Annual reports. Figure 2-6 shows the sewers inspected and cleaned throughout 2013 in the Bronx, which encompasses the entire watershed of the Hutchinson River within NYC.

DEP recently conducted a sediment accumulation analysis to quantify levels of sediments in the combined sewer systems. For this analysis, the normal approximation to the hypergeometric distribution was used to randomly select a sample subset of sewers representative of the modeled systems as a whole, with a confidence level commensurate to that of the IW watershed models. Field crews investigated each location, and estimated sediment depth using a rod and tape. Field crews also verified sewer pipe sizes shown on maps, and noted physical conditions of the sewers. The data were then used to estimate the sediment levels as a percentage of overall sewer area. The aggregate mean for the entire NYC was approximately 1.25 percent, with a standard deviation of 2.02 percent.

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. According to DEP's SPDES 2014 BMP report (for calendar year 2013), no intercepting sewers were inspected or sediment removed in the Hunts Point WWTP service area throughout this specific year.

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

The Hutchinson River watershed within NYC is entirely served by the Hunts Point WWTP. The Plant is undergoing rehabilitation to enhance nitrogen removal, and other miscellaneous improvements to existing facilities.

2.2 Waterbody Characteristics

The Hutchinson River is a unique and complex waterbody with a tidally affected section, as well as an upstream freshwater section. The river begins in Westchester County and flows into NYC. As described earlier, multiple sources impact the river, including municipal stormwater and dry weather discharges from multiple municipalities in Westchester County, and CSOs and stormwater from NYC. This section of the report describes the features and attributes of the Hutchinson River. Characterization of the waterbody provides basic information for assessing the impact of wet weather inputs as well as in the creation of approaches and solutions that mitigate the impact from wet weather discharges.

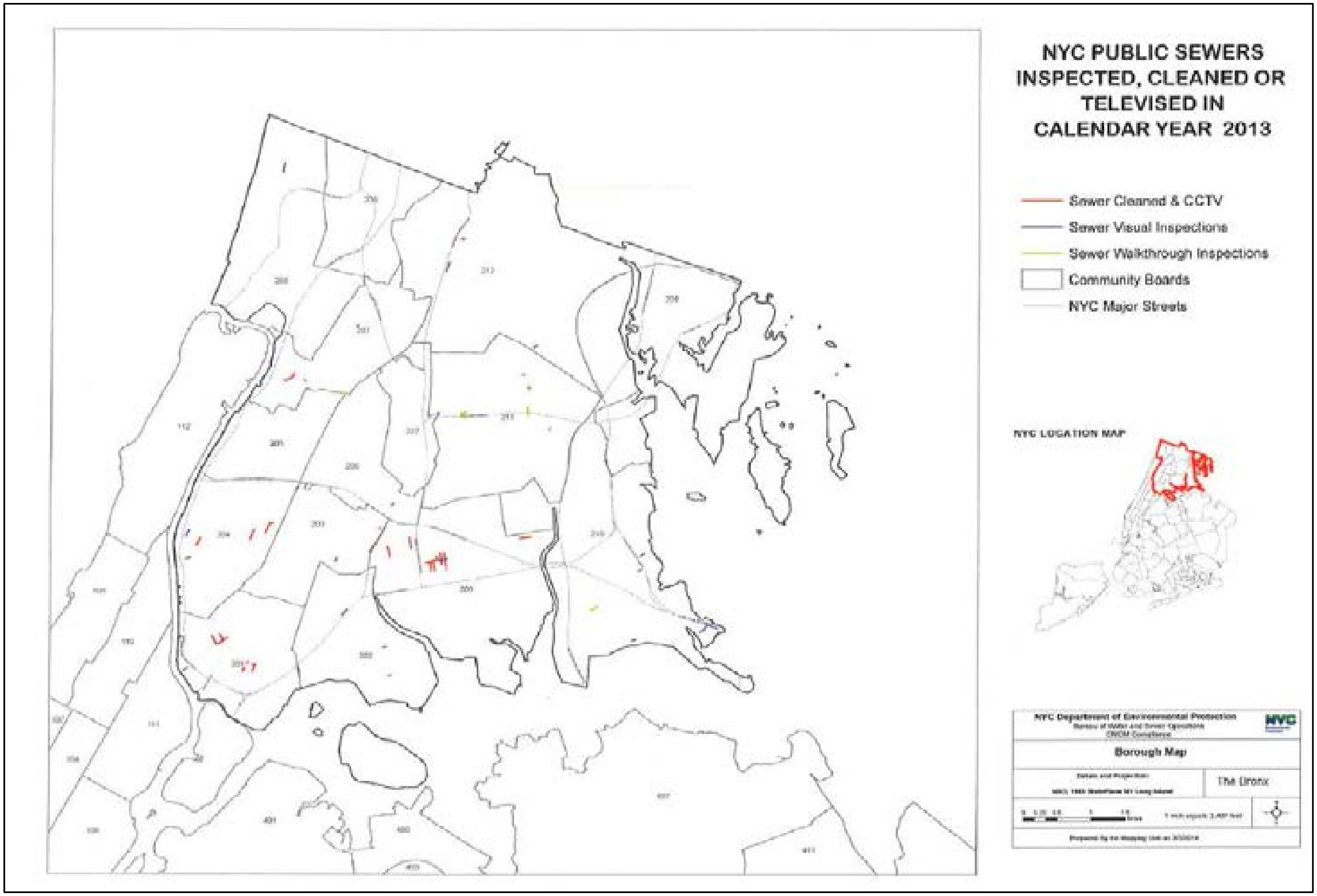

Figure 2-6. Sewers Inspected and Cleaned Throughout 2013

2.2.a Description of Waterbody

The Hutchinson River is classified as a tidal tributary to the East River. Freshwater flows come from CSO and stormwater discharges and from Westchester County, NY. The river flows 5 miles (8 kilometers) south from Scarsdale, through Westchester County and the Bronx in NYC until it empties into Eastchester Bay.

The Hutchinson River estuary portion has a diurnal tidal cycle with a tidal amplitude of 2 feet. Depths in the tidal Hutchinson River range from 4.25 to 6.5 feet at the mouth. Widths range from 200 to 350 feet at the head end to 1,600 feet at the mouth of Eastchester Bay.

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 Clean Water Act (CWA), the State of New York has established water quality standards (WQS) for all navigable waters within its jurisdiction. The State has developed a system of waterbody classifications based on designated uses that include five saline classifications for marine waters. DEC considers the Class SA and Class SB classifications to fulfill the CWA goals of fully supporting aquatic life and recreation. Class SC supports aquatic life and recreation but the primary and secondary recreational use of the waterbody is limited due to other factors. Class I supports the CWA goal of aquatic life protection and also supports secondary contact recreation. SD waters are suitable only for fish, shellfish and wildlife survival because natural or manmade conditions limit the attainment of higher standards. The Hutchinson River is classified by New York State as a Class SB saline surface water with best uses designated for primary and secondary contact recreation and fishing.

Numerical standards corresponding to these waterbody classifications are as shown in Table 2-4. Dissolved oxygen (DO) is the numerical standard that DEC uses to establish whether a waterbody supports aquatic life uses. Total and fecal coliform bacteria concentrations are the numerical standards that DEC uses to establish whether a waterbody supports recreational uses. In addition to numerical standards, 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 2-5, these criteria apply to all five classes of marine waters.

Table 2-4. New York State Numerical Surface WQS (Saline)

Class	Usage	Dissolved Oxygen (mg/L)	Total Coliform (MPN/100mL)	Fecal Coliform (MPN/100mL)	Enterococci (MPN/100mL)[(7)]
SA	Shellfishing for market purposes, primary and secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥ 4.8[(1)] ≤ 3.0[(2)]	≤ 70[(3)]	N/A	
SB	Primary and secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.	≥ 4.8[(1)] ≤ 3.0[(2)]	≤ 2,400[(4)] ≤ 5,000[(5)]	≤ 200[(6)]	≤ 35[(8)]

SC	Limited primary and secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.	$\geq$ 4.8[1] $\leq$ 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.	$\geq$ 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.	$\geq$ 3.0	N/A	N/A	N/A

(1) Chronic standard based on daily average. The DO concentration may fall below 4.8 mg/L for a limited number of days, as defined by 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 standard (never less than 3.0 mg/L).
(3) Median most probable number (MPN) value in any series of representative samples.
(4) Monthly median value of five or more samples.
(5) Monthly 80th percentile of five or more samples.
(6) Monthly geometric mean of five or more samples.
(7) This standard, although not promulgated by DEC, is now an enforceable standard in New York State since the USEPA established January 1, 2005 as the date upon which the criteria must be adopted for all coastal recreational waters
(8) 30-day moving geometric mean.

Table 2-5. 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.

Note that the enterococci criterion of 35 cfu/100mL listed in Table 2-4, 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 DEC's interpretation of the Beaches Environmental Assessment and Coastal Health (BEACH) Act, the criterion applies on a 30-day moving geometric mean (GM) basis during recreational season (May 1st to October 31st). Furthermore, this criterion is not applicable to the tributaries of the Long Island Sound and the East River tributaries and therefore would not apply to the Hutchinson River under current water quality classifications.

Currently, DEC is conducting its federally-mandated "triennial review" of the NYS WQS, in which States are required to review their WQS 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 WQS regulations. DEC has indicated that in accordance with the 2012 EPA recreational water quality criteria, DEC intends to establish the enterococci criterion as a promulgated standard through a formal rulemaking within NYS sometime in the future.

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 NYC. Hutchinson River is an interstate water and is regulated by IEC as a Class A water. In designated areas, Class A waters shall be suitable for shellfish harvesting; Hutchinson River is not designated as such. Numerical standards for IEC regulated waterbodies are shown in Table 2-6, while narrative standards are shown in Table 2-7.

Table 2-6. Interstate Environmental Commission Numeric Water Quality Standards

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

Table 2-7. IEC Narrative Regulations

Classes	Standard
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, colors or turbidity to the extent that none of the forgoing shall be noticeable in the water or deposited along the shore or an 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.

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

EPA Policies and Regulations

For designated bathing beach areas, the EPA has established an enterococci reference level of 104 cfu/100mL to be used by agencies for announcing bathing advisories or beach closings in response to pollution events. For non-designated beach areas of primary contact recreation, which are used infrequently for primary contact, the EPA has established an enterococci reference level of 501 cfu/100mL be considered indicative of pollution events.

These reference levels, according to the EPA documents, are not regulatory 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.

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

As there are no bathing beaches located in the Hutchinson River, these criteria do not apply. 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 RWQC recommends two sets of numeric thresholds (Table 2-8) and includes limits for both the GM and a statistical threshold value (STV). The STV is a new limit and is intended to be a value that should not be exceeded by more than 10 percent of the samples taken.

Table 2-8. 2012 RWQC Recommendations

Criteria Elements	Recommendation 1 (estimated illness rate 36/1,000)		Recommendation 2 (estimated illness rate 32/1,000)	
Indicator	GM (cfu/100mL)	STV (cfu/100mL)	GM (cfu/100mL)	STV (cfu/100mL)
Enterococci (marine & 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. It is DEP's understanding that DEC intends to follow Recommendation 2 to update water quality criteria. The LTCP analyses for the Hutchinson River were therefore based on the enterococci numerical criteria associated with EPA's RWQC Recommendation 2.

2.2.a.2 Physical Waterbody Characteristics

The Hutchinson River, a tributary to the East River, runs 5 miles south from Scarsdale, through Westchester County and the Bronx, until it empties into Eastchester Bay. For the purposes of this report, the study area includes only the portion of the river within NYC.

The Hutchinson River exhibits diverse characteristics throughout its reaches. Much of the shoreline consists of natural areas interspersed with altered area. Figure 2-7 shows both the eastern and western shoreline of the river looking north. Natural areas in the southern reaches of the river generally consist of sandy areas. Natural areas located in the northern reaches of the river are comprised of vegetated parkland owned by the New York City Department of Parks and Recreation (NYCDPR). Altered areas consist primarily of rip-rap and bulkhead. Upland areas are generally altered, with the main exception being Pelham Bay Park.

Figure 2-7. Eastern and Western Shoreline of the Hutchinson River with Co-op City in the Background (Looking North)

Shoreline Physical Characterization

The shorelines of the Hutchinson River consist primarily of natural areas. Nearly the entire eastern shoreline of the Hutchinson River, between Shore Road to a point just north of Boston Road, is natural. The majority of this stretch is part of Pelham Bay Park, and the shoreline is mostly inaccessible, being bounded by the Hutchinson River Parkway. A portion of Pelham Bay Park is located between Shore Road and Erskine Place. This area consists of natural, vegetated shoreline and extends along the shores of an inlet just west of the Bronx and Pelham Parkway. A closed landfill is located south of Shore Road. The shoreline along the perimeter of the landfill is mainly rip-rap.

The shoreline of the river between Erskine Place and the northern Bellamy Loop consists primarily of rip-rap. This area stretches along the open space for Co-op City South and Co-op City North. This is also one of the few areas where the river is easily accessible. The western shoreline between the Bellamy Loop North and the New England Thruway (I-95) consists predominantly of altered areas of rip-rap and bulkheaded shoreline.

The western shoreline between the New England Thruway (I-95) and Boston Road consists predominantly of natural areas in a highly industrial area of the Bronx. The western shoreline in the stretch between Boston Road to the Westchester County boundary line is entirely altered. It consists of a bulkheaded shoreline in a highly industrial area. The eastern shoreline in this stretch consists of bulkheaded shorelines with areas of natural profile.

Shoreline Slope

The slope of the Hutchinson River shoreline ranges from gentle (less than 5 degrees) to intermediate (from 5 degrees up to 20 degrees) as shown in Figure 2-8. The eastern shoreline of Pelham Bay Park, from the Hutchinson River Parkway to the border of Westchester County, consists generally of areas of intermediate slope interspersed with areas of gentle slope. The western shoreline of the Hutchinson

River, from the Hutchinson River Parkway to the border of Westchester County, consists generally of areas of gentle slope interspersed with areas of intermediate slope. The area from the New England Thruway (I-95) to the border of Westchester County on the western shoreline consists of intermediate slope with rip-rap and bulkhead interspersed along the stretch. North of Boston Street consists of only bulkheaded shoreline. This stretch of the river on the eastern shoreline is dominated by gentle slopes with an occasional intermediate slope.

Waterbody Sediment Surficial Geology/Substrata

Limited available bottom data indicate that the primary material comprising the shoreline bottom of the Hutchinson River is qualitatively classified as sand. The primary source of this information is observations of river bottom characteristics from three sampling stations using a Ponar® dredge.

Figure 2-8. Hutchinson River Shoreline Slope

Waterbody Type

Hutchinson River is classified as a Minor River-Tidal Tributary based on Title 6 NYCRR, Chapter X, Part 935. As noted previously, the river is tidal throughout the Bronx but receives freshwater input in Westchester County, NY and from CSO and stormwater discharges. Most of the length of the river is considered an embayment (either natural or manmade). A very small part of the river at the northern reach is classified as the Minor River-Tributary-freshwater source.

The DEC Freshwater Wetland Maps indicates that no freshwater wetlands are located within 150 feet of the Hutchinson River shoreline. However, the National wetlands Inventory maps define one freshwater wetland system along the shorelines of the Hutchinson River.

The upland habitat of the Hutchinson River is a mix of natural and altered areas including altered, herbaceous communities and scarcely vegetated areas. The majority of the upland area between Shore Road and the Bronx-Westchester County Line is composed of altered areas. Areas of natural upland are generally scarcely vegetated. Such areas are located at the end of Watt Avenue, just south of Erskine Place, between Debbs Place and the northernmost point of Co-op City Boulevard, and between Hollers Avenue and Boston Road. An area of herbaceous communities is located just west of the Bronx and Pelham Parkway.

The majority of the upland habitat between Shore Road and the Bronx-Westchester County Line on the eastern shore consists of natural areas with intermittent altered areas. The natural areas are generally scarcely vegetated. A stretch of herbaceous communities stretches from the Conrail-Amtrak railroad to the Pelham Bay Parkway. Between the Pelham Bay Parkway and the Bronx-Westchester County Line, the upland habitat is composed of altered areas.

Tidal/Estuarine Systems Biological Systems

Intertidal/Estuarine Wetlands

Approximately 175 acres of wetlands are located along the shoreline of the Hutchinson River, with the majority of acreage on the eastern shore, south of the New England Thruway crossing. The areas are shown in Figure 2-9.

Six types of wetlands are found along the Hutchinson River. All are estuarine (E) and intertidal (2).The largest wetland along the Hutchinson River (68.3 acres) is estuarine and intertidal with emergent vegetation dominated by Phragmites, and is irregularly flooded and affected by partial drainage (E2EM5Pd classification). This wetland is located near mid-reach of the tidal Hutchinson River and is not directly adjacent to the shoreline. A small wetland (2.4 acres) classified as estuarine and intertidal with emergent vegetation and is irregularly flooded and affected by partial drainage (E2EM1Pd) and is adjacent to the larger wetland on the inland side. The second largest wetland (51.7 acres) is estuarine and intertidal with persistent emergent vegetation and irregular flooding (E2EM1P). This wetland is adjacent to the shoreline and extends from near the head of the tidal river (New England Thruway crossing) to mid-reach. An area of 14.6 acres has a mixed classification of E2EM5/1P and is adjacent to the shoreline and the 51.7 acre wetland area. The distribution of the remaining wetland areas is fragmented. Four areas totaling 18 acres are classified as E2EM5P, the largest of which (9.9 acres) is on the western shore of the river. Two small wetlands (5 acres and 3.8 acres) are classified as E2Em5Pd and one very small wetland (0.42 acres) on the western shore is classified as E2EM1P. Three areas totaling 11 acres are regularly flooded and classified as E2EM5N. Finally, two areas totaling 3 acres are regularly flooded flats classified as E2FLN.

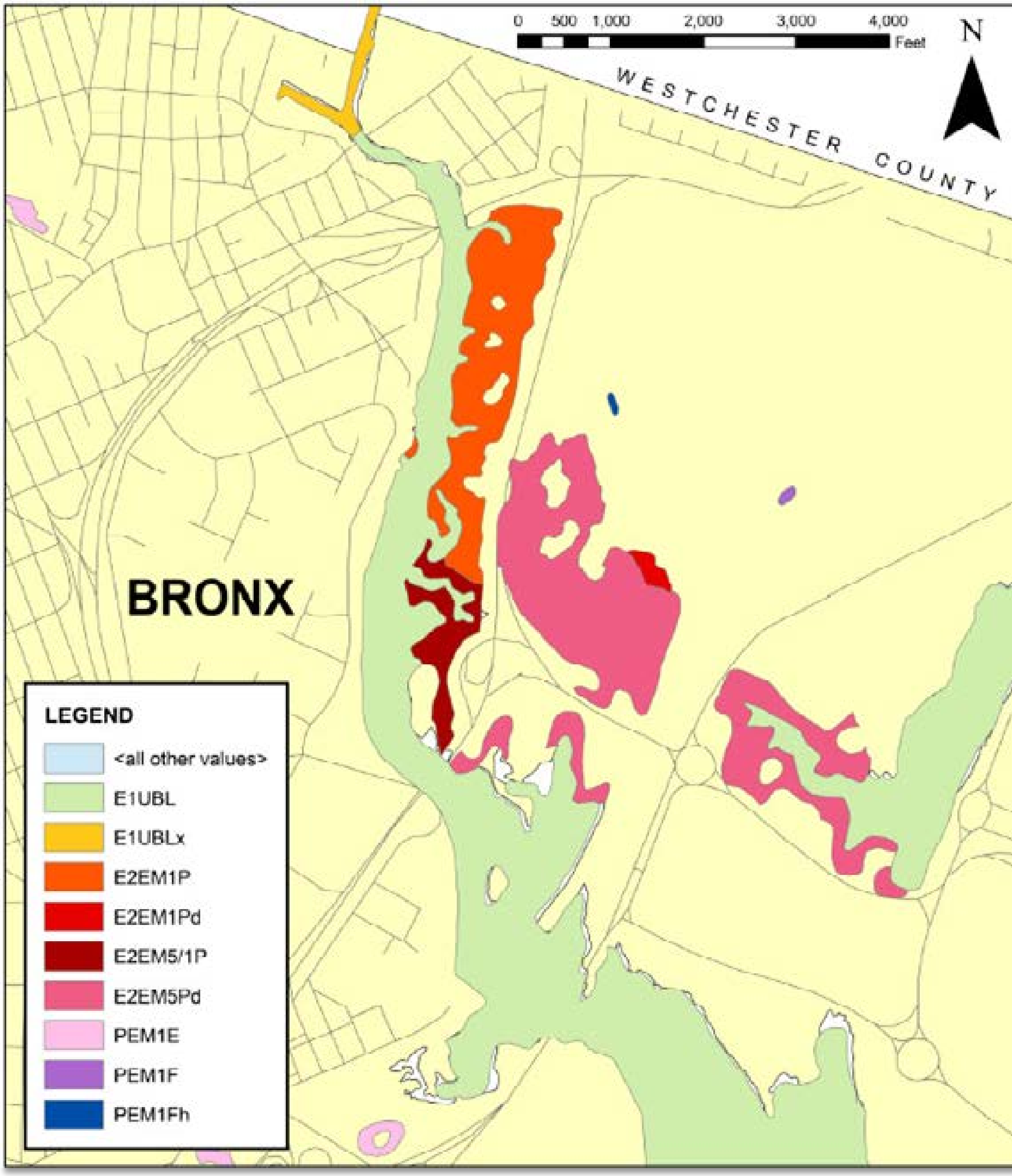

Figure 2-9. Wetlands Along Hutchinson River Shoreline

Aquatic and Terrestrial Communities

The Hutchinson River supports aquatic communities which are similar to those found throughout the New York/New Jersey (NY/NJ) Harbor. The Hutchinson River and Eastchester Bay are situated such that they have a substantial exchange of water with the western Long Island Sound, which provides somewhat higher water quality than many of the other tributaries and bay systems around the Harbor. These aquatic communities contain typical estuarine species, but they have been highly modified by physical changes to the original watershed, shoreline, and to water and sediment quality. These changes represent some of the constraints to the Hutchinson River in reaching its full potential to support a diverse aquatic life community and to provide a fishery source for anglers.

In Hutchinson River, pier piles and bulkheads likely provide the majority of underwater substrates that can support epibenthic communities. From epibenthic studies (in 2000 and 2001) it was found that 21 taxa were identified (Hutchinson River WWFP, 2007). The major groups found were tunicates, hydroids, barnacles and polychaetes. To a lesser extent mussels, gastropods, sponges, shrimp and crabs were also found. It was also found that most of the epibenthic community did not exhibit a specific vertical distribution suggesting that the entire water column is being used as habitat for epibenthic organisms and that stratification and low DO levels do not limit epibenthic organism growth in the lower water column (DEP, 2007). In the Hutchinson River it appears as if DO concentrations may be less limiting to the development of epibenthic communities than the amount of available hard substrate for settlement, recruitment and species interactions (predation and competition). In addition the upper reaches of the river generally had lower diversity than that found near the mouth.

The fish community of the Hutchinson River was sampled as part of the Hutchinson River Field Sampling Analysis Plan (FSAP) (DEP, 2004). A total of 23 taxa were collected. Weakfish, blueback herring and striped bass were found in the upper reaches of the river and to a lesser extent pipefish, American eel, Atlantic herring and Atlantic silversides were found.

Freshwater Systems Biological Systems

No New York State regulated freshwater wetlands are located in the watershed of the tidal Hutchinson River (i.e., freshwater wetlands greater than 12.4 contiguous acres). One small freshwater wetland (2.8 acres) classified as palustrine with persistent emergent vegetation and seasonal flooding (PEM1E) surrounds a small pond on the western shore of the river.

2.2.a.3 Current Public Access and Uses

The waterfront area surrounding the Hutchinson River is dominated by industry to the north and parkland in the central and southern reaches of the eastern shore. No formal river access facilities exist along the Hutchinson River. Informal areas of access to the waterfront are shown in Figure 2-10. The two principal informal access areas are near Co-op City North and Co-op City South. At Co-op City North, the section of the river north of Bellamy Loop South is part of the open space for Co-op City North. The open space area includes walking paths and two ball fields just north of Bellamy Loop North. Although the Hutchinson River is informally accessible here, canoe/kayak launching poses a hinderance due to rip-rap along the shoreline.

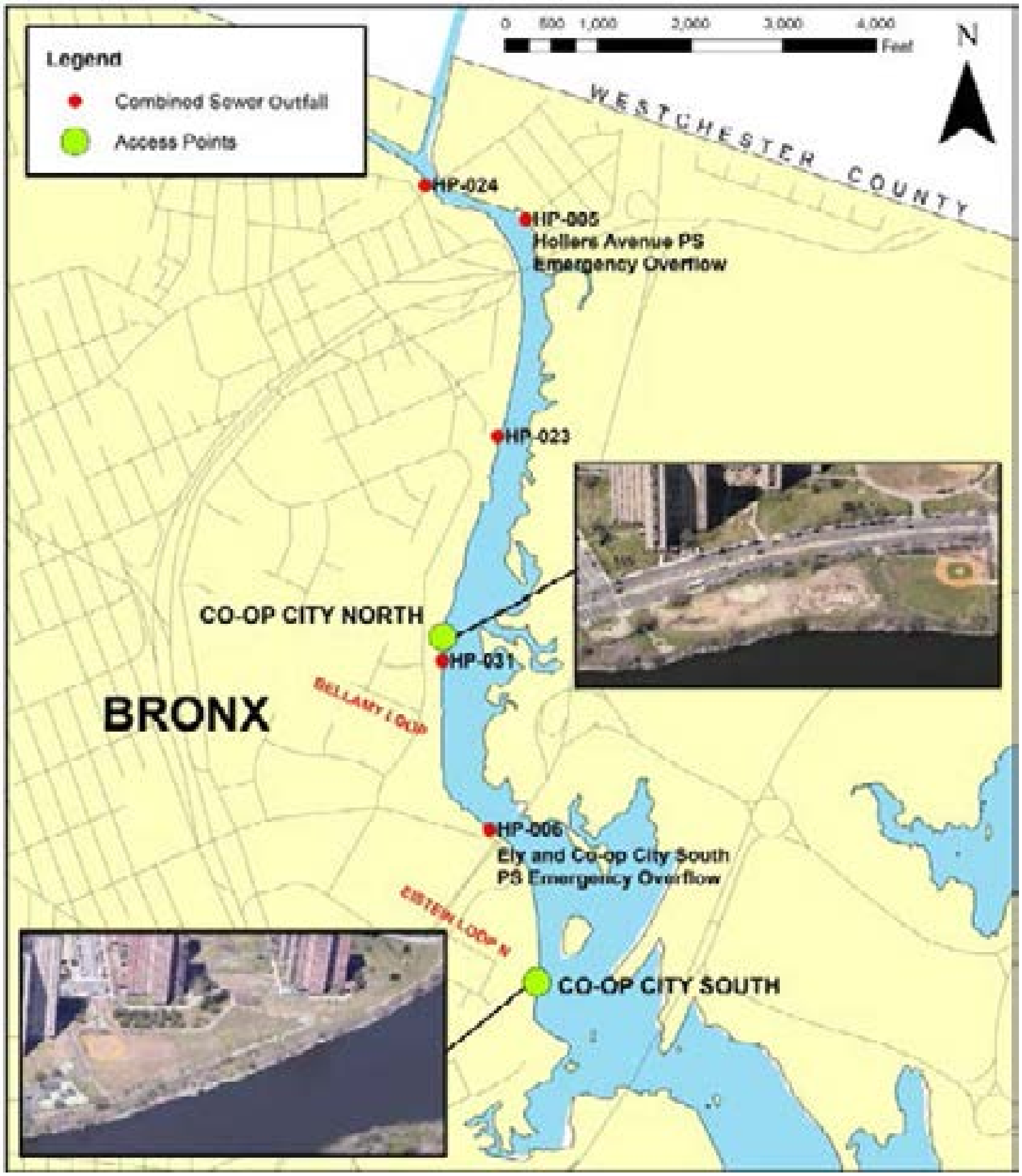

Figure 2-10. Hutchinson River Access Areas

The section of the Hutchinson River north of Erskine Place and south of the Hutchinson River Parkway East is part of the open space area for Co-op City South. The open space area includes a walking path near the water and a ball field at the termination of Einstein Loop North. The river is informally accessible here and, again, canoe/kayak launching is hindered due to rip-rap.

The Hutchinson River Restoration Project is currently investigating potential locations in the Lower Hutchinson River area to provide formal canoe/kayak launching/access facilities.

The most common use of the Hutchinson River is commercial boating. Secondary contact recreation in the form of recreational boating is an additional use, although this activity is mainly prevalent in Eastchester Bay where there are several marinas and private beach clubs. There are no known areas within the study area where formal access is provided directly to the river for the purposes of primary or secondary contact recreation. There are no official or even un-official swimming areas currently being used in the Hutchinson River. In fact, the establishment of bathing beaches within the river is prohibited by local law (New York City Health Code, Article 167.13 - Water Quality Standards).

2.2.a.4 Identification of Sensitive Areas

Federal CSO Policy requires that the long term CSO control plan 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
- Waters with primary contact recreation
- Waters with threatened or endangered species and their habitat
- Additional areas determined by the Permitting Authority (i.e., DEC).

General Assessment of Sensitive Areas

An analysis of the waters of the Hutchinson River with respect to the CSO Policy was conducted and is summarized in Table 2-9.

While wetlands are present throughout Pelham Bay Park, there are no sensitive areas in the Hutchinson River assessment area, based on the following information:

- There are no ONRW waters, National Marine Sanctuaries, or public water supplies in or near the waters of New York Harbor;

- There are no designated shellfishing areas within Hutchinson River or the upper East River;

- There are no bathing beaches in or near Hutchinson River. Bathing beaches are explicitly prohibited by local law in the upper East River and its tributaries;

Table 2-9. Sensitive Areas in Hutchinson River Creek

CSO Discharge Receiving Water Segments	Current Uses Classification of Waters Receiving CSO Discharges Compared to Sensitive Areas Classifications or Designations (1)						
	ONRW	National Marine Sanctuaries	Threatened or Endangered Species of Habitat	Primary Contact Recreation	Public Water Supply Intake	PWS Protected Area	Shellfish Bed
Hutchinson River	None	None (2)	None(3)	None(4)	None(5)	None(5)	None

Notes:

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

- There are no threatened or endangered marine animal species or their designated habitat in Hutchinson River according to responses to Freedom of Information Act (FOIA) letter requests to the New York Natural Heritage Program, the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service (USFWS); and

- None of the items specifically listed by DEC are within or adjacent to the Hutchinson River study area.

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 program 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 NYC. The number of water quality parameters measured has also increased from five in 1909 to over 20 at present.

Harbor water quality has improved drastically 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 New York 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. The LTCP program will look at 10 waterbodies and their drainage basins and will develop a comprehensive plan for each waterbody.

The 2012 State of the Harbor Report focuses on the most recent water quality data collected by DEP. Fecal coliform bacteria, DO, chlorophyll 'a' and Secchi transparency are the water quality parameters used in the Harbor Water Quality Study. Data are presented in four sections, each delineating a geographic region within the Harbor. The Hutchinson River is included in the Upper East River-Western Long Island Sound (UER-WLIS) section. This area contains nine open water monitoring stations and five tributary sites as shown in Figure 2-11. None of the sites is located in the Hutchinson River. The closest stations include E8 and E10 in Long Island Sound.

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

DEP Harbor Survey Data

No data collected within the Hutchinson River are available from sampling conducted by DEP's Harbor Survey Monitoring Program (HSM) in recent years. Currently, the HSM does not routinely sample locations within the Hutchinson River.

Sentinel Monitoring Program

DEP conducts routine sampling at 71 locations in NYC waters in dry weather to inform the agency of potential illicit discharges to their MS4 storm sewers. If elevated pathogen levels are detected during the quarterly dry weather sampling, DEP deploys its internal staff to track down and eliminate the sources of pollutants. The Sentinel Monitoring Program sampling station (S-62) in the Hutchinson River is located in the vicinity of the LTCP monitoring station HR-02.

Data Discussion

The receiving water stations HR-01 through HR-09 of the LTCP sampling program (Field Sampling Data Report for Hutchinson River TMDL/WLA, 2012) as well as the Sentinel Monitoring Program sampling station S-62 are depicted in Figure 2-12.

Figures 2-13 and 2-14 present a number of statistical parameters of the LTCP and Sentinel Monitoring data sets over the same period (May 2012 through September 2012). 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 corresponding water quality criteria are also shown for fecal coliform bacteria and Enterococci, although currently the Enterococci criterion does not apply to the Hutchinson River.

Figures 2-12 presents data collected at stations HR-01 through HR-09 for fecal coliform bacteria. Due to the proximity between stations HR-02 and S-62, the Sentinel Monitoring Program results for the concurrent period are included in the statistics shown for station HR-02. Figure 2-13 presents Enterococci data for the same stations, along with the monthly GM reference level.

The data indicate that the bacteria concentrations upstream of the Bronx-Westchester County border are elevated within the data period with GMs for Enterococci ranging from approximately 1,960 cfu/100mL at station HR-07 to 5,260 cfu/100mL at station HR-08. Fecal coliform bacteria concentrations range from 5,090 cfu/100mL to 10,480 cfu/100mL for stations HR-07 and HR-08, respectively. The 75th percentile excursions above these values reach 8,000 cfu/100mL for Enterococci and exceed 30,000 cfu/100mL for fecal coliform bacteria. Single wet weather sample excursions reach 56,000 cfu/100mL for Enterococci and 60,000 cfu/100mL for fecal coliform.

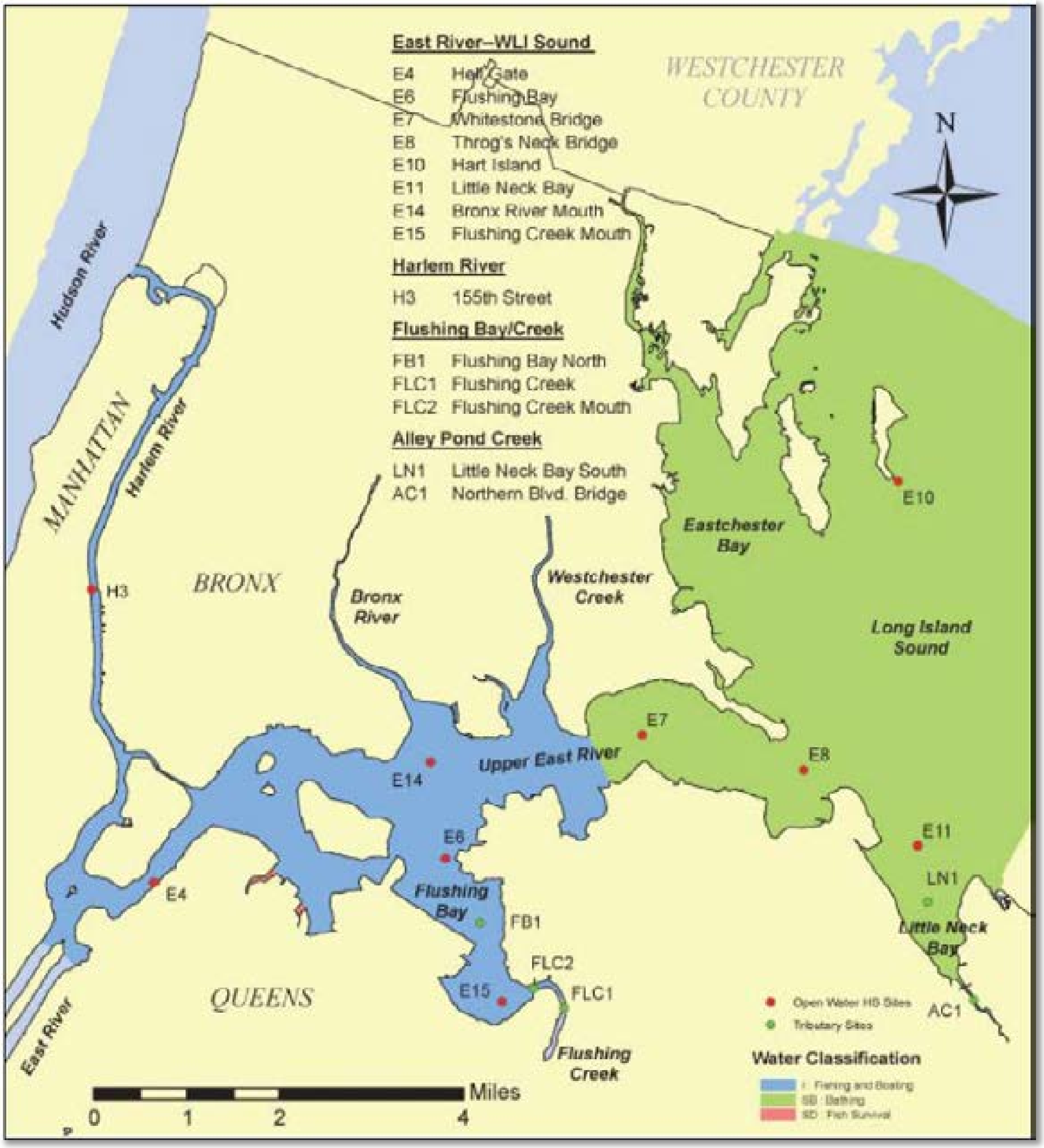

Figure 2-11. Harbor Survey UER-WLIS Region

Figure 2-12. LTCP Sampling Program and Sentinel Monitoring Program Sampling Station

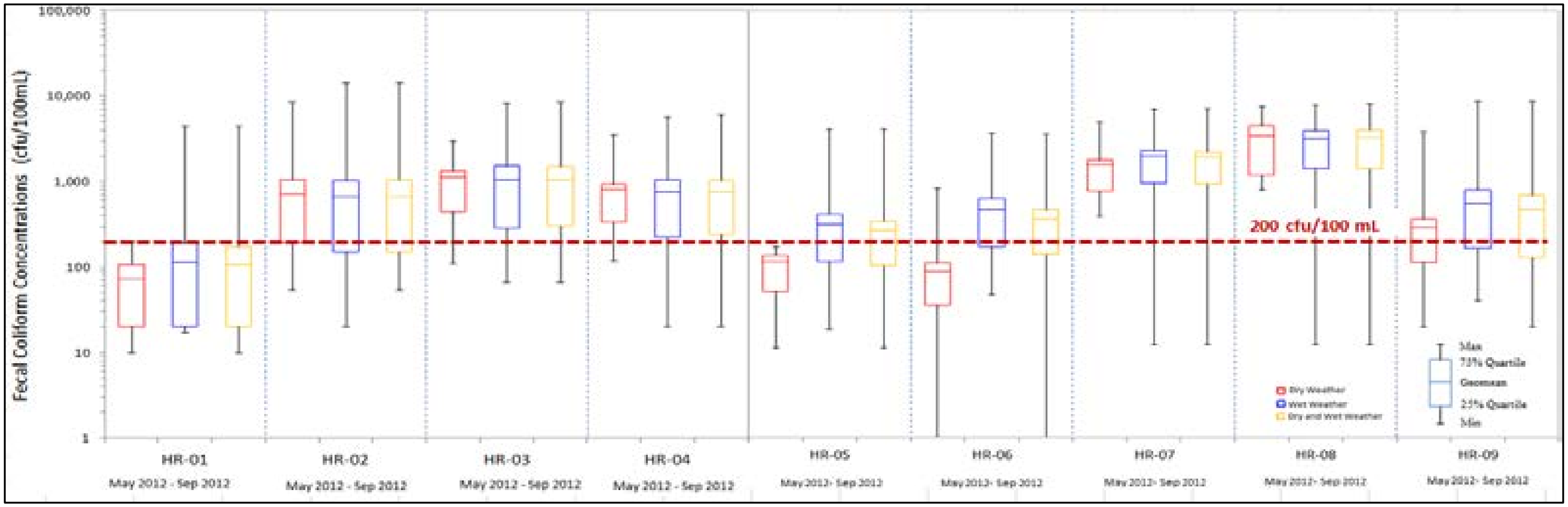

Figure 2-13. Fecal Coliform Data from LTCP and Sentinel Monitoring Programs – Hutchinson River, May – December 2012

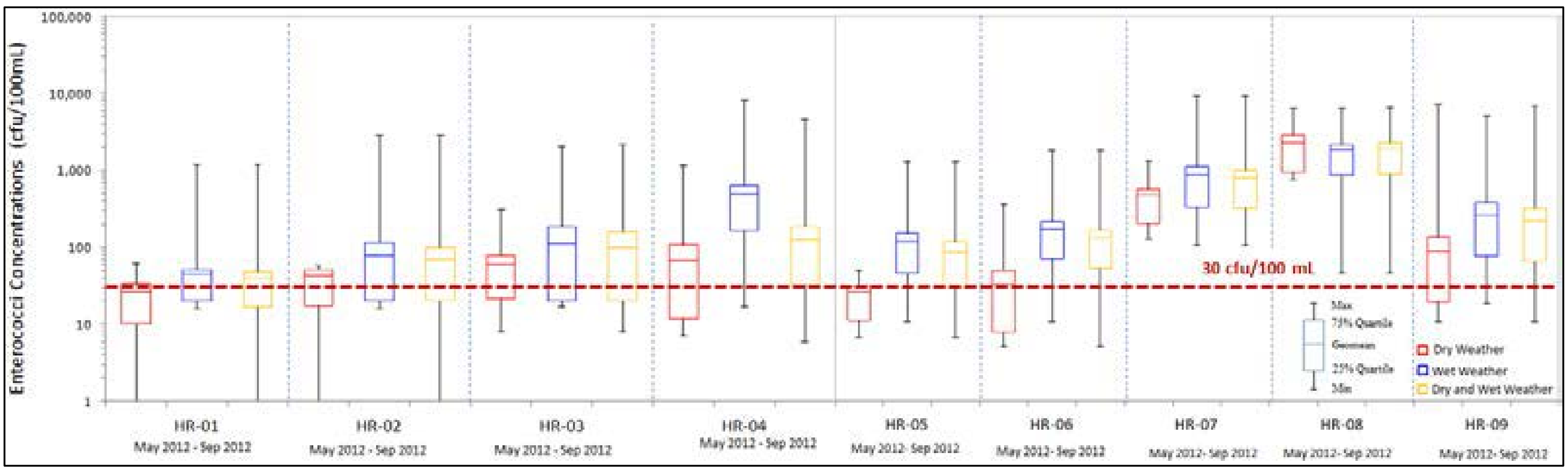

Figure 2-14. Enterococci Data from LTCP and Sentinel Monitoring Programs – Hutchinson River, May – December 2012

Receiving water sampling during dry and wet weather was conducted at the nine locations designated as HR-01 to HR-09 in Figure 2-12. The intent of the sampling was to confirm existing water quality conditions, and to provide data to support calibration of the water quality model of the Hutchinson River. The results in terms of dry and wet weather geometric means for Enterococci and fecal coliform bacteria are summarized in Table 2-10.

Table 2-10. Geometric Means of In-stream Bacteria Samples

River Station	Enterococci (cfu/100mL)		Fecal Coliform (cfu/100mL)	
	Dry	Wet	Dry	Wet
HR-09	179	618	589	1,495
HR-08	7,606	4,964	12,253	10,132
HR-07	1,010	2,264	3,973	5,377
HR-06	55	313	140	1,134
HR-05	31	207	184	684
HR-04	34	112	467	521
HR-03	38	92	670	773
HR-02	26	58	381	516
HR-01	17	26	53	95

As indicated in Table 2-10, significantly elevated concentrations of Enterococci and fecal coliform bacteria were found in the dry weather samples at in-stream stations HR-08 and HR-07. These concentrations were consistent with elevated bacteria counts found in dry weather samples from storm drain HR-08 in Westchester County, and suggest the presence of sanitary sewage connections to that storm drain. Dry weather flow with elevated bacterial concentrations was also observed at storm drain HR-06 in Westchester County. These stormwater outfalls are shown in Figure 2-12. The bacteria concentrations obtained for stormwater outfalls HR-06 and HR-08 are shown in Table 2-11. However, in-stream dry weather bacteria concentrations at stream sampling location HR-06 were significantly lower than at stations HR-07 and HR-08. The lower impact may be due to somewhat lower concentrations in the dry weather flow at storm drain HR-06, greater dilution due to the greater width and depth of the river at station HR-06, as well as increased tidal flushing, as compared to the upstream stations.

The Enterococci and fecal coliform bacteria concentrations and variability of the CSOs sampled at outfalls HP-023 and HP-024 are within the typical range expected for this type of effluent, as shown in Table 2-11.

Table 2-11. Summary of Land-side Sampling Results

Outfall	*Enterococci*			Fecal Coliform		
	No. Samples	Range (cfu/100mL)	MLE[4] (cfu/100mL)	No. Samples	Range (cfu/100mL)	MLE[4] (cfu/100mL)
HR-08N (dry)[1]	4	2,700 – 5,600	**6,800**	4	20,000 – 44,000	**28,600**
HR-08S (dry) [2]	4	10,900 – 21,000	**16,700**	4	51,000 – 140,000	**82,600**
HR-06 (dry)	5	2,800 – 670,000	**10,000**	3	700 – 36,000	**12,700**
HR-08[3] (wet)	13	12,000 – 510,000	**70,000**	13	17,000 – 230,000	**105,000**
HR-06 (wet)	15	7,500 – 71,000	**46,000**	15	17,000 – 250,000	**80,000**
HP-637	16	12,600 – 360,000	**58,000**	16	7,000 – 136,000	**40,000**
HP-639	12	5,300 – 164,000	**47,000**	12	5,400 - >60,000	**31,000**
HP-023	16	44,000 – 410,000	**118,100**	15	>600 – 3,700,000	**1,006,000**
HP-024	6	31,000 – 310,000	**121,500**	6	40,000 – 1,100,000	**357,300**

Notes:
(1) Sample from north barrel of twin-barrel outfall.
(2) Samples from south barrel of twin-barrel outfall.
(3) Samples composited from north and south barrel for wet weather.
(4) MLE = Maximum likelihood estimator.

3.0 CSO BEST MANAGEMENT PRACTICES

The State Pollutant Discharge Elimination System (SPDES) permits for all 14 Waste Water Treatment Plants (WWTP) in New York City require Department of Environmental Protection (DEP) to report annually on the progress of the following 13 combined sewer overflow (CSO) best management practices (BMPs):

1. CSO Maintenance and Inspection Program
2. Maximum Use of Collection Systems for Storage
3. Maximize Flow to Publicly Owned Treatment Plant (POTW)
4. Wet Weather Operating Plan (WWOP)
5. Prohibition of Dry Weather Flow (DWF)
6. Industrial Pretreatment
7. Control of Floatable and Settleable Solids
8. Combined Sewer 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 are shown in Table 3-1.

On May 8, 2014 the DEP and New York State Department of Environmental Conservation (DEC) entered into an administrative BMP Consent Order[1], referred to as the 2014 CSO BMP Order on Consent, which is an extension and replacement of the 2010 CSO BMP Order. The 2014 CSO BMP Order on Consent addresses remaining milestones from the 2010 CSO BMP Order by including an updated Schedule of Compliance identifying the milestones that have been completed and new dates for the milestones to be completed.

[1] 2014 CSO BMP Order on Consent. DEC File No. R2-20140203-112.

Upcoming 2014 CSO BMP Order on Consent tasks include, but are not limited to:

- Issuing Notice to Proceed to Construction for repair, rehab or replacement of interceptors,
- Post-construction compliance monitoring,
- Maximizing flow at WWTPs,
- CSO monitoring and equipment at key regulators,
- Updating wet weather operating plans with throttling protocols and updating critical equipment lists,
- Bypass reporting,
- Key regulator monitoring reporting,
- Regulators with CSO monitoring equipment identification program reporting; and
- Hydraulic modeling verification.

This section is based on the practices summarized in the 2013 Best Management Practices Annual Report (2013 BMP Annual Report) and the 2014 CSO BMP Order on Consent.

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

EPA Nine Minimum Controls	SPDES Permit Best Management Practices
NMC 1: Proper Operations 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 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 Wet 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 Floatables and Settleable Solids
NMC 7: Pollution Prevention	BMP 6: Industrial Pretreatment BMP 7: Control of Floatables and Settleable Solids BMP 12: Control of Runoff
NMC 8: Public Notification to Ensure that the Public Receives Adequate Notification of CSO Occurrences and CSO Impacts	BMP 13: Public Notification
NMC 9: Monitoring to Effectively Characterize CSO Impacts and the Efficacy of CSO Controls	BMP 1: CSO Maintenance and Inspection Program BMP 5: Prohibition of Dry Weather Overflow BMP 6: Industrial Pretreatment BMP 7: Control of Floatables and Settleable Solids

This section presents brief summaries of each BMP and their respective relationships to the federal NMCs. In general, the BMPs address operation and maintenance procedures, maximum use of existing systems and facilities, and related planning efforts to maximize capture of CSO and reduce contaminants in the combined sewer system (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 System and the 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;
- Telemetering of regulators;
- Reporting of regulator telemetry results;
- Recording and reporting of events that cause discharge at outfalls during dry weather; and,
- DEC review of inspection program reports.

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

3.2 Maximizing Use of Collection System for Storage

This BMP addresses NMC 2 (Maximum Use of the Collection System for Storage) and requires 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 2013 BMP Annual Report, describing the status of citywide Supervisory Control and Data Acquisition (SCADA), regulators, tide gates, interceptors, in-line storage projects, and collection system inspections and cleaning.

Additional data gathered from the 2014 CSO BMP Order on Consent, such as CSO monitoring, will be used to verify and/or further calibrate the hydraulic model developed for the CSO Long Term Control Plans (LTCPs).

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 one and one-half times design dry weather flow (1.5xDDWF) through the secondary treatment works during wet weather. The actual process control set points may be established by the WWOP required in BMP 4.

NYC'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 WWOP. 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 Annual Report indicate that DEP's WWTPs generally complied with this BMP during 2013.

The 2014 CSO BMP Order on Consent has a number of requirements related to maximizing wet weather flows to WWTPs, including but not limited to:

- An enforceable compliance schedule to ensure that DEP maximizes flow to and through the WWTP during wet weather events;
- Incorporating throttling protocol and guidance at the WWTPs;
- Updating the critical equipment lists for WWTPs, which includes screening facilities at pump stations that deliver flow directly to the WWTP and at WWTP headworks; and,
- Reporting bypasses to the DEC per the 2014 CSO BMP Order on Consent.

3.4 Wet Weather Operating Plan

This BMP addresses NMC 1 (Proper Operations 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). To maximize treatment during wet weather events, WWOPs were developed for each WWTP drainage area in accordance with the DEC publication entitled *Wet Weather Operating Practices for POTWs With Combined Sewers*. 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 Biological Nutrient Removal (BNR) processes, if required.

The Hunts Point WPCP Wet Weather Operating Plan, dated April 2010, was approved by DEC in October 2010.

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 overflow event be promptly abated and reported to DEC within 24 hours. A written report must follow within 14 days and contain information per SPDES permit requirements. The status of the shoreline survey, the Dry Weather Discharge Investigation report, and a summary of the total bypasses from the treatment and collection system are provided in the BMP Annual Report.

Dry weather overflows from the CSS are prohibited and DEP's goal is to reduce and/or eliminate dry weather bypasses. An examination of the data for regulators, pump stations and WWTPs revealed that there was no dry weather bypassing to Hutchinson River due to regulators or WWTP bypasses. One pump station bypass was reported in 2013. A bypass of 0.533 MG to the Hutchinson River from the Conner Street Pump Station occurred on March 8 - 9, 2013 due to operator error placing the pumps in a manual mode instead of automatic mode. As required, this was reported to DEC.

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); 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 lbs/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 lbs/day of total metals from regulated industries bypassed to CSOs in 2013 (DEP, 2013).

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), 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 operations 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 implements floatables containment systems within the receiving waterbody associated with applicable CSO outfalls. Requirements for system inspection, service and maintenance are also established.

- Institutional, Regulatory, and Public Education: The report must also include recommendations for alternative City programs and an implementation schedule to 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 Systems and the CSO's), requiring all combined sewer replacements to be approved by the New York State Department of Health (DOH) and to be specified within the 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 citywide plan, and addresses specific projects occurring in the reporting year. No projects are reported for the Hunts Point WWTP service area in the 2013 BMP Annual Report.

3.9 Combined Sewer Extension

To minimize stormwater 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 the CSOs). A brief status report is provided in the 2013 BMP 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 the CSOs), and prohibits sewer connections and extensions that would exacerbate recurrent instances of either sewer back-up or manhole overflows upon letter notification from DEC. 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 the CSOs). The 2008 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 BMP Annual Report.

3.12 Control of Runoff

This BMP addresses NMC 7 (Pollution Prevention) 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 the 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 to Ensure that the Public Receives Adequate Notification of CSO Occurrences and CSO Impacts) as well as NMC 1 (Proper Operations and Regular Maintenance Programs for the Sewer System and the CSOs) and NMC 9 (Monitoring to Effectively Characterize CSO Impacts and the Efficacy of CSO Controls).

This BMP requires easy-to-read identification signage to be placed at or near CSO outfalls, with contact information for DEP, to allow the public to report observed dry weather overflows. All signage information and appearance must comply with the Discharge Notification Requirements listed in the SPDES permit. This BMP also requires that a system be in place to determine the nature and duration of an overflow event, and that potential users of the receiving waters are notified of any resulting, potentially harmful conditions. The BMP allows the New York City Department of Health and Mental Hygiene (DOHMH) to implement and manage the notification program. Accordingly, the Wet Weather Advisories, Pollution

Advisories and Closures are tabulated for all NYC public and private beaches. There are no bathing beaches in or near Hutchinson River. Bathing beaches are explicitly prohibited in the upper East River and its tributaries by Local Law.

3.14 Characterization and Monitoring

Previous studies have characterized and described the Hunts Point WWTP collection system and the water quality for Hutchinson River (see Chapters 3 and 4 of the Hutchinson River WWFP, 2007). Additional data was collected and are analyzed in the Water Quality and Sewer System Report (September 2014) and 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.

Future monitoring includes the installation of CSO monitoring equipment (doppler sensors in the telemetry system and inclinometers where feasible) at key regulators for the purpose of detecting CSO discharges (2014 CSO BMP Order on Consent). Following installation of the CSO monitoring equipment, a monthly report of all known or suspected CSO discharges from key regulators outside the period of a critical wet weather event will be submitted to the DEC. Additional quarterly and one comprehensive report summarizing one year of known or suspected CSO discharges will be submitted to the DEC describing the cause of each discharge and providing options to reduce or eliminate similar future events with an implementation schedule.

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 11 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

Combined sewer overflow (CSO) facility planning in Hutchinson River began under the East River CSO Facility Planning Project, which focused on quantifying and assessing the impacts of CSO discharges to the Upper East River, Western Long Island Sound and their tributaries, including the Hutchinson River, Westchester Creek, and the Bronx River. The initial recommendation for Hutchinson River was made in the mid-1990s, and featured 7 million gallons (MG) of off-line storage. The proposed configuration of the storage facilities evolved over time, and a revised CSO Facilities Plan for the Hutchinson River prepared in 2005 identified a 3 MG storage tank at outfall HP-024, and 4 MG storage tank at outfall HP-023. The 2012 Order on Consent included milestones for conducting water quality sampling and developing a report on the water quality and sewer system for the Hutchinson River. In addition, the 2012 Order on Consent deleted the requirement for construction of these CSO tanks and required a waste load allocation analysis to better quantify the need for CSO controls. As such, no grey infrastructure projects were planned or implemented in the Hutchinson River as a result of the previous CSO facilities planning or the 2012 Order on Consent. The field sampling and sampling report were completed in 2012, and the Water Quality and Sewer System Report were submitted on July 1, 2013 in accordance with the 2012 Order on Consent milestones, and the revised submittal dated September 2014.

4.1.a Completed Projects

There are no completed grey infrastructure projects associated with CSO reduction in Hutchinson River.

4.1.b Ongoing Projects

No additional grey infrastructure projects associated with CSO reduction in Hutchinson River are ongoing.

4.1.c Planned Projects

No grey infrastructure projects associated with CSO reduction are currently planned in Hutchinson River.

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

No other water quality improvement measures are planned for Hutchinson River at this time.

4.3 Post-Construction Monitoring

The Post-Construction Compliance Monitoring (PCM) Program is integral to the optimization of the Hutchinson River Long Term Control Plan (LTCP), providing data for model validation and feedback on system performance. Each year's data set will be compiled and evaluated to refine the understanding of the interaction between Hutchinson River and the actions identified in this LTCP, with the ultimate goal of fully attaining compliance with current water quality standards (WQS) or for supporting a Use Attainability Analysis (UAA) to revise such standards, as appropriate. The data collection monitoring will contain two basic components:

1. Receiving water data collection in Hutchinson River using New York City Department of Environmental Protection (DEP) Harbor Survey Monitoring (HSM) locations (no locations in the Hutchinson River are currently sampled under the HSM program but will be added as described below); and

2. Modeling of the collection system and receiving waters to characterize water quality using the existing InfoWorks CS^{TM} (IW) and East River Tributaries (ERTM) models, respectively.

The details provided herein are limited to the Hutchinson River PCM and may be modified as the DEP's CSO program advances through the completion of other LTCPs, including the citywide LTCP in 2017.

PCM in the Hutchinson River will commence prior to the actions identified in this LTCP becoming operational to establish a pre-control baseline. Build-out of green infrastructure (GI) would be factored into the final scheduling. Monitoring will continue for several years after the actions identified in this LTCP are in place, as part of the adaptive management approach, in order to assess if the water quality improvements are similar to those predicted by the models (i.e., difference between the projected and actual performance).

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

PCM for the Hutchinson River will consist of sample collection at two proposed new locations in the river (stations HR-01 and HR-02) and one location in the East River (existing HSM station E-12). Figure 4-1 presents a map of the HSM station locations. Station E-12 has been recently sampled and has been sampled historically. Stations HR-01 and HR-02, in Figure 4-1, are in similar locations to stations HR-05 and HR-02 from the 2012 sampling program described in the 2013 Water Quality and Sewer System Report. All stations related to the Hutchinson River PSM program will be sampled a minimum of twice per month from May through September and monthly during the remainder of the year.

The parameters related to water quality that will be measured include dissolved oxygen, fecal coliform, enterococci, chlorophyll 'a', and Secchi depth. Except for enterococci, these parameters have been used by New York City to identify historical and spatial trends in water quality throughout New York Harbor for decades. Dissolved oxygen and chlorophyll 'a' are collected and analyzed at surface and bottom locations; the remaining parameters are measured at the surface only.

A more detailed discussion of the PCM methodologies can be found in the *Post-Construction Compliance Monitoring and CSO Retention Facility Overflow Summary for Calendar Year 2012* (DEP, 2013).

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

Any flow and effluent quality monitoring program would be dependent on the types and sizes of proposed CSO controls implemented under this LTCP. Effluent quality data is not expected to be collected routinely at an unmanned facility, nor is routine CSO flow and effluent quality data anticipated to be collected from

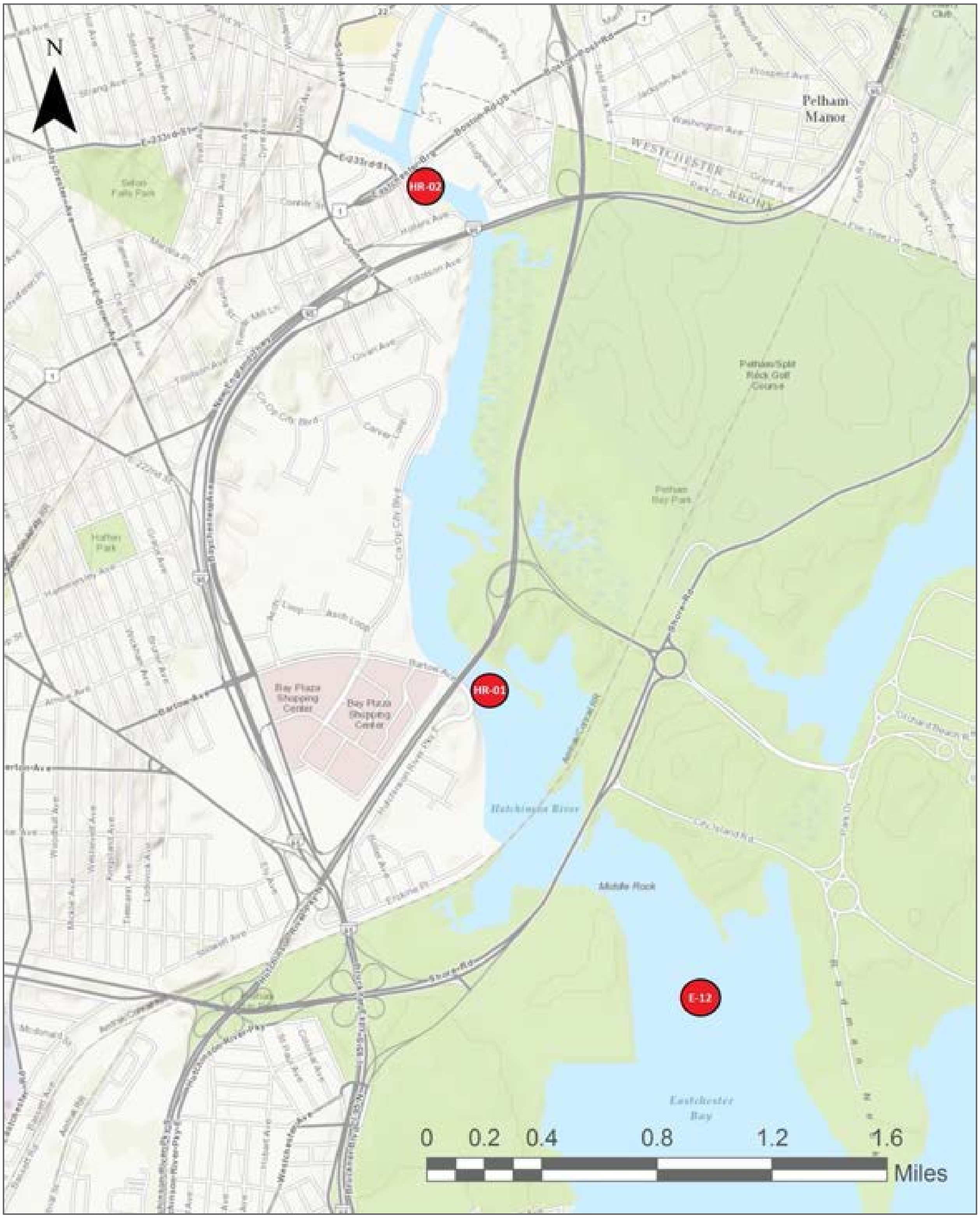

Figure 4-1. Harbor Survey Monitoring Stations to be Used for Hutchinson River Post-Construction Compliance Monitoring

outfalls for which no controls have been provided. If the implemented control is permitted under a State Pollutant Discharge Elimination System (SPDES) permit, any stipulations required by that permit regarding effluent monitoring would be followed.

4.3.c Assessment of Performance Criteria

Any CSO controls implemented under this LTCP will be designed to achieve a specific set of water quality and/or CSO reduction goals as established in this LTCP, and as directed in the subsequent basis of design report (BODR) that informs the design process. If no additional CSO controls are proposed, then affirmation of water quality projections would be necessary. In both cases, the PCM data, coupled with the modeling framework used for annual reporting, will be used to assess the performance of the CSO controls implemented in comparison to the agreed-upon water quality goals.

Differences between actual overflows and model-predicted overflows are often attributable to the fact that the model results are based on the rainfall measured at a single National Oceanic and Atmospheric Administration (NOAA) rain gauge being taken to represent the rainfall over the entire drainage area. In reality, storms move through the area so that the rainfall actually varies over time and space. Because rainfall patterns tend to even out over the area over time, the practice of using the rainfall measured at one nearby location typically provides good agreement with long term performance for the collection system as a whole; however, model results for any particular storm may vary somewhat from the observed.

Given the uncertainty associated with potentially widely varying precipitation conditions, rainfall analysis is an essential component of the PCM. For Hutchinson River, the most representative long term rainfall data record is available from the National Weather Service's LaGuardia Airport (LGA) gauge. Rain data for each calendar year of the PCM program will be compared to the 10-year model period (2002-2011) and to the John F. Kennedy International Airport (JFK) 2008 rain data used for alternatives evaluations. Statistics including number of storms, duration, total annual and monthly depths, and relative and peak intensities will be used to classify the particular reporting year as wet or dry relative to the time series on which the concept was based.

The reporting year will be modeled utilizing the existing IW/ERTM framework using the reporting year tides and precipitation. The resulting CSO discharges and water quality attainment will then be compared with available PCM data for the year as a means of validating model output. The level of attainment will be calculated from the modeling results and coupled with the precipitation analysis to determine relative improvement and the existence of any gap. Three successive years of evaluation will be necessary before capital improvements are considered, but operational adjustments will be considered throughout operation and reporting.

5.0 GREEN INFRASTRUCTURE

By capturing stormwater runoff and managing it through the processes of volume retention, infiltration, evapotranspiration, and re-use, green infrastructure (GI) can reduce stormwater discharge to combined sewer systems (CSS).[1] In 2010, the New York City Department of Environmental Protection (DEP) wrote and adopted the *NYC Green Infrastructure Plan: A Sustainable Strategy for Clean Waterways* ("GI Plan"), which was subsequently incorporated into the 2012 Order on Consent.

The 2012 Order on Consent requires DEP to control the equivalent of stormwater generated by one inch of precipitation on 1.5 percent of impervious surfaces in combined areas citywide by December 31, 2015. If this 1.5 percent goal is not met, DEP must certify that $187M has been encumbered for the purpose of GI and submit a contingency plan to New York State Department of Environmental Conservation (DEC) by June 20, 2016. By 2030, DEP is required to control the equivalent of stormwater generated by one inch of precipitation on ten percent of impervious surfaces citywide in combined areas. Over the next 20 years, DEP is planning for $2.4B in public and private funding for targeted GI installations, and $2.9B in cost-effective grey infrastructure upgrades to reduce combined sewer overflows (CSOs). The Green Infrastructure Program, including citywide and CSO tributary area specific implementation, is described below. Pursuant to the 2012 Order on Consent, DEP publishes the *Green Infrastructure Annual Report* every April 30th to provide details on GI implementation and other related efforts. 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 GI Plan 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 3.8B gallons per year (BGY), or approximately 2 BGY more than an all-grey strategy. In addition to capturing stormwater that would otherwise add to CSO volumes in New York City (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 Benefit Project (EBP) funds, through fiscal year (FY) 2023 for GI projects.[2] OGI, along with other DEP bureaus and partner City agencies, is tasked with designing and constructing GI practices that divert stormwater away from the sewers and direct it to areas where it can infiltrate the ground, evapotranspire, be stored, or detained. OGI has developed design standards for Right-of-way Bioswales (ROWBs) and designed other projects that include pervious pavement, rain gardens, and green and blue roofs. DEP's "Area-wide" 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 DEP's website.

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[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”) for GI implementation based on several criteria. DEP reviews the annual CSO volume, frequency of CSO events, as well as outfalls that may be affected by Waterbody/Watershed Facility Plans (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 2012 Order on Consent milestones. The Priority Areas are shown in Figure 5-1.

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

DEP utilizes the Area-wide strategy for all public property retrofits, as described in more detail in the *2013 Green Infrastructure Annual Report*. 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.

DEP manages several of its own design and construction contracts for right-of-way and on-site GI practices. Additionally, the New York City Economic Development Corporation (EDC), Department of Parks and Recreation (DPR), and Department of Design and Construction (DDC) manage several of these Area-wide contracts on behalf of DEP.

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.

DEP launched its new website design at www.nyc.gov/dep in 2013. As part of this update, 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 Green Infrastructure Program, including Standard Designs for ROWBs (type of GI practices most often employed). Users can also view a map of the Priority CSO Tributary Areas to learn whether GI is coming to their neighborhood.

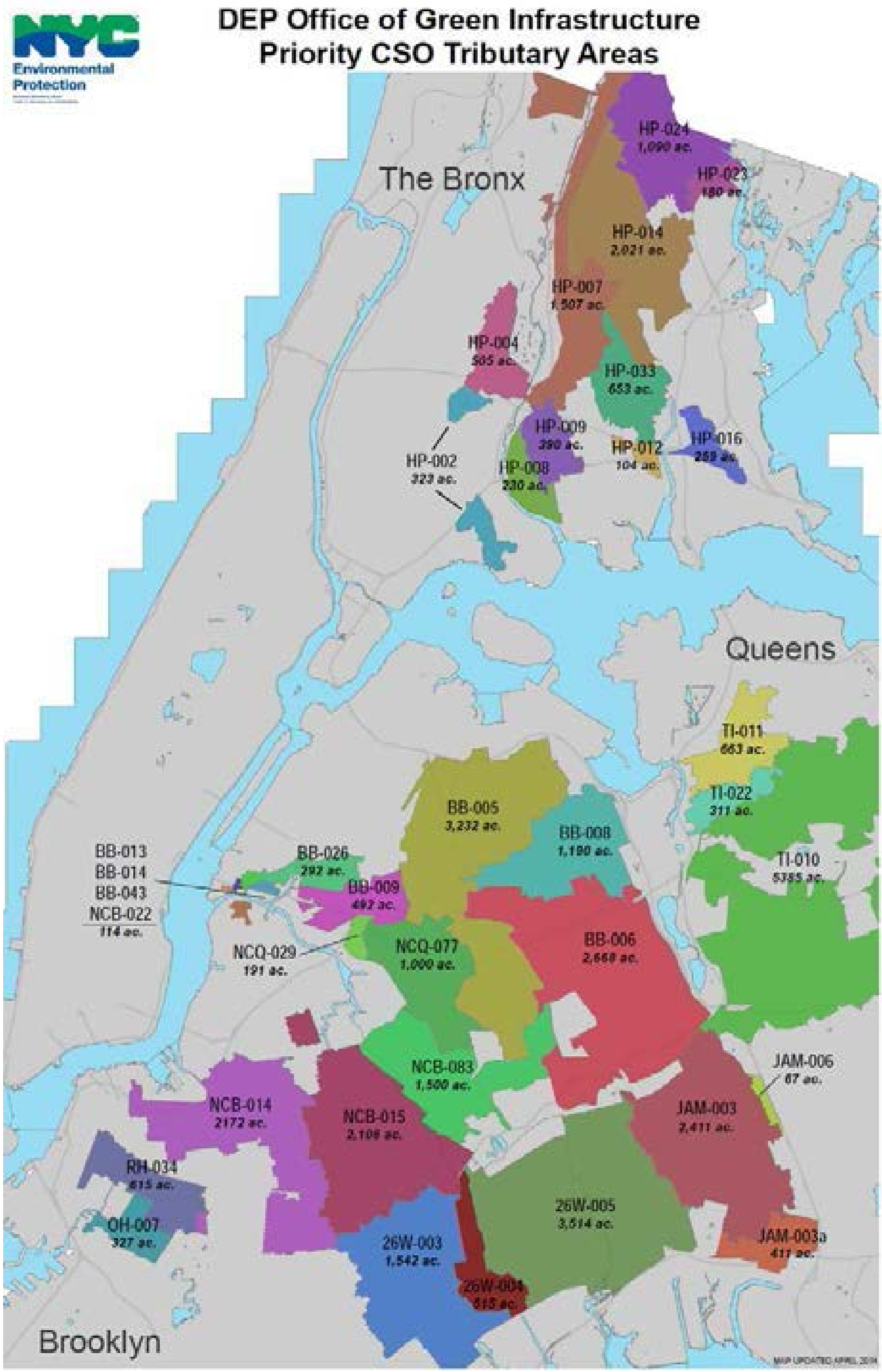

Figure 5-1. Priority CSO Tributary Areas for Green Infrastructure Implementation

DEP also created an educational video on the Green Infrastructure Program. This video gives a brief explanation of the environmental challenges caused by CSOs while featuring GI technologies such as retention/detention systems, green/blue roofs, rain gardens, porous paving and permeable pavers. The video is available at DEP's YouTube page.

In order to provide more information about the Green Infrastructure 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.

DEP notifies abutting property owners in advance of right-of-way GI construction projects. In each contract area, DEP and its partner agencies provide construction liaison staff to be present during construction. The contact information for the construction liaison is affixed to the door hangers, for use if the need to alert NYC to a problem arises during construction.

Additionally, DEP continues to make presentations to elected officials and their staff, community boards, and other civic and environmental organizations about the Green Infrastructure Program, upcoming construction schedules, and final GI locations as an ongoing part of its outreach efforts.

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

The *2013 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 a requirement of the 2012 Order on Consent. In addition, Quarterly Progress Reports are posted on the DEP Long Term Control Plan (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 Green Infrastructure Program applies an adaptive management approach, based on information collected and evaluated 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 with the number of constructed GI.

Pilot Monitoring Program

DEP initiated site selection and design of its Pilot Monitoring Program in 2009. This 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 30 pilot individual GI practices have been constructed and monitored as part of the citywide pilot program for GI. These practices include right-of-way GI such as bioswale rain gardens, rooftop practices such as 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 monitoring sites was completed. Pilot Monitoring Program results are currently being used to improve GI designs and validate modeling methods and parameters. Results are further discussed in Section 5.3.e.

Neighborhood Demonstration Area Projects

The 2012 Order on Consent includes 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 Hutchinson River, the Newtown Creek and Jamaica Bay CSO tributary areas. DEP 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 Compliance Monitoring (PCM) Report in August 2014. These results will be incorporated into the 2016 Performance Metrics Report, which will model the CSO reductions anticipated to result from GI projects. Pre-construction monitoring for all three Demonstration Projects started in fall 2011, and PCM continued throughout 2013.

Construction of ROWBs as part of the Hutchinson River Green Infrastructure Demonstration Project was completed in April 2013 by DPR. There were 22 ROWBs installed within the 24-acre tributary area, and the design, construction, and monitoring costs were approximately $625,000. In the 23-acre Jamaica Bay Green Infrastructure Demonstration Project, DEP completed 31 right-of-way GI installations in 2012 and the permeable pavement retrofit projects at New York City Housing Authority's (NYCHA) Seth Low Houses in 2013. The total design, construction, and monitoring costs were approximately $1.5M. In the 16-acre Newtown Creek Green Infrastructure Demonstration Project, 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 $1.6M for design, construction, and monitoring. For more detailed information on the Demonstration Projects, see the *2012 Green Infrastructure Annual Report.*

While DEP's Pilot Monitoring Program provides performance data for individual GI installations, the Demonstration 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

Green Infrastructure Schoolyards

The "Schoolyards to Playgrounds" program, one of PlaNYC 2030's initiatives aimed at ensuring that all New Yorkers live within a ten-minute walk from a park, is a collaboration between the non-profit Trust for Public Land (TPL), DPR, New York City Department of Education (DOE), and New York City School Construction Authority (SCA) to renovate public school playgrounds and extend playground access to surrounding neighborhoods. In 2011, DEP joined TPL, SCA, and DOE funding up to $5M for construction of up to ten GI schoolyards each year for the next four years. The partnership is a successful component of DEP's strategy to leverage public-private partnerships to improve public property using GI retrofits.

See the Green Infrastructure Annual Reports, "Citywide Implementation," for up-to-date information on completed public property retrofit projects.

5.3.c Performance Standard for New Development

DEP's stormwater performance standard ("stormwater rule") enables NYC to manage stormwater runoff more effectively, and to reduce the rate of runoff into NYC's CSSs from new development or major site expansions. Promulgated in July 2012,[3] the stormwater rule requires any new house or site connections to NYC's CSS to comply with stricter stormwater release rates, effectively requiring greater on-site 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 on-site 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 NYC. For a new development, the stormwater release rate[5] is required to be 0.25 cubic feet per second (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] As discussed in Section 5.4.c. below, DEP anticipates that the stormwater rule will contribute to CSO reduction in each priority watershed.

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 2012 Order on Consent requires the Green Infrastructure Grant Program to commit $3M of EBP funds[8] to projects by 2015. DEP plans to meet this commitment in 2014.

Green Roof Property Tax Abatement

The NYC Green Roof Tax Abatement (GRTA) has provided a fiscal incentive to install green roofs on private property since 2008. DEP has worked with the Mayor's Office of Long Term Planning and Sustainability (OLTPS), the Department of Buildings (DOB), the Department of Finance (DOF) and the Office of Management and Budget (OMB), as well as environmental advocates and green roof designers,

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[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.

to modify and extend the GRTA through 2018. DEP has met with stakeholders and incorporated much of their feedback to improve the next version to help increase the number of green roofs in NYC. 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. Also, given that rooftop farms tend to be larger than typical green roofs (generally approximately 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 DOF on a pro rata basis. See the *2013 Green Infrastructure Annual Report* for up-to-date information on the Green Roof Property Tax Abatement.

5.3.e Projected vs. Monitoring Results

Pilot Monitoring Program

As mentioned above, more than 30 pilot GI practices 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, total suspended solids (TSS), total organic carbon (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 and monitor other aspects of source control performance at five-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 practices 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 practices 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 type. In many cases, bioretention practices have fully retained the volume of one-inch storms they received.

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 Demonstration 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 is culminating in the submission of a Post-Construction Compliance Monitoring Report in August 2014 and 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 calculate the CSO reduction benefits in the future.

The three Demonstration Projects were selected because the existing CSSs were suitable for monitoring flow in a single sewer pipe of a certain size, and were not influenced by surcharging hydraulic conditions. In each of the Demonstration Projects, DEP identified GI opportunities 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 Project 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 managed) for use in scaled-up GI planning and implementation in other (non-demo) areas of NYC;
- Determine a representative permeability range for ROWB infiltration; and
- Utilize monitoring data to inform future ROWB designs.

Project data collected will be used to calibrate the InfoWorks CS™ (IW) computer model to the monitored flows for 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

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

5.4.b Opportunities for Cost-Effective CSO Reduction Analysis

There were no GI-related cost-effective opportunities for CSO reduction to report in this section.

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

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

Watershed-specific implementation rates for GI are estimated based on the best available information from modeling efforts. Specific WWFPs, the Green Infrastructure Plan, CSO outfall tiers data, and historic building permit information were reviewed to better assess waterbody-specific GI penetration rates.

The following criteria were applied to compare and prioritize watersheds in order to determine watershed-specific GI penetration 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 recreational 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 saturate GI implementation rates within the priority watersheds; such that the total managed impervious acres will still be achieved in accordance with the 2010 Green Infrastructure Plan, except for the East River and Open Waters.

Green Infrastructure Baseline Penetration Rate – Hutchinson River

Based on the above criteria, Hutchinson River's characterization ultimately determined that the watershed is a priority CSO tributary area for DEP and GI has been planned there. This particular watershed has a total combined sewer impervious area of 1,128 acres out of a total drainage area within NYC of 2,552 acres. DEP projects GI penetration rates in the Hutchinson River watershed as follows:

- 111 acres (10 percent) are expected to be managed using ROWBs and Stormwater Greenstreets.
- 32 acres (3 percent) are expected to be managed in on-site private properties in Hutchinson River by 2030 through new development and compliance with the Stormwater Performance Standard.
- 15 acres (1 percent) are expected to be managed in on-site public properties.

This acreage would represent 14 percent of the total combined sewer impervious area in the watershed by 2030.

DEP conservatively estimated new development trends based on DOB building permit data from 2000 to 2011 and has projected that data for the 2012-2030 period to account for compliance with the stormwater performance standard.

Furthermore, as LTCPs are developed, baseline GI penetration 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 46 million gallons (MG) from this GI implementation based on the 2008 baseline rainfall condition.

DEP is working on the implementation of GI contracts in the CSO tributary areas of HP-023 and HP-024, as shown in Figure 5-2.

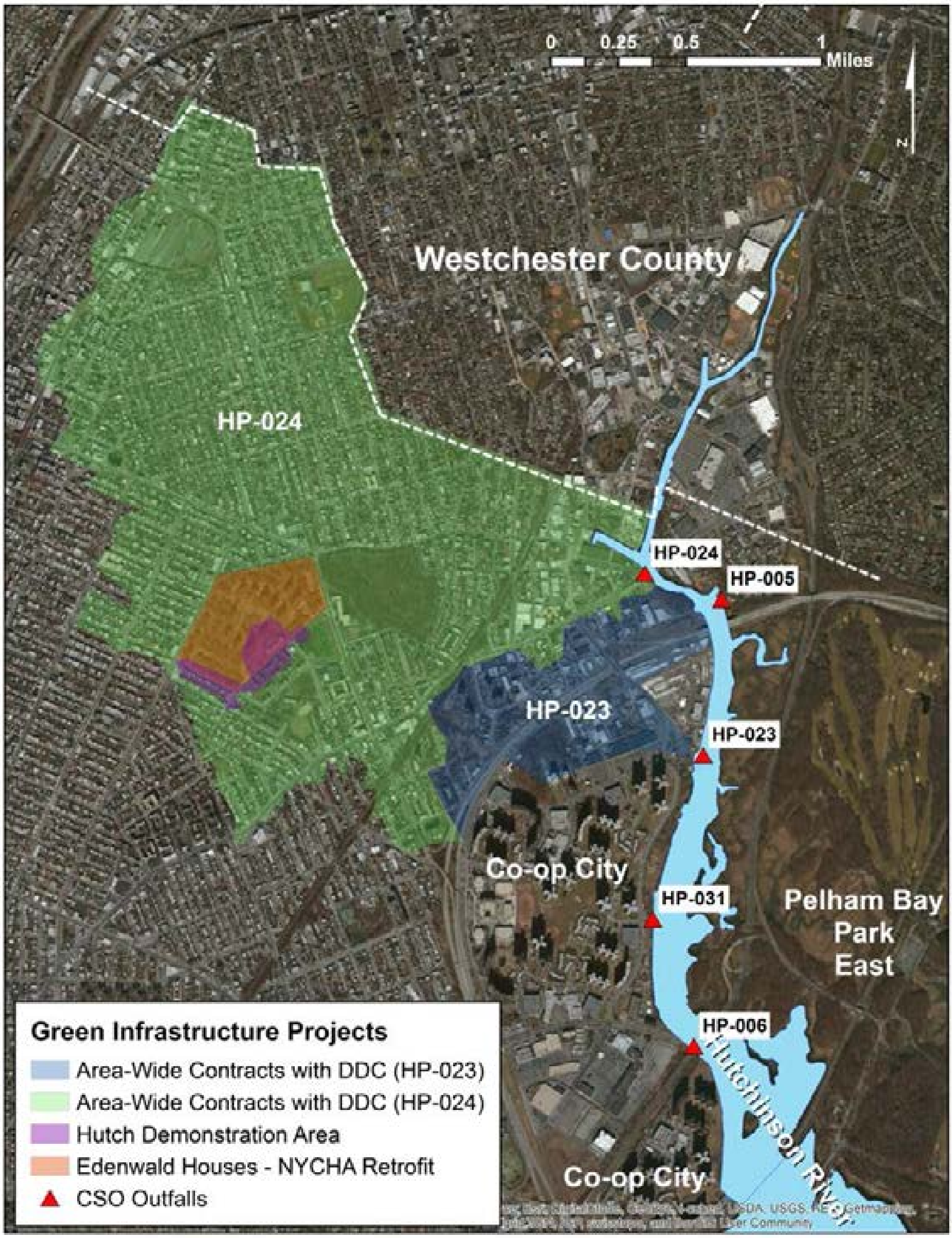

Figure 5-2. Green Infrastructure Contracts

6.0 BASELINE CONDITIONS AND PERFORMANCE GAP

Key to development of the Hutchinson River Long Term Control Plan (LTCP) is the assessment of water quality using applicable water quality standards (WQS) within the waterbody. Water quality was assessed using the East River Tributaries Model (ERTM) water quality model, verified with both Harbor Survey and the synoptic water quality data collected in 2012. The ERTM water quality model simulated ambient bacteria concentrations within Hutchinson River for a set of baseline conditions, as described in this section, to assess future conditions. The InfoWorks CS (IW) sewer system model was used to provide flows and loads from intermittent wet weather sources as input to the ERTM model.

The assessment of water quality described herein starts with a baseline condition simulation to determine the future bacterial levels without CSO controls. Next a simulation was performed to determine bacteria levels under the assumption of 100 percent combined sewer overflow control. The baseline condition was then compared to a 100 percent CSO Control simulation. The gap between the two scenarios was then compared to assess whether bacteria criteria can be attained through application of CSO controls. Two types of continuous water quality simulations were performed to evaluate the gap between the calculated baseline bacteria levels and the Existing Water Quality (WQ) Criteria and Future Primary Contact WQ Criteria. As detailed below, 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 the control alternatives presented in Section 8. A 10-year (2002-2011) simulation was performed for bacteria to assess the baseline conditions, evaluate the performance gap and analyze the impacts of the final alternative.

This section of the LTCP describes the baseline conditions, the bacteria concentrations and loads calculated by the IW model and the resulting bacteria concentrations calculated by the ERTM water quality model. It further describes the gap between calculated baseline bacteria concentrations and the existing and future WQS. The section presents two approaches to closing the gap: the first approach involves determining whether the gap can be closed through CSO reductions alone (100 percent CSO Control); the second approach conducts a waste load allocation (WLA) analysis examining reductions from all sources (CSO, separate sewer system and direct drainage) to close the gap.

The Hutchinson River WLA approach included multiple steps and assumptions as the river has freshwater and tidal sections which receive discharges from both Westchester County and (NYC sources. To perform the WLA analysis, it was necessary that a set of critical conditions be established for setting the maximum allowable waste loads. For fresh water streams and rivers, WLA analyses are generally performed under low flow (minimum average 7-consecutive day low flows that occur once in 10 years – 7Q10) summer conditions. Neither DEC regulations nor EPA or DEC technical guidance documents define critical conditions for establishing WLAs in tidal waters or for wet weather and non-point source assessments. EPA does recommend that critical or design conditions be developed to attempt to represent reasonable worst case conditions (EPA, 1991). As such, DEP as discussed herein, established a set of critical conditions which are expected to provide compliance with the existing and future bacteria WQS greater than 95 percent of the time.

Once these critical conditions were established, the next step was to assume the Hutchinson River was in compliance with Existing WQ Criteria at the freshwater-tidal boundary, the area where discharges are only from Westchester County. This assumption was necessary in order to develop the WLA for the tidal section of the Hutchinson River, where NYC CSOs discharge. The 2002-2011 period was used for the analysis to examine the occurrence of excursions above the existing fecal coliform criterion monthly geometric mean (GM). Station HR-05, located downstream of the largest CSO outfall (HP-024), was chosen as the location for the WLA analysis because it consistently had the highest fecal coliform concentrations in the Hutchinson River after the presumed reductions in the loads in the freshwater section brought that section into attainment. The month with the highest monthly fecal coliform GM in each of the 10 years was selected at Station HR-05 for comparison. Based on the analysis, August 2011 was identified as the reference month to use for the WLA analysis as it represented a critical condition for the tidal portion of the Hutchinson River. If the WLA results in attainment during August 2011 conditions, it would be expected that the Hutchinson River would achieve 97.5 percent attainment of the Existing WQ Criteria for fecal coliform (117 out of 120 months).

These analyses are presented for the Existing WQ Criteria and for Future Primary Contact WQ Criteria. It should be noted that the enterococci criterion does not apply to tributaries such as the Hutchinson River under the BEACH Act of 2000; therefore, Hutchinson River water quality assessments for existing Class SB only considered the fecal coliform criterion (200 cfu/100mL). Future Primary Contact WQ Criteria assessments take into account both enterococci and fecal coliform criteria for primary contact recreation.

6.1 Define Baseline Conditions

Establishing baseline conditions is an important step in the LTCP process, since the baseline conditions will be used to compare and contrast the effectiveness of CSO controls and to predict whether water quality goals would be attained after the implementation of the identified preferred alternative LTCP. Baseline conditions for this LTCP were established in accordance with guidance set forth by DEC to represent future conditions. Specifically, these conditions included the following assumptions:

- The design year was established as 2040.
- The Hunts Point Wastewater Treatment Plant (WWTP) receives and can accept and treat peak flows at two times design weather flow (2xDDWF).
- Green Infrastructure (GI) in 14 percent of the impervious surfaces within the combined sewer service areas.

Mathematical modeling tools were used to calculate the CSO volume and pollutant 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 as presented in Section 8.

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 the Hutchinson River LTCP, the baseline conditions were developed in a manner consistent with the earlier Waterbody/Watershed Facility Plans (WWFPs) for other waterbodies. However, based on more recent data, as well as the public comments received on those WWFPs, it was recognized that some of the baseline condition model input data needed to be updated to reflect more recent meteorological conditions, as well as current operating characteristics of various collection and conveyance system components. Furthermore, the mathematical models were also updated from their configurations and levels of calibration developed and documented prior to this LTCP. IW model modifications reflected a better understanding of pollutant sources, catchment areas and new or upgraded physical components of the system. In addition, a model recalibration report was issued in

2012 (*InfoWorks Citywide Recalibration Report, June 2012a*) that used improved impervious surface satellite data. Water quality model updates included more refined model segmentation. Updates to the IW model and the water quality model are described in *Hutchinson River CSO Waste Load Allocation Water Quality and Sewer System Report (DEP, 2014).* The new IW model network was then used to estimate CSO volumes and loads for the baseline conditions. It also was used as a tool to estimate CSO volumes and loads resulting from CSO control alternatives evaluated in Section 8. Following are the baseline modeling conditions primarily related to dry weather flow (DWF) rates, wet weather capacity for the Hunts Point WWTP, sewer conditions, precipitation conditions and tidal boundary conditions. Each of these is briefly discussed in the following:

- **Wet Weather Capacity**: The rated wet weather capacity at the Hunts Point WWTP is 400 MGD (2xDDWF). A project was completed in 2004 to upgrade the treatment plant including the plant headworks and main sewage pumps so that the plant is capable of accepting, pumping and treating combined sewage to a maximum flow of 400 MGD. Effective May 8, 2014, DEC and DEP entered into an administrative consent order for CSO BMPs (2014 CSO BMP Order on Consent) 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, including all conveyance elements with equivalent diameters of 48 inches or larger, 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.

- **Source Loadings:** The Hutchinson River receives flows and pollutant loadings from Westchester County. During 2012, the outflow from Pelham Lake, which forms the headwaters for the Hutchinson River within the LTCP study area, was sampled on multiple occasions. In addition, storm sewers within Mt. Vernon, which discharge into the river, were sampled. For the baseline conditions, Pelham Lake outflow concentrations were considered to be consistent with those sampled in 2012, as were stormwater concentrations emanating from Mt. Vernon (Westchester County). Illicit dry weather loadings observed in Westchester County during the 2012 sampling were not included in the baseline conditions.

6.1.a Hydrological Conditions

For this LTCP, the precipitation characteristics for 2008 were used for the baseline condition, as well as for alternatives evaluations and were considered as being representative to a typical rainfall year. 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 population growth in NYC. In 2014, DEP completed detailed analysis for water demand and wastewater flow projections. A detailed geographical information system (GIS) analysis was performed to apportion total population among the 14 WWTP drainage areas. For this analysis, Transportation Analysis Zones (TAZs) were overlaid with WWTP drainage areas. Population projections for 2010-2040 were derived from population projections developed by the New York City Department of City Planning (DCP) and New York Metropolitan Transportation Council (NYMTC). These analyses used the 2010 census data to reassign population values to the watersheds in the model and project sanitary flows to 2040. 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 Best Management Practices (BMPs), along with brief summaries of each and their respective relationships to the U.S. Environmental Protection Agency (EPA) Nine Minimum Controls (NMCs) were reported in Section 3.0, as they pertain to Hutchinson River 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 combined sewer system (CSS), thereby improving water quality conditions.

The following provides an overview of the specific elements of various DEP, State Pollutant Discharge Elimination System (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 the Hutchinson River:

- Sentinel Monitoring: In accordance with BMPs #1 and #5, DEP collects quarterly samples of bacteria water quality at the mouth of the Hutchinson River (HR-01, Figure 2-12) in dry weather to assess whether dry weather sewage overflows occur or illicit connections to storm sewers exist. No evidence of illicit sanitary sewer connections was observed based on these data. Although illicit sources of pollution 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: 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 the CSO BMP Order, the Hunts Point WWTP treats wet weather flows up to 2xDDWF that are conveyed to the plant. DEP follows the wet weather operating plan and receives and treats 2xDDWF regularly. Cleaning of the interceptor sediments has increased the ability of the system to convey 2xDDWF to the WWTP.

- Wet Weather Operation Plans (WWOP): The Hunts Point WWOP (BMP #4) establishes procedures for pumping at the plant headworks to assure treatment of 2xDDWF.

6.1.d Elements of Facility Plan and GI Plan

NYC has not developed any plans that currently require construction of grey infrastructure in the Hutchinson River watershed. As discussed in Section 5.0, the Hutchinson River watershed is one of the more promising areas for GI build-out in NYC. DEP has projected a 14 percent level of GI implementation, which has been assumed in the baseline model.

6.1.e Non-CSO Discharges

In several sections of the Hunts Point WWTP drainage area, stormwater drains directly to receiving waters without entering the combined system or separate storm sewer system. These areas were depicted as "Direct Drainage" in Figure 2-3 (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. However, these areas are comparatively small: of the 4,847 acres of drainage area tributary to the Hutchinson River downstream from Pelham Lake, 29 percent (1,410 acres) is served by combined sewers. The remaining 71 percent is divided between direct drainage (532 acres) and separately sewered stormwater outfalls within NYC (610 acres) and within Westchester County (2,295 acres). In addition, the drainage area upstream from Pelham Lake in Westchester County, which is considered the upstream end of the LTCP study area, consists of an additional 3,470 acres, all of which are served by separate storm sewers and direct drainage.

Although the IW model is used to estimate volume and loads from non-CSO sources in the area of interest, the current model consolidates the drainage areas within the Municipal Separate Storm Sewer System (MS4). Thus, the stormwater subcatchments are only modeled in a simplified way and do not contain any details of the internal storm pipe system. Therefore, the stormwater flow and loads are estimates.

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 incorporated the implementation of a 14-percent GI build-out or no grey infrastructure. Using these overflow volumes, pollutant loadings from the CSOs were generated using the enterococci, fecal coliform and Biochemical Oxygen Demand (BOD) concentrations and provided input to the receiving water quality model, ERTM. ERTM was assessed using 2012 monitoring data collected during the Hutchinson River LTCP as well as Sentinel Monitoring data for the same period. The assessment consisted of comparing the cumulative frequency distribution of 2012 collected concentration data against the cumulative frequency distribution of the model for storms of similar sizes.

In addition to CSO pollutant loadings, storm sewer discharges and direct drainage impact the water quality in the Hutchinson River. The pollutant concentrations assigned to the various sources of pollution to Hutchinson River are summarized in Table 6-1. Concentrations in Table 6-1 represent typical stormwater, direct drainage and sanitary sewage for the Hutchinson River drainage area and are based on data collected from the Hutchinson River area. Concentrations assigned to Westchester County stormwater are based on data collected from two stormwater outfalls during the period of May through September 2012 during four precipitation events. Maximum likelihood estimate (MLE) concentrations were calculated from the combined data of the two outfalls to assign the bacteria concentrations. The Pelham Lake Outflow data was collected during the same May through September 2012 timeframe. These data were used to derive hourly dry and wet weather for the ten year long term simulation period using statistical Monte Carlo methods to define the variability of the bacteria concentrations used in future conditions analyses from observed data. During wet-weather a precipitation versus concentration relationship was developed to assign wet-weather bacteria concentrations to Pelham Lake outflow.

Typical baseline volumes of CSO, stormwater and direct drainage to the Hutchinson River are summarized in Table 6-2 for the 2008 year. The specific SPDES permitted outfalls associated with these sources were shown in Figure 2-5. Additional tables can be found in Appendix A. The information in these tables is provided for the 2008 rainfall condition.

For the modeling simulations, CSO concentrations were calculated using the stormwater and sanitary concentrations assigned in Table 6-1, multiplied by the flow calculated by the IW model. The model provides a calculated fraction of flow from stormwater and flow from sanitary sources, as follows:

Table 6-1. Pollutant Concentrations for Various Sources in the Hutchinson River

Pollutant Source		Enterococci (cfu/100mL)	Fecal Coliform (cfu/100mL)	BOD_5[1] (mg/L)
Stormwater NYC[1]		50,000	35,000	15
Stormwater Westchester County[1]		50,000	100,000	15
Direct Drainage[3]		6,000	4,000	15
Sanitary Sewage[2]		1,000,000	4,000,000	110
Pelham Lake Outflow	Dry[1]	190[4]	500[4]	2.7[5]
	Wet[1]	1,300[4]	3,300[4]	

Notes:
(1) Hutchinson River CSO Waste Load Allocation Water Quality and Sewer System Report, 2014
(2) HydroQual Memo to DEP, 2005a.
(3) Basis – NYS Stormwater Manual, Charles River LTCP, National Stormwater Data Base for commercial and industrial land uses.
(4) GM of sampling data – modeled using Monte-Carlo techniques.
(5) Average concentration.

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

Location	Outfall Type	Inflow		Enterococci		Fecal Coliform	
		(MG)	Percent	(Organisms) x 10^{13}	Percent	(Organisms) x 10^{13}	Percent
NYC	CSO	323	8.8	173	42.7	512	54.8
	Storm Outfall	176	4.8	33	8.1	23	2.5
	Direct Drainage	198	5.4	4.4	1.1	3	0.3
Westchester County	Storm Outfall	923	25.4	175	42.2	350	37.4
	Pelham Lake	2,018	55.5	20	4.9	47	5.0

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

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

For 2008, the IW model calculates that a total of 323 MG of discharges from CSOs, with 132 MG from HP-023, 170 MG from HP-024 and 21 MG from HP-031. For the two locations with the majority of the CSO overflow by volume, the fraction of the overflow that was calculated by the IW model to be associated with sanitary sewage ranges from 6 percent (HP-024) to 14 percent (HP-023), with the remainder being stormwater. This mixture of flows results in CSO concentrations for enterococci of about 145,000 cfu/100mL at 10 percent sanitary, for fecal coliform of about 431,500 cfu/100mL at 10 percent sanitary and for BOD_5 of about 24 mg/L at 10 percent sanitary. An example of the IW CSO concentration calculation for CSO enterococci concentration is presented below using sanitary and storm runoff concentrations from Table 6-1:

145,000 cfu/100mL = 0.1 x 1,000,000 cfu/100mL + 0.9 x 50,000 cfu/100mL

Generally, the calculated geometric mean (GM) bacteria concentrations for the CSO outfalls approximate the concentrations measured in 2012 where individual samples ranged from 31,000 to 410,000 cfu/100mL. As such, the calculated concentrations are used herein for the baseline conditions, representing conservative estimates of the CSO loadings. As DEP's program has progressed, it has been determined that monitoring of CSO overflow quality is required at key locations and sampling sanitary concentrations in the combined sewer lines is also required to develop a better database that can be used to improve the accuracy of the CSO loadings. In this case, the monitoring results confirmed that this calculation approach was a valid way to use the model to calculate CSO overflow concentrations.

Table 6-2 provides the total annual volume and average source loadings based on the 2008 year. Refer to Figure 2-5 for the location of the Hutchinson River SPDES permitted outfalls.

6.3 Performance Gap

Concentrations of bacteria and DO in the Hutchinson River 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. As discussed in Section 2, sources of pollutants to the river include the outflow from Pelham Lake and wet weather runoff. Since much of the flow and pollutant loads discharged into this waterbody are the result of runoff from rainfall events, the frequency, duration and amounts of rainfall strongly influence the Hutchinson River's water quality. The Hutchinson River portion of the ERTM model was used to simulate bacteria and DO concentrations for the baseline conditions using 2002-2011 rainfall and tidal data. Hourly model calculations were saved for post-processing and comparison with the Existing WQ Criteria and Future Primary Contact WQ Criteria, 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 to individually address the following:

- Existing WQ Criteria (Class SB); and

- Future Primary Contact WQ Criteria.

Within these sections, analyses are developed to reflect the differences in attainment both spatially and temporally. The spatial assessment focuses on the tidal portions of the river, which receives the inflows from NYC sources of pollution as well as a portion of the Westchester County stormwater and the freshwater portion of the river.

Discharges to the freshwater section are all from Westchester County: Pelham Lake outflow and stormwater from MS4 and direct drainage overflows. The temporal assessment focuses on compliance with the applicable fecal coliform water quality criteria over the entire year and in the case of enterococci, during the recreational season of May 1st through October 31st.

A summary of the criteria that were applied is shown in Table 6-3.

Table 6-3. Classifications and Standards Applied

Analysis	Numerical Criteria Applied
Existing WQ Criteria – Primary Contact	SB: Fecal Monthly GM ≤ 200 cfu/100mL
Future Primary Contact WQ Criteria(1)	Entero: rolling 30-d GM – 30 cfu/ 100mL Entero: STV – 110 cfu/100mL

Notes:
GM = Geometric Mean; STV = 90 Percent Statistical Threshold Value.
(1) This Future Primary Contact WQ Criteria has not yet been proposed by DEC. For such criteria to take effect, DEC must first adopt the criteria in accordance with rulemaking and environmental review requirements. DEP reserves all rights with respect to any administrative and/or rule making process that DEC may engage in to revise WQS.

Analyses in this LTCP are performed using the 30-day rolling GM of 30 cfu/100mL and the statistical threshold value (STV) of 110 cfu/100mL for enterococci. DEC has recently advised DEP that it plans to adopt those recreational criteria in 2015.

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

The first step in assessing the performance gap was to calculate the Hutchinson River fecal coliform concentrations under baseline conditions and then to establish whether the gap could be closed through reductions to CSO overflows. The assessment was to determine if the river water quality would comply with Existing WQ Criteria. A 10-year simulation of bacteria water quality was performed for the baseline loading conditions, assuming all known dry weather illicit discharges from Westchester County have been eliminated. The results of these simulations are summarized in Table 6-4. The results shown in this table summarize the highest calculated monthly GM in each of the 10 years of the long term simulation. The maximum monthly GM is presented for each year and for each sampling location in the river. The shaded locations (Stations HR-09 to HR-07) shown in Table 6-4 and subsequent tables are the freshwater section of the river in Westchester County. The unshaded portions of the table present the results for the tidal or marine section of the river.

Table 6-4. Calculated 10-Year Baseline Fecal Coliform Maximum Monthly GM and Attainment of Existing WQ Criteria

Station		(a) Monthly Maximum Fecal Coliform Geometric Mean (cfu/100mL)									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
		March	March	March	October	January	December	February	June	February	August
HR-09	Fresh Water	1,077	1,068	1,074	1,516	1,289	1,347	1,247	2,236	1,148	1,830
HR-08		1,243	1,199	1,396	1,765	1,561	1,794	1,639	3,178	1,302	2,060
HR-07		1,307	1,449	1,853	1,592	1,652	2,252	2,038	3,847	1,255	2,069
HR-06	Tidal	301	297	170	260	387	751	623	587	281	439
HR-05		257	249	119	214	311	640	506	499	223	442
HR-04		200	193	79	156	244	485	399	348	165	345
HR-03		197	176	70	149	243	457	367	335	152	319
HR-02		151	130	52	118	186	310	277	236	116	243
HR-01		40	40	11	45	55	69	80	51	34	77
Station		(b) Fecal Coliform - Annual Attainment (Percent of Months)									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
HR-09	Fresh water	0	0	0	0	0	0	0	0	0	0
HR-08		0	0	0	0	0	0	0	0	0	0
HR-07		0	0	0	0	0	0	0	0	0	0
HR-06	Tidal	83	58	83	75	75	83	75	67	83	58
HR-05		83	75	92	83	83	83	83	75	83	67
HR-04		100	83	100	92	83	83	83	83	100	83
HR-03		100	83	100	92	83	83	83	83	100	83
HR-02		100	100	100	92	100	83	92	83	100	83
HR-01		100	100	100	100	100	100	100	100	100	100

This table presents the maximum monthly geometric means (units of cfu/100mL) for each year in the 10-year simulation at each location. The table also presents the annual attainment (percent) of the fecal coliform GM criterion of 200 cfu/100mL. The baseline condition shown in the table presents the 10-year long term attainment for the existing fecal coliform criterion. It shows the existing Class SB criterion (monthly GM of 200 org/100mL) is not met at any location in the Westchester County freshwater section of the river (Stations HR-09 to HR-07 shading). Within this freshwater section the calculations indicate the river never attains the fecal coliform standards, meaning none of the months reach compliance.

The water quality improves moving downstream through the tidal section of the river (Stations HR-06 to HR-01). As noted in the table, fecal coliform concentrations are calculated to be in attainment 100 percent of the time at the most downstream end of the system approaching Eastchester Bay for each year in the 10-year simulation. At the upper end of the tidal reach (Station HR-06) attainment varies from 58 percent to 83 percent, generally representing higher levels of attainment during the recreational period with lower attainment outside that period. It should be noted that because the waterbody is a tidal river, there is no enterococci limit for the Existing WQ Criteria.

Next, another analysis was performed in the tidal section to determine whether 100 percent control of NYC CSO would close the gap between the baseline projected fecal coliform water quality conditions and the Existing WQ Criteria. This analysis paralleled the analysis discussed above with the exception that all CSO bacteria source concentrations were set to zero. The results of this 100 percent CSO control analysis are provided in Table 6-5 for the 10-year simulation period.

Table 6-5 summarizes both the highest calendar month fecal coliform GM (cfu/100mL) and annual attainment of the standards for the 10-year period. As noted, results improve somewhat downstream in the tidal portion of the river with improvements in attainment equaling one or two additional months (8 and 16 percent improvements). There continues to be less attainment with standards in the upper portions of the tidal section of the river. Attainment of the standards remains at zero percent in the freshwater section of the river, even where there are no CSO sources.

Table 6-5. Calculated 10-Year Fecal Coliform Maximum Monthly GM and Attainment of Existing Water Quality Criteria with 100% CSO Control

Station		(a) Monthly Maximum Fecal Coliform Geometric Mean (cfu/100mL)									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
		March	March	March	October	January	December	February	June	February	August
HR-09	Fresh water	1,077	1,068	1,074	1,516	1,289	1,347	1,247	2,236	1,148	1,830
HR-08		1,243	1,199	1,396	1,765	1,561	1,794	1,639	3,178	1,302	2,060
HR-07		1,307	1,449	1,853	1,592	1,652	2,252	2,038	3,847	1,255	2,069
HR-06	Tidal	225	238	170	192	313	557	464	468	245	283
HR-05		178	184	116	135	234	415	345	333	188	222
HR-04		130	131	76	88	173	284	257	207	133	162
HR-03		124	118	67	76	162	253	233	181	115	151
HR-02		99	91	51	64	131	184	184	142	88	118
HR-01		28	29	11	26	40	44	55	31	27	36
Station		**(b) Fecal Coliform - Annual Attainment (Percent of Months)**									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
HR-09	Fresh water	0	0	0	0	0	0	0	0	0	0
HR-08		0	0	0	0	0	0	0	0	0	0
HR-07		0	0	0	0	0	0	0	0	0	0
HR-06	Tidal	83	67	92	92	75	83	83	75	92	67
HR-05		100	100	100	92	92	92	83	83	100	83
HR-04		100	100	100	100	100	92	92	83	100	100
HR-03		100	100	100	100	100	92	92	92	100	100
HR-02		100	100	100	100	100	100	100	92	100	100
HR-01		100	100	100	100	100	100	100	100	100	100

In summary, the gap between baseline fecal coliform concentrations and the Existing WQ Criteria cannot be closed with 100 percent control of CSOs alone.

Water quality model simulation results are presented in Table 6-6 for DO concentrations and measures of attainment for year 2008 as calculated at the bottom of the water column. Water quality calculations indicate that the overall attainment of the Class SB criterion daily average of 4.8 mg/L is at a low of 60 percent for the year at Station HR-06 in the tidal portion of the river. Even though there are excursions below the DO criterion 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 baseline DO attainment of the 4.8 mg/L criterion is between 60 and 98 percent in the tidal section of the river. With 100 percent CSO removal, these numbers increase by 11 to 15 percent between Stations HR-06 and HR-04. For the acute standard of never less than 3.0 mg/L, the model calculates annual attainment to range from 79 to 99 percent attainment at Stations HR-06 through HR-01. Annual attainment improves with 100 percent CSO Control. Similar to bacteria, the entire gap between the baseline conditions and the DO criterion cannot be closed with CSO control alone.

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

Station		Annual Attainment Percent Attainment (Bottom of Water Column)			
		Baseline		100% CSO Control	
		>=4.8 mg/L	>=3.0 mg/L	>=4.8 mg/L	>=3.0 mg/L
HR-09	Fresh Water	100	100	100	100
HR-08		100	100	100	100
HR-07		97	100	97	100
HR-06	Tidal	60	83	71	90
HR-05		70	92	82	97
HR-04		79	96	94	99
HR-03		92	99	98	99
HR-02		98	99	98	99
HR-01		97	99	97	99

Results for the assessment with depth averaged DO concentrations and measures of attainment for year 2008 are presented in Table 6-7. Water quality calculations indicate that the overall attainment of the Class SB criterion daily average of 4.8 mg/L is at a low of 79 percent for the year at Station HR-06 in the tidal portion of the river. Even though there are excursions below the DO criterion 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 6-7, annual baseline DO attainment of the 4.8 mg/L criterion is between 79 and 99 percent in the tidal section of the river. With 100 percent CSO removal, these numbers increase by 8 to 13 percent between Stations HR-06 and HR-04. For the acute standard of never less than 3.0 mg/L, the model calculates annual attainment to range from 99 to 100 percent attainment at Stations HR-06 through HR-01. Annual attainment improves with 100 percent CSO Control.

Table 6-7. Model Calculated DO Attainment (2008)

Station		Annual Attainment Percent Attainment (Water Column Average)			
		Baseline		100% CSO Control	
		>=4.8 mg/L	>=3.0 mg/L	>=4.8 mg/L	>=3.0 mg/L
HR-09	Fresh Water	100	100	100	100
HR-08	Fresh Water	100	100	100	100
HR-07	Fresh Water	98	100	99	100
HR-06	Tidal	69	95	92	99
HR-05	Tidal	75	97	96	99
HR-04	Tidal	88	98	98	100
HR-03	Tidal	96	100	99	100
HR-02	Tidal	98	100	100	100
HR-01	Tidal	98.09	100	100	100

Although there are some improvements in attainment that can be gained through complete CSO removal, this option does not completely close the gap and bring the waterbody into full attainment of either the dissolved oxygen or bacteria water quality standards.

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

The Hutchinson River is already classified as Class SB by the DEC, and is thus classified for Swimmable/Fishable Uses.

6.3.c Loading Reductions Needed to Attain Current Water Quality Standards

Hutchinson River is a complex waterbody as the river is comprised of both freshwater and tidal sections and impacted by pollutant loadings from multiple jurisdictions. The freshwater section is impacted by multiple Westchester County municipalities whereas the tidal section is impacted by both Westchester County municipalities as well as NYC. As discussed in Section 6.3.a, complete control of NYC CSO sources will not attain the Existing WQ Criteria in the Hutchinson River. Even with removal of CSOs, other loadings to the river result in the calculated concentrations exceeding the current water quality standards.

In order to account for these complexities, a WLA approach was employed to evaluate overall bacteria loading reductions from all sources required to attain both the Existing WQ Criteria and Future Primary Contact WQ Criteria. This analysis was done by assuming the freshwater portion of the Hutchinson River was in attainment with applicable water quality criteria thus eliminating any uncertainties with stormwater loadings and potentially unaccounted for illicit discharges in Westchester County.

More specifically, the freshwater section of the Hutchinson River was adjusted to meet the Existing WQ Criteria (200 cfu/100mL fecal coliform) on an annual basis and an analysis was also done for the Future Primary Contact WQ Criteria (30 cfu/100mL enterococci) and STV (110 cfu/100mL) on a seasonal basis. The corresponding waste load allocations were then calculated for the tidal section of the Hutchinson River assuming the freshwater section is in full attainment with applicable water quality standards. The results for this analysis are discussed in detail below.

The WLA approach included the following steps and assumptions:

1. For the upstream freshwater section of the Hutchinson River, reductions to the Westchester County wet weather loads and Pelham Lake overflow loads were assumed to be in full attainment of the Existing WQ Criteria bacterial criterion on an annual basis for the analyses based on that criterion. For analyses based on the future enterococci RWQC, the Westchester County wet weather loads and Pelham Lake overflow loads were assumed to be in full attainment of the RWQC on a recreational season basis (May 1st to October 31st). This step established the freshwater load reductions, but does not apportion the loadings to individual sources or categories of sources.

2. Load reductions required to bring the tidal section of the Hutchinson River into attainment with the Existing WQ Criteria and with the Future Primary Contact WQ Criteria were assessed. Full attainment of the freshwater section at the tidal boundary was assumed in the tidal section assessment. This established the total load reductions to the tidal section of the Hutchinson River.

3. Equal percent reductions to each of the bacterial source loads within the tidal section were assumed until the bacterial standards were met. The sources are: NYC stormwater into the tidal section; Westchester County wet weather discharges into the tidal section; and NYC CSO's into the tidal section. This provides an overall estimate of the total reductions required to bring the fresh and tidal sections of the river into attainment of the standards.

4. Additional sensitivity analyses were conducted to assess how these total load reductions to the tidal section of the Hutchinson River would be achieved if the practical limits for the reductions in municipal stormwater bacteria were limited to a maximum of 15 percent. For these analyses, stormwater reductions of 0 percent, 10 percent and 15 percent were assigned and resulting CSO bacteria reductions were assessed in the tidal portion of the river. The coupling analyses between CSO and MS4 load reductions also provided information for alternative selection process. This evaluation included the assessment of whether NYC WLA load reductions could be achieved through CSO controls also, eliminating the need for reductions in MS4 loads.

5. As DEC regulations and guidance do not define critical conditions for conducting WLA analyses in tidal systems, DEP selected a level of protection for this analysis that targets a high level of compliance with the bacteria WQ criteria. The fecal coliform concentrations were calculated assuming the freshwater section is in attainment and are shown in Table 6-8. The table presents the maximum monthly fecal coliform concentrations for each year in the 10-year period. The August 2011 month was selected as the reference month to assess the WLA. As shown in Table 6-8, August 2011 represents the month with the fourth highest concentrations within the ten year assessment period of 120 months. Assuming August 2011 will be in compliance by reducing CSO loads at HR-05 from 229 cfu/100mL to the Existing WQ Criteria 117 months of 120 months would be expected to be in compliance. This results in 97.5 percent attainment which exceeds the 95 percent DEC allowable attainment level.

6. DEP has selected August 2011 conditions to be representative of critical conditions for performing the WLA calculations.

Table 6-8. Monthly Fecal Coliform Geometric Mean Concentrations at Station HR-05 during 2002-2011 with the Baseline and Freshwater Section in Attainment

Year	HR-05 Monthly Geo-Mean, with "HR-07" in Compliance											
ID	January	February	March	April	May	June	July	August	September	October	November	December
2002	35	10	124	40	27	39	6	8	16	27	87	55
2003	11	47	108	46	20	156	6	19	39	16	60	160
2004	15	30	27	68	62	19	53	13	19	7	80	69
2005	61	32	30	85	4	12	7	4	2	102	37	267
2006	128	53	8	58	37	52	31	11	9	73	147	41
2007	51	34	52	200	17	23	52	25	5	28	37	257
2008	51	196	64	27	31	24	6	22	25	14	58	137
2009	26	17	18	73	26	160	79	23	4	42	16	470
2010	18	74	131	23	18	7	7	4	8	23	19	44
2011	67	53	164	114	24	20	8	229	21	43	32	78

The following sections of this report summarize the results of the WLA analyses described above.

6.3.c.1 Freshwater Hutchinson River

As discussed in Section 6.3.a, the freshwater section of the river experiences elevated concentrations of fecal coliform bacteria (Table 6-4). Reductions to the Pelham Lake outflow and to the wet weather flows entering the Hutchinson River from Westchester County are required to bring the freshwater section of the river into full attainment. These reductions were developed from the baseline simulation results based on reductions required to bring fecal coliform concentrations during the most critical month in each year into compliance at the end of the freshwater section of the river (Table 6-9). As noted in Table 6-9, an average reduction of 72.2 percent was required for the Pelham Lake outflow fecal coliform concentrations, thereby reducing the dry and wet weather concentrations by an average of 72.2 percent. As noted in Table 6-9, this 72.2 percent reduction is an average and reduction would be greater in some years.

In addition to the Pelham Lake outflow reductions, Westchester County wet-weather reductions averaging 95.6 percent were also required to bring the freshwater section of the river into full attainment with the fecal coliform standards. This requires the existing measured wet weather fecal coliform concentrations of 100,000 cfu/100mL being reduced to 4,400 cfu/100mL.

These reductions resulted in fecal coliform concentrations calculated in the freshwater section of the river as it flows into the tidal section (Station HR-07) that approximated the Class B required level of a maximum monthly fecal coliform concentration of 200 cfu/100mL. The fecal coliform monthly GM concentrations resulting from the freshwater WLA reductions are provided in Table 6-10 for the rainfall year 2011, the simulation period selected for performing the WLA calculations. These results provide a starting point for development of load reduction scenarios for the more downstream tidal portions of the river.

Table 6-9. Required Bacteria Reductions to Attain Existing Fecal Coliform Criterion at End of Freshwater Section (Station HR-07)

Year	Pelham Lake Outflow (1)	Westchester County Wet Weather (1)
	Reduction %	Reduction %
2002	70.6	93.0
2003	74.9	95.2
2004	74.9	96.8
2005	67.0	96.0
2006	72.9	94.6
2007	73.5	97.4
2008	74.9	96.8
2009	75.4	98.0
2010	64.2	93.5
2011	73.7	95.1
Average	72.2	95.6

Notes:

(1) The estimated reductions shown above assume the elimination of the known dry weather discharges into Hutchinson River downstream of Pelham Lake but it's uncertain whether additional illicit dry weather discharges may exist upstream of Pelham Lake or if stormwater discharges may have a sanitary component.

Table 6-10. Calculated 2011 Monthly Fecal Coliform Concentrations with Loadings to Freshwater Section of River Adjusted to Comply with Criterion at End of Freshwater Section (HR-07)

Station		Monthly 2011 Fecal Coliform GM (cfu/100mL)											
		January	February	March	April	May	June	July	August	September	October	November	December
HR-09	Fresh water	182	190	194	190	189	178	171	194	186	185	182	185
HR-08	Fresh water	184	210	212	192	186	162	156	213	189	194	172	177
HR-07	Fresh water	153	199	185	171	158	126	118	174	134	159	136	143
HR-06	Tidal	71	63	156	106	28	23	10	177	22	46	37	80
HR-05	Tidal	67	53	164	114	24	20	8	229	21	43	32	78
HR-04	Tidal	61	44	154	108	20	17	8	204	19	38	26	67
HR-03	Tidal	66	44	167	116	21	17	9	208	21	42	27	71
HR-02	Tidal	62	40	155	104	18	14	9	179	21	39	25	65
HR-01	Tidal	24	16	57	29	7	6	4	64	9	15	12	24

As noted in Table 6-10, calculated monthly fecal coliform GMs at the end of the freshwater section of the river attain the required standard of 200 cfu/100mL for all months of the year with the 73.7 percent reduction for Pelham Lake and 95.1 percent reduction for Westchester County wet-weather. For the critical month of August, the monthly GM in the tidal section of the river is calculated to be 229 cfu/100mL, which is above the standard of 200 cfu/100mL. It should be noted that the critical month (February) for compliance at the freshwater tidal boundary (HR-07) (doesn't directly align with the critical month (August) in the tidal section (HR-05). This provides a slight margin of safety for the month of August.

6.3.c.2 Tidal Hutchinson River

As shown in Table 6-10, reductions in the concentrations of fecal coliform bacteria to bring the freshwater section into attainment do not result in attainment of the fecal coliform in the tidal section for the critical 2011 WLA period. With the Westchester County reductions in place, the tidal section requires an additional fecal coliform reduction of 14 percent from all sources to be in attainment. This total load reduction for fecal coliform could be apportioned to all sources equally or with varying CSO load reductions coupled with stormwater reductions which is discussed in more details under Section 6.3.f. Table 6-11 shows the model simulation results when an equal reduction of 14 percent was applied to all point sources (the concentrations of Westchester wet-weather sources, NYC stormwater and CSOs) discharged to the tidal section of the river. The tidal section is in attainment as a result of the 14 percent reduction in point sources to the tidal section of the river. No reduction was applied to direct drainage sources in the analysis.

Table 6-11. Calculated 2011 Monthly Fecal Coliform Concentrations with Loadings to Freshwater and Tidal Sections of River Adjusted to Comply with the Existing Water Quality Criteria - Fecal Coliform

Station		Monthly 2011 Fecal Coliform GM (cfu/100mL)											
		January	February	March	April	May	June	July	August	September	October	November	December
HR-09	Fresh water	182	190	194	190	189	178	171	194	186	185	182	185
HR-08		184	210	212	192	186	162	156	213	189	194	172	177
HR-07		153	199	185	171	158	126	118	174	134	159	136	143
HR-06	Tidal	66	59	141	95	26	21	9	157	21	43	34	73
HR-05		61	49	146	101	22	18	8	199	20	39	29	70
HR-04		55	40	136	95	18	15	8	178	17	35	24	60
HR-03		59	40	146	101	19	15	9	181	19	38	24	63
HR-02		55	36	136	91	17	13	8	155	19	35	22	58
HR-01		22	15	52	26	7	5	4	57	8	13	11	22

In summary, to fully attain the Existing WQ Criteria in the tidal portion of the Hutchinson River, the area impacted by NYC sources, sources to both the freshwater and tidal sections need to be reduced significantly. First, fecal coliform bacteria concentrations from sources to the freshwater section of the river would need to be reduced by the 73.7 and 95.1 percent for Pelham Lake outflow and Westchester wet-weather, respectively. In addition, Westchester and NYC sources to the tidal section of the river would both have to be reduced by an additional 14 percent for the critical month of August 2011.

6.3.d Future Primary Contact WQ Criteria

As noted in Section 2.0, EPA released its 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 standards would include a rolling 30-day GM of either 30 cfu/100mL or 35 cfu/100mL and a 90^{th} percentile 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 condition model simulation results was conducted using both the 30 cfu/100mL GM and 110 cfu/100mL 90^{th} percentile STV criteria, to assess attainment with these future RWQC. As noted earlier, DEC has advised DEP that it plans to adopt the 30-day rolling GM for enterococci of 30 cfu/100mL, with a not-to-exceed the 90^{th} percentile STV of 110 cfu/100mL, which is the more stringent of the options presented in the RWQC recommendations.

6.3.e Load Reductions Needed to Attain Future Primary Contact Water Quality Criteria

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 the Hutchinson River. That analysis consisted of first assessing the baseline conditions for enterococci and then determining whether complete CSO reduction could close the gap between the baseline conditions and the future recreational water quality criterion of a 30-day rolling GM enterococci concentration of 30 cfu/100mL. The results of the analyses are presented in Table 6-12 for attainment of the rolling 30-day GM criterion. All results are for the attainment of the future recreational water quality criterion during the May 1^{st} to October 31^{st} recreational period defined by the DEC.

Table 6-12. Calculated 10-Year Baseline Enterococci Maximum 30-day GM and Attainment (Percent) of Future Primary Contact Water Quality Criteria

Station		(a)Maximum 30-Day Enterococci Geometric Mean (cfu/100mL)									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
HR-09	Fresh water	562	1,069	426	734	815	492	391	914	530	829
HR-08		724	1,555	538	940	1,034	508	464	1455	604	1,033
HR-07		909	2,118	678	1,030	1,445	561	526	2,185	705	1,334
HR-06	Tidal	165	533	90	156	313	183	78	405	85	246
HR-05		145	469	75	122	272	177	64	343	72	226
HR-04		105	335	53	87	197	144	48	230	50	163
HR-03		97	302	50	81	180	135	45	201	44	144
HR-02		75	215	39	62	124	107	35	135	35	105
HR-01		19	53	11	20	29	36	9	29	12	29

Table 6-12. Calculated 10-Year Baseline Enterococci Maximum 30-day GM and Attainment (Percent) of Future Primary Contact Water Quality Criteria

Station		(b) Enterococci - Recreational Season Attainment (Percent)									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
HR-09	Fresh water	0	0	0	0	0	0	0	0	0	0
HR-08		0	0	0	0	0	0	0	0	0	0
HR-07		0	0	0	0	0	0	0	0	0	0
HR-06	Tidal	44	39	24	65	17	39	55	28	69	19
HR-05		62	54	30	79	29	46	66	36	72	38
HR-04		75	63	52	90	46	58	80	44	84	59
HR-03		81	68	59	91	55	64	83	46	89	62
HR-02		89	76	73	92	73	78	96	66	93	67
HR-01		100	92	100	100	100	97	100	100	100	90

As shown in Table 6-12, very similar to the results provided for fecal coliform, baseline conditions do not result in compliance with the Future RWQC (30 day rolling GM 30 cfu/100mL) at any location in the river, except for the most downstream location near Eastchester Bay (Station HR-01). However, attainment in the tidal section of the river is higher than in the freshwater section. Results of the calculations for the STV portion of the criterion provided even lower levels of attainment, which were calculated to generally be at less than 10 percent.

Water quality modeling analyses conducted to assess attainment with complete removal of the CSO bacteria loadings, as provided in Table 6-13, show increases in attainment. However even with complete CSO removal, the enterococci criterion of a maximum GM of 30 cfu/100mL is not attained anywhere except in the downstream most portion of the system.

Table 6-13. Calculated 10-Year Enterococci Maximum 30-day GM and Attainment (Percent) of Future Primary Contact Water Quality Criteria with 100 Percent CSO Control

Station		(a) Maximum 30-Day Enterococci Geometric Mean (cfu/100mL)									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
HR-09	Fresh water	562	1,069	426	734	815	492	391	914	530	829
HR-08		724	1,555	538	940	1,034	508	464	1,455	604	1,033
HR-07		909	2,118	678	1,030	1,445	561	526	2,185	705	1,334
HR-06	Tidal	140	410	79	134	254	130	70	342	75	193
HR-05		111	294	61	94	185	108	54	247	56	145
HR-04		75	193	41	62	125	84	39	155	38	101
HR-03		66	163	37	53	106	77	35	127	33	86
HR-02		53	127	31	43	78	66	28	94	27	64
HR-01		14	32	9	14	19	24	8	20	9	17

Table 6-13. Calculated 10-Year Enterococci Maximum 30-day GM and Attainment (Percent) of Future Primary Contact Water Quality Criteria with 100 Percent CSO Control

Station		(b) Enterococci - Recreational Season Attainment (Percent)									
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
HR-09	Fresh water	0	0	0	0	0	0	0	0	0	0
HR-08		0	0	0	0	0	0	0	0	0	0
HR-07		0	0	0	0	0	0	0	0	0	0
HR-06	Tidal	55	43	26	67	24	45	63	70	23	23
HR-05		75	59	41	88	40	58	78	79	54	54
HR-04		89	71	70	93	64	77	91	93	67	67
HR-03		92	76	79	94	79	88	95	95	70	70
HR-02		94	86	95	96	91	92	100	100	78	78
HR-01		100	98	100	100	100	100	100	100	100	100

Since the analyses showed that it was not possible to close the gap between baseline conditions and the enterococci criterion of 30 cfu/100mL with 100 percent CSO control, a WLA analysis was performed to assess the total loading reductions required to attain the RWQC. This analysis was also performed in a stepwise fashion moving from the upstream freshwater portion of the river to the downstream tidal portion of the river.

6.3.e.1 Freshwater Hutchinson River

The water quality model was run to assess reductions to the Pelham Lake outflow and to the wet-weather sources entering the Hutchinson River from Westchester County that were required to bring the freshwater section of the river into full attainment with the Future Primary Contact WQ Criteria rolling 30-day maximum 30 cfu/100mL enterococci concentration. As noted in Table 6-14, a 10-year average reduction of 88 percent was required for the Pelham Lake outflow enterococci bacteria concentrations, thereby reducing the Pelham Lake dry weather concentrations from about 190 cfu/100mL to about 23 cfu/100mL. Wet weather concentration reductions of 88 percent would require the existing measured concentration of 1,300 cfu/100mL to be reduced to about 160 cfu/100mL. As noted in Table 6-14, required reductions would be greater in some years.

Table 6-14. Westchester County Enterococci Loading Reductions Required to Bring the River into Attainment at the end of the Freshwater Section (HR-07)

Year	Pelham Lake Outflow (1)	Westchester County Wet Weather (1)
	Reduction (%)	Reduction (%)
2002	87.8	99.1
2003	88.5	99.5
2004	88.0	98.8
2005	87.8	99.2
2006	87.8	99.4

Table 6-14. Westchester County Enterococci Loading Reductions Required to Bring the River into Attainment at the end of the Freshwater Section (HR-07)

Year	Pelham Lake Outflow [1]	Westchester County Wet Weather [1]
	Reduction (%)	Reduction (%)
2007	88.1	97.0
2008	88.1	97.8
2009	88.4	99.6
2010	87.2	98.3
2011	88.4	98.7
Average	88.0	98.7

Notes:

(1) The estimated reductions shown above assume the elimination of the known dry weather discharges into Hutchinson River downstream of Pelham Lake but it's uncertain whether additional illicit dry weather discharges may exist upstream of Pelham Lake or if stormwater discharges may have a sanitary component.

In addition to the reductions required of the outflow from Pelham Lake, Westchester County wet-weather reductions averaging 98.7 percent, for the long term 10-year simulation period, were also required to bring the freshwater section of the river into attainment with the future enterococci bacteria standards. This would result in the existing measured enterococcus stormwater concentrations of 50,000 cfu/100mL being reduced to 650 cfu/100mL. For the year 2011 conditions, a reduction of 88.4 percent was required for Pelham Lake enterococci and 98.7 percent for Westchester County wet-weather to bring the freshwater section of the river into attainment with the potential Future Primary Contact WQ Criteria during the recreational season.

These reductions resulted in calculated enterococci bacteria concentrations at the freshwater/tidal section boundary that approximated the future criterion level of a maximum 30-day GM concentration of 30 cfu/100mL. The results of this analysis are provided in Table 6-15 for 2011, the selected year for performing the WLA calculations. However, as summarized in Table 6-15, even with these calculated levels of load reductions, the resulting concentrations downstream in the tidal section exceeded 30 cfu/100mL. These results provide a starting point for development of load reduction scenarios for the more downstream tidal portions of the river.

Table 6-15. Calculated 2011 Maximum 30-day Recreational Season Enterococci Concentrations with Loadings to Freshwater Section of River Adjusted to Comply with Criterion at the end of the Freshwater Section (HR-07)

Station		Maximum 30-day GM Enterococci Concentration (cfu/100mL)		90th Percentile STV during Maximum 30-day GM Period (cfu/100mL)	
		Baseline	Freshwater River in Attainment	Baseline	Freshwater River in Attainment
HR-09	Fresh water	1,069	30	9,847	45
HR-08		1,555	34	20,386	222
HR-07		2,118	30	17,580	223
HR-06	Tidal	533	53	4,625	907
HR-05		469	76	5,597	2,302
HR-04		335	74	3,392	1,929
HR-03		302	80	2,613	1,593
HR-02		215	71	1,626	1,237
HR-01		53	23	727	622

6.3.e.2 Tidal Hutchinson River

As shown in Table 6-15, reductions in the concentrations of enterococci at the outflow from Pelham Lake and from the wet-weather sources in Westchester County, to bring the freshwater Hutchinson River into attainment at the boundary with the tidal zone, do not result in attainment of the RWQC in the tidal section for the critical 2011 period. The reductions applied to both freshwater sources for 2011 were 88.4 percent and 98.7 percent for Pelham Lake and Westchester County wet-weather flow, respectively.

With those reductions in place, an additional reduction of 69 percent was applied to the concentrations of Westchester County wet-weather, NYC stormwater and CSOs discharged into the tidal section of the river to reach the calculated enterococci concentrations that attained the 30-day rolling GM component of the standards (Table 6-16) during the selected WLA period of 2011. No reduction was applied to direct drainage sources into the tidal portion of the river for this analysis.

In summary, to attain the future enterococci recreational season criterion in the tidal portion of the Hutchinson River (the area impacted by NYC sources) for the 2011 period, enterococci concentrations from sources to the freshwater section river would need to be reduced by 88.4 (Pelham Lake) and 98.7 percent (Westchester wet-weather). The Westchester County and NYC sources to the tidal section of the river would have to be reduced by 69 percent, with the exception of direct drainage. These wet weather load reductions are higher than the reductions needed to attain the Existing WQ Criteria. Even higher reductions would be required to fully attain a future criterion enterococci STV concentration of 110 cfu/100mL.

Table 6-16. Calculated 2011 Maximum 30-day Enterococci Concentrations with Loadings to Freshwater and Tidal Sections of River Adjusted to Comply with Criterion

Station		Maximum 30-day GM Enterococci Concentration (cfu/100mL)			90th Percentile STV during Maximum 30-day GM Period (cfu/100mL)		
		Baseline	Freshwater River in Attainment	Freshwater River in Attainment, Tidal River CSO and Wet Weather Reduced	Baseline	Freshwater River in Attainment	Freshwater River in Attainment, Tidal River CSO and Wet Weather Reduced
HR-09	Fresh water	1,069	30	30	9,847	45	45
HR-08		1,555	34	34	20,386	222	222
HR-07		2118	30	30	17,580	223	223
HR-06	Tidal	533	53	23	4,625	907	345
HR-05		469	76	30	5,597	2,302	859
HR-04		335	74	28	3,392	1,929	629
HR-03		302	80	29	2,613	1,593	503
HR-02		215	71	26	1,626	1,237	398
HR-01		53	23	11	727	622	254

6.3.f Waste Load Allocation Sensitivity Analyses

As noted above, under baseline conditions the source reductions summarized in Table 6-17 would be required under the waste load allocation discussed previously. These reductions do not result in attainment of the Future Primary Contact WQ Criteria value of 110 cfu/100mL.

Table 6-17. Summary of WLA Reduction Requirements

Location	Load Sources	Existing WQ Criteria - Fecal Coliform Load Reductions from Baseline Conditions (%)	Future Primary Contact WQ Criteria – Enterococci Load Reductions from Baseline Conditions (%)
Freshwater Section	Pelham Lake and Westchester County Wet Weather	73.7 95.1	88.4 98.7
Tidal Section	NYC CSO and Stormwater plus Westchester County Wet Weather	14	69

Additional analyses were conducted herein and summarized in Table 6-18 to further assess viable methods that could be employed to comply with the WLA requirements for the tidal section since general literature indicates that the maximum practical bacteria stormwater reductions are on the order of 10 to 15 percent.

Table 6-18. Summary of Tidal Section WLA Reduction Alternatives

Location	Criteria	WLA Reduction Requirement (%)	Source	Reduction Scenarios (%)		
Tidal Section	Existing WQ Criteria - Fecal Coliform Load Reductions from Baseline Conditions	14	Municipal Stormwater(1)	0	10	14
			CSO	17	15	14
	Future Primary WQ Criteria – Enterococci Load Reductions from Baseline Conditions	69	Municipal Stormwater(1)	0	10	15
			CSO	94	90	88

Notes:
(1) Includes both NYC and Westchester County stormwater to the tidal section.

As noted in Table 6-18, there are multiple approaches that could be employed to attain the WLA requirements instead of using equal reductions of both stormwater and CSO bacteria. For example, a 17 percent CSO reduction of fecal coliform would result in 0 percent municipal stormwater reduction being necessary. This example shows that after the Westchester County wet-weather sources are abated in the freshwater section of the river, the CSOs become a major contributor to non-attainment of the fecal coliform standard near station HR-05. This is because of the proximity of the CSOs to the station, the small fraction of the Westchester County wet-weather flow that discharges to the tidal section of the river, and that most of the NYC stormwater discharges are in the lower portion of the river.

6.3.g Component Analysis

A load source component analysis was conducted for the 2008 baseline condition using LaGuardia Airport rainfall data, to provide a better understanding of how each source type contributes to bacteria concentrations in the Hutchinson River. The source types include the East River at the mouth of the river, Pelham Lake outflow stormwater from Westchester County, stormwater from NYC, direct drainage and CSOs. The analysis was completed at Stations HR-09, HR-08 and HR-07 in the freshwater section and Stations HR-06 through HR-01 in the tidal section using the ERTM model. The analysis included the calculation of fecal coliform and enterococci bacteria GMs in total and from each component. For fecal coliform, a maximum winter month (February) was analyzed because the decay rate is lower in winter, resulting in generally higher fecal coliform concentrations. Enterococci was evaluated on a recreational season (May 1st to October 31st) basis. The calculated values were then compared to applicable numeric criteria to determine the relative contribution of each component to non-attainment of those criteria.

Table 6-19 summarizes the fecal coliform component analysis for the maximum winter month. The fecal coliform criterion is exceeded during this month (February) at all locations in the river, except for the downstream end of the system near Eastchester Bay (HR-01). If DEP were to fully remove the CSO, there would be no changes from non-attainment to attainment, as reductions from other sources would still be required to comply with either the Existing WQ Criteria or Future Primary Contact WQ Criteria on an annual basis.

Table 6-19 also summarizes the enterococci component analysis. The 30-day GM concentrations are calculated to exceed the 30 cfu/100mL criterion at all locations within the river during the recreation season except at HR-01. The 30-day GM maximum concentration attributable to NYC CSO sources during the recreational season is calculated to be 13 cfu/100mL at Station HR-06. As this concentration is less than 30 cfu/100mL, CSO alone would not cause an excursion of 30 cfu/100mL during the recreational season.

It should be noted that the results in Table 6-19 may differ from results provided in other tables which are based on the 10-year simulation as those simulations use JFK Airport rainfall.

Table 6-19. Fecal and Enterococci GM Source Components

Source	Station	Fecal Coliform Contribution (cfu/100mL)	Enterococcus Contribution (cfu/100mL)
		Annual Worst Month February Monthly GM	Max 30-Day Rolling GM during the Recreation Season
Hutchinson River	HR-09	1,096	322
Westchester Stormwater	HR-09	150	50
NYC Stormwater	HR-09	0	0
NYC Direct Runoff	HR-09	0	0
NYC CSO	HR-09	0	0
East River	HR-09	0	0
Total	HR-09	**1,246**	**372**
Hutchinson River	HR-08	865	251
Westchester Stormwater	HR-08	773	185
NYC Stormwater	HR-08	0	0
NYC Direct Runoff	HR-08	0	0
NYC CSO	HR-08	0	0
East River	HR-08	0	0
Total	HR-08	**1,638**	**436**
Hutchinson River	HR-07	830	218
Westchester Wet Weather	HR-07	1,207	309
NYC Stormwater	HR-07	0	0
NYC Direct Runoff	HR-07	0	0
NYC CSO	HR-07	0	0
East River	HR-07	0	0
Total	HR-07	**2,037**	**527**
Hutchinson River	HR-06	87	9
Westchester Wet Weather	HR-06	713	113
NYC Stormwater	HR-06	82	9
NYC Direct Runoff	HR-06	20	11
NYC CSO	HR-06	192	13
East River	HR-06	2	1
Total	HR-06	**1,096**	**156**

Table 6-19. Fecal and Enterococci GM Source Components

Source	Station	Fecal Coliform Contribution (cfu/100mL)	Enterococcus Contribution (cfu/100mL)
		Annual Worst Month February Monthly GM	Max 30-Day Rolling GM during the Recreation Season
Hutchinson River	HR-05	61	6
Westchester Wet Weather	HR-05	523	79
NYC Stormwater	HR-05	78	13
NYC Direct Runoff	HR-05	28	16
NYC CSO	HR-05	179	13
East River	HR-05	2	1
Total	HR-05	**872**	**128**
Hutchinson River	HR-04	39	4
Westchester Wet Weather	HR-04	351	52
NYC Stormwater	HR-04	78	11
NYC Direct Runoff	HR-04	17	9
NYC CSO	HR-04	156	10
East River	HR-04	3	1
Total	HR-04	**292**	**87**
Hutchinson River	HR-03	28	3
Westchester Wet Weather	HR-03	254	35
NYC Stormwater	HR-03	109	18
NYC Direct Runoff	HR-03	11	5
NYC CSO	HR-03	153	11
East River	HR-03	3	1
Total	HR-03	**559**	**73**
Hutchinson River	HR-02	14	1
Westchester Stormwater	HR-02	122	16
NYC Stormwater	HR-02	135	18
NYC Direct Runoff	HR-02	6	3
NYC CSO	HR-02	96	5
East River	HR-02	6	1
Total	HR-02	**379**	**44**
Hutchinson River	HR-01	4	1
Westchester Stormwater	HR-01	26	3
NYC Stormwater	HR-01	27	3
NYC Direct Runoff	HR-01	2	0
NYC CSO	HR-01	23	2
East River	HR-01	14	2
Total	HR-01	**96**	**11**

Table 6-19 indicates that CSO impacts to attainment are limited to the tidal portion of the Hutchinson River, although the extent of CSO contribution varies both spatially and temporally. This LTCP identifies the alternatives focusing on reduction of the remaining CSO discharges to the river.

6.3.h Time to Recover

Analyses provided above examine the long term impacts of wet weather sources, as required by existing and future primary contact bacteria criteria (monthly GM and 30-day GM). Shorter term impacts are not evaluated by using these regulatory criteria. Therefore, to gain insight to the shorter term impacts of wet weather sources of bacteria, DEP has reviewed the New York State Department of Health (DOH) guidelines relative to single sample maximum bacteria concentrations that they believe “constitute a potential hazard to health if used for bathing”. The presumption is that if the bacteria concentrations are lower than these levels, then the waterbodies do not pose potential hazards if primary contact is practiced.

> **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; ….

Fecal coliform concentrations that exceed 1,000 cfu/100mL and or enterococci concentrations exceeding 104 cfu/100mL are considered potential hazards by the NYSDOH. Water quality modeling analyses were conducted herein to assess the amount of time following the end of rainfall required for the tidal portion of Hutchinson River to recover and return to concentrations less than 1,000 cfu/100mL fecal coliform and 110 cfu/100mL enterococci. In EPA's 2012 guidance document one of its recommendations is the use of a Beach Action Value (BAV) for making beach notification decisions. For states that do not use a BAV, EPA suggested using the criteria STV values as "do not exceed" values for beach notifications. Based on this guidance an enterococci concentration of 110 cfu/100mL was chosen for the time to recover analysis.

The baseline water quality model calculations for the Hutchinson River bacteria concentrations were examined 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 110 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. Under the baseline assumptions the freshwater portion of the river does not attain primary contact standards.

The LaGuardia Airport rainfall data were first analyzed 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 resulted in a 90th percentile rainfall event of 1.09 inches.

The rainfall event data were then compared against water quality model bacteria results for the 10 recreational seasons to determine how long it would take for the water column concentration to return to target threshold concentrations from the end of the rain event. Results are presented herein for the tidal portion of the system since that is where NYC stormwater and CSO loads are discharged. Since the portion of the system impacted by NYC is tidal, the change in concentration over time is not a constant decrease, so the last time the concentration returned to the target threshold after each rain event was considered (as opposed to the first, which might have been the result of tidal influences). 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 110 cfu/100mL for enterococci. The various rainfall events were then placed into rain event size “bins” ranging from less than 0.1 inch to greater than 1.5 inch, as shown in Table 6-20. 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 6-20.

Table 6-20. Time to Recover – Tidal Section of River

Rain Event Size (in.)	Station	Time to Recover (hours)			
		Fecal Threshold (1000 cfu/100mL)		Enterococci Threshold (110 cfu/100mL)	
		Baseline	100% CSO Control	Baseline	100% CSO Control
<0.1	HR-06	-	-	-	-
0.1-0.4	HR-06	-	-	-	-
0.4-0.8	HR-06	27	20	50	46
0.8-1.0	HR-06	32	25	57	51
1.0-1.5	HR-06	36	32	61	58
>1.5	HR-06	36*	32	61*	58*
<0.1	HR-05	-	-	-	-
0.1-0.4	HR-05	-	-	-	-
0.4-0.8	HR-05	25	15	49	43
0.8-1.0	HR-05	29	20	55	47
1.0-1.5	HR-05	38	29	60	55
>1.5	HR-05	38*	31	60*	55*
<0.1	HR-04	-	-	-	-
0.1-0.4	HR-04	-	-	-	-
0.4-0.8	HR-04	19	-	45	29
0.8-1.0	HR-04	27	12	53	41
1.0-1.5	HR-04	31	21	55	51
>1.5	HR-04	31	26	58	52
<0.1	HR-03	-	-	-	-
0.1-0.4	HR-03	-	-	-	-

Table 6-20. Time to Recover – Tidal Section of River

Rain Event Size (in.)	Station	Time to Recover (hours)			
		Fecal Threshold (1000 cfu/100mL)		Enterococci Threshold (110 cfu/100mL)	
		Baseline	100% CSO Control	Baseline	100% CSO Control
0.4-0.8	HR-03	17	-	41	33
0.8-1.0	HR-03	24	5	552	40
1.0-1.5	HR-03	30	16	55	51
>1.5	HR-03	30	21	56	51[(1)]
<0.1	HR-02	-	-	-	-
0.1-0.4	HR-02	-	-	3	3
0.4-0.8	HR-02	6	-	30	18
0.8-1.0	HR-02	15	3	43	30
1.0-1.5	HR-02	23	6	52	42
>1.5	HR-02	29	17	53	42
<0.1	HR-01	-	-	-	-
0.1-0.4	HR-01	-	-	-	-
0.4-0.8	HR-01	-	-	-	-
0.8-1.0	HR-01	-	-	-	-
1.0-1.5	HR-01	-	-	-	-
>1.5	HR-01	8	-	35	20

Notes:
(1) In a few cases the time to recover was calculated to be less than the next smaller rain event bin. In those cases, both bins were set equal to the higher time to recover.

7.0 PUBLIC PARTICIPATION AND AGENCY COORDINATION

New York City Department of Environmental Protection (DEP) is committed to implementing a proactive and robust public participation program to inform the public of the development of the watershed-specific and citywide Long Term Control Plans (LTCPs). Public outreach and public participation are important aspects of plans designed to reduce combined sewer overflow (CSO)-related impacts to achieve waterbody-specific water quality standards (WQS), consistent with the federal CSO Policy and the Clean Water Act (CWA), and in accordance with U.S. Environmental Protection Agency (EPA) and New York State Department of Environmental Conservation (DEC) mandates.

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

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

7.1 Local Stakeholder Team

DEP began the public participation process for the Hutchinson River LTCP by reaching out to the Bronx Borough President's Office and Community Boards, to identify the stakeholders who would be instrumental to the development of this LTCP. Stakeholders identified included both citywide and regional groups, including environmental organizations (Co-op City residents, Bronx Council for Environmental Quality, Riverkeeper, New York City Watertrail Association, and the Hutchinson River Restoration Project); community planning organizations; design and economic organizations; academic and research organizations; and City government agencies (Bronx Borough Office).

7.2 Summaries of Stakeholder Meetings

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

Public Meetings

- Public Meeting #1: Hutchinson River LTCP Kickoff Meeting (March 26, 2014)

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

DEP and DEC co-hosted a Public Kickoff Meeting to initiate the water quality planning process for long term control of CSOs in the Hutchinson River Waterbody. The two-hour event, held at the Harry S. Truman High School in the Bronx, served to provide overview information about DEP's LTCP Program, present information on the Hutchinson River watershed characteristics and status of waterbody improvement projects, obtain public information on waterbody uses in Hutchinson River, and describe additional opportunities for public input and outreach. The presentation can be found at http://www.nyc.gov/dep/ltcp. Approximately 15 people from the public attended the event as well as a representative from the DEC.

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

- CSO reductions and potential existing and future CSO-related projects in Hutchinson River;
- Modeling baseline assumptions utilized during LTCP development;
- Rainfall amounts and other assumptions utilized during LTCP development;
- Water quality data collection;
- Existing Hutchinson River CSO discharges; and
- Future public meeting announcements.

Stakeholder comments and DEP's responses were posted to DEP's website, and are also described in Appendix B, Long Term Control Plan (LTCP) Hutchinson River Kickoff Meeting – Summary of Meeting and Public Comments Received.

- Public Meeting #2: Hutchinson River LTCP Alternatives Review Meeting (September 9, 2014)

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

On September 9, 2014, DEP hosted a second Public Meeting to continue discussion of the water quality planning process for long term control of CSOs in Hutchinson River. The purpose of the two-hour event, held in the Bronx, was to describe the alternatives identification and selection process, and receive public comment on the information. The presentation is on DEP's LTCP Program Website: http://www.nyc.gov/dep/ltcp. About 15 stakeholders attended the event, from several different non-profit, community planning, environmental, economic development, and governmental organizations, as well as the general public.

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

- Modeling baseline assumptions utilized during LTCP development, including the rainfall conditions utilized;
- Existing and future predicted CSO discharges;
- Water quality data collection;
- Stormwater inputs/contributions to Hutchinson River;

- Green infrastructure and grey infrastructure potential alternatives;
- Opportunity to review and comment on the draft Hutchinson River LTCP; and
- Future public meeting announcements.

Stakeholder comments and DEP's responses were posted to DEP's website, and are also described in Appendix C, Long Term Control Plan (LTCP) /Hutchinson River Public Meeting #2 – Summary of Meeting and Public Comments Received.

- Public Meeting #3: Draft LTCP Review Meeting

  Objectives: Present LTCP after review by DEC.

  This meeting schedule is to be announced. The purpose is to present the final recommended plan to the public after DEC review. Outcomes of the discussion and a copy of presentation materials will be posted to DEP's website.

Stakeholder Meetings

Meeting with Riverbay's Legislative Committee: 7 pm, 2049 Bartow Avenue, Bronx (April 24th, 2014)

DEP held a public meeting at Co-op City to explain the LTCP planning process. Staff from DEP presented information on the LTCP program, Hutchinson River water quality and waterbody characteristics. Approximately 20 members from the public attended this meeting.

7.3 Coordination with Highest Attainable Use

Comprehensive analysis of baseline conditions, along with the future anticipated conditions after implementing the recommended LTCP projects, show that Hutchinson River is not in attainment with its current Class SB classification, and it is not feasible for the waterbody to meet the WQ criteria associated with the primary contact WQ criteria or Class SB classification. Furthermore, combinations of natural and manmade features prevent both the opportunity and feasibility of primary contact recreation in many parts of Hutchinson River. Primary contact recreation is prohibited by City law. The continued presence of non-CSO discharges, most notably stormwater from New York City and from Westchester County upstream, prevents attainment of Class SB standards, even when 100 percent CSO volume reduction is considered.

7.4 Internet Accessible Information Outreach and Inquiries

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

Table 7-1. Summary of Hutchinson River LTCP Public Participation Activities Performed

Category	Mechanisms Utilized	Dates (if applicable) and Comments
Regional LTCP Participation	Citywide LTCP Kickoff Meeting and Open House	• June 26, 2012
	Annual citywide LTCP Meeting – Modeling Meeting	• February 28, 2013
Waterbody-specific Community Outreach	Public meetings and open houses	• Kickoff Meeting: March 26, 2014 • Meeting #2: September 9, 2014 • Meeting #3: TBD
	Stakeholder meetings and forums	• Riverbay (Co-op City) Legislative Committee April 24, 2014
	Elected officials briefings	• Bronx Borough Cabinet Briefing: February 5 and March 5, 2014
Data Collection and Planning	Establish online comment area and process for responding to comments	• Comment area added to website on October 1, 2012 • Online comments receive response within two weeks of receipt
	Update mailing list database	• DEP updates master stakeholder database (700+ stakeholders) before each meeting
Communication Tools	Program Website or Dedicated Page	• LTCP Program website launched June 26, 2012 and frequently updated • Hutchinson River LTCP webpage launched February 2014 and frequently updated
	Social Media	• TBD
	Media Outreach	• Published advertisements in newspapers, Caribbean Life, Bronx Times, Bronx Times Reporter and La Voz.
	Frequently Asked Questions (FAQs)	• LTCP FAQs developed and disseminated beginning March 26, 2014 via website, meetings and email

Table 7-1. Summary of Hutchinson River LTCP Public Participation Activities Performed (Continued)

Category	Mechanisms Utilized	Dates (if applicable) and Comments
Communication Tools	Print Materials	• LTCP FAQs: March 26, 2014 • LTCP Goal Statement: June 26, 2012 • LTCP Public Participation Plan: June 26, 2012 • Hutchinson River Summary: March 26, 2014 • LTCP Program Brochure: March 26, 2014 • Glossary of Modeling Terms: February 28, 2013 • Meeting advertisements, agendas and presentations • PDFs of poster board displays from meetings • Meeting summaries and responses to comments • Quarterly Reports • Waterbody/Watershed Facility Plans (WWFPs)
	Translated Materials	• As-needed basis
	Portable Informational Displays	• Poster board displays at meetings
Student Education	Participate in ongoing education events	• N/A
	Provide specific green and grey infrastructure educational modules	• N/A

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

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

A specific Hutchinson River LTCP webpage was created in February 2014, and includes the following information:

- Hutchinson River public participation and education materials
  - Hutchinson River Summary Paper
  - LTCP Public Participation Plan
- Hutchinson River LTCP Meeting Announcements
- Hutchinson River Kickoff Meeting Documents – March 26, 2014
  - Advertisement
  - Meeting Presentation
  - Meeting Summary and Response to Comments
- Bronx Community Board meeting Presentations – February and March 2014
- Hutchinson River Meeting #2 Meeting Documents – September 2014
  - Meeting Advertisement
  - Meeting Presentation
- Meeting Summaries and Responses to Comments

8.0 EVALUATION OF ALTERNATIVES

This section of the Long Term Control Plan (LTCP) describes the development and evaluation of combined sewer overflows (CSO) control measures and watershed-wide alternatives. A CSO control measure is defined as a technology (e.g., treatment or storage), practice (e.g., Nine Minimum Controls (NMCs) or Best Management Practices (BMPs), or other method (e.g., source control or green infrastructure (GI)) capable of abating CSO discharges or the effects of such discharges on the environment. Alternatives evaluated herein are comprised of a single CSO control measure or a group of control measures that will collectively address the water quality objectives for the Hutchinson River.

This section contains the following information:

- Process for developing and evaluating CSO control alternatives that reduce CSO discharges and improve water quality (Section 8.1).
- CSO control alternatives and their evaluation (Section 8.2).
- CSO reductions and water quality benefits achieved by the higher-ranked alternatives, as well as their estimated costs (Sections 8.3 and 8.4).
- Cost-performance and water quality attainment assessment for the higher ranked alternatives to select the preferred alternative (Section 8.5).
- Use Attainability Analysis (UAA) and site-specific targets to demonstrate continuing water quality improvements for the Hutchinson River (Sections 8.6 and 8.7)

As described in Section 6.3, a 100 percent reduction in CSO loads to the Hutchinson River would not result in attainment of Existing WQ Criteria, due to the influence of non-CSO loads from sources located in New York City (NYC) and Westchester County. As a result, and consistent with direction from DEC, DEP applied a waste load allocation (WLA) approach to calculate the CSO load reductions needed to meet the Existing WQ Criteria in the tidal section of the Hutchinson River. Under this approach, the Class B freshwater reach of the Hutchinson River was assumed to be in compliance with Existing WQ Criteria. Based on this assumption, DEP then calculated the subsequent reductions in loadings to the Class SB saline or tidal reach necessary to bring the saline reach into compliance. As detailed in Section 6.3, achieving CSO and stormwater load reductions in the tidal reach to bring the month of August 2011 into compliance was demonstrated to result in 97.5 percent attainment of Existing WQ Criteria over a 10-year period (2002 to 2011). This level of control would provide a margin of safety over the 95 percent attainment level that, in accordance with guidance from DEC, has been accepted as being equivalent to full attainment.

As shown in Table 6-18, a 14 percent reduction in CSO and stormwater fecal coliform loads in the tidal reach of the river would be required to achieve compliance for the August 2011 period (with the freshwater reach in compliance). A 17 percent reduction in the CSO loading would be required for the August 2011 period if there was no credit taken for stormwater reduction in the tidal section of the river. As described in the sections below, alternatives were identified that would meet the 14 and 17 percent load reduction targets. In addition, a series of other alternatives were also identified to provide a range of higher levels of control, for the purpose of assessing cost-effectiveness. To assess the cost-effectiveness of the higher levels of control, the alternatives were assessed on the basis of cost versus bacteria load reduction, and cost versus percent attainment of water quality criteria. To be consistent with the approach taken in the other LTCPs produced under this program, cost-effectiveness was assessed based on the 2008 typical year rainfall, with baseline non-CSO loads included. For the Hutchinson River, these loads included current loads in the freshwater reach with the exception that known dry weather flow sources were removed. This approach provides a realistic view of the expected improvement in attainment until such time as the upstream, non-CSO loads are mitigated.

8.1 Considerations for LTCP Alternatives under the Federal CSO Policy

This LTCP addresses the water quality objectives of the federal CWA and EPA CSO Control Policy and NYS Environmental Conservation Law. It builds upon the EPA NMCs, CSO Control Policy, as well as the information presented in DEP's June 2013 Hutchinson River CSO Waste Load Allocation Water Quality and Sewer System Report (DEP, 2013).

Consistent with the LTCP Goal Statement, this LTCP includes a UAA which examines whether applicable waterbody classifications, criteria, or standards should be adjusted by the State because the proposed alternative set forth in this LTCP will not achieve existing WQS or the Section 101(a)(2) goals. The UAA assesses the waterbody's highest attainable use, which the State will consider in adjusting WQS, classifications, criteria and developing waterbody-specific criteria.

The remainder of Section 8.1 discusses the development and evaluation of CSO control measures and watershed-wide alternatives to comply with the CWA in general, and with the CSO Control Policy in particular. The evaluation factors considered for each alternative are described, followed by the process for evaluating and ranking the alternatives.

8.1.a Performance

Section 6.0 presents evaluations of baseline LTCP conditions for the Hutchinson River and concludes that there are performance gaps because the Existing WQ Criteria for bacteria are not attained. Therefore, discussion of performance for Hutchinson River alternatives will focus on bacteria criteria for both the Existing WQ Criteria (Class SB) and Future Primary Contact WQ Criteria. The former are presented in Table 2-4 and the latter are presented in Table 2-8.

During the development of control alternatives, DEP examined performance to evaluate WQS attainment. As noted above, the target for load reduction for the Hutchinson River needed to attain WQS was established through a WLA process. Cost-effectiveness of alternatives was assessed based on the 2008 typical year, with baseline wet weather loads to the freshwater section included except for known dry weather flow sources. The level of control of alternatives was determined by using the watershed model to determine resulting CSO volumes and bacteria load reductions, and using the water quality model to project levels of attainment beyond baseline conditions.

LTCPs are typically developed with alternatives that span a range of CSO volumetric reductions. Accordingly, this LTCP includes alternatives that consider zero and 100 percent reductions in CSO volume. Intermediate levels of CSO volume control, approximately 25, 50 and 75 percent, are also evaluated. However, for some alternative control measures, such as disinfection, while there may be no reduction in CSO volume, there may be a reduction in bacteria loading. Performance of each control alternative is measured against its ability to meet the WQS and water quality requirements for the 2040 planning horizon.

8.1.b Impact on Sensitive Areas

As described in Section 2.0, there are no sensitive areas within Hutchinson River. Thus, this consideration was not applicable to this LTCP.

8.1.c Cost

Cost estimates for the alternatives were computed 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 the purpose of this LTCP, all costs are in June 2014 dollars.

For the LTCP alternatives, Probable Bid Cost (PBC) was used as the estimate of the capital cost. Annual operation and maintenance (O&M) costs were then used to calculate the total or Net Present Worth (NPW) over the projected useful life of the project. For the purpose of this LTCP, a lifecycle of 20 years and an interest rate of 3 percent were used resulting in a Present Worth Factor of 14.877.

To quantify costs and benefits, alternatives were compared based on reductions of both CSO discharge volume and bacteria loading against the total cost of the alternative. These costs were then used to plot the performance and attainment curves. Should a pronounced inflection point appear in the resulting graphs as a so-called knee-of-the-curve (KOTC), it would indicate a potential cost-effective alternative for further consideration. In essence, this would reflect the alternative that achieves the greatest appreciable water quality improvements per unit of cost. However, this may not necessarily be the lowest cost alternative. The final preferred alternative must be capable of attaining water quality in a fiscally responsible and affordable manner to ensure that resources are properly allocated across the overall citywide LTCP program. These monetary considerations also must be balanced with non-monetary factors such as technical feasibility and operability, which are discussed below.

8.1.d Technical Feasibility

Several factors were considered when evaluating technical feasibility, including:

- Effectiveness for controlling CSO
- Reliability
- Implementation

The effectiveness of CSO control measures was assessed based on their ability to reduce CSO frequency, volume, and pollutant load. Reliability is an important operational consideration and can have an impact on overall effectiveness of a control measure. Therefore, reliability and proven history were used to assess the technical feasibility and cost effectiveness of a control measure.

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

8.1.e Cost-Effective Expansion

All alternatives evaluated were sized to handle the 2040 design year CSO volume, with the understanding that the predicted and actual flows may differ. To help mitigate the difference between predicted and actual flows, adaptive management was considered for those CSO technologies that can be expanded in the future to capture additional CSO flows or volumes, should it be needed. In some cases, this may have influenced the siting of the facilities, or may have given preference to a facility that could be expanded at a later date with minimal cost and disruption of operation.

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

As regulatory requirements change, such as the need for improvements in nutrient removal or disinfection, the ability of a CSO control technology to be retrofitted to handle process improvements may improve the rating of that technology.

8.1.f Long Term Phased Implementation

The final preferred plan is structured in a way that makes it adaptable to change via expansion and modifications in response to new regulatory and/or local drivers. The preferred plan project(s) would be implemented over a multi-year schedule. Permitting and approval requirements have to be identified prior to selection of the alternative. These were identified along with permit schedules where appropriate. With the exception of GI, which is assumed to occur on both private and public property, most of the CSO grey technologies are limited to City-owned property and right-of-way-acquisitions. As necessary, DEP will work closely with other City and State agencies to ensure proper coordination.

8.1.g Other Environmental Considerations

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

8.1.h Community Acceptance

As described in Section 7.0, DEP is committed to involving the public, regulators and other stakeholders throughout the planning process. The scope of the LTCP, background and newly collected data, WQS, and the development and evaluation of alternatives were presented at two public meetings. Community acceptance of the preferred alternative is essential to its success. The Hutchinson River LTCP is intended to improve water quality. The public’s health and safety are a priority of the Plan. Raising awareness of, and access to, waterbodies is a goal for DEP and was considered during the alternative analysis. Several CSO control measures, such as GI, have been shown to enhance communities while increasing local property values and, as such, the benefits of GI were considered in the formation of the final preferred plan.

8.1.i Methodology for Ranking Alternatives

In developing the Hutchinson River LTCP, DEP employed a multi-step process to evaluate control measures and alternatives. These steps included:

1. Evaluating benchmarking scenarios, including baseline and 100 percent CSO control and the WLA process, to establish the range of control within the Hutchinson River watershed. The results of this step are described in Section 6.0.

2. Prioritizing the CSO outfalls for possible controls using baseline conditions.

3. Developing a list of promising control measures for further evaluation based in part on the prioritized CSO list.

4. Conducting a “brainstorming” workshop on June 11, 2014, to review the most promising control measures, identify fatal flaws, and to solicit additional ideas to explore.

5. Establishing three intermediate levels of CSO control between baseline and 100 percent control for which receiving water quality simulations were conducted.

6. Evaluating alternatives according to the previously described LTCP criteria and the predicted (modeled) water quality benefits of each alternative.

7. Conducting a second LTCP workshop on August 20, 2014, which evaluated the costs and water quality benefits of the alternatives under consideration.

8. Conducting follow-up meetings with DEP to further refine the alternatives and the analysis of water quality impacts.

The focal points of this process were the two workshops listed above. Prior to the first workshop, the universe of control measures that were evaluated in the 2007 WWFP were revisited from the perspective of the LTCP Goal Statement (see 2012 Order on Consent) with the addition of new technologies or control measures that have been made available since that time. The resultant list of possible control measures was then introduced at the first workshop where DEP operational and engineering staff applied their expertise for further analysis. The list of control measures, grouped into their respective major category of control are listed in Table 8-1.

The findings of the first workshop were then subjected to follow-up evaluations as to the ability of control measures to close the gaps in WQS attainment and other applicable evaluation criteria. These evaluations are summarized in Section 8.2. The results of these further evaluations became the topic of the second workshop.

Table 8-1. List of Control Measures Evaluated

Category	Control Measures
Source Control	High Level Storm Sewers (HLSS)
	Inflow Control
	Additional GI
System Optimization	Raising Weirs/Adjusting Regulators
	Real Time Control
	Dry Weather Flow (DWF) Connection Relief
Storage	Tanks
	Tunnels
	Shafts
Treatment with Disinfection	Retention/Treatment Basin (RTB)
	Outfall Disinfection
	High-rate Clarification (HRC)
	Vortex Separation
Floatables Control	Netting
	Containment Booms
	Manual Bar Screens
	Mechanical Screens
	Underflow Baffles
Enhanced Conveyance	Relief Sewers
	Pump Station Improvements
Receiving Water Improvements	Dredging

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

Each control measure was initially evaluated on three of the key considerations described in Section 8.1. These include: (1) benefits, as expressed by level of CSO control and attainment; (2) costs; and (3) challenges, such as siting and operations. Using this methodology, the control measures listed in Section 8.1 were evaluated on a cost-performance basis and used to develop the basin-wide alternatives.

Following the LTCP outline, these control measures are described under the following categories: Other Future Grey Infrastructure, Other Future Green Infrastructure and Hybrid Green/Grey Alternatives, and subsets thereof. It should be noted that not all of the categories in the LTCP outline are applicable to Hutchinson River as explained in this chapter. In addition, during the first workshop, a number of the control measures listed in Section 8.1 were determined to have sufficient negative attributes relative to the other alternatives to warrant elimination from further evaluations. Those control measures are also presented below, with the reasons why they were not evaluated further.

8.2.a Other Future Grey Infrastructure

For the purpose of this LTCP, "Other Future Grey Infrastructure" refers to potential grey infrastructure beyond existing control measures implemented based on previous planning documents. "Grey infrastructure" refers to systems used to control, reduce or eliminate discharges from CSOs. These are the technologies that have been traditionally employed by DEP and other wastewater utilities in their CSO planning and implementation programs. They typically include retention tanks, tunnels and treatment facilities, including satellite facilities, and other similar capital-intensive facilities. As described in Section 4.0, for the Hutchinson River, no grey infrastructure control measures were implemented under previous CSO control programs and facility plans.

8.2.a.1 High Level Sewer Separation

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

Currently, DEP does not have any HLSS projects planned for the watershed. DEP did consider HLSS in the WWFP. However, the additional and more frequent pollution loadings that would result from the new stormwater discharges, in addition to the potential construction impacts and risks associated with extensive near-surface pipe installation, resulted in DEP dismissing this control measure. For these reasons, HLSS were not investigated further for the Hutchinson River.

8.2.a.2 Sewer Enhancements

Sewer enhancements, also known as system optimization, aim to reduce CSO through improved operating procedures or modifications to the existing collection system infrastructure. Examples include control gate modifications, regulator or weir modifications, inflatable dams and real time control (RTC) or increasing the capacity of select conveyance system components including gravity lines, pump stations (PS) and/or force mains (including force main relocation). These control measures generally retain more of the combined sewage within the collection system during storm events. The benefits of retaining this additional volume must be balanced against the potential for sewer back-ups and flooding, as well as the potential for relocation of CSO discharge in the watershed or an adjacent watershed. Viability of these control measures is system-specific, depending on existing physical parameters such as pipeline diameter, length, slope and elevation.

Weir-Raising

The raising of weirs at the regulators associated with outfalls HP-023 and HP-024 was evaluated under the WWFP, and was not recommended due to limited benefits in terms of net CSO volume reduction. Modeling indicated that raising weirs was predicted to reduce CSO volume at the associated outfall, but would result in increased CSO volumes at other hydraulically-related outfalls. For example, raising the weir at HP-024 reduced CSO volume at that outfall, but increased CSO volume at HP-23 downstream in the Hutchinson River, and at outfalls HP-12 and HP-14 in Westchester Creek. Due to the configuration of the collection system, limited in-system storage was available to allow reduction in CSO without increasing CSO discharges at other outfalls. Weir-raising was re-assessed using the updated IW collection system model, and findings were consistent. Accordingly, the raising of weirs was not evaluated further.

Real-Time Control

RTC measures, such as remotely-activated gates, were also evaluated in the WWFP. Similar to the weir raising, the limited availability of in-system storage resulted in limited benefits to RTCs, and implementation of RTCs was not recommended. Since the updated collection system model confirmed the limited availability of in-system storage, RTCs were not further evaluated.

Dry Weather Flow Connection Relief

Analysis of output from the updated collection system model resulted in the identification of a potential optimization measure that involved up-sizing the short connecting pipe between the regulator associated with outfall HP-031 and the interceptor. Increasing the connection from 15 to 24-inch diameter was predicted to reduce the activation frequency of outfall HP-031 from 35 to 17 in the typical rainfall year. The net annual CSO volume reduction associated with this alternative, however, was only 1.3 MG, and this alternative was predicted to increase CSO volume in the Westchester River system by 2.5 MG in the typical year. Also, a mechanism would be needed to limit the peak flow through this connection in larger storms, avoiding an increase of the downstream hydraulic grade line and consequent increase of downstream CSOs. Due to the modest predicted reduction in CSO volume, the potential downstream impacts, and the need for a mechanical device to control the peak flow in larger storms, this alternative was not evaluated further.

Interceptor Relief

Relief of the main trunk interceptor that conveys flows from the Hutchinson River subsystem to the Westchester River subsystem was evaluated in the WWFP. This alternative was found to be relatively expensive, and result in increased CSO discharges to Westchester Creek and the East River. In addition, the public expressed opposition to construction impacts along the route of the proposed relief interceptor during the second public meeting on May 7, 2014. Modeling of the interceptor relief alternative with the updated collection system model confirmed the findings of the previous evaluations in terms of impacts on Westchester Creek and East River CSOs. For these reasons, interceptor relief was not evaluated further.

Pump Station Improvements

Increasing the capacity of the Connor Street Pump Station, in conjunction with interceptor relief, was evaluated in the previous WWFP. The findings were similar to the interceptor relief alternative described above. This control measure was re-evaluated with the updated collection system model, and the results were similar to the previous evaluations. This control measure was therefore not evaluated further.

8.2.a.3 Retention/Treatment Alternatives

A number of the control measures considered for Hutchinson River fall under this category. For the purposes of this LTCP, the term storage is used in lieu of retention. This includes in-line storage, storage shafts, storage tanks, and deep tunnel storage. Treatment technologies considered are also described.

Retention Alternatives – In-line Storage

In-line storage is typically used when existing conveyance elements can be retrofitted to provide cost-effective storage and resultant CSO volume reduction. Modifications to the existing system need to be made in order to realize the additional storage capacity in the form of bending weirs, inflatable dams or fixed weirs. As described above, in the Hutchinson River system, very limited in-system storage is available, and this alternative was not evaluated further.

Retention Alternatives – Shaft Storage

Shaft storage involves constructing a deep circular shaft to provide storage, with pump-out facilities to dewater the shaft after the storm event. Shaft storage construction techniques would be similar to those used to construct deep tunnel construction or access shafts. The benefit of shaft storage is that it allows for relatively larger storage volumes with relatively smaller facility footprints. The disadvantages of shaft storage include the depth of the shaft, complex pumping operations, and the relatively small number of operating shaft storage facilities nationwide. Since the range of levels of CSO control could be provided by more conventional storage tanks or tunnels, storage shafts did not appear to offer significant advantages that would outweigh their disadvantages. For these reasons, shaft storage was not evaluated further.

Retention Alternatives – Storage Tanks

The previous planning efforts had identified alternatives for storage tanks at outfalls HP-023 and HP-024. Using the updated collection system model, sizing of storage tanks was assessed to provide a range of levels of CSO control, from 25 to 100 percent capture at HP-023 and HP-024. A siting study was conducted to identify potential sites for storage in the vicinity of those two outfalls. Although issues with site acquisition, coordination with current uses, and likelihood of contaminated soil were identified, the siting the study found that the sites previously identified for the tanks remained the most viable sites. Using those sites as a basis, it was determined that storage tanks sized to provide 75 or 100 percent CSO volume capture would not reasonably fit on the sites. As an example, to capture 100 percent of the annual CSO volume at HP-024 with a tank side water depth not to exceed 30 ft., the tank footprint required would be approximately 385 ft. x 350 ft. Therefore, the storage tank alternatives consisted of tanks sized for a lesser range of overall waterbody wide percent CSO volume capture (25 or 45 percent).

The proposed layouts of the tanks for HP-024 and HP-023 are presented in Figures 8-1 and 8-2, respectively. As indicated in Figure 8-1, the storage tank alternative at HP-024 would involve constructing a diversion structure on the existing outfall downstream of the existing regulators. A connecting pipe from the diversion structure would pass under the Route 1 overpass, and convey flow to the storage tank located on the site to the south. The sizes and characteristics of the tank layouts associated with 25 and 45 percent volume capture are summarized in Table 8-2. The tank would have mechanically-cleaned influent bar screens, and dewatering pumps sized to dewater the tank in approximately one day.

Preliminary hydraulic analyses indicated that under dry weather flow conditions, the interceptor system has capacity to accept the dewatering rates indicated without causing downstream overflows. These dewatering rates would need to be re-assessed in the context of alternatives in other waterbodies that might also be dewatering to the Hunt's Point system at the same time. The dewatering force main would tie into the local sewer system adjacent to the facility. The storage tank would be below grade, with an above-grade building housing a screenings room, odor control equipment, and electrical equipment. The

4.9 MG storage tank, in conjunction with the 2.9 MG storage tank at HP-023, would provide an overall 45 percent capture of the total annual CSO volume to the Hutchinson River (including the remaining volume at outfall HP-031 which would not be addressed by this alternative). The 1.7 MG storage tank, in conjunction with the 1.0 MG storage tank at HP-023, would provide 25 percent capture of the total annual CSO volume to the Hutchinson River (including the remaining volume at outfall HP-031 which would not be addressed by this alternative).

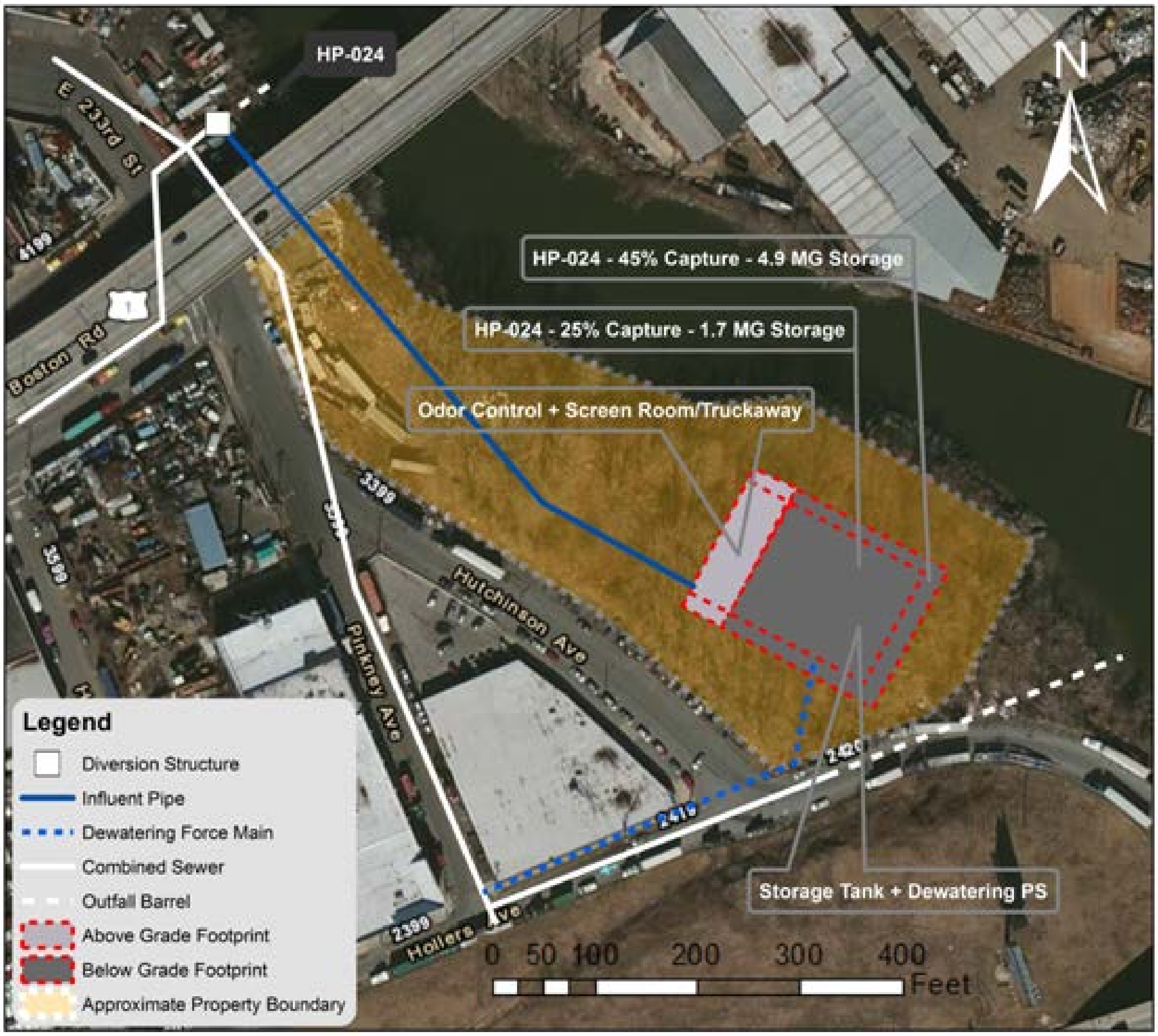


Figure 8-1. Proposed Layout of Storage Tank at HP-024

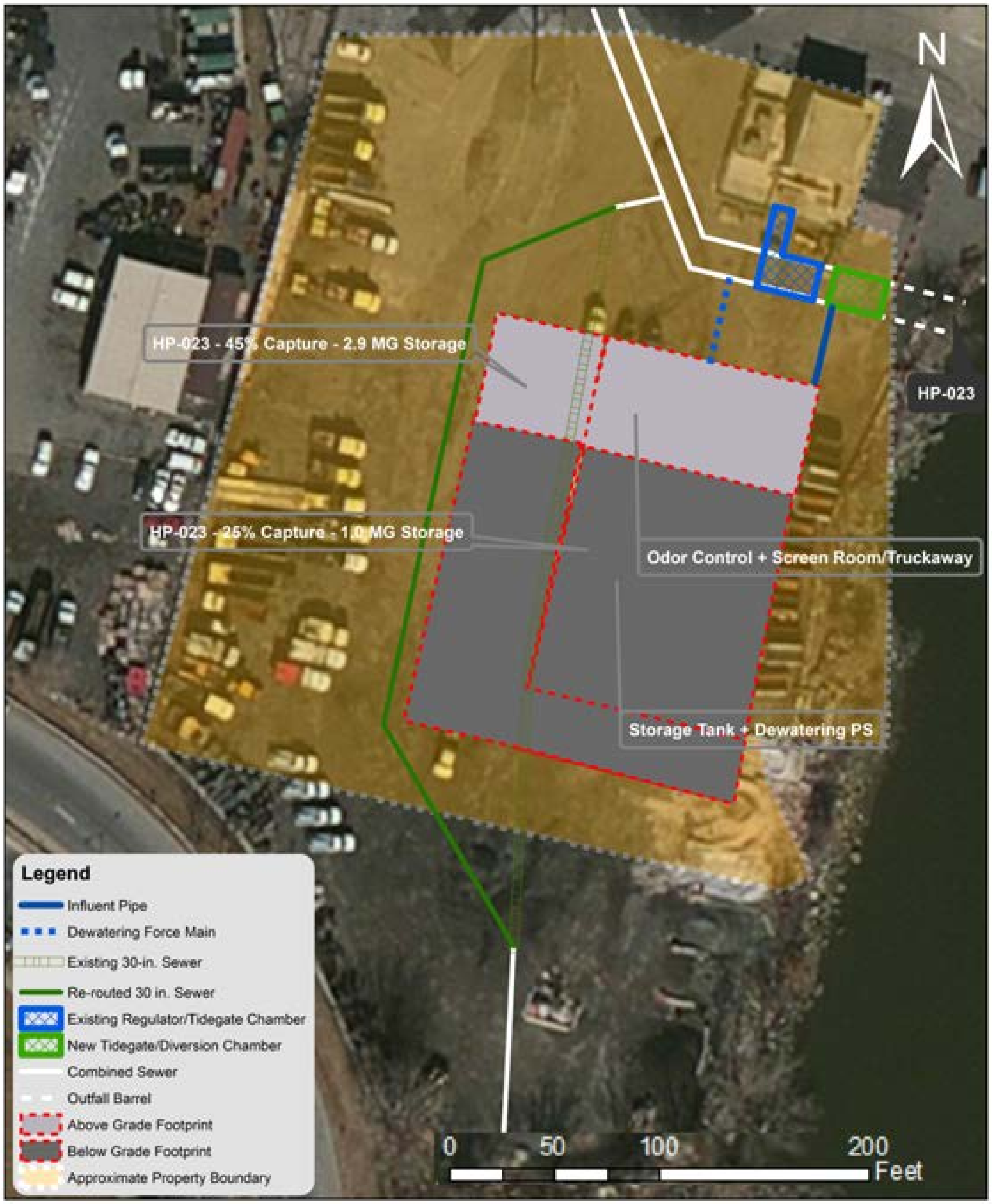


Figure 8-2. Proposed Layout of Storage Tank at HP-023

As indicated in Figure 8-2, the storage tank at HP-023 would be located adjacent to the Connor Street Pump Station. A new diversion structure with tidegates would be constructed on the outfall downstream of the existing tidegates. The storage tank would have features similar to those described for the HP-024 tank. The storage volumes and characteristics of the tank layouts associated with 25 and 45 percent volume capture are shown in Table 8-2.

Table 8-2. Storage Tank Characteristics

CSO Volume Reduction (%)	Outfall	Tank Volume (MG)	Tank Dewatering Rate (MGD)	Above Grade Footprint [W x L (ft.)]	Below Grade Footprint [W x L (ft.)]	Tank Side Water Depth (ft.)	Influent Pipe Diameter (ft.)	Dewatering Force Main Diameter (ft.)
45	HP-024	4.9	4.9	160 x 50	160 x 210	30	6.0	1.50
	HP-023	2.9	2.9	155 x 50	155 x 200	20	6.0	1.00
25	HP-024	1.7	1.7	140 x 50	140 x 185	15	5.0	1.00
	HP-023	1.0	1.0	105 x 50	105 x 155	15	5.0	0.67

A summary of the benefits, costs and challenges associated with storage tanks include:

<u>Benefits</u>

Storage tanks can be:

- An effective technology for volumetric capture, particularly for short duration, high peak flow applications
- Compatible with DEP operations
- Amenable for modifications to increase CSO control through process enhancements

<u>Cost</u>

The estimated NPW for the storage tank alternatives are as follows:

- 25 percent capture:
  - HP-024: $167 million
  - HP-023: $111 million
  - Total: $278 million
- 45 percent capture:
  - HP-024: $255 million
  - HP-023: $182 million
  - Total: $437 million

The development of these cost estimates is presented in Section 8.3.

Challenges

Challenges generally associated with storage tanks include the following:

- Large permanent footprint
- Screening (to reduce large debris in tank) creates residual to be disposed
- Pumping (for tank dewatering) required
- Odor control may be required
- Post-event cleanup
- Time required for post-event dewatering
- Monitoring requirements
- Risks of unforeseen geotechnical conditions

Site-specific challenges for the HP-024 and HP-023 storage tanks include the following:

- Site acquisition for the HP-024 site. This site is currently privately owned.
- Coordination with DOT operations at HP-023 site.
- Potential for encountering contaminated soil at either site.
- Availability of reliable power source. DEP operations staff indicated that the electrical power supply in this area has been problematic in the past.
- Limited space for new diversion structures between the existing regulators and the outfalls

Retention Alternatives – Upstream Equalization Storage Tanks

Whereas the storage tank alternatives described above involve storing flows diverted from the outfalls downstream of the CSO regulators, another storage option considered was diverting flow to equalization storage basins at locations upstream of the CSO regulators. These options were investigated in areas upstream of outfalls HP-024 and HP-023. Equalization was evaluated for the conduits that contributed the highest percentage of flow to the regulators at HP-024 and HP-023, respectively. In each case, the most significant source of flow was a conduit originating at an internal overflow structure on the main trunk interceptor that runs through the Hutchinson River project area. For outfall HP-024, this conduit started at internal overflow structure 26W as a 138 x 120 inch conduit, increasing to 144 x 120 inch conduit feeding into the HP-024 regulator 15A.

Limited sites for an equalization storage basin were identified along this conduit. The only site of sufficient size that would not require demolition of existing buildings was the parkland adjacent to Marolla Place. A 20 MG equalization basin located at this site was predicted to reduce annual CSO volume at outfall HP-024 by 80 percent. However, even if a smaller tank were constructed to provide a lower level of control, it was considered unlikely that this heavily-wooded parkland site could feasibly be acquired for construction of an equalization tank.

At outfall HP-023, the conduit contributing the highest percentage of flow originates at internal overflow structure 18W as a 54-inch conduit, increasing to 144 x 78 inch conduit feeding into the HP-023 regulator

15. As with the equalization basin for outfall HP-024, limited sites for an equalization storage basin were identified along this conduit. The only site of sufficient size that would not require demolition of existing buildings was the parkland adjacent to Rombouts Avenue. A 6 MG equalization basin located at this site was predicted to reduce annual CSO volume at outfall HP-024 by 40 percent. However, even if a smaller tank were constructed to provide a lower level of control, it was considered unlikely that this heavily-wooded parkland site could feasibly be acquired for construction of an equalization tank.

For these reasons, upstream equalization storage for outfalls HP-023 and HP-024 were not evaluated further.

Retention Alternatives – Deep Tunnels

Due to the limited availability of sites for storage tanks within the Hutchinson River watershed, deep storage tunnels were identified as a potentially viable approach to providing high levels of CSO capture through storage. Unlike traditional tank storage, tunnel storage requires less permanent above-ground property per equivalent unit storage volume. Tunnel construction involves the boring of linear storage conduits deep in the ground and typically in bedrock. Shafts are required to construct the tunnel, and to convey flow from the near-surface collection system to the deep tunnel. A dewatering PS and an odor control system are also included with such facilities.

For the purpose of the Hutchinson River LTCP, tunnel storage was evaluated to accomplish a range of CSO volume controls including approximately 50, 75 and 100 percent from outfalls HP-023, HP-024 and HP-031. Figure 8-3 shows the overall plan view of the tunnel. Having the tunnel run only between outfalls HP-023 and HP-024 was not considered feasible, due to the excessively large diameter that would be needed to provide the higher range of levels of control. Figures 8-4 and 8-5 present a site layout of the upstream and downstream tunnel shafts. For outfall HP-031, a near-surface connecting conduit would be required from the regulator to the tunnel shaft, to avoid picking up separate stormwater that enters the outfall downstream of the regulator. This connecting conduit would follow the general alignment of the existing outfall. A deep dewatering PS would be constructed at the downstream end of the tunnel. The force main from this PS would follow the alignment of the new connecting conduit, back to the main interceptor trunk. The tunnel diameters associated with the range of levels of control are presented in Table 8-3. Key characteristics of the various elements associated with the deep tunnel alternatives are summarized in Table 8-4.

Preliminary hydraulic analysis indicated that under dry weather flow conditions, the interceptor system has capacity to accept the dewatering rates indicated without causing downstream overflows. Note that for the 100 percent capture alternative, the dewatering rate would require two days to dewater the tunnel. The downstream system would not have the capacity to allow dewatering the 100 percent capture tunnel in one day. These dewatering rates would need to be re-assessed in the context of alternatives in other waterbodies that might also be dewatering to the Hunt's Point system at the same time.

Figure 8-3. Proposed Route of Storage Tunnel

Figure 8-4. Layout of Upstream Storage Tunnel Shaft

Figure 8-5. Layout of Downstream Storage Tunnel Shaft

Table 8-3. Deep Tunnel Storage Characteristics

Annual CSO Volume Reduction[1] (%)	Tunnel Length (ft.)	Tunnel Diameter (ft.)	Tunnel Design Storage Volume (MG) [2]	Tunnel Dewatering Rate (MGD)
100	5,400	39	43.5	22
76	5,400	24	17.0	17
48	5,400	16	7.6	8

Notes:
(1) Reduction in total annual CSO volume from HP-023, HP-024 and HP-031.
(2) Actual tunnel volume reflects 10 percent margin of safety over design volume.

Table 8-4. Key Characteristics of Upstream and Downstream Deep Tunnel Elements

Annual CSO Volume Reduction (%)	Upstream End Near HP-024			Downstream End Near HP-031				
	Influent Pipe Diameter (ft.)	Influent Pipe Slope (ft.)	Retrieval Shaft Diameter (ft.)	Mining Shaft Diameter (ft.)	Dewatering Pump Station Diameter (ft.)	Dewatering Pump Station Capacity (MGD)	Dewatering Force Main Diameter (ft.)	Connecting Pipe Diameter (ft.)
100	11	0.001	55	65	75	22	2.5	3.5
76	8.5	0.001	30	45	75	17	2.5	3.0
48	7	0.001	25	35	70	8	1.5	3.0

A summary of the benefits, costs and challenges associated with tunnel storage include:

Benefits

The benefits of tunnel storage include:

- Effective technology for high volumetric capture of CSO
- Following construction, small above-ground footprint

Cost

The estimated NPW for the deep tunnel storage alternatives are:

- 48 percent capture: $633 million
- 76 percent capture: $706 million
- 100 percent capture: $829 million

The development of these cost estimates is presented in Section 8.3.

<u>Challenges</u>

The challenges associated with tunnel storage generally include:

- Deep pump-out facility required
- Depth of tunnels complicates O&M and safety conditions
- Odor control may be required
- Periodic tunnel entry for inspection/cleaning required (normally contracted to specialty firm)
- Monitoring requirements
- Unforeseen geotechnical conditions
- Potential for hydraulic surge conditions if tunnel over-fills

Site-specific challenges for the HP-023/HP-024/HP-031 storage tunnel include:

- Site acquisition for the HP-024 receiving and drop shaft site. This site is currently privately owned.
- Coordination with DOT operations at the HP-023 drop shaft site.
- Potential for encountering contaminated soil at the shaft sites.
- Availability of reliable power source as electrical power supply in this area has been problematic in the past.
- Limited space for new diversion structures between the existing regulators and the outfalls.
- Construction of the connecting conduit for HP-031 and dewatering force main.
- Coordination of tunnel dewatering with other CSO operations in the Westchester Creek and Bronx River watersheds.

Treatment Alternative – Retention/Treatment Basin (RTB) with Seasonal Disinfection

RTBs differ from storage basins or tanks as they are typically designed to capture a much smaller CSO volume but provide sedimentation treatment when they fill and discharge. Thus, they are categorized as a treatment rather than a storage measure. RTB treatment can include disinfection. As there are currently no facilities in the Hutchinson River watershed which could accommodate a disinfection system, DEP would need to construct a new facility to house the disinfection storage and feed equipment, as well as a chlorine contact tank to provide the necessary contact time for effective treatment.

DEP examined the requirements for an RTB with Seasonal Disinfection facility. For this application, the RTB tank was intended to serve as the contact tank for disinfection, and the tank was preliminarily sized to provide 15 minutes of contact time. Pilot testing would be required to refine the contact time necessary to achieve the desired bacteria kills. DEP would seek to optimize sodium hypochlorite dose to achieve a two-log kill and avoid the need for dechlorination. DEP will be conducting chlorination studies as part of the Alley Creek LTCP implementation. The information collected in that study would be used to supplement operations at this facility. Sodium hypochlorite would be dosed at the disinfection facility during the recreational season (May through October). The tanks would be provided with influent screens, and automatic tank flushing systems. Due to the depth of the tanks and the hydraulic grade line, effluent pumping would be required to discharge treated flow to the Hutchinson River. Dewatering pumps would also be provided to return the contents of the tank remaining at the end of the storm to the interceptor system.

Although not primarily designed for that purpose, some settling of TSS would be expected as flow passes through the contact tank, hence the term "RTB with Disinfection". Dosing of sodium hypochlorite solution would occur just downstream of the influent screens. An above-grade building would house the chemical storage and feed equipment, as well as a screenings room/truckway, odor control facilities, and electrical equipment. The disinfection facilities would only be operated during the recreational season (May 1st through October 31st).

Options for providing RTBs with seasonal disinfection for the Hutchinson River include providing an individual facility at either outfall HP-023 or HP-024, or providing a single consolidated facility to treat flows from both HP-023 and HP-024. Given the relative elevations of the regulator weirs at the two outfalls, and the general ground surface elevations, conveying flow from outfall HP-024 to a facility at outfall HP-023 would minimize the depth of excavation required for a consolidated facility.

Figure 8-6 presents a layout for an individual RTB with Seasonal Disinfection facility for outfall HP-024, and Figure 8-7 presents a layout for an individual RTB with Seasonal Disinfection facility for outfall HP-023. Figure 8-8 presents a layout of a consolidated RTB with Seasonal Disinfection facility for outfall HP-024 and HP-023 flows, located adjacent to outfall HP-023. Figure 8-9 shows a potential route for the consolidation conduit from outfall HP-024 to the consolidated facility at outfall HP-023. Table 8-5 summarizes general design parameters of these RTB facilities for outfall HP-024, HP-023 and consolidated treatment at outfall HP-023. Table 8-6 provides additional dimensional information for the individual RTB facilities, and Table 8-7 provides additional dimensional information for the consolidated RTB facilities.

A summary of the benefits, costs and challenges associated with RTB with Seasonal Disinfection include:

<u>Benefits</u>

Benefits of RTB with Seasonal Disinfection facilities include:

- Targets bacteria, the key pollutant contributing to non-attainment of WQS
- Hypochlorite disinfection can be performed concurrent with solids removal in RTBs
- Smaller footprint than storage tanks for equivalent level of control
- Amenable for modifications to increase CSO control through process enhancements
- Compatible with concurrent disinfection (disinfection within RTB – no separate chlorine contact basin required)

Figure 8-6. RTB with Seasonal Disinfection Facility at HP-024

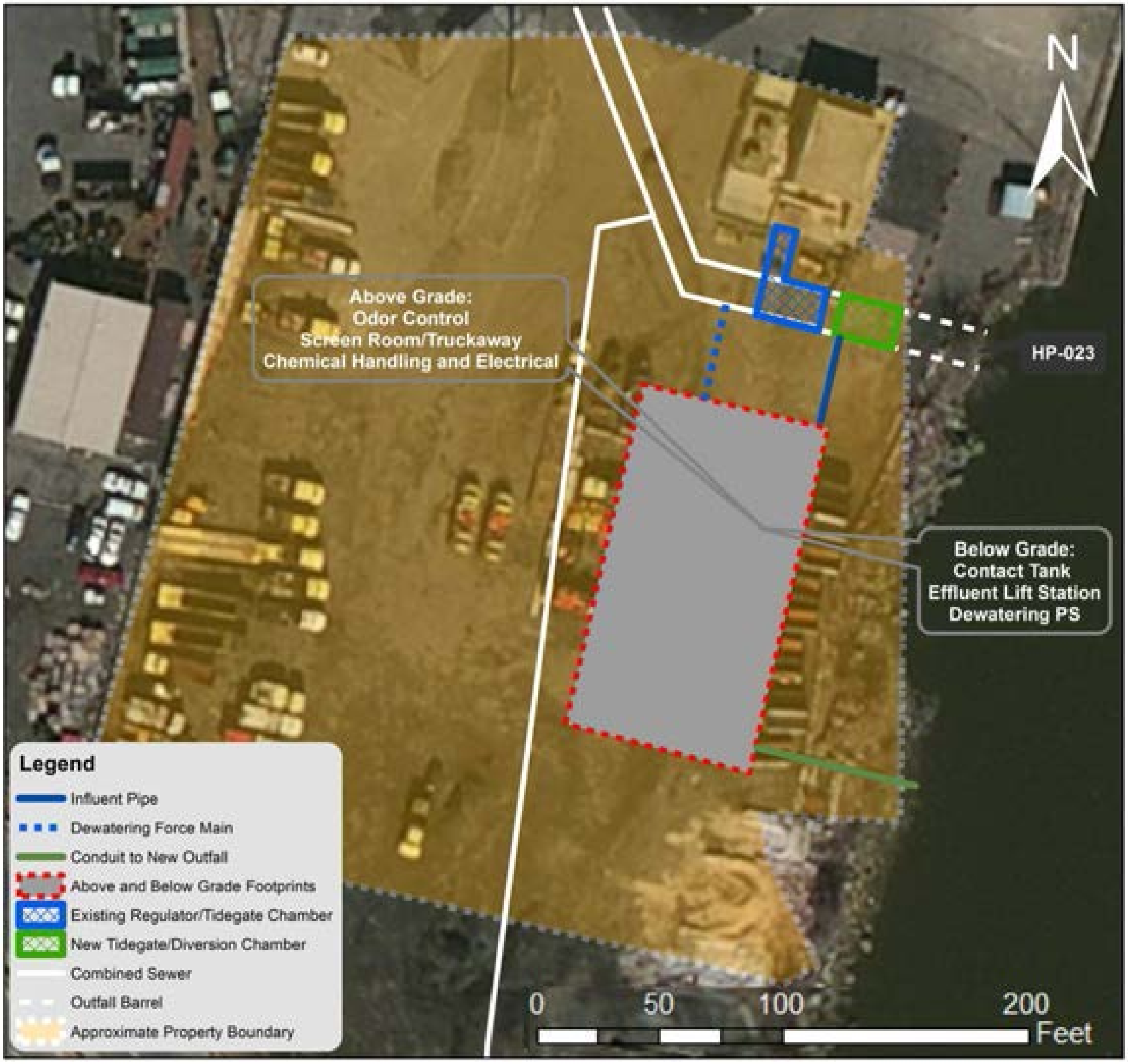


Figure 8-7. RTB with Seasonal Disinfection Facility at HP-023

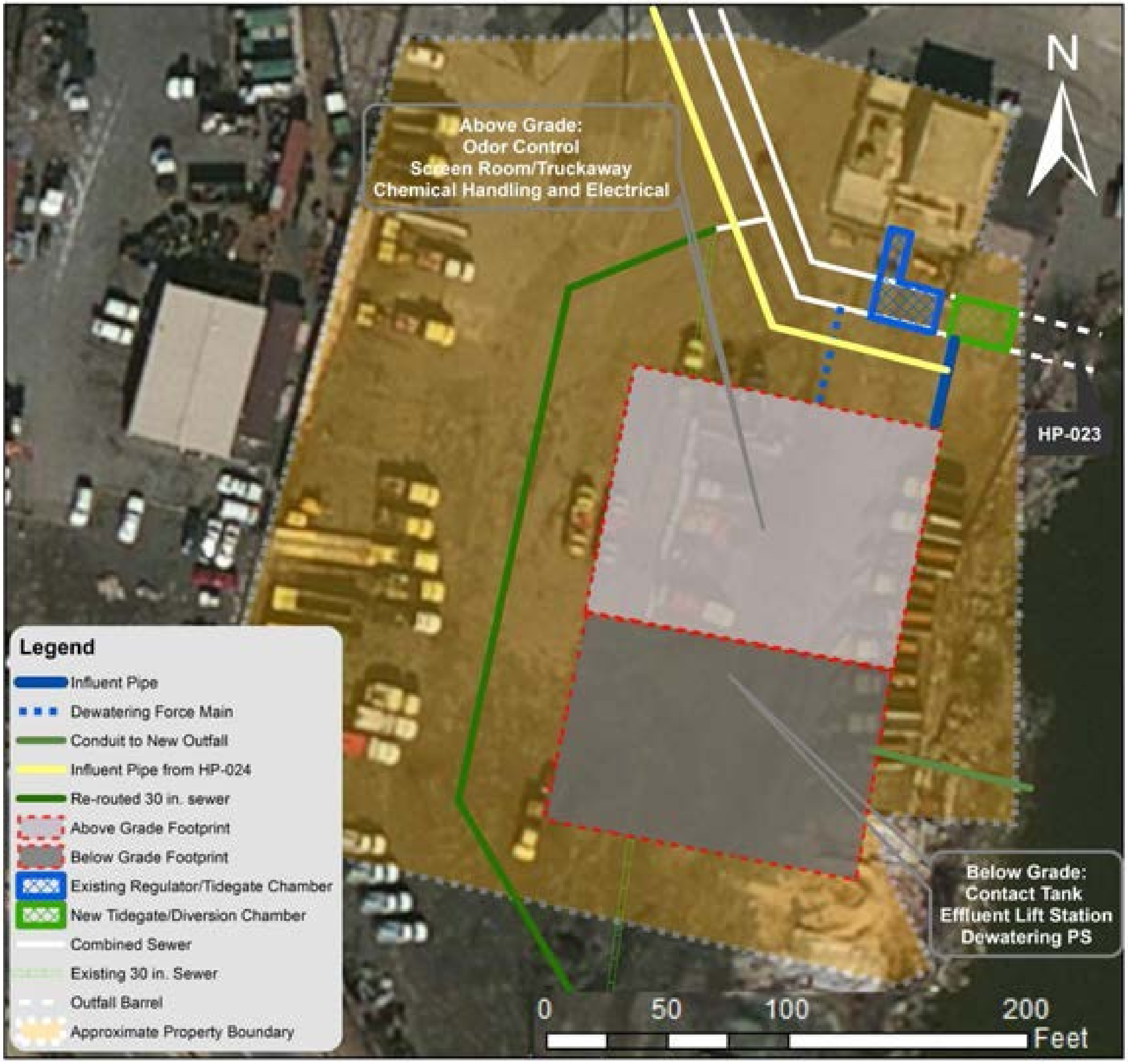


Figure 8-8. Consolidated RTB with Seasonal Disinfection Facility at HP-023

Figure 8-9. Consolidation Conduit from HP-024 to Consolidated RTB with Seasonal Disinfection Facility at HP-023

Table 8-5. RTB with Seasonal Disinfection Facility Characteristics

Outfall	Overall Percent Control of Bacteria Load[(1)]		Facility Component Sizing		
	Recreational Season[(2)]	Annual Equivalent[(3)]	RTB Tank Volume (MG)	RTB Facility Peak Effluent Pumping Capacity (MGD)	RTB Dewatering Pump Capacity (MGD)
HP-024	40	25	1.6	150	1.6
HP-023	50	34	0.73	70	0.73
HP-023/024	88	66	2.1	203	2.1
HP-023/024	78	57	1.3	123	1.3
HP-023/024	62	43	0.64	62	0.64

Notes:
(1) Reduction in total annual CSO bacteria load, including outfalls HP-023, HP-024, and HP-031.
(2) May 1st through October 31st (Recreational Season)
(3) Assuming no disinfection for November through April.

Table 8-6. RTB with Seasonal Disinfection Facility Characteristics for Individual Facilities at Outfall HP-024 and HP-023

Outfall	Influent Pipe Diameter (ft.)	Above Grade Footprint [WxL(ft.)]	Below Grade Footprint [WxL(ft.)]	Contact Tank (MGD)		Effluent Lift Station Capacity (MGD)	Dewatering PS Capacity (MGD)	Dewatering Force Main Diameter (ft.)
				Side Water Depth (ft.)	Storage Capacity (MG)			
HP-023	6.5	130x85	130x190	15	1.6	150	1.6	0.67
HP-024	6	80x145	80x145	20	0.73	70	0.75	0.67

Table 8-7. Characteristics of Consolidated RTB with Seasonal Disinfection Facility at Outfall HP-023

Control Level (Rec. Season % Capture)	Influent Pipe Diameter (ft.)		Above Grade Footprint [WxL(ft.)]	Below Grade Footprint [WxL(ft.)]	Contact Tank (MGD)		Effluent Lift Station Capacity (MGD)	Dewatering PS Capacity (MGD)	Dewatering Force Main Diameter (ft.)
	From HP-023	From HP-024			Side Water Depth (ft.)	Storage Capacity (MG)			
88	8.5	6.5	130x100	130x190	20	2.1	203	2.0	1.0
78	7.0	6.0	120x95	120x180	15	1.3	123	1.5	1.0
62	5.5	4.0	85x120	85x150	15	0.64	62	1.0	0.67

Cost

The estimated NPW for the RTB with Seasonal Disinfection alternatives are:

- HP-024, 40 percent recreational season capture: $345 million
- HP-023, 50 percent recreational season capture: $212 million
- HP-023/024, 88 percent recreational season capture: $403 million
- HP-023/024, 78 percent recreational season capture: $329 million
- HP-023/024, 62 percent recreational season capture: $231 million

The development of these cost estimates is presented in Section 8.3.

Challenges

Challenges generally associated with RTB with Seasonal Disinfection facilities include:

- Not consistent with current DEP operations, as DEP does not currently operate a remote wet weather disinfection facility
- O&M required for disinfection
- Process control requirements for disinfection system
- Although targeting a low effluent TRC, acute chlorine toxicity is still a potential concern.
- Potential for effluent limits and monitoring requirements (including total residual chlorine (TRC))
- Chemical delivery, storage and feed equipment required
- Need for floatables control
- Effluent pumping with its associated cost and operational and maintenance complexity
- Odor control may be required
- Post event dewatering (pumped) and clean-up required

Site-specific challenges for the HP-024 and HP-023 RTB with Seasonal Disinfection facilities include:

- Site acquisition for the HP-024 site. This site is currently privately owned.
- Coordination with DOT operations at HP-023 site.
- Potential for encountering contaminated soil at either site.
- Availability of reliable power source as electrical power supply in this area has been problematic in the past.
- Limited space for new diversion structures between the existing regulators and the outfalls.
- Unforeseen geotechnical conditions

Treatment Alternative – Seasonal Disinfection in New Outfall HP-024

A variation on the concept of the RTB facility with seasonal disinfection is to use the outfall pipe to provide contact time for disinfection, in lieu of providing an RTB tank. At both outfalls HP-024 and HP-023, the distance between the CSO regulators and the end of the existing outfalls is too short to provide 15 minutes of detention time for the range of flow rates being considered. However, if the overflow at HP-024 was diverted to a new pipe running south parallel to the river, that pipe could be sized to provide 15 minutes of detention time for a range of flow rates, and still allow gravity discharge to the river at the downstream end of the new pipe. This alternative would include the following components:

- Diversion structure downstream of the HP-024 regulator (similar to the diversion structure under the storage tank and RTB alternatives). The existing HP-024 outfall would remain in place.
- Connecting pipe to a disinfection facility, with a flow control gate/valve, to limit the flow to the disinfection facility to the intended design flow rate. Sodium hypochlorite would be dosed at the disinfection facility during the recreational season (May through October). As with the RTB with disinfection facilities, this alternative would optimize the sodium hypochlorite dose to achieve a two-log kill and avoid the need for dechlorination. The information collected in the Alley Creek disinfection study would be used to supplement operations at this facility. Flow in excess of the design disinfection capacity would continue to discharge at the existing HP-024 outfall.
- New pipe running south from the disinfection facility, terminating at a weir structure. The pipe diameter, length and downstream weir elevation would be set to provide 15 minutes of detention time in the pipe at the design flow rate.
- A new effluent outfall to the Hutchinson River, downstream of the new weir structure.
- Small (<= 1 MGD) dewatering pumps in the weir structure, to dewater the volume held behind the weir at the end of the storm. The dewatering force main would tie into the existing sewer system.
- Floatables control for the flow discharged through the new outfall. The specific approach/ technology for floatables control would be determined during preliminary facility design.

For outfall HP-024, outfall disinfection alternatives were sized for a range of design flow rates, including 25, 50, and 150 MGD. A number of combinations of pipe lengths and diameters would provide the detention time at each design flow rate. At 150 MGD, a 10-foot diameter pipe would need to extend 3,000 feet south, nearly all the way to outfall HP-023. Extending the HP-024 pipe beyond outfall HP-023 was not considered feasible due to the elevation conflict with the HP-023 outfall as discussed further below, and providing a pipe larger than 10-foot diameter was not considered practical due to constructability issues. Since a 10-foot diameter pipe was needed for 150 MGD, the alternatives for the smaller design flow rates were also developed assuming a 10-foot diameter pipe, to allow for potential future expansion.

The performance of the outfall disinfection alternatives was initially assessed against the WLA load reduction targets for CSO controls with or without stormwater load reductions. Specifically, the performance of the alternatives in terms of fecal coliform load removal for the August 2011 period was determined. The predicted load reductions of these alternatives for the August 2011 period is summarized in Table 8-8.

Table 8-8. Performance of Seasonal Disinfection Alternatives For Fecal Coliform Reductions in New Outfall HP-024 for August 2011

Peak Flow to New Outfall for Disinfection (MGD)	Percent Fecal Coliform Load Reduction for August 2011 (%)
25	14.2
50	23.4
150	40.0

As indicated in Table 8-8, sizing the HP-024 outfall disinfection for 25 MGD would meet the 14 percent fecal coliform load reduction in CSO loadings required to achieve 97.5 percent attainment for the 10-year period. Sizing the outfall disinfection for 50 MGD would exceed the WLA projections for both CSO and Stormwater reductions.

The alternatives for HP-024 would all discharge by gravity back to the Hutchinson River, due to the relatively high elevation of the existing regulator weirs at HP-024 (elevation 5), and the natural slope of the ground surface between HP-024 and HP-023. One of the significant advantages of the Seasonal Disinfection in New Outfall for HP-024 alternative is the elimination of the need for effluent pumping achieved by moving the outfall downstream along the river. Figure 8-10 presents a layout of the outfall disinfection alternatives for HP-024. Table 8-9 summarizes general design parameters of these facilities for outfall HP-024.

Table 8-9. Design Parameters for Seasonal Disinfection in New Outfall HP-024

Design Flow Rate for Disinfection	Percent Control of Bacteria Load in Recreational Season[1] (%)	Facility Component Sizing		
		New Outfall Length (ft.)	New Outfall Diameter (ft.)	Contact Volume Provided for 15-minute Detention Time (MG)
25	16	600	10	0.26
50	24	1,200	10	0.52
150	37	3,000	10	1.56

Notes:
(1) Reduction in CSO bacteria load, including outfalls HP-023, HP-024, and HP-031, based May 1st through October 31st for 2008 typical year.

A similar concept was considered for outfall HP-023, but was not determined to be feasible. The existing regulator weir at HP-023 is considerably lower in relation to the river level than the weir at HP-023 (-4.5 at HP-023 vs. +5.0 at HP-024), and the land running south from HP-023 is relatively flat, in comparison to the 10-foot drop in elevation between HP-024 and HP-023. With these conditions, an extension of the HP-023 outfall to the south to provide contact time would require a downstream PS to discharge the flow to the river. Because of that, outfall disinfection for HP-023 would not provide a cost advantage over the RTB with disinfection alternative for HP-023. Connecting the HP-024 outfall to an extension of the HP-023 outfall would similarly require effluent pumping at the downstream end, cost significantly more with little water quality benefit, and would significantly complicate the disinfection controls.

Figure 8-10. 25, 50 and 150 MGD Seasonal Disinfection in New Outfall HP-024

A summary of the benefits, costs and challenges associated with Seasonal Disinfection in New Outfall HP-024 include:

Benefits

Benefits of Seasonal Disinfection in New Outfall HP-024 include:

- Targets bacteria, the key pollutant contributing to non-attainment of WQS at lower cost than RTB alternatives
- Avoids need for effluent pumping associated with the RTB alternatives (still needs a dewatering pumping system)
- Provides floatables control
- Amenable for modifications to increase CSO control through extension of outfall

Cost

The estimated NPW for the Seasonal Disinfection in New Outfall HP-024 alternatives are:

- 25 MGD, 16 percent recreational season capture: $83 million
- 50 MGD, 24 percent recreational season capture: $108 million
- 150 MGD, 37 percent recreational season capture: $168 million

The development of these costs is presented in Section 8.3.

Challenges

Challenges generally associated with seasonal outfall disinfection include:

- Solids deposition in outfall
- Outfall dewatering
- Permitting of new outfall
- Although targeting a low effluent TRC, acute chlorine toxicity is still a potential concern.
- Potential for effluent limits and monitoring requirements (including total residual chlorine [TRC])
- Chemical delivery, storage and feed equipment required
- O&M required for disinfection and floatables control

Site-specific challenges for the Seasonal Disinfection in New Outfall HP-024 alternative include:

- Impact on New York City Department of Transportation (DOT) bus facilities during construction
- Potential utility conflicts along pipe route
- Need to cross under Interstate 95 and US Route 1
- Site acquisition for disinfection facility

- Potential for encountering contaminated soils at site
- Limited space for new diversion structure between the existing regulator and the outfall
- Unforeseen geotechnical conditions
- Availability of reliable power source as the electrical power supply in this area has been problematic in the past

Treatment Alternative – High Rate Clarification (HRC)

High rate clarification (also referred to as ballasted flocculation or ballasted sedimentation) is a traditional gravity settling process enhanced with both flocculation using settling aids and a ballast material to significantly increase surface loading rates and improve total suspended solids (TSS) removal performance. High rate clarification requires more mechanical equipment and chemical storage and feed processes than the RTB with disinfection facilities, and would still require an additional contact tank for disinfection. Given that the main benefit of high rate clarification is higher TSS removal, and TSS was not identified as a source of non-attainment of WQS, high rate clarification was not evaluated further.

Treatment Alternative – Vortex Separation

Vortex separation facilities provide floatable solids and TSS removal through vortex action within a circular vessel at a high surface overflow rate. Vortex separation TSS removal performance is highly dependent on the particle size distribution in the influent flow, and a vortex facility sized to provide 15 minutes of contact time for disinfection would not provide a significant footprint advantage over an RTB with disinfection facility. For these reasons, vortex separation was determined to provide no advantages over the RTB with disinfection facilities and was not evaluated further.

Floatables Control

Floatables control technologies or control measures are designed to reduce floatables items from CSOs. However, DEP's recent experience with end-of-pipe floatables control technologies, such as in-line netting, has not been favorable. Netting facilities and bar screens installed within the Bronx River watershed have been particularly problematic, requiring excessive maintenance. Floatables control alone will not reduce bacteria loads to the river, and therefore would not meet the target bacterial load reduction required to achieve attainment under the WLA scenario. For these reasons, floatables control was not carried forward as a stand-alone alternative. Floatables control has, however, been included as an element within the RTB with Seasonal Disinfection and Seasonal Disinfection at Outfall HP-024 alternatives.

Receiving Water Improvements

Receiving water improvements would include such measures as outfall relocation, dredging, and in-stream aeration. Outfall relocation was not considered feasible due to the distance required to convey flow to a different waterbody. Dredging was not considered, as sediment in the river was not identified as a contributor to non-attainment of WQS. Current receiving water modeling has confirmed the limited impact of CSO on the level of attainment of dissolved oxygen (DO) criteria. In fact, calculations revealed that 100 percent CSO control would do little to improve the level of DO compliance. For these reasons, CSO impacts were not a driver for receiving water improvements, and these control measures were not evaluated further in the Hutchinson River.

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

As discussed in Section 5.0, DEP expects 158 acres of total implemented GI to be managed in the Hutchinson River watershed by 2030. This acreage includes 111 acres of Right-of-Way (ROW) implemented GI, 32 acres of implemented GI to be managed in on-site private properties and 15 acres of GI to be managed in on-site public property. This acreage represents 14 percent of the total combined sewer system impervious area in the watershed. This GI has been included in the baseline model projections, and is thus not categorized as an LTCP alternative.

For the purpose of this LTCP, “Other Future Green Infrastructure” is defined as GI alternatives that are in addition to those included in the baseline conditions. Because the baseline level of GI penetration for this watershed significantly exceeds the 10 percent citywide goal, and due to the difficulties in finding additional sites to implement GI control measures, additional GI is not being considered for this LTCP at this time.

8.2.c Hybrid Green/Grey Alternatives

Hybrid green/grey alternatives are those that combine traditional grey control measures with GI control measures, to achieve the benefits of both. However, as noted above, the baseline GI penetration rate for this watershed is already substantial and further GI is not planned at this time. Therefore, this control is not proposed for the Hutchinson River LTCP.

8.2.d Retained Alternatives

A summary of the evaluation of the control measures presented above is contained in Table 8-10, including those which were retained for further evaluation as basin-wide alternatives. The reasons for dropping the non-retained controls from further consideration are also noted in the table.

Further details of the retained alternatives are presented in Table 8-11.

The retained alternatives for Hutchinson River (Alternatives 1 through 13) were then analyzed further for their ability to reduce pollutants and improve water quality, as described in Sections 8.3 through 8.5, including the critically important cost-performance and cost-attainment evaluations.

8.3 CSO Reductions and Water Quality Impact of Retained Alternatives

To evaluate their effects on the pollutant loadings and water quality impacts, the retained alternatives listed in Table 8-10 were analyzed using both the Hutchinson River watershed (IW) and receiving water/waterbody or water quality (ERTM) models. Evaluations of CSO volume reductions and/or bacteria load reductions for each alternative are presented below. In all cases, the reductions shown are relative to the baseline conditions using 2008 John F. Kennedy International Airport (JFK) rainfall as described in Section 6.0. The baseline assumptions are described in detail in Section 6.0. While no grey infrastructure projects from the WWFP were implemented in the Hutchinson River, the baseline includes the proposed 14 percent GI penetration.

Table 8-10. Summary of Preliminary Evaluations

Control Measure	Retained for Further Analysis?	Remarks
High-level Sewer Separation	NO	High construction impacts, negative WQ impacts of additional stormwater loads
Sewer Enhancements	NO	Limited benefit due to limited availability of in-system storage.
In-line Storage	NO	Limited benefit due to limited availability of in-system storage.
Shaft Storage	NO	Concern with depth of shafts, O&M issues; no clear benefit over more conventional storage approaches
Storage Tanks	YES	See Table 8-11 below
Deep Tunnel Storage	YES	See Table 8-11 below
RTB with Seasonal Disinfection	YES	See Table 8-11 below
Seasonal Disinfection in New Outfall HP-024	YES	See Table 8-11 below
High-Rate Clarification	NO	More complex than RTB with disinfection; TSS does not contribute to non-attainment of WQS.
Vortex Separation	NO	No clear benefit compared to RTB with disinfection.
Floatables Control	NO	Will not attain WLA load reduction target as a stand-alone control measure. Floatables control is included as an element of the RTB with Seasonal Disinfection and Seasonal Disinfection in New Outfall HP-024 alternatives.
Receiving Water Improvements	NO	Not practical to relocate outfalls; no driver for dredging; limited benefit to in-stream aeration
Additional GI	NO	Limited opportunity beyond targeted GI penetration rate

Table 8-11. Summary of Retained Alternatives

Alternative	Description
1. Storage Tanks at HP-023 and HP-024 to provide 45% annual CSO control	2.9 MG storage tank at outfall HP-023 and 4.9 MG storage tank at outfall HP-024. Includes influent coarse screening, and facilities capable of dewatering the tanks in one day.
2. Storage Tanks at HP-023 and HP-024 to provide 25% annual CSO control	1.0 MG storage tank at outfall HP-023 and 1.7 MG storage tank at outfall HP-024. Includes influent coarse screening, and facilities capable of dewatering the tanks in one day.
3. Storage Tunnel for HP-023, HP-024 and HP-031 to provide 100% annual CSO control	39-ft. dia., 5,400 LF tunnel to capture CSO from outfalls HP-023, HP-024 and HP-031. Includes 22 MGD dewatering PS.
4. Storage Tunnel for HP-023, HP-024 and HP-031 to provide 76% annual CSO control	24-ft. dia., 5,400 LF tunnel to capture CSO from outfalls HP-023, HP-024 and HP-031. Includes 17 MGD dewatering PS.
5. Storage Tunnel for HP-023, HP-024 and HP-031 to provide 48% annual CSO control	16-ft. dia., 5,400 LF tunnel to capture CSO from outfalls HP-023, HP-024 and HP-031. Includes 8 MGD dewatering PS.
6. Individual RTB with disinfection facility at HP-024 to provide 40% seasonal CSO control	1.6 MG contact tank, with influent screens, 150 MGD effluent pumping, 1.6 MGD dewatering pumping, and disinfection chemical storage and feed equipment. Facilities located at outfall HP-024.
7. Individual RTB with disinfection facility at HP-023 to provide 50% seasonal CSO control	0.73 MG contact tank, with influent screens, 70 MGD effluent pumping, 0.73 MGD dewatering pumping, and disinfection chemical storage and feed equipment. Facilities located at outfall HP-023.
8. Consolidated HP-023/HP-024 RTB with disinfection facility at HP-023 to provide 88% seasonal CSO control	2.1 MG contact tank, with influent screens, 203 MGD effluent pumping, 2.1 MGD dewatering pumping, and disinfection chemical storage and feed equipment. Facilities sized for flows from outfalls HP-023 and HP-024, with consolidation conduit to carry flows from outfall HP-024 to facility located at outfall HP-023.
9. Consolidated HP-023/HP-024 RTB with disinfection facility at HP-023 to provide 78% seasonal CSO control	1.3 MG contact tank, with influent screens, 123 MGD effluent pumping, 1.3 MGD dewatering pumping, and disinfection chemical storage and feed equipment. Facilities sized for flows from outfalls HP-023 and HP-024, with consolidation conduit to carry flows from outfall HP-024 to facility located at outfall HP-023.
10. Consolidated HP-023/HP-024 RTB with disinfection facility at HP-023 to provide 62% seasonal CSO control	0.64 MG contact tank, with influent screens, 62 MGD effluent pumping, 0.64 MGD dewatering pumping, and disinfection chemical storage and feed equipment. Facilities sized for flows from outfalls HP-023 and HP-024, with consolidation conduit to carry flows from outfall HP-024 to facility located at outfall HP-023.
11. 25 MGD Seasonal Disinfection in New Outfall HP-024	New 10-ft. diameter, 600 LF outfall pipe with 25 MGD disinfection facility for outfall HP-024. New outfall configured to provide 15 minutes detention time at 25 MGD. Floatables control to be provided for new outfall.
12. 50 MGD Seasonal Disinfection in New Outfall HP-024	New 10-ft. diameter, 1,200 LF outfall pipe with 50 MGD disinfection facility for outfall HP-024. New outfall configured to provide 15 minutes detention time at 50 MGD. Floatables control to be provided for new outfall.
13. 150 MGD Seasonal Disinfection in New Outfall HP-024	New 10-ft. diameter, 3,000 LF outfall pipe with 150 MGD disinfection facility for outfall HP-024. New outfall configured to provide 15 minutes detention time at 150 MGD. Floatables control to be provided for new outfall.

8.3.a CSO Volume and Bacteria Loading Reductions of Retained Alternatives

Table 8-12 summarizes the projected reductions in CSO volume and bacteria loads for the retained alternatives. These data are plotted on Figure 8-11.

It should be noted that because the Hutchinson River alternatives serve outfalls in predominantly combined areas, the bacteria loading reductions of the alternatives are aligned with their projected CSO volume reductions.

8.3.b Water Quality Impacts

This section qualitatively describes the levels of attainment with applicable bacteria criteria within Hutchinson River that would be achieved through implementation of the retained CSO control alternatives listed in Table 8-11, but without the other load reductions identified through the WLA.

Hutchinson River is a Class SB waterbody. Historic and recent water quality monitoring, along with baseline condition modeling using ERTM, revealed that the Hutchinson River is currently not in attainment with the Class SB Existing WQ Criteria. None of the alternatives presented above would result in full attainment when non-CSO pollutant loadings are considered, especially with regards to the sources to the upstream freshwater section of the river. As explained in the gap analysis presented in Section 6.3, bacteria loadings from other sources influence the fecal and enterococci concentrations to the extent that, without the other load reductions identified through the WLA, even 100 percent CSO control would not result in full attainment of the Existing WQ Criteria. As such, a UAA is included in this Hutchinson River LTCP.

8.4 Cost Estimates for Retained Alternatives

Evaluation of the proposed alternatives requires an appropriate level of cost estimating for each alternative. The methodology for developing these costs is dependent on the type of technology and its unique operation and maintenance requirements. As noted previously, the capital costs were developed as PBC and the total NPW costs were determined using the PBC estimated plus the NPW of the projected O&M costs at an assumed interest rate of 3 percent over a 20-year life cycle. All costs are in June 2014 dollars.

8.4.a Storage Tank Alternatives

Costs for the two storage tanks alternatives, Alternative 1 - 4.9 MG storage tank at HP-024 and 2.9 MG storage tank at HP-023, as well as Alternative 2 – 1.7 MG storage tank at HP-024 and 1.0 MG storage tank at HP-023, are summarized in Table 8-13. These costs include the tanks, new diversion structures and connecting piping from the diversion structures to each tank, influent coarse screens, dewatering pumps with dewatering force mains to the local sewer system, and above-grade facilities for odor control, electrical, and screenings handling. An allowance has been included for providing a reliable source of electrical power to each facility. Based on available information, it has also been assumed that rock excavation is anticipated, and rock excavation costs have been included in the estimates.

Table 8-12. Hutchinson River Retained Alternatives Summary of Performance (2008 Rainfall)

Alternative	Annual CSO Volume (MGY)	Annual CSO Volume Reduction(1) (%)	Annual Bacteria Reduction		Recreational Season Bacteria Reduction	
			Fecal Coliform (%)	Enterococci (%)	Fecal Coliform (%)	Enterococci (%)
Baseline Conditions	323	-	-	-		
1. 4.9 MG Storage Tank at HP-024; 2.9 MG Storage Tank at HP-023	176	45	52	51	50	49
2. 1.7 MG Storage Tank at HP-024; 1.0 MG Storage Tank at HP-023	242	25	31	30	29	28
3. 39-ft Diameter, 44 MG Tunnel	0	100	100	100	100	100
4. 24-ft Diameter, 17 MG Tunnel	77	76	83	82	83	82
5. 16-ft Diameter, 7.6 MG Tunnel	170	47	58	57	55	53
6. Individual RTB with disinfection facility at HP-024 to provide 40% seasonal CSO control	217(2)	33	24(3)	25(3)	39	41
7. Individual RTB with disinfection facility at HP-023 to provide 50% seasonal CSO control	240(2)	26	34(3)	33(3)	51	49
8. Consolidated HP-023/HP-024 RTB with disinfection facility at HP-023 to provide 88% seasonal CSO control	116(2)	64	66(3)	65(3)	88	88
9. Consolidated HP-023/HP-024 RTB with disinfection facility at HP-023 to provide 79% seasonal CSO control	146(2)	55	57(3)	57(3)	79	78
10. Consolidated HP-023/HP-024 RTB with disinfection facility at HP-023 to provide 62% seasonal CSO control	200(2)	38	43(3)	42(3)	62	61
11. Seasonal Disinfection at Outfall HP-024 (25 MGD)	279(2)	13	9(3)	9(3)	16	16
12. Seasonal Disinfection at Outfall HP-024(50 MGD)	250(2)	20	14(3)	14(3)	24	24
13. Seasonal Disinfection at Outfall HP-024(150 MGD)	225(2)	30	21(3)	21(3)	37	37

Notes:
(1) CSO volume reduction from baseline conditions.
(2) Remaining volume does not include treated volume discharged during the recreational season.
(3) Based on 2-log kill in recreational season, and no treatment during non-recreational season.

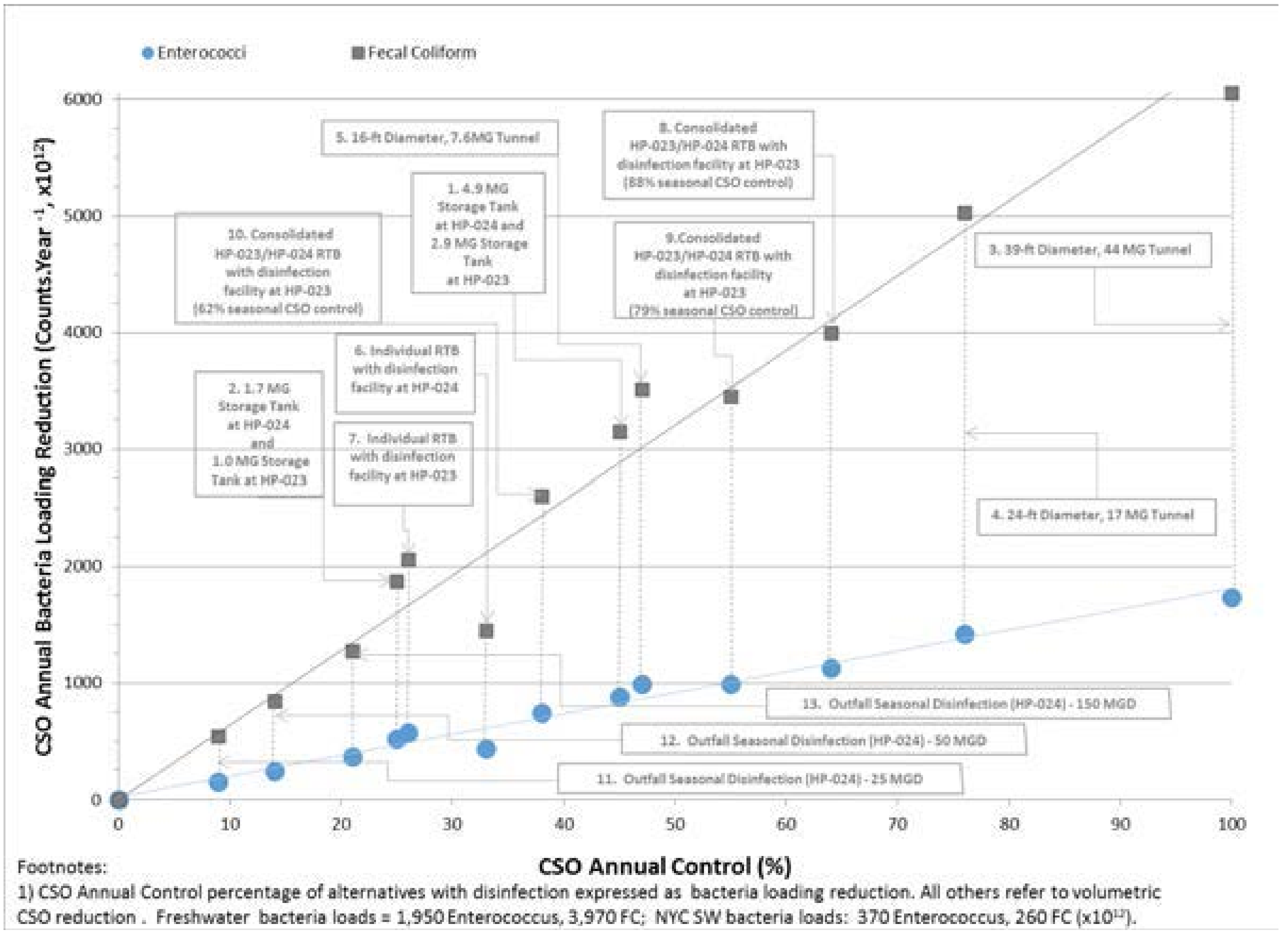


Figure 8-11. CSO Volume Reductions vs. Annual Total Bacteria Loading Reduction (2008 Rainfall)

As indicated in Table 8-13, the net present worth for Alternatives 1 and 2 are $437M and $278M, respectively.

Table 8-13. Costs for Storage Tank Alternatives

Item	Alternative 1 4.9 MG Storage Tank at HP-024; 2.9 MG Storage Tank at HP-023	Alternative 2 1.7 MG Storage Tank at HP-024; 1.0 MG Storage Tank at HP-023
June 2014 PBC ($ Million)	399	242
Annual O&M Cost ($ Million)	2.58	2.42
Net Present Worth ($ Million)	437	278

8.4.b Tunnel Alternatives

Cost estimates for the three retained tunnel alternatives, Alternative 3 – 39-ft. diameter, 44 MG Tunnel, Alternative 4 – 24-ft. diameter, 17 MG Tunnel, and Alternative 5 – 16-ft. diameter, 7.6 MG Tunnel, are summarized in Table 8-14. The estimated total NPW ranges between $633M to $829M for the smallest and largest tunnel, respectively. These costs include the boring of the deep tunnel, multiple shafts, dewatering PS and force main, odor control systems and other ancillary facilities.

Table 8-14. Tunnel Alternatives Costs

Cost Component	Tunnel Storage Alternative		
	Alternative 3 39-ft. Diameter, 44 MG Tunnel	Alternative 4 24-ft. Diameter, 17 MG Tunnel	Alternative 5 16-ft. Diameter, 7.6 MG Tunnel
June 2014 PBC ($ Million)	809	688	620
Annual O&M Cost ($ Million)	1.33	1.16	0.85
Net Present Worth ($ Million)	829	706	633

8.4.c Retention/Treatment Basin (RTB) with Seasonal Disinfection Alternatives

Costs for the RTB with seasonal disinfection alternatives are summarized in Table 8-15. The alternatives include Alternative 6 - 203 MGD Consolidated RTB with Seasonal Disinfection Facility for HP-023/HP-024; Alternative 7 - 123 MGD Consolidated RTB with Seasonal Disinfection Facility for HP-023/HP-024; Alternative 8 - 62 MGD Consolidated RTB with Seasonal Disinfection Facility for HP-023/HP-024; Alternative 9 - 70 MGD Consolidated RTB with Seasonal Disinfection Facility for HP-023; and Alternative 10 - 150 MGD Consolidated RTB with Seasonal Disinfection Facility for HP-024. These costs include the tanks, new diversion structures and connecting piping from the diversion structures to each tank, influent screens, effluent pumps with new outfall, dewatering pumps with dewatering force mains to the local sewer system, and above-grade facilities for odor control, electrical, chemical storage and feed equipment, and screenings handling. An allowance has been included for providing a reliable source of electrical power to each facility. As noted above for storage tanks, an allowance for rock excavation has been included.

As indicated in Table 8-15, the total net present worth for Alternatives 6 to 10 ranges from $212M to $403M.

Table 8-15. Costs for RTB with Seasonal Disinfection Alternatives

Cost Element	Alternative 6 150 MGD Individual RTB with Seasonal Disinfection Facility for HP-024	Alternative 7 70 MGD Individual RTB with Seasonal Disinfection Facility for HP-023	Alternative 8 203 MGD Consolidated RTB with Seasonal Disinfection Facility for HP-023/ HP-024	Alternative 9 123 MGD Consolidated RTB with Seasonal Disinfection Facility for HP-023/ HP-024	Alternative 10 62 MGD Consolidated RTB with Seasonal Disinfection Facility for HP-023/ HP-024
June 2014 PBC ($ Million)	327	195	383	309	212
Annual O&M Cost ($ Million)	1.21	1.17	1.35	1.32	1.29
Net Present Worth ($ Million)	345	212	403	329	231

8.4.d Seasonal Disinfection for New Outfall HP-024

Costs for the Seasonal Disinfection for New Outfall HP-024 alternatives are summarized in Table 8-16. The alternatives include Alternative 11 - 25 MGD Seasonal Disinfection in New Outfall HP-024; Alternative 12 - 50 MGD Seasonal Disinfection in New Outfall HP-024; and Alternative 13 - 150 MGD Seasonal Disinfection in New Outfall HP-024. These costs include the new diversion structures and connecting piping from the diversion structures to the disinfection facility, new 10-ft. diameter conduit to provide contact time, downstream weir structure with dewatering pumps and dewatering force main to the local sewer system, new outfall structure, floatables control and above-grade facilities for odor control, electrical, and chemical storage and feed equipment. The chlorination system design will be coordinated with the results of the Alley Creek chlorination study findings. The 2-log kill approach is meant to minimize chlorine discharges and toxicity is not expected to be a concern in the Hutchinson River. The flows in the river are much greater and the channel is deeper than Alley Creek. The TRC issue will be re-visited during design. It was also assumed that rock excavation would be required with this series of control measures.

As indicated in Table 8-16, the total net present worth (NPW) for Alternatives 11 to 13 ranges from $83M to $168M.

Table 8-16. Costs for Seasonal Disinfection in New Outfall HP-024 Alternatives 11, 12 and 13

Cost Element	Alternative 11 25 MGD Seasonal Disinfection in New Outfall HP-024	Alternative 12 50 MGD Seasonal Disinfection in New Outfall HP-024	Alternative 13 150 MGD Seasonal Disinfection in New Outfall HP-024
June 2014 PBC ($ Million)	64	90	149
Annual O&M Cost ($ Million)	1.25	1.25	1.27
Net Present Worth ($ Million)	83	108	168

The cost estimates of these retained alternatives were then used in the development of the cost-performance and cost-attainment plots presented in Section 8.5.

8.5 Cost-Attainment Curves for Retained Alternatives

The final step of the analysis is the evaluation of the cost-effectiveness of the alternatives based on their NPW and projected impact in attainment of applicable WQS.

8.5.a Cost-Performance Curves

Using the results of the previous analyses and costing discussed above, three cost-performance curves were developed for the retained alternatives: one for volumetric control and one each for enterococci and fecal coliform bacteria control. For volumetric control, presented as Figure 8-12, the plot shows the relationship of percent CSO control to the total NPW cost for each of the alternatives listed in Table 8-11. For alternatives that include disinfection treatment, bacteria loading reduction is plotted. As shown, there are two points for those alternatives that include disinfection: annual equivalent in blue and the recreational season of May 1st through October 31st in green. The former represents the actual level of annual CSO control that would be realized with disinfection operational only during the recreational season whereas the recreational season point shows the level of CSO control that would occur during the defined recreational season. Percent annual volumetric CSO control ranges from of a low of between 13 percent for Alternative 11 – Seasonal Disinfection in New Outfall HP-014 (25 MGD) to a high of 100 percent control for Alternative 3 - 39-foot Diameter Tunnel. The range of costs associated with these end points are $83M to $829M.

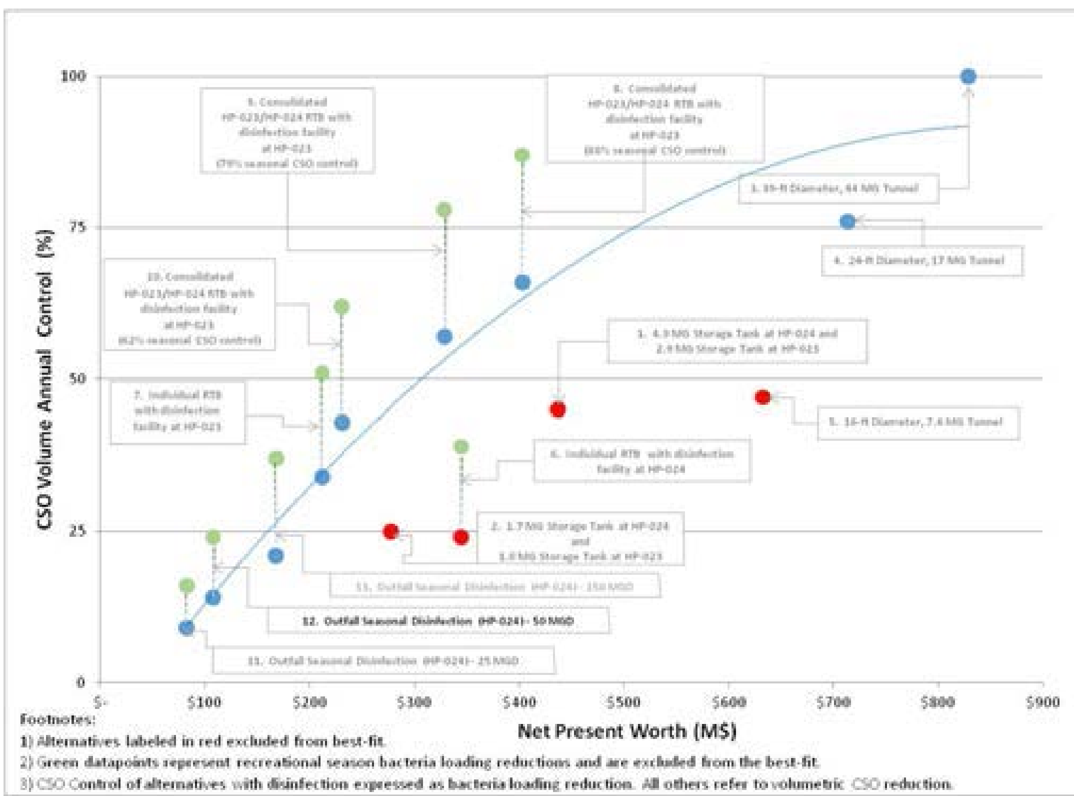


Figure 8-12. Cost vs. CSO Volume Reductions (2008 Rainfall)

A second order best-fit curve was then developed based on those alternatives that were judged to be cost-effective for a particular level of CSO annual volume control. The intent of developing a best-fit curve was to see if an inflection point could be identified. The inflection point, or "knee-of-the-curve", would represent the most cost-effective point on the curve. Outliers along the curve, shown in red, were excluded from the best-fit cost curve. For example, for an approximate 25 percent CSO level of control, Alternative 7 - Individual RTB with Seasonal Disinfection in New Outfall HP-023, was shown to be more cost effective than Alternative 2, two separate storage tanks at HP-023 and HP-024. As such, the latter was considered an outlier and not included in the best-fit plot.

While the second-order curve does not show a clear KOTC, all three tunnel alternatives (Alternatives 3, 4 and 5) appear to be well past the cost-effective range. The remaining non-outlier alternatives (Alternatives 2, 7, 8, 9, 10, 11, 12 and 13) appear to be on the steep slope part of the curve which represents a degree of cost-effectiveness.

Similar to CSO volumetric control, Figures 8-13 and 8-14 plot the NPW of the retained alternatives against their associated projected annual enterococci and fecal coliform bacteria loading reductions, respectively. The primary Y-axis (left side) shows percent bacteria reductions using baseline CSO loading as the benchmark whereas the secondary Y-axis (right side) includes the total bacteria loading reductions including other non-CSO sources of bacteria, most notably, stormwater. The total loadings used in the computation of the percent total annual bacteria loading reductions included the loadings originated in Westchester County.

Excluding the outliers described above, percent enterococci seasonal CSO loading reduction ranged from a low of approximately 16 percent with Alternative 11 - Seasonal Disinfection in New Outfall HP-014 (25 MGD), to a high of 100 percent with Alternative 3 - 39-foot Diameter Tunnel. Due to the equal effectiveness of the disinfection process for both indicator bacteria, similar results were computed for fecal coliform for the non-100 percent control alternatives.

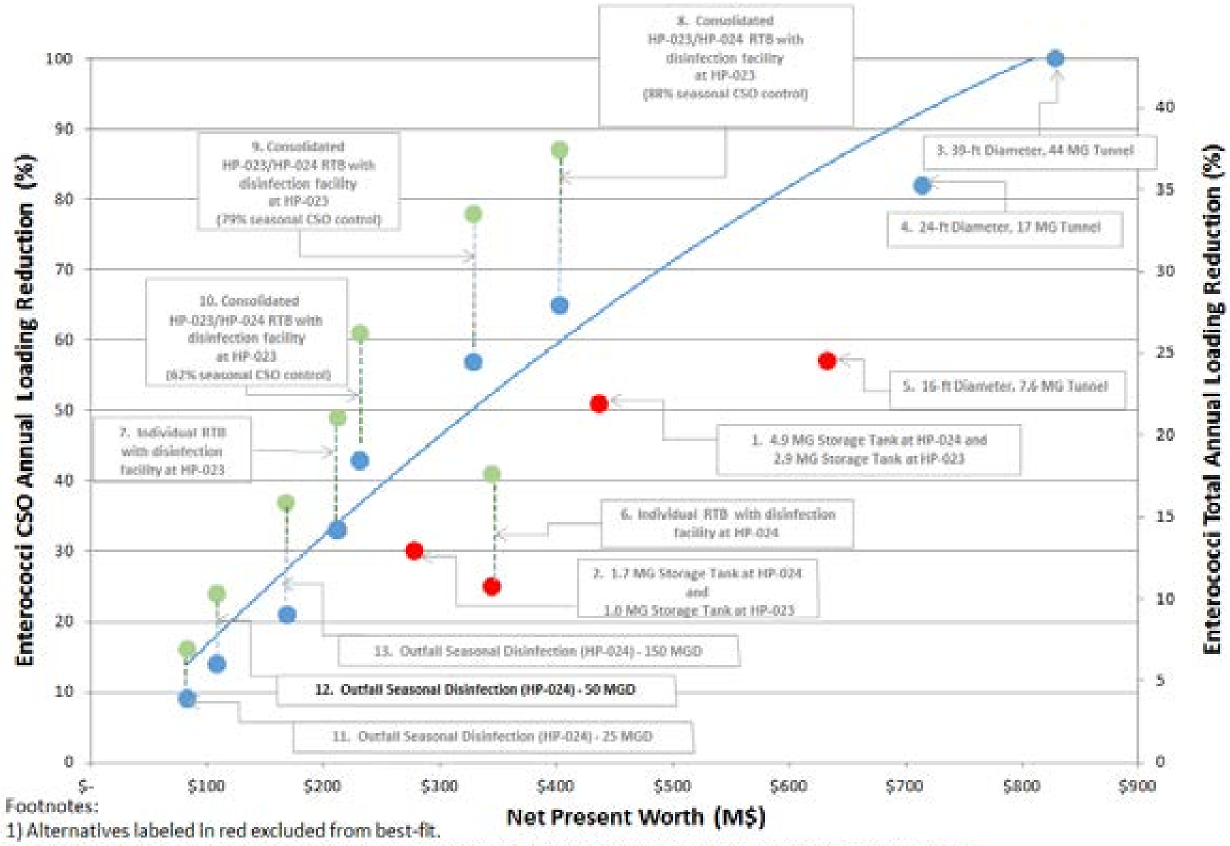
With respect to KOTCs for the bacteria reduction, a similar conclusion can be made for the three tunnel alternatives as was concluded for the volumetric curve; they are well beyond the cost-effective portion of the curves. Further, the remaining non-outlier alternatives (Alternatives 2, 7, 8, 9, 10, 11, 12 and 13) again appear to be on the steep slope part of the curve which represents a higher degree of cost-effectiveness.

8.5.b Cost-Attainment Curves

This section addresses costs of the CSO alternatives versus their ability to attain the following three WQ parameters:

- Existing WQ Criteria - Fecal coliform – Geometric Mean (GM)
- Future Primary Contact WQ Criteria - Enterococci - GM
- Future Primary Contact WQ Criteria - Enterococci – Statistical Threshold Value (STV)

The analysis covers all of the stations within the tidal or saline portion of the river with the exception of HR-04 which is physically close to HR-05 and has similar water quality. The analysis presented herein assumes that the freshwater section of the river reflects the baseline conditions with baseline freshwater loads, and not the WLA conditions.



Footnotes:
1) Alternatives labeled in red excluded from best-fit.
2) Green datapoints represent recreational season Enterococci loading reductions and are excluded from the best-fit.
3) Total annual loading reductions account for Westchester County loadings.

Figure 8-13. Cost vs. Enterococci Loading Reduction (2008 Rainfall)

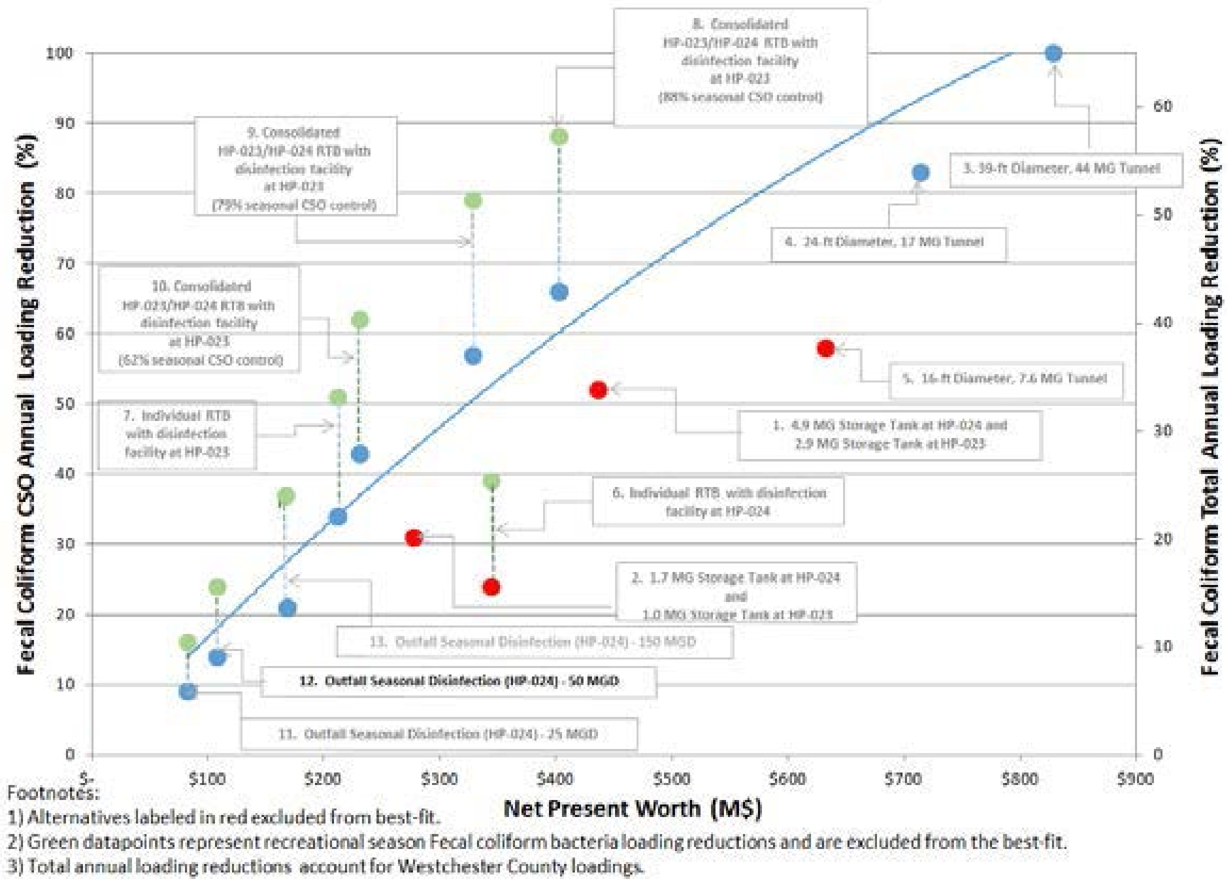


Figure 8-14. Cost vs. Fecal Coliform Bacteria Loading Reduction (2008 Rainfall)

As previously discussed in Section 6.0, and illustrated in Figures 8-15 through 8-19 below, full attainment of existing Class SB bacteria criteria only occurs at station HR-01 near the confluence with Eastchester Bay. Because of loadings from upstream sources, the level of attainment decreases as the stations head upstream towards the boundary with Westchester County with the lowest level of attainment at station HR-06. This trend is also projected for the other two WQ attainment parameters: GM and STV criteria of the Future Primary Contact WQ Criteria. However, of the two Future Primary Contact WQ Criteria parameters, only the GM criterion is fully attained at station HR-01.

With respect to the projected improvement in the level of attainment due to CSO control only (with no reductions in the other loads identified in the WLA), no gain is projected to occur for the existing Class SB fecal coliform criterion at all of the plotted stations with exception of station HR-05. Only minimal gains are projected for the future primary contact GM enterococci criteria at all stations with the exception of HR-01 at Eastchester Bay where full attainment is projected to be currently met. For example, the projected attainment for this criteria at station HR-05 would only increase from a roughly 48 percent under baseline conditions to in the range of 52 to 56 percent for corresponding NPW values of between $83M to approximately $400M.

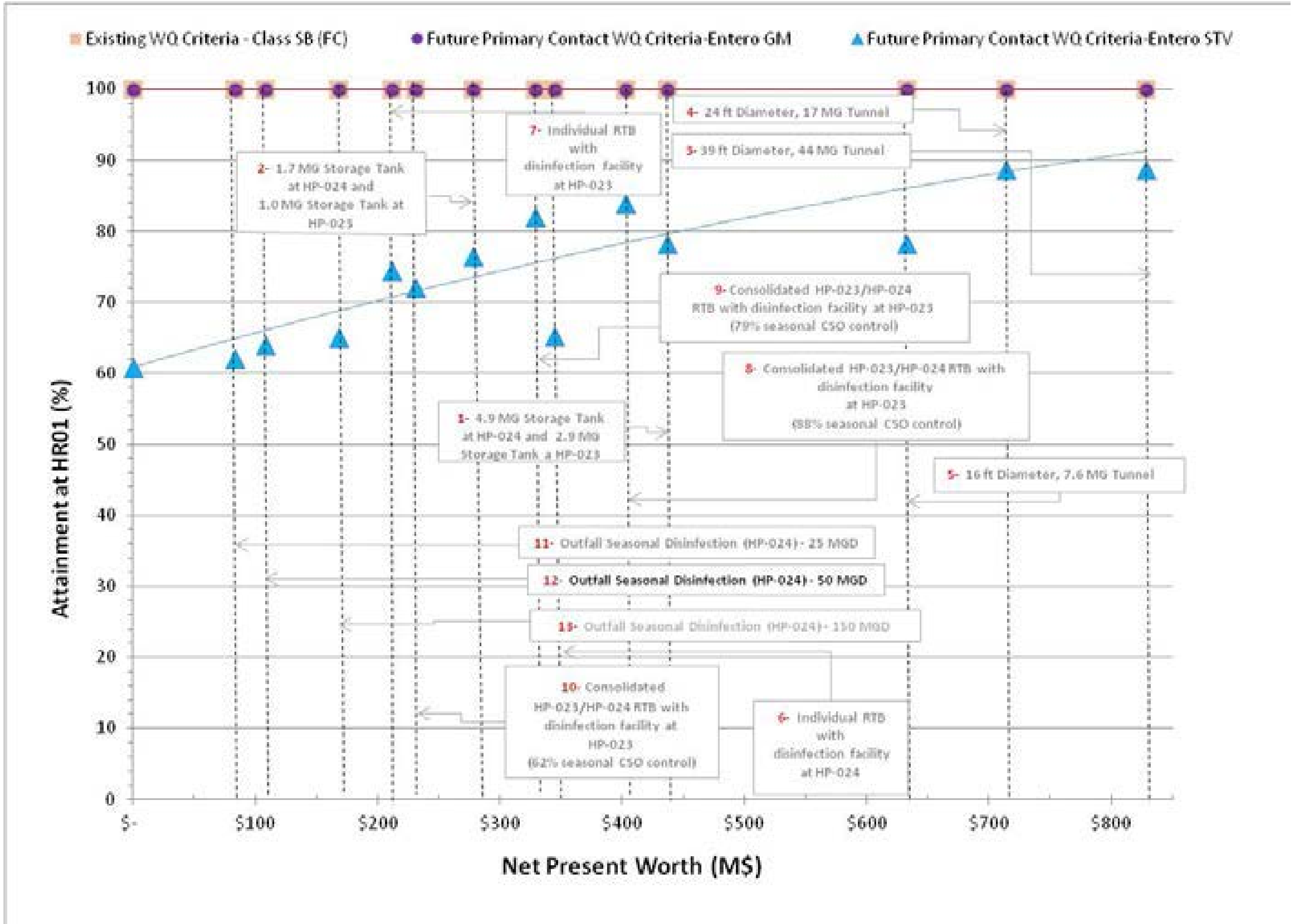


Figure 8-15. Cost vs. WQ Attainment at Station HR-01 (2008 Rainfall)

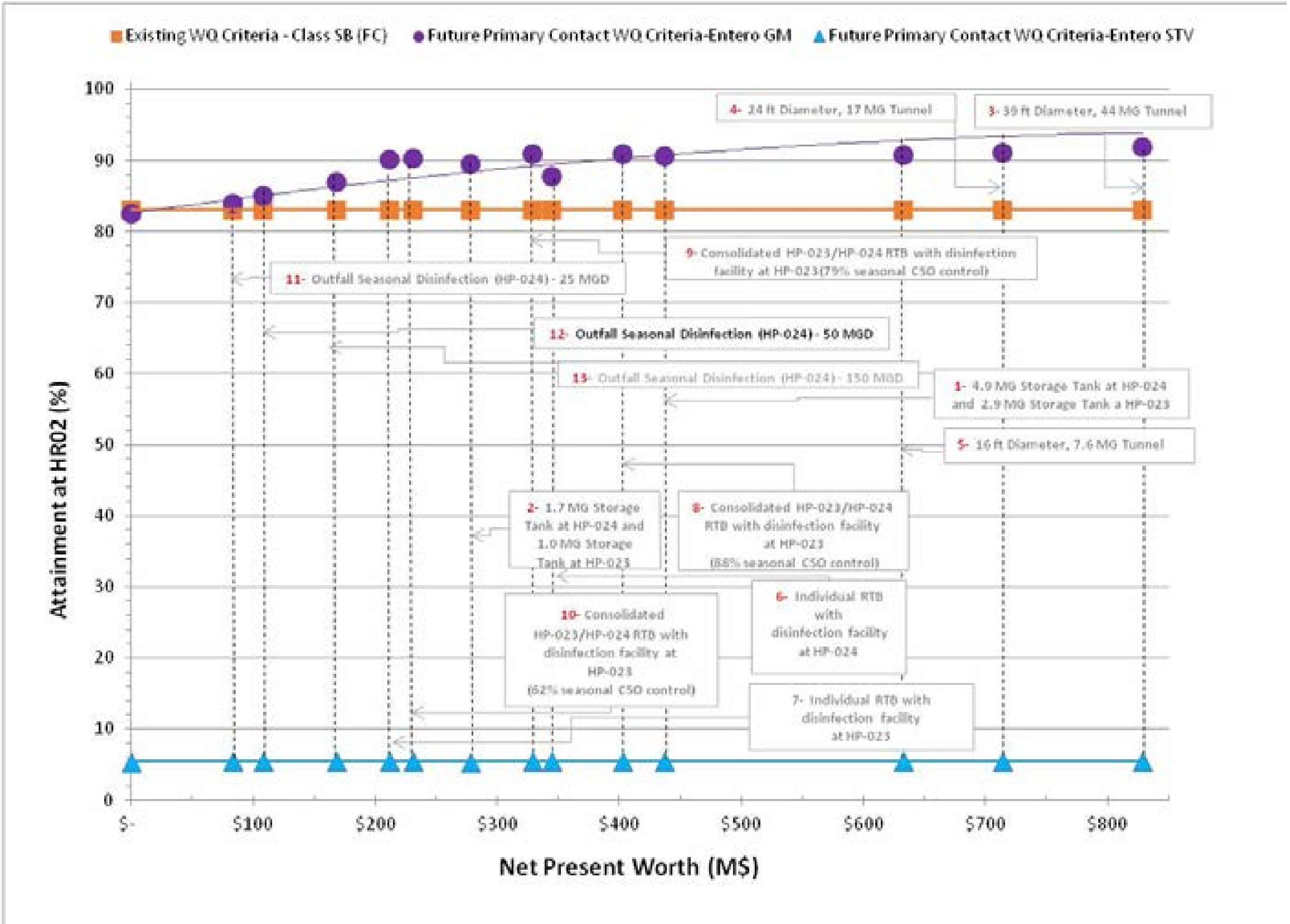


Figure 8-16. Cost vs. WQ Attainment at Station HR-02 (2008 Rainfall)

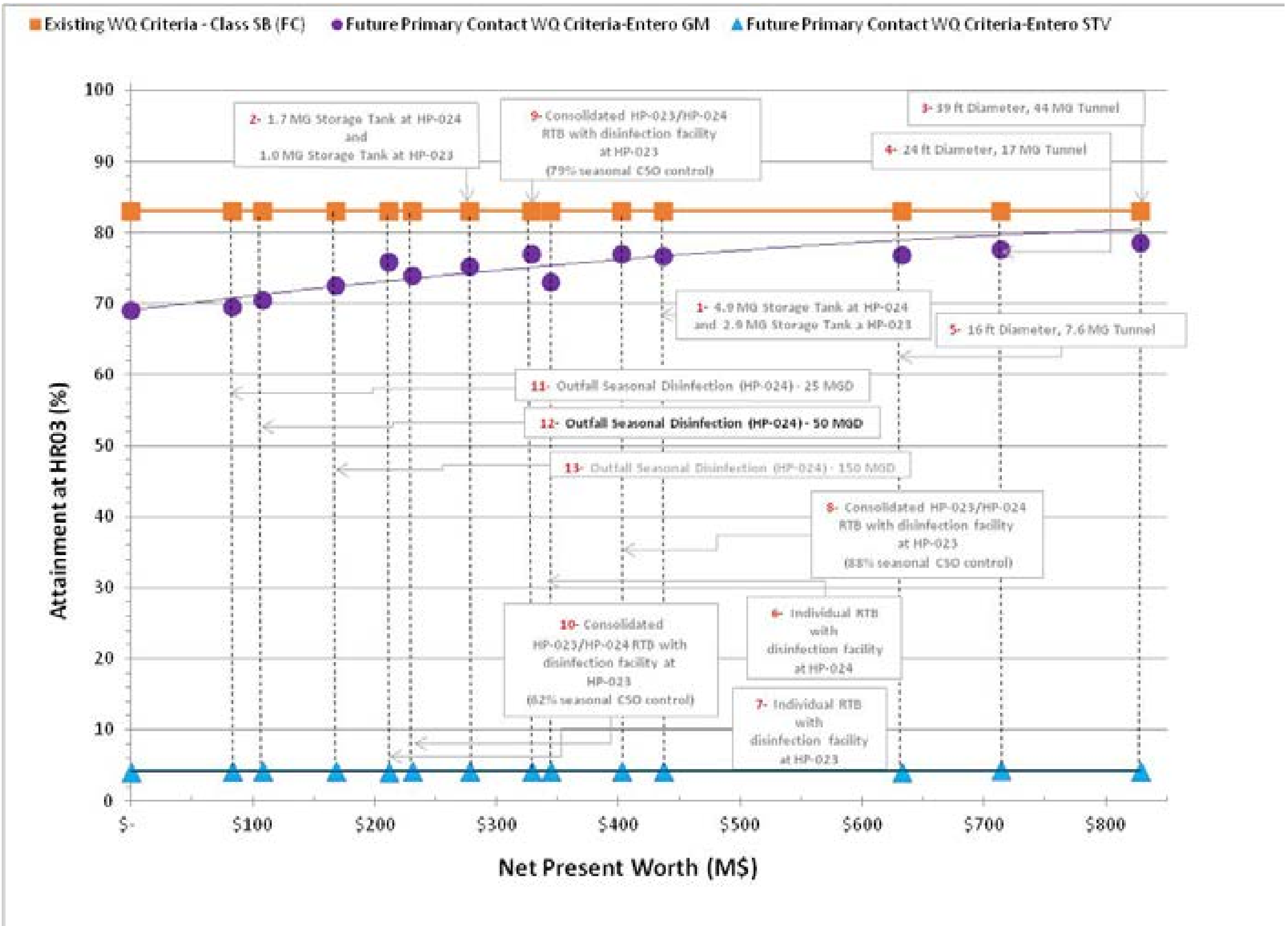


Figure 8-17. Cost vs. WQ Attainment at Station HR-03 (2008 Rainfall)

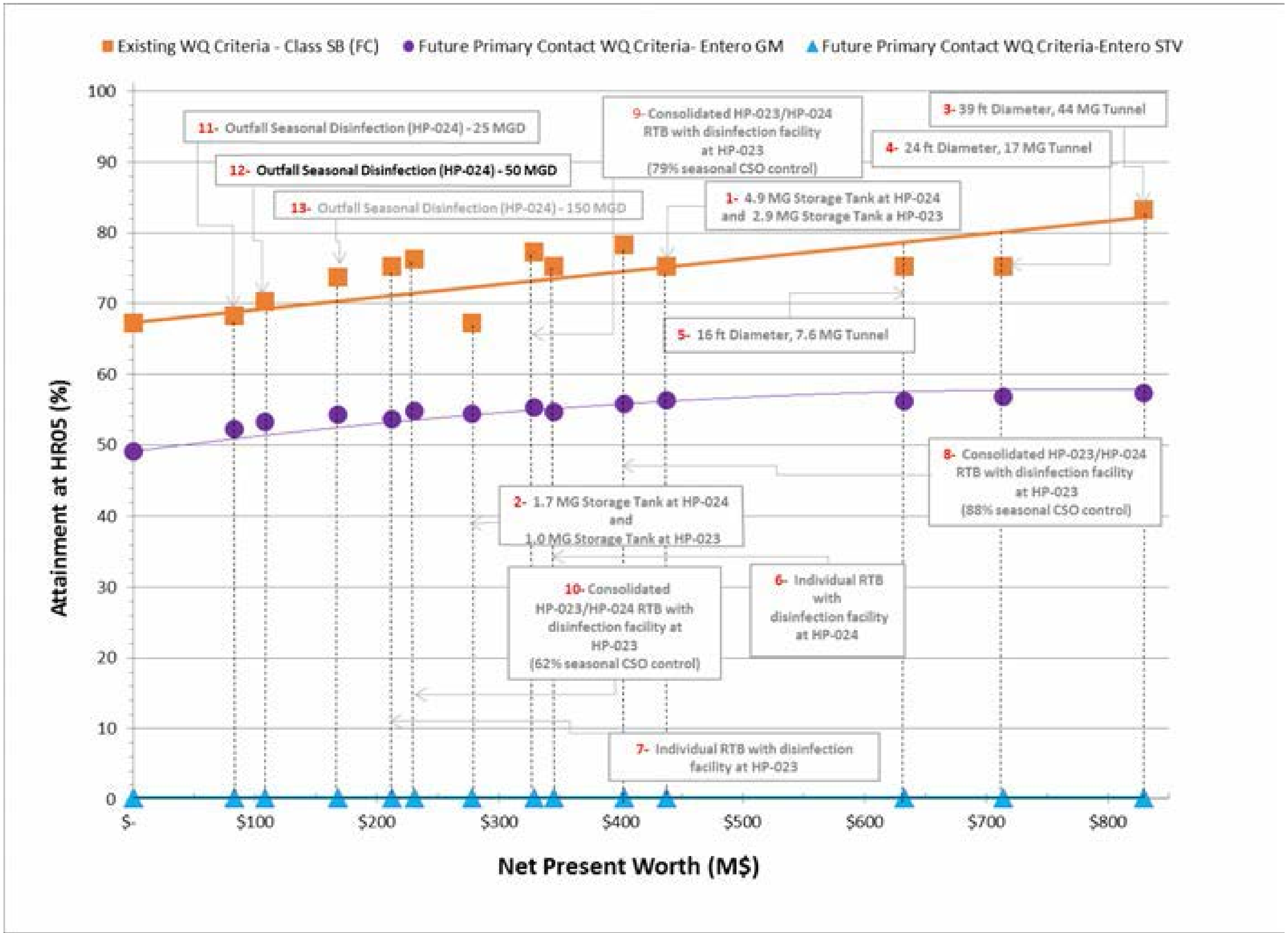


Figure 8-18. Cost vs. WQ Attainment at Station HR-05 (2008 Rainfall)

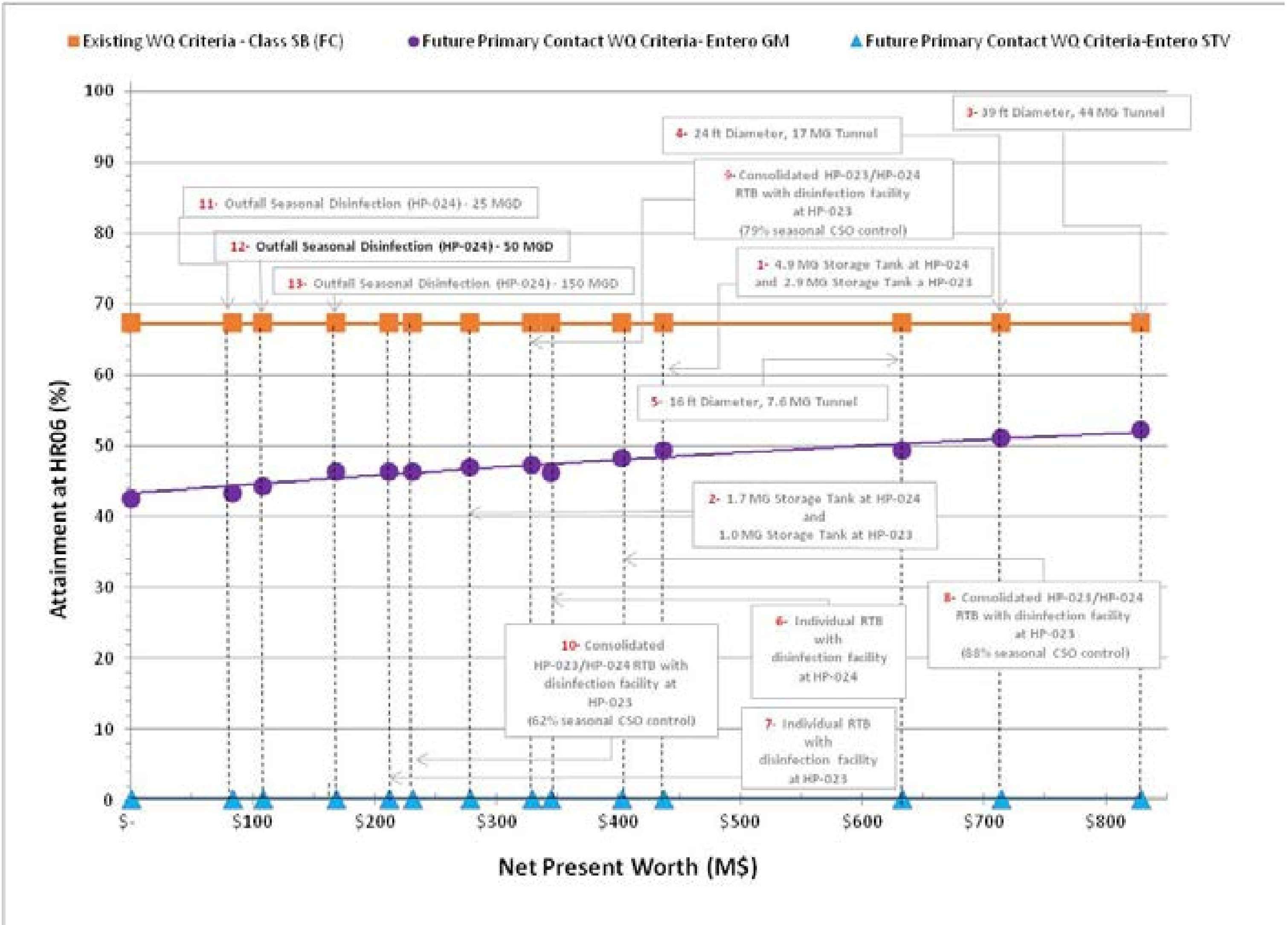


Figure 8-19. Cost vs. WQ Attainment at Station HR-06 (2008 Rainfall)

With regard to the STV criterion, there is virtually no gain in level of attainment at any of the stations other than station HR-01 at Eastchester Bay, where it increases from 60 percent at baseline conditions to nearly 90 percent with 100 percent CSO control. At all of the other stations, the baseline and 100 percent CSO control attainment levels are well below 10 percent.

None of the low- to medium-cost retained alternatives listed in Table 8-11 are effective in increasing the level of attainment of the Future Primary Contact WQ Criteria.

8.5.c Waste Load Allocation (WLA) Approach

As shown in Table 6-17, a 14 percent reduction in both CSO and stormwater loadings in the tidal reach of the river for the August 2011 period would be necessary in order to achieve 97.5 percent attainment of the current Class SB fecal coliform criterion under the WLA scenarios (freshwater in compliance). Further, Table 6-18 shows that the level of CSO control would need to increase to 17 percent to achieve 97.5 percent attainment if there were no credit taken for stormwater reduction.[1] Thus, using the 17 percent WLA CSO reduction target for August 2011, Table 8-8 demonstrates that Alternative 12 – Seasonal Disinfection in New Outfall HP-024 (50 MGD) would satisfy the required load reduction, with a margin of safety, at a reasonable level of capital investment. Therefore, Alternative 12 is identified as the preferred alternative.

8.5.d Time to Recover Analysis

Analyses were conducted with the ERTM model to evaluate the length of time fecal coliform concentrations and enterococci concentrations would exceed target values of 1,000 and 110 cfu/100mL, respectively. These target values are discussed further in Section 8.7.a, and represent concentrations above which bathing would be unadvisable. These analyses were performed for the baseline conditions of upstream freshwater bacteria concentrations unchanged from present levels, with the exception that suspected illicit dry weather discharges are removed. The analysis was conducted for a rainfall event sequence that occurred August 14, 2008 (0.96 inches) and August 15, 2008 (1.02 inches) which fell over approximately 4 hour periods each day.

The results of this analysis are provided in Figure 8-20 for both fecal coliform bacteria and for enterococci. The results represent the amount of time it takes after the end of the August 15 rainfall for the bacteria concentrations to return to the target levels at river station HR-05, closest to the CSO outfalls. Results indicate that for fecal coliform bacteria the baseline recovery time is about 20 hours while for enterococci the baseline recovery time is about 38 hours. Results are provided in Figure 8-20 for each of the alternatives evaluated. As noted there is a fairly linear reduction in recovery time with no individual CSO control alternative providing a significant improvement over the previous alternative.

[1] To the extent that the preferred alternative provides treatment beyond the level necessary to meet the CSO WLA, DEP does not intend for this LTCP to create a requirement to select CSO control projects for future LTCPs that account for separate stormwater discharges or otherwise exceed Clean Water Act requirements.

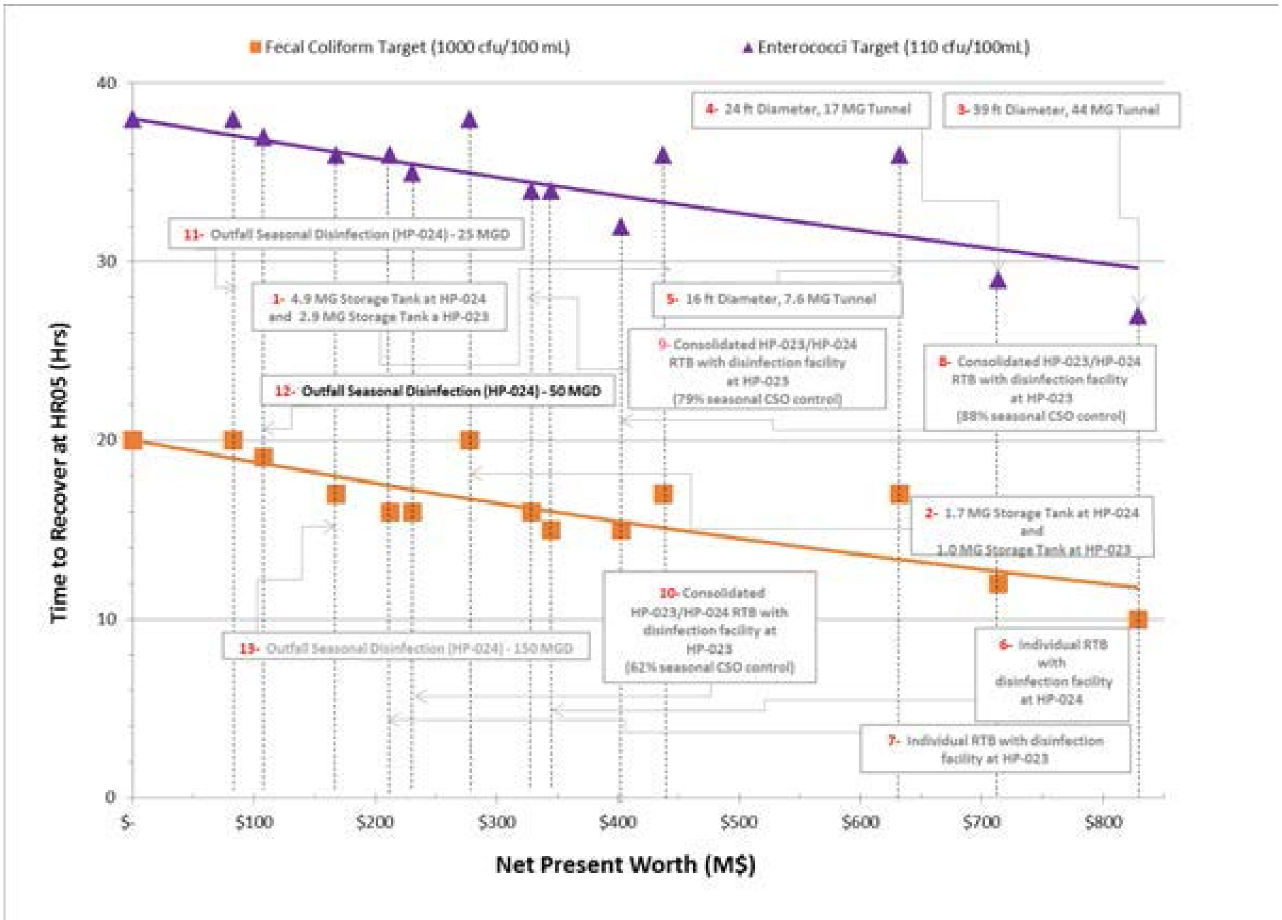


Figure 8-20. Time to Recover at River Station HR-05

8.5.e Conclusion on Preferred Alternative

DEP has identified Alternative 12 as DEP's preferred alternative: a 50 MGD Seasonal Disinfection facility that includes:

- 10-ft. diameter,1,200 linear feet (LF) outfall pipe to provide 15 minutes detention time
- Floatables control prior to discharge

The key findings of the cost performance and cost attainment analyses have informed the selection of this preferred alternative. First, the Hutchinson River is not currently meeting the Existing WQ Criteria, and is not projected to do so even with 100 percent CSO control due to current loadings from other sources. Similarly, the Hutchinson River will not meet the Future Primary Contact WQ Criteria (GM and STV) with 100 percent CSO control. Second, the cost-attainment curves did not identify an alternative that was clearly more cost-effective than the others (i.e., the curves did not produce a clear inflection point). Thus, with the exception of station HR-01 at Eastchester Bay, all of the alternatives along the potentially cost-effective portion of the cost-performance curves resulted in no improvement in the Future Primary Contact WQ STV criterion and less than a 10 percent improvement for the Future Primary Contact WQ GM criterion over baseline conditions.

However, under the WLA approach that takes into account reductions from other sources, a 14 percent reduction in CSO fecal coliform loading would result in CSO discharges not interfering with potential attainment of the current Class SB criterion. A 17 percent reduction in CSO fecal coliform loading would result in both CSO and Stormwater discharges not interfering with potential attainment of the current Class SB criterion in the NYC section of the river. DEP has determined that by selecting an alternative that will control CSO fecal coliform loadings in excess of 17 percent, DEP can cost-effectively meet the WLA derived bacteria reduction targets for City wet weather sources.

The ERTM WQ model was then used to characterize WQS attainment for this preferred alternative by running the model for the full 10 year simulation period under the baseline freshwater loading conditions (i.e. without the reductions in other loads identified in the WLA). The results of these runs are summarized in Tables 8-17 and 8-18 for the annual and recreational season attainment, respectively.

Examination of projected attainment in the Hutchinson River presented in the two tables show that the criteria are not attained for the annual or recreational periods for either the Existing WQ Criteria (Class SB) or with the Future Primary Contact WQ Criteria in the freshwater section of the river. In the tidal section of the river, attainment is less than 95 percent for fecal coliform on an annual basis, with the exception of station HR-01 at Eastchester Bay where full attainment is calculated. As noted above, 95 percent attainment of applicable water quality criteria would constitute compliance with the existing WQS in accordance with guidance from DEC. More of the river has greater than 95 percent fecal attainment during the recreational season when disinfection is applied. All but station HR-06, in Westchester County, has at least 95 percent attainment of the fecal criterion during the recreational season. Attainment of the of the Future Primary Contact WQ criteria is below 95 percent with the exception of station HR-01 compared against the rolling 30-day GM criterion.

Table 8-17. Calculated Bacteria Attainment for the Preferred Alternative

Station	Calculated 10-year Bacteria Attainment - Annual Period	
	Existing WQ Criteria	
	Criterion	Attainment (%)
HR-09	Fecal <=200	0
HR-08	Fecal <=200	0
HR-07	Fecal <=200	0
HR-06	Fecal <=200	77
HR-05	Fecal <=200	84
HR-04	Fecal <=200	90
HR-03	Fecal <=200	91
HR-02	Fecal <=200	94
HR-01	Fecal <=200	100

Table 8-18. Calculated 10-year Bacteria Attainment for the Preferred Alternative - Recreational Season Only

Station	Existing WQ Criteria		Future Primary Contact WQ Criteria	
	Criterion	Attainment (%)	Criterion	Attainment (%)
HR-09	Fecal <= 200	0	Entero <=30	0
			STV <= 110	0
HR-08	Fecal <= 200	0	Entero <=30	0
			STV <= 110	0
HR-07	Fecal <= 200	0	Entero <=30	0
			STV <= 110	0
HR-06	Fecal <= 200	92	Entero <=30	41
			STV <= 110	3
HR-05	Fecal <= 200	95	Entero <=30	55
			STV <= 110	4
HR-04	Fecal <= 200	95	Entero <=30	68
			STV <= 110	8
HR-03	Fecal <= 200	97	Entero <=30	72
			STV <= 110	8
HR-02	Fecal <= 200	97	Entero <=30	83
			STV <= 110	13
HR-01	Fecal <= 200	100	Entero <=30	99
			STV <= 110	60

Table 8-19 provides a summary of the calculated attainment (vertically averaged) of the Hutchinson River for dissolved oxygen for the preferred alternative. As noted in the table, there is a high level of DO attainment for the never less than 3 mg/L component of the water quality criterion. The daily average 4.8 mg/L component of the criterion is not fully attained but has improved over baseline conditions (Table 6-6) by a few percent.

Table 8-19. Calculated Dissolved Oxygen Attainment for the Preferred Alternative

Station	Calculated 2008 Dissolved Oxygen -- Annual Period	
	Hourly Attainment, % >= 3.0 mg/L	Daily Attainment, % >= 4.8 mg/L
	Existing WQ Criteria	
	Attainment (%)	Attainment (%)
HR-09	100	100
HR-08	100	100
HR-07	100	98
HR-06	95	73
HR-05	97	78
HR-04	99	90
HR-03	100	97
HR-02	100	98
HR-01	100	98

The preferred alternative is based on a WLA approach. In addition, it is projected to result in very high seasonal attainment with existing pathogen criteria even with the large pathogen loadings from the freshwater portion of the Hutchinson River. It is likely with continued abatement of illicit connections and improved stormwater management in Westchester County that the entire tidal portion of the river may be able to attain exiting pathogen criteria during recreational period greater than 95 percent of the time.

The preferred alternative has an estimated construction cost of $90M, and a NPW cost of $108M. The annual O&M costs for this alternative were estimated to be $1.25M. As noted above, the LTCP cost estimates are considered AACE Class 5 estimates, with accuracy ranges of -50 percent to +100 percent. Therefore, the construction cost of the preferred alternative could range from $45M to $180M. This alternative would result in a projected seasonal reduction of fecal coliform of approximately 25 percent for the 2008 typical year. For the August 2011 period, this alternative would provide a fecal coliform reduction of 23 percent, significantly above the 17 percent threshold for CSO loadings that would be required without additional stormwater controls. Again, using this WLA approach, this level of CSO control brings the river into compliance based upon the specifically-defined water quality and pollutant loading conditions as were described in detail in Section 6.3.

A summary of the benefits of the preferred alternative include:

- Using the baseline conditions described in Section 6.0, a high level of bacteria from CSO will be controlled during the May 1st through October 31st recreational season.

- Because attainment of the current Class SB criteria are not predicted to occur in the immediate future when accounting for all wet weather sources to the river, a UAA submitted with this LTCP, proposes interim bacteria criteria for the waterbody.

- GI build-out, as included in the baseline conditions, will continue to improve water quality as the preferred alternative is being implemented.

- The level of CSO control proposed meets the WLA targets both for CSO and stormwater combined.

Figure 8-21 shows the conceptual layout of the preferred alternative. The proposed schedule for the implementation of Alternative 12 is presented in Section 9.2.

8.6 Use Attainability Analysis

The CSO Order requires a UAA to be included in LTCPs “where existing WQS 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 WQS or the Section 101(a)(2) goals”. The UAA shall “examine[e] whether applicable waterbody classifications, criteria, or standards should be adjusted by the State.” The UAA process specifies that States can remove a designated use which is not an existing use if the scientific assessment can demonstrate that attaining the designated use is not feasible for at least one of six reasons:

1. Naturally occurring pollutant concentrations prevent the attainment of the use; or

Figure 8-21. Alternative 12 - 50 MGD Seasonal Disinfection in New Outfall HP-024

2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the waterbody to its original condition or to operate such modification in a way that would result in the attainment of the use; or

5. Physical conditions related to the natural features of the waterbody, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

6. Controls more stringent than those required by Sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

As part of the LTCP, elements of a UAA, including the six conditions presented above, will be used to determine if changes to the designated use are warranted, considering a potential adjustment to the designated use classification as appropriate. Because the Hutchinson River does not currently, and is not projected to meet the Existing WQ Criteria even with 100 percent CSO control, a UAA is attached hereto as Appendix D.

8.6.a Use Attainability Analysis Elements

The objectives of the CWA include providing for the protection and propagation of fish, shellfish, wildlife, and recreation in and on the water. Cost-effectively maximizing the water quality benefits associated with CSO reduction is a cornerstone of this LTCP.

To simplify this process, DEP and DEC have developed a framework that outlines the steps taken under the LTCP in two possible scenarios:

- Waterbody meets WQ requirements. This may either be the existing WQS (where primary contact is already designated) or assess for an upgrade to the Primary Contact WQ Criteria (where the existing standard is not a Primary Contact WQ Criteria). In either case, a high-level assessment of the factors that define a given designated use is performed, and if the level of control required to meet this goal can be reasonably implemented, a change in designation may be pursued following implementation of CSO controls and post-construction monitoring.

- Waterbody does not meet WQ requirements. In this case, if a higher level of control is not feasible, the UAA must justify the shortcoming using at least one of the six criteria (see Section 8.6 above). It is assumed that if 100 percent elimination of CSO sources does not result in attainment, the UAA would include factor number 3 at a minimum as justification (human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied, or would cause more environmental damage to correct than to leave in place).

As discussed in Section 2.0 and 6.0, Westchester County sources, NYC CSOs, NYC stormwater and direct drainage contribute to bacteria levels in the Hutchinson River. As noted in Table 6-19 of Section 6.0, Westchester County sources contribute all of the fecal coliform and enterococci bacteria to freshwater section of the river at stations HR-09 through HR-07. The highest fecal coliform and enterococci concentrations calculated in the tidal portion of the river occur at station HR-06. For the year 2008, fecal coliform at station HR-06, Westchester County sources contribute a maximum monthly GM of 800 cfu/100mL, NYC stormwater discharges and direct drainage contribute a maximum monthly GM of 102 cfu/100mL, and NYC CSO contributes 192 cfu/100mL at this location. Even with 100 percent CSO control, the non-CSO sources would cause an exceedance in the fecal coliform standard. At station HR-06, the major contributors to enterococci are Westchester County sources with 122 cfu/100mL. NYC stormwater and direct drainage contribute 20 cfu/100mL and CSOs contribute 13 cfu/100mL to the maximum 30-day GM. It should be noted that the non-CSO sources alone result in maximum recreation period 30-day GM concentrations of enterococci that are higher than the Future Primary Contact WQ Criterion of 30 cfu/100mL for the Hutchinson River.

To reduce bacteria loads to the Hutchinson River, Westchester County municipalities will be required to eliminate dry-weather discharges and illicit connections. However, even when these sources are abated, Westchester County will continue to contribute bacteria to the Hutchinson River via other sources. Thus, while DEP has proposed a plan to invest additional resources to reduce bacteria discharged from Hutchinson River CSOs (which will also capture the WLA allocation for NYC stormwater) during the recreational season, there will continue to be other sources of bacteria that will preclude attainment of the existing and future WQS criteria within portions the Hutchinson River.

8.6.b Fishable/Swimmable Waters

As noted in Section 8.1, and in other previous sections, the goal of this LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific WQS, consistent with EPA's CSO Control Policy and subsequent guidance. DEC considers the SA and SB classifications as fulfillment of the CWA's fishable/swimmable goal.

The preferred alternative summarized in Section 8.5 results in the following levels of attainment with fishable/swimmable criterion.

Water quality modeling analyses, conducted for the Hutchinson River and summarized in Tables 8-17 and 8-18, shows that the freshwater section of the river is not predicted to comply with the Existing WQ Criteria (Class SB) monthly fecal coliform criterion of 200 cfu/100mL during the 10-year simulation period. In the tidal portion of the river, annual fecal coliform attainment is calculated to be between 77 and 100 percent over the entire length of the river, on average, during the 10-year simulation period. For the recreational season, the freshwater section continues to have 0 percent attainment while the tidal section improves to 92 to 100 percent attainment for fecal coliform.

Compliance with the Future Primary Contact WQ Criteria of 30 cfu/100mL for enterococci is predicted (Table 8-18) to be lower than attainment of the fecal coliform criterion. Attainment of the enterococci 30-day rolling GM during the recreational season is 0 percent in the freshwater section and between 41 and 99 percent from station HR-06 to HR-01. Attainment of the 110 cfu/100mL STV concentration during the recreational season is 0 percent in the freshwater section and between 3 and 60 percent from station HR-06 to HR-01.

As noted, DEP is proposing disinfection of HP-024 during the recreational season to reduce the human source of bacteria during the recreational season (May 1st through October 31st). Even with CSO disinfection, the results are not predicted to change Hutchinson River compliance sufficiently enough to attain Existing WQ Criteria 100 percent of the time throughout the entire river because of the remaining bacteria sources. Since the Existing WQ Criteria (Class SB) standards are projected to be un-attainable, a UAA is required at this time for the Hutchinson River.

A UAA is required to justify this based on the relevant criteria listed above. Since the analyses prove that even 100 percent elimination of CSO sources does not result in attainment, the UAA includes a discussion of factor number 3 as justification (human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied, or would cause more environmental damage to correct than to leave in place). The UAA also cites the lack of access and channel suitability for primary contact recreational activities.

8.6.c Assessment of Highest Attainable Use

The analyses contained herein, as noted above in Section 8.5c and summarized in Table 8-20, indicate that the existing use (Class SB), as well as the existing use with Future Primary Contact WQ Criteria, are not projected to be attained within the Hutchinson River with the preferred alternative. Further, analyses conducted and described in Section 6.0 showed that even if 100 percent CSO control was achieved, this control would not result in full compliance with the existing Class SB 200 cfu/100mL fecal criterion or the 30-day rolling GM or 90th percentile STV enterococci criteria.

Table 8-20. Preferred Alternative Compliance with Clean Water Act Bacteria Water Quality Criteria (Annual Basis)

Bacteria Standards Met Under Preferred Alternative	
Existing WQ Criteria	**Future Primary Contact WQ Criteria**
<95 Percent Attainment	<95 Percent Attainment

The modeling analysis assessed whether the preferred plan would improve water quality to allow for the existing use (Class SB) primary contact recreation, both annually and during the recreational season, as well as for the Future Primary WQ criteria during the recreational season. As shown in Tables 8-17 and 8-18, fecal coliform bacteria levels do not attain the Class SB criterion with construction of the preferred plan and planned GI on an annual basis. The Hutchinson River cannot fully attain the existing Class SB fecal coliform criterion along the entire length of the river or the Future Primary WQ enterococci criteria through CSO controls alone.

8.7 Water Quality Goals

DEP has developed an approach to move toward the goal of primary contact recreation water quality conditions with the preferred alternative. However, as noted, the EPA RWQC primary contact recreation geometric mean criteria (GM or STV) cannot be fully attained in the Hutchinson River even with this additional level of protection. Therefore, DEP is proposing that (a) DEC consider site-specific water quality geometric mean targets for the Hutchinson River, and (b) DEP issue advisories for periods when elevated bacteria concentrations are present in primary contact waters, and (c) DEC not adopt RWQC STV values as proposed at 110 or 130 cfu/100mL. The advisory approach is an approach that has been in place at NYC DOHMH certified bathing beaches for many years (http://www.nyc.gov/html/doh/html/environmental/beach-homepage.shtml).

8.7.a Site-Specific Water Quality Targets

Based on the analyses of the waterbodies, and the WQS associated with the designated uses, the following conclusions can be drawn:

The Hutchinson River does not currently meet the Existing WQ Criteria for fecal coliform. Also, the Hutchinson River will not meet the existing water standard for fecal coliform on an annual basis nor will it meet the Future Primary Contact Recreation criteria for enterococci with the preferred plan. The primary reason for nonattainment is non-NYC CSO discharges. Without controlling the loads from the non-CSO sources identified in the WLA, it is not feasible for the Hutchinson River to fully meet existing or future WQS.

As described later in Section 9.0, DEP is committed to investigating ways to improve water quality in the Hutchinson River. DEP is committed to completing the construction of the GI that is part of the baseline condition and the implementation of the preferred alternative. Therefore, although attaining fishable/swimmable WQS in the Hutchinson River is a long term future target, non-NYC sources, manmade features and industrial uses prevent the opportunity and feasibility of primary contact recreation in the Hutchinson River.

Future Water Quality

DEP is committed to improving water quality in the Hutchinson River. Recreational season disinfection of the overflow that controls the WLA for both NYC CSO and stormwater from HP-024 is a major step in improving water quality in the Hutchinson River. Toward that end, DEP suggests that site-specific water quality targets be established for the tidal section of the Hutchinson River that will provide a feasible compliance target and also allow DEP to continue to improve water quality in the system over time. Site-specific targets are suggested to advance towards the numerical limits established by DEC, SC bacteria standards and Future Primary Contact WQ Criteria with 2012 EPA RWQC. These targets are shown in Table 8-21 for the recreational season and discussed below for both the recreational and non-recreational seasons.

DEP has identified the following attainable bacteria targets:

- Recreational Season (May 1st through October 31st): Uses of the Hutchinson River are generally oriented around the recreational season. During the recreational season, boaters use the waters. The preferred alternative in Section 8.5 is recreational season disinfection of the HP-024 effluent up to 50 MGD so that human bacteria discharged from the outfall are reduced. DEP projects the potential to attain the following numerical site-specific targets during the recreational season against which additional water quality improvements could be measured:

  Upper Hutchinson River tidal section – Interstate 95 north to East Colonial Avenue

    Maximum rolling 30-day GM enterococci value of 150 cfu/100mL

    Monthly fecal coliform GM concentration of 400 cfu/100mL

  Lower Hutchinson River tidal section – south of Interstate 95

    Maximum rolling 30-day GM enterococci value of 100 cfu/100mL

    Monthly fecal coliform GM concentration of 200 cfu/100mL

- Non-recreational Season (November 1st through April 30th): Uses in the Hutchinson River are reduced; boating is still an activity for the transition periods between summer and winter. DEP projects the potential to attain the following numerical site-specific targets during the non-recreational season against which additional water quality improvements could be measured:

  Upper Hutchinson River tidal section – Interstate 95 north to East Colonial Avenue

  Monthly fecal coliform GM concentration of 600 cfu/100mL

  Lower Hutchinson River tidal section – south of Interstate 95

  Monthly fecal coliform GM concentration of 400 cfu/100mL

The identified recreational season water quality targets are summarized in Table 8-21 in comparison to the bacteria water quality 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. A post construction monitoring (PCM) program will be implemented upon completion of the preferred CSO control alternative. The PCM will be used to gauge the effectiveness of this CSO control technology, but could also be used to assess the success of ongoing regulatory actions in Westchester County and, if appropriate, be used as a basis for adjusting the site-specific criteria presented in the UAA.

Table 8-21. Summary of Recreational Season Bacteria Water Quality Targets for the Tidal Section of the Huchinson River

Location	Existing WQ Criteria	Future Primary Contact WQ Criteria	Site-Specific Targets with Disinfection (cfu/100mL)	Attainment with Site-Specific Targets (%)
Upper Tidal River	Fecal Coliform ≤ 200	Fecal Coliform No change	Fecal Coliform ≤ 400	96
	Enterococci N/A	Enterococci ≤ 30	Enterococci ≤ 150	95
Lower Tidal River	Fecal Coliform ≤ 200	Fecal Coliform No change	Fecal Coliform ≤ 200	95
	Enterococci N/A	Enterococci ≤ 30	Enterococci ≤ 100	95

Also as noted, DEP does not believe that adoption of the STV portions of the 2012 EPA RWQC is warranted at this time for the Hutchinson River. Analyses presented herein clearly show that adoption of STV values of 110 cfu/100mL is not attainable. Alternatively, DEP believes that if an STV value is required, it should be derived specifically for individual portions of the Hutchinson based on measured enterococci concentrations and their variability.

> **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; ….

Within the Hutchinson River concentrations of bacteria are elevated during and after rainfall events. Toward that end, DEP has reviewed the NYSDOH guidelines relative to single sample maximum bacteria concentrations that they believe "constitutes a potential hazard to health if used for bathing." The presumption is that if the bacteria concentrations are lower than these levels, then the waterbodies do not pose a potential hazard if primary contact is practiced.

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 described herein assess the amount time following the end of rainfall required for the Hutchinson River to recover and return to concentrations less than 1,000 cfu/100mL fecal coliform and 110 cfu/100mL enterococci. In the EPA 2012 guidance document one of its recommendations is the use of a Beach Action Value (BAV) for making beach notification decisions. For states that do not use a BAV, EPA suggested using the criteria STV values as "do not exceed" values for beach notifications. Based on this guidance an enterococci concentration of 110 cfu/100mL was chosen for the time to recover analysis.

The analyses consisted of examining the water quality model calculated Hutchinson River bacteria concentrations for recreational periods (May 1st through October 31st) extracted from 10 years of model simulations. The time to return (or "time to recover") to 1,000 or 110 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 8-22 for the stations in the NYC portion of the tidal section of the Hutchinson River. 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. Recovery times are generally less than 60 hours for enterococci and less than 36 hours for fecal coliform during the recreational season.

Table 8-22. Tidal Section Time to Recover (hours) To Fecal = 1,000 cfu/100mL and Entero = 110 cfu/100mL

	HR-05		HR-04		HR-03		HR-02		HR-01	
Rain Event Size (in)	Fecal	Entero	Fecal	Entero	Fecal	Entero	Fecal	Entero	Fecal	Entero
<0.1	-	-	-	-	-	-	-	-	-	-
0.1-0.4	-	-	-	-	-	-	-	-	-	-
0.4-0.8	20	46	11	41	14	38	5	28	-	-
0.8-1.0	27	54	25	49	23	49	14	41	-	-
1.0-1.5	36	60	30	55	25	54	21	49	-	-
>1.5	36[(1)]	60[(1)]	29	55	28	54	28	52	7	31

Notes:

(1) In a few cases the time to recover was calculated to be less than the next smaller rain event bin. In those cases, both bins were set equal to the higher time to recover.

8.8 Recommended LTCP Elements to Meet Water Quality Goals

Water quality in Hutchinson River will be improved with the preferred alternative set forth and the implementation of the planned GI projects and other actions identified herein.

The actions identified in this LTCP include:

1. Alternative 12 – Seasonal Disinfection of 50 MGD of CSO in a 1,200 foot long, 10 foot diameter pipe, including a new outfall to the river, has been identified as the preferred alternative. Appropriate floatables control measures for the new outfall will be evaluated during design. The estimated construction cost is $90M (Class 5 range $45M to $180M) and the annual O&M cost is $1.25M. The net present worth for the $90M construction cost and annual O&M costs is $108M. The new disinfection facility would be operational during the recreational season (May 1st through October 31st), and would provide a 23 percent reduction in CSO bacteria loadings to the tidal section for the August 2011 period. Under the WLA approach, which assumes freshwater in compliance, a 17 percent CSO reduction with no stormwater reductions for the August 2011 model run would result in 97.5 percent attainment over the 10-year period of analysis. Therefore, no future stormwater reductions are required to meet the WLA load reduction target with this identified preferred alternative. Although this LTCP concerns CSOs, DEP believes this alternative is the most cost effective solution for both CSO and stormwater and is therefore going beyond the focus of this LTCP to address both wet weather sources.

2. Section 9.0 presents the implementation of the identified elements. Significant coordination, funding approvals, land acquisitions and permitting will be required for the design and construction.

3. A UAA is provided with site-specific targets for the NYC tidal section in Appendix D.

4. DEP will continue to invest in water quality improvements through the Green Infrastructure program.

DEP is committed to improving water quality in this waterbody, which will be advanced by the improvements and actions identified in this plan. These identified actions have been balanced with input from the public and awareness of the cost to the citizens of New York City.

9.0 LONG-TERM CSO CONTROL PLAN IMPLEMENTATION

The evaluations performed for this Hutchinson River Long Term Control Plan (LTCP) concluded that Alternative 12, 50 MGD Seasonal Disinfection in New Outfall HP-024, is the preferred alternative. This conclusion was the result of the cost performance and cost attainment analyses that were presented in Section 8.5 that showed that Seasonal Disinfection would provide a high level of attainment with current water quality standards (WQS) and the significantly more costly alternatives would only result in marginal improvements over that predicted for Alternative 12. As demonstrated in both Sections 6.0 and 8.0, due to the influence of non-NYC wet weather sources to the river, significant gains in WQS attainment cannot be achieved through the control of the combined sewer overflow (CSO) discharges alone.

9.1 Adaptive Management (Phased Implementation)

Adaptive management, as defined by EPA, is the process by which new information about the characteristics of a watershed is incorporated into a watershed management plan. The process relies on establishing a monitoring program, evaluating monitoring data and trends and making adjustments or changes to the plan. In the case of this LTCP, DEP will continue to apply the principles of adaptive management based on its annual evaluation of monitoring data which will be collected to optimize the operation and effectiveness once the actions identified in this LTCP are constructed.

Another aspect of the LTCP’s phased adaptive management relates to interim or incremental water quality. Because of the inability to meet existing and Future Primary Contact WQ Criteria (2012 EPA RWQC), the concept of “Site-Specific Targets” is discussed for the Hutchinson River in Section 8.7 and Appendix D. The water quality of the river will be monitored and compared with these incremental targets as part of PCM.

NYC will also develop a program to further address stormwater discharges as part of the upcoming MS4 permit. This program, along with the actions identified in this LTCP, may further improve water quality in the Hutchinson River.

DEP will also continue to monitor water quality of the river through its ongoing monitoring programs. When evidence of dry weather sources of pollution is found, track downs will be initiated. Such activities will be reported to DEC on a quarterly basis as is currently required under the WWTP SPDE) permit.

9.2 Implementation Schedule

The implementation schedule to construct the facilities associated with the 50 MGD Seasonal Disinfection and New Outfall HP-024 is presented in Figure 9-1. The schedule presents the duration of time needed perform the engineering design, advertise and bid the construction contracts and complete the construction of the actions identified in this LTCP.

The required facilities identified in this LTCP will be designed and constructed in two phases. Phase I will involve the work necessary to construct the new outfall sewer and Phase II will include the work needed for the disinfection facility and floatables control. Phasing of the work is required as the outfall alignment will need to be finalized prior to the initiation of the design of the disinfection facility and floatables control. The implementation schedule begins with the approval of this LTCP by DEC. As three waterbodies –

Westchester Creek, Hutchinson River, and Bronx River – are part one sewershed, as detailed below, it may be prudent to revisit this schedule upon the completion of the Bronx River LTCP when the interrelationships among these three waterbodies is fully understood.

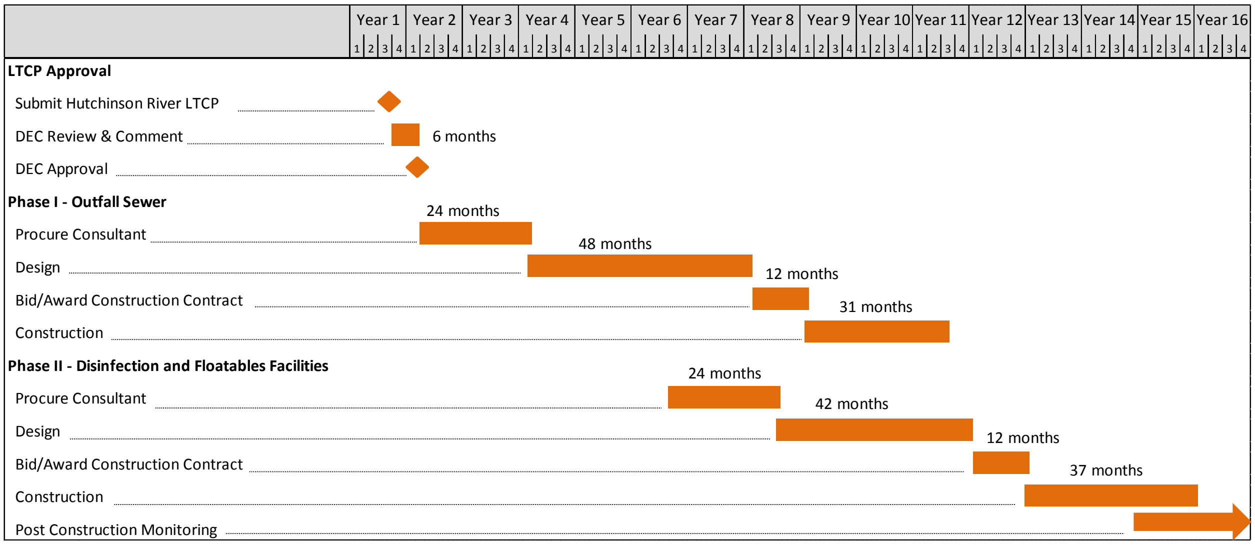


Figure 9-1. Implementation Schedule

Implementation Schedule: Considerations using a Sewershed Approach

In addition to this Hutchinson River LTCP, there are two other waterbodies in the Bronx for which LTCPs have been or will be developed. Westchester Creek LTCP was submitted to DEC in June 2014. Bronx River LTCP will be developed and submitted in 2015. The watersheds within NYC boundaries for these three waterbodies all drain via the combined sewer system to the Hunts Point WWTP, thereby forming a "sewershed". This interconnectivity lends itself to a watershed approach which can more accurately assess pollutant sources that result in nonattainment of WQS and for prioritizing the implementation schedule for proposed remedies that will result in the greatest benefit for water quality and the community as a whole.

As the combined sewer system for each of these waterbodies is hydraulically connected, potential remedies that reduce CSO in one waterbody by capturing and conveying larger flows to the WWTP may adversely affect conditions in the other waterbodies. Specifically, increased conveyance from the Bronx River collection system is capable of displacing capacity in the interceptor and would cause overflows to occur sooner and more frequently in the Westchester Creek and Hutchinson River systems. Conversely, pump station improvements in the Westchester Creek or Hutchinson River watersheds would supply flow to the Hunts Point WWTP more quickly and could negatively impact the Bronx River collection system hydraulics, resulting in increased CSO volume.

In addition to hydraulic interrelationships among the three waterbodies, there are differences among the uses reported for each waterbody by residents. The Bronx River, for example, is highly regarded as a cultural and environmental resource. Residents have indicated high levels of recreational use ranging from kayaking to swimming along stretches of the Bronx River during the recreational season. Conversely, Westchester Creek and Hutchinson River experience far lower levels of waterfront and in-water activity. Thus, depending on the findings of the Bronx River LTCP, prioritizing investments in the Bronx River may be a preferred approach.

NYC has finite resources to invest in water quality improvements. Other factors, such as manmade conditions and the importance of continuing certain industrial uses and navigation of particular waterbodies, must also be considered. NYC must be cognizant of costs and the associated benefits of selected water quality improvements. DEP seeks to develop a prioritization plan which takes into account these multiple considerations as well as others which might be identified. A phased approach to water quality investments will require weighing multiple priorities and developing an implementation schedule reflective of them all.

Development of the most effective plans and implementation schedule requires the full analysis of each of the three waterbodies within the Hunts Point sewershed. Therefore, the implementation schedule should be adaptive to include additional information and/or adjustments once this sewershed analysis is completed.

9.3 Operation Plan/O&M

DEP is committed to effectively operating the Hutchinson River LTCP components as they are built-out during the implementation period. To the extent DEP has information from other seasonal CSO disinfection facilities, DEP will apply lessons-learned to maximize efficient operations and water quality benefits.

9.4 Projected Water Quality Improvements

As described in Section 8.4, Alternative 12 will result in improved water quality in the saline portion of the Hutchinson River including a high degree of reduction of the human or CSO-derived bacteria during the recreational season. Improvements in water quality will also be realized as GI projects are built-out.

Other improvements in water quality are expected to continue as the result of reduction in the amount of bacteria discharged from Westchester County sources, as well as from implementation of NYC's MS4s program.

9.5 Post Construction Monitoring Plan and Program Reassessment

A PCM program will be developed as part of the implementation of the Hutchinson River LTCP. PCM will be integral to the optimization of LTCP implementation, providing data for model validation, feedback to facility operations, and an assessment metric for the effectiveness of these facilities. Specifically this will include monitoring of facilities associated with Alternative 12, described in Section 8.5, plus the build-out of the GI described in Section 5.0, which is included in the LTCP Baseline Conditions of Section 6.0. Prior to the initiation of the PCM program, DEP will continue to perform its ongoing monitoring programs including Harbor Survey Monitoring (see Section 4.0) and Sentinel Monitoring of the shoreline.

9.6 Consistency with Federal CSO Policy

The Hutchinson River LTCP was developed to comply with the requirements of the EPA CSO Control Policy and associated guidance documents, and the CWA. Development of the LTCP revealed that even with 100 percent CSO control the river cannot attain the Existing WQ Criteria on an annual basis nor support the Future Primary Contact WQ Criteria,. It also showed that the Hutchinson River is not suitable for primary contact recreation due to several natural and manmade factors listed in the UAA discussion of Section 8.6. A UAA has therefore been prepared and is attached to the LTCP (see Appendix D) as a means to formally demonstrate and acknowledge the suitability of site-specific criteria for the Hutchinson River.

9.6.a Affordability and Financial Capability

EPA has recognized the importance of taking a community's financial status into consideration, and in 1997, issued "Combined Sewer Overflows: Guidance for Financial Capability Assessment and Schedule Development." This financial capability guidance contains a two-phased assessment approach. Phase I examines affordability in terms of impacts to residential households. This analysis applies the residential indicator (RI), which examines the average cost of household water pollution costs (wastewater and stormwater) relative to a benchmark of two percent of service area-wide median household income (MHI). The results of this preliminary screening analysis are assessed by placing the community in one of three categories:

- Low economic impact: average wastewater bills are less than one percent of MHI.
- Mid-range economic impact: average wastewater bills are between one percent and two percent of MHI.
- Large economic impact: average wastewater bills are greater than two percent of MHI.

The second phase develops the Permittee Financial Capability Indicators (FCI), which examine several metrics related to the financial health and capabilities of the impacted community. The indicators are compared to national benchmarks and are used to generate a score that is the average of six economic indicators, including bond rating, net debt, MHI, local unemployment, property tax burden, and property tax collection rate within a service area. Lower FCI scores imply weaker economic conditions and thus the increased likelihood that additional controls would cause substantial economic impact.

The results of the RI and the FCI are then combined in a Financial Capability Matrix to give an overall assessment of the permittee's financial capability. The result of this combined assessment can be used to establish an appropriate CSO control implementation schedule.

Importantly, EPA recognizes that the procedures set out in its Guidance are not the only appropriate analyses to evaluate a community's ability to comply with CWA requirements. EPA's 2001 "Guidance: Coordinating CSO Long-term Planning with Water Quality Standards Reviews" emphasizes this by stating:

> *The 1997 Guidance "identifies the analyses states may use to support this determination [substantial and widespread impact] for water pollution control projects, including CSO LTCPs. States may also use alternative analyses and criteria to support this determination, provided they explain the basis for these alternative analyses and/or criteria* (U.S. EPA, 2001, p. 31,).

Likewise, EPA has recognized that its RI and FCI metrics are not the sole socioeconomic basis for considering an appropriate CSO compliance schedule. EPA's 1997 Guidance recognizes that there may be other important factors in determining an appropriate compliance schedule for a community, and contains the following statement that authorizes communities to submit information beyond that which is contained in the guidance:

> *It must be emphasized that the financial indicators found in this guidance might not present the most complete picture of a permittee's financial capability to fund the CSO controls. … Since flexibility is an important aspect of the CSO Policy, permittees are encouraged to submit any additional documentation that would create a more accurate and complete picture of their financial capability* (U.S. EPA, 1997, p. 7,).

Furthermore, EPA in 2012 released its "Integrated Municipal Stormwater and Wastewater Planning Approach Framework," which is supportive of a flexible approach to prioritizing projects with the greatest water quality benefits and the use of innovative approaches like green infrastructure (U.S. EPA, 2012). EPA, in conversation with communities, the U.S. Conference of Mayors, and the National Association of Clean Water Agencies, is also preparing a Financial Capability Framework which clarifies and explains the flexibility within their CSO guidance.

This section of this LTCP begins to explore affordability and financial capability concerns as outlined in the 1997 and 2001 Guidance documents. This section will also explore additional socioeconomic indicators that reflect affordability concerns within the NYC context. As DEP is tasked with preparing ten LTCPs for individual waterbodies and one LTCP for the East River and Open Waters, DEP expects that a complete picture of the effect of the comprehensive CSO Program would be available in 2017 to coincide with the schedule for completion of all the plans.

9.6.a.1 Background on DEP Spending

As the largest water and wastewater utility in the nation, DEP provides over a billion gallons of drinking water daily to more than eight million NYC residents, visitors and commuters, as well as, one million upstate customers. DEP maintains over 2,000 square miles of watershed comprised of 19 reservoirs, three controlled lakes, several aqueducts, and 6,600 miles of water mains and distribution pipes. DEP also collects and treats wastewater. Averaged across the year, the system treats approximately 1.3 billion gallons of wastewater per day collected through 7,400 miles of sewers, 95 pump stations and 14 in-city WWTP. In wet weather, the system can treat up to 3.5 billion gallons per day of combined storm and sanitary flow. In addition to the WWTPs, DEP has four CSO storage facilities. DEP recently launched a $2.4B GI program, of which $1.5B will be funded by DEP, and the remainder will be funded through private partnerships.

9.6.a.2 Currently Budgeted and Recent Completed Mandated Programs

As shown in Figure 9-2, from Fiscal Year (FY) 2002 through FY 2013, 62 percent of DEP's capital spending was for wastewater and water mandates. Many projects have been important investments that safe-guard our water supply and improve the water quality of our receiving waters in the Harbor and its estuaries. These mandates and associated programs are described below.

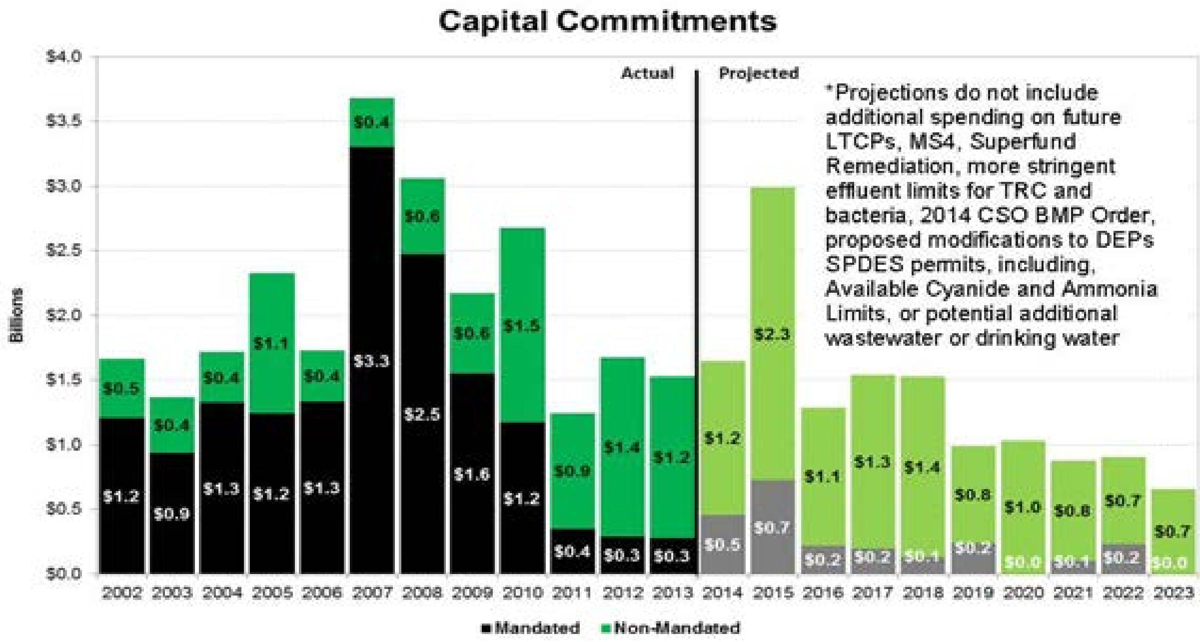


Figure 9-2. Historical and Projected Capital Commitments

Wastewater Mandated Programs

The following wastewater programs and projects have been initiated to comply with Federal and state laws and permits:

- CSO abatement and stormwater management programs

  DEP has initiated a number of projects to reduce CSOs and eliminate excess infiltration and inflow of groundwater and stormwater into the wastewater system. These projects include: construction of CSO abatement facilities, optimization of the wastewater system to reduce the volume of CSO discharge, controls to prevent debris that enters the combined wastewater system from being discharged, dredging of CSO sediments that contribute to low DO and poor aesthetic conditions, and other water quality based enhancements to enable attainment of the WQS. These initiatives impact both the capital investments that must be made by DEP as well as operations and maintenance (O&M) expenses. Historical commitments and those currently in DEP's ten year capital plan for CSOs are estimated to be about $3.3B. FY13 annual operating costs for stormwater expenses are estimated to have been about $63M. DEP expects that it will be required to make additional investments in stormwater controls pursuant to MS4 requirements.

- Biological nutrient removal

  In 2006, NYC entered into a Consent Judgment (Judgment) with the DEC, which required DEP to upgrade five WWTPs by 2017 in order to reduce nitrogen discharges and comply with draft SPDES nitrogen limits. Pursuant to a modification and amendment to the Judgment, DEP has agreed to upgrade three additional WWTPs and to install additional nitrogen controls at one of the WWTPs, which was included in the original Judgment. As in the case of CSOs and stormwater, these initiatives include capital investments made by DEP ($280M to date and an additional $123M in the 10-year capital plan) as well as O&M expenses (chemicals alone in FY13 amounted to $2.5M).

- Wastewater Treatment Plant Upgrades

  The Newtown Creek WWTP has been upgraded to secondary treatment pursuant to the terms of a Consent Judgment with DEC. The total cost of the upgrade is estimated to be $5B. In 2011, DEP certified that the Newtown Creek WWTP met the effluent discharge requirements of the CWA, bringing all 14 WWTPs into compliance with the secondary treatment requirements.

Drinking Water Mandated Programs

Under the federal Safe Drinking Water Act and the New York State Sanitary Code, water suppliers are required to either filter their surface water supplies or obtain and comply with a determination from EPA that allows them to avoid filtration. In addition, EPA has promulgated a rule known as Long Term 2 (LT2) that requires that unfiltered water supplies receive a second level of pathogen treatment [e.g., ultraviolet (UV) treatment in addition to chlorination] by April 2012. LT2 also requires water suppliers to cover or treat water from storage water reservoirs. The following DEP projects have been undertaken in response to these mandates:

- Croton Watershed - Croton Water Treatment Plant

  Historically, NYC’s water has not been filtered because of its good quality and long retention times in reservoirs. However, more stringent federal standards relating to surface water treatment have resulted in a federal court consent decree (the Croton Water Treatment Plant Consent Decree), which mandates the construction of a full-scale water treatment facility to filter water from NYC’s Croton watershed. Construction on the Croton Water Treatment Plant began in late 2004. DEP estimates that the facility will begin operating in 2015. To date, DEP has committed roughly $3.2B in capital costs. During start-up and after commencement of operations, DEP will also incur annual expenses for labor, power, chemicals, and other costs associated with plant O&M. For FY15, O&M costs are estimated to be about $23M.

- Catskill/Delaware Watershed - Filtration Avoidance Determination

  Since 1993, DEP has been operating under a series of Filtration Avoidance Determinations (FADs), which allow NYC to avoid filtering surface water from the Catskill and Delaware systems. In 2007, EPA issued a new FAD (2007 FAD), which requires NYC to take certain actions over a ten-year period to protect the Catskill and Delaware water supplies. In 2014, the New York State Department of Health (DOH) issued mid-term revisions to the 2007 FAD. Additional funding has been added to the Capital Improvement Plan (CIP) through 2017 to support these mid-term FAD revisions. DEP has committed about $1.5B to date and anticipates that expenditures for the current FAD will amount to $200M.

- UV Disinfection Facility

  In January 2007, DEP entered into an Administrative Order on Consent (UV Order) with EPA pursuant to EPA's authority under LT2 requiring DEP to construct a UV facility by 2012. Since late 2012, water from the Catskill and Delaware watersheds has been treated at DEP's new UV disinfection facility in order to achieve Cryptosporidium inactivation. To date, capital costs committed to the project amount to $1.6B. DEP is also now incurring annual expenses for property taxes, labor, power, and other costs related to plant O&M. FY13 O&M costs were $20.8M including taxes.

9.6.a.3 Future System Investment

Over the next nine years, the percentage of already identified mandated project costs in the CIP is anticipated to decrease, but DEP will be funding critical but non-mandated state of good repair projects and other projects needed to maintain NYC's infrastructure to deliver clean water and treat wastewater. Moreover, DEP anticipates that there will be additional mandated investments as a result of MS4 compliance, proposed modifications to DEP's in-city WWTP SPDES permits, Superfund remediation, CSO LTCPs, and the 2014 CSO Best Management Practices Consent Order. It is also possible that DEP will be required to invest in an expensive cover for Hillview Reservoir as well as other additional wastewater and drinking water mandates. Additional details for anticipated future mandated and non-mandated wastewater programs are provided below, with the exception of CSO LTCPs which are presented in Section 9.6.f.

Potential or Unbudgeted Wastewater Regulations

- MS4 Permit Compliance

  Currently, DEP's separate stormwater system is regulated through DEP's 14 WWTP-specific SPDES permits. On February 5, 2014, DEC issued a draft MS4 permit that will cover MS4 separate stormwater systems for all City agencies. Under the proposed MS4 permit, the permittee will be NYC.

  DEP will be responsible for developing a stormwater management program plan for NYC to facilitate compliance with the proposed permit terms as required by DEC. This plan will also develop the legal authority to implement and enforce the stormwater management program as well as develop enforcement and tracking measures and provide adequate resources to comply with the MS4 permit. Some of the potential permit conditions identified through this plan may result in increased costs to DEP and those costs will be more clearly defined upon completion of the plan. The permit also requires NYC to conduct fiscal analysis of the capital and O&M expenditures necessary to meet the requirements of this permit, including any development, implementation and enforcement activities required, within three years of the Effective Permit date.

  The draft MS4 permit compliance costs are yet to be estimated. DEP's annual historic stormwater capital and O&M costs have averaged $131.6M. However, given the more stringent draft permit requirements, future MS4 compliance costs are anticipated to be significantly higher than DEP's current stormwater program costs. The future compliance costs will also be shared by other NYC departments that are responsible for managing stormwater. Total compliance costs for stormwater programs in other major urban areas, such as Philadelphia and Washington DC, are projected to be \$2.4B and \$2.6B, respectively, which will result in extensive annual expenditures. Each of these programs contains both grey and green infrastructure components, similar to those anticipated for NYC, to meet mandated requirements. The geographic area covered by NYC's MS4 program is larger than the MS4 area in either Philadelphia or Washington DC. NYC's MS4 area is over 131 square miles, while Philadelphia's MS4 area is just over 78 square miles, and Washington DC's area is even less at approximately 31 square miles, or about 25 percent of that in NYC.

- Draft SPDES Permit Compliance

  In June 2013, DEC issued draft SPDES permits which, if finalized, will have a substantial impact on DEP's Total Residual Chlorine (TRC) program and set more stringent ammonia and available cyanide limits. These proposed modifications include requirements that DEP:

  - Perform a degradation study to evaluate the degradation of TRC from the chlorine contact tanks to the edge of the designated mixing zone for comparison to the water-quality-based effluent limit and standard. The scope of work for this study is required within six months of the effective date of the SPDES permit, and the study must be completed 18 months after the approval of the scope of work. Based upon verbal discussions with DEC, DEP believes that this study may result in the elimination of the 0.4 mg/L uptake credit previously included in the calculation of TRC limits thereby decreasing the effective TRC limits by 0.4 mg/L at every WWTP.

  - Comply with new unionized ammonia limits. These proposed limits will, at some WWTP, potentially interfere with the chlorination process, particularly at 26th Ward and Jamaica.

  - Monitor for available cyanide and ultimately comply with a final effluent limit for available cyanide. Available cyanide can be a byproduct of the chlorination process.

  - DEC has also advised DEP that fecal coliform, the parameter that has been historically used to evaluate pathogen kills and chlorination performance/control, will be changing to enterococcus. This change will likely be incorporated in the next round of SPDES permits scheduled in the next five years. Enterococcus has been shown to be harder to kill with chlorine and may require process changes to disinfection that would eliminate the option of adding de-chlorination after the existing chlorination process.

  The potential future costs for these programs have yet to be determined. Preliminary compliance costs for TRC control and ammonia control are estimated to be up to \$560M and \$840M, respectively.

- CSO Best Management Practices Order

  On May 8, 2014, DEC and DEP entered into an agreement for the monitoring of CSO compliance, reporting requirements for bypasses, and notification of equipment out of service at the WWTP during rain events. The 2014 CSO Best Management Practice (BMP) Order on Consent incorporates, expands, and supersedes the 2010 CSO BMP Order by requiring DEP to install new monitoring equipment at identified key regulators and outfalls and to assess compliance with requirements to "Maximize Flow to the WWTP". The costs for compliance for this Order have not yet been determined, but DEP expects this program to have significant capital costs as well as expense costs.

- Superfund Remediation

There are currently three Superfund sites in NYC, at various stages of investigation. The Gowanus Canal Remedial Investigation/Feasibility Study (RI/FS) is complete, and remedial design work will take place in the next three to five years. The Newtown Creek RI/FS completion is anticipated for 2018, and the Former Wolff-Alport Chemical Corporation has only recently been listed as a Superfund site.

DEP's ongoing costs for these projects are estimated at about $50-60M for the next ten years, not including design or construction costs for the Gowanus Canal. EPA's selected remedy for the Gowanus Canal requires that NYC build two combined sewage overflow retention tanks. While the EPA estimated cost is $78M, the DEP estimate based on actual construction experience in NYC is $380-760M for construction, with an additional $40-80M for design. Potential alternatives to the EPA selected remedy will be evaluated during the Gowanus LTCP process. Similar Superfund mandated CSO controls at Newtown Creek could add costs of $1-2B.

Potential, Unbudgeted Drinking Water Regulation

- Hillview Reservoir Cover

LT2 also mandates that water from uncovered storage facilities (including DEP's Hillview Reservoir) be treated or that the reservoir be covered. DEP has entered into an Administrative Order with the DOH and an Administrative Order with EPA, which mandate NYC to begin work on a reservoir cover by the end of 2018. In August 2011, EPA announced that it would review LT2 and its requirement to cover uncovered finished storage reservoirs such as Hillview. DEP has spent significant funds analyzing water quality, engineering options, and other matters relating to the Hillview Reservoir. Potential costs affiliated with construction are estimated to be on the order of $1.6B.

Other: State of Good Repair Projects and Sustainability/Resiliency Initiatives

Wastewater Projects

- Climate Resiliency

In October 2013, on the first anniversary of Hurricane Sandy, DEP released the NYC Wastewater Resiliency Plan, the nation's most detailed and comprehensive assessment of the risks that climate change poses to a wastewater collection and treatment system. The groundbreaking study, initiated in 2011 and expanded after Hurricane Sandy, was based on an asset-by-asset analysis of the risks from storm surge under new flood maps at all 14 WWTPs and 58 of NYC's pumping stations, representing more than $1B in infrastructure.

DEP estimates to spend $447M in cost-effective upgrades at these facilities to protect valuable equipment and minimize disruptions to critical services during future storms. It is estimated that investing in these protective measures today will help protect this infrastructure from over $2B in repeated flooding losses over the next 50 years. DEP is currently pursuing funding through the EPA State Revolving Fund Storm Mitigation Loan Program.

DEP will coordinate this work with the broader coastal protection initiatives, such as engineered barriers and wetlands, described in the 2013 report, “A Stronger, More Resilient New York,” and continue to implement the energy, drinking water, and drainage strategies identified in the report to mitigate the impacts of future extreme events and climate change. This includes ongoing efforts to reduce CSOs with green infrastructure as part of LTCPs and build-out of high level storm sewers that reduce both flooding and CSOs. It also includes build-out of storm sewers in areas of Queens with limited drainage and continued investments and build-out of the Bluebelt system.

- Energy projects at WWTPs

NYC’s blueprint for sustainability, *PlaNYC 2030: A Greener, Greater New York*, set a goal of reducing NYC’s greenhouse gases (GHG) emissions from 2006 levels by 30 percent by 2017. This goal was codified in 2008 under Local Law 22. In order to meet the PlaNYC goal, DEP is working to reduce energy consumption and GHG emissions through: reduction of fugitive methane emissions, investment in cost-effective, clean energy projects, and energy efficiency improvements.

Fugitive methane emissions from WWTPs currently account for approximately 170,000 metric tons (MT) of carbon emissions per year and 30 percent of DEP’s overall emissions. To reduce GHG emissions and to increase on-site, clean energy generation, DEP has set a target of 60 percent beneficial use of the biogas produced by 2017. Recent investments by DEP to repair leaks and upgrade emissions control equipment have already resulted in a 30 percent reduction of methane emissions since a peak in 2009. Going forward, DEP has approximately $500M allocated in its CIP to make additional system repairs to flares, digester domes, and digester gas piping, in order to maximize capture of fugitive emissions for beneficial use or flaring.

A 12 megawatt cogeneration system is currently in design for the North River WWTP and estimated to be in operation in Spring 2019. This project will replace ten direct-drive combustion engines, which are over 25 years old and use fuel oil, with five new gas engines enhancing the WWTP’s operational flexibility, reliability, and resiliency. The cogeneration system will produce enough energy to meet the WWTP’s base electrical demand and the thermal demand from the treatment process and building heat, in addition to meeting all of the WWTPs emergency power requirements. The project is taking a holistic approach and includes: (1) improvements to the solids handling process to increase biogas production and reduce treatment, transportation and disposal costs; (2) optimization of biogas usage through treatment and balancing improvements; and (3) flood proofing the facility to the latest FEMA 100-year flood elevations plus 32 inches to account for sea level rise. The cogeneration system will double the use of anaerobic digester gas produced on-site; eliminate fuel oil use, and off-set utility electricity use, which will reduce carbon emissions by over 10,000 metric tons per year, the equivalent of removing ~2,000 vehicles from the road. The total project cost is estimated at $212M. DEP is also initiating an investment-grade feasibility study to evaluate the installation of cogeneration at the Wards Island WWTP, NYC's second largest treatment WWTP.

To reduce energy use and increase energy efficiency, DEP has completed energy audits at all 14 in-city WWTPs. Close to 150 energy conservation measures (ECMs) relating to operational and equipment improvements to aeration, boilers, dewatering, digesters, HVAC, electrical, thickening and main sewage pumping systems have been identified and accepted for implementation. Energy reductions from these ECMs have the potential to reduce greenhouse gas emissions by over 160,000 MT of carbon emissions at an approximate cost of $140M. DEP is developing implementation plans for these measures.

Water Projects

- Water for the Future

  In 2011, DEP unveiled Water for the Future: a comprehensive program to permanently repair the leaks in the Delaware Aqueduct, which supplies half of New York's drinking water. Based on a 10-year investigation and more than $200M of preparatory construction work, DEP is currently designing a bypass for a section of the Delaware Aqueduct in Roseton and internal repairs for a tunnel section in Wawarsing. Since DEP must shut down the Aqueduct when it is ready to connect the bypass tunnel, DEP is working on projects that will supplement NYC's drinking water supply during the shutdown, such as developing the groundwater aquifers in Jamaica, Queens, and implementing demand reduction initiatives, such as offering a toilet replacement program. Construction of the shafts for the bypass tunnel is underway, and the project will culminate with the connection of the bypass tunnel in 2021. The cost for this project is estimated to be about $1.5B.

- Gilboa Dam

  DEP is currently investing in a major rehabilitation project at Gilboa Dam at Schoharie Reservoir. Reconstruction of the dam is the largest public works project in Schoharie County, and one of the largest in the entire Catskills. This project is estimated to cost roughly $440M.

As shown in Figure 9-3, increases in capital expenditures have resulted in increased debt. While confirmed expenditures may be on the decline over the next few years, debt service continues to be on the rise in future years, occupying a large percentage of DEP's operating budget (approximately 45 percent in FY15).

9.6.b Background on History of DEP Water and Sewer Rates

The NYC Water Board is responsible for setting water and wastewater rates sufficient to cover the costs of operating NYC's water supply and wastewater systems (the "System"). Water supply costs include those associated with water treatment, transmission, distribution, and maintaining a state of good repair. Wastewater service costs include those associated with wastewater conveyance and treatment, as well as stormwater service, and maintaining a state of good repair. The NYC Municipal Water Finance Authority ("MWFA") issues revenue bonds to finance NYC's water and wastewater capital programs, and the costs associated with debt service consume a significant portion of the System revenues.

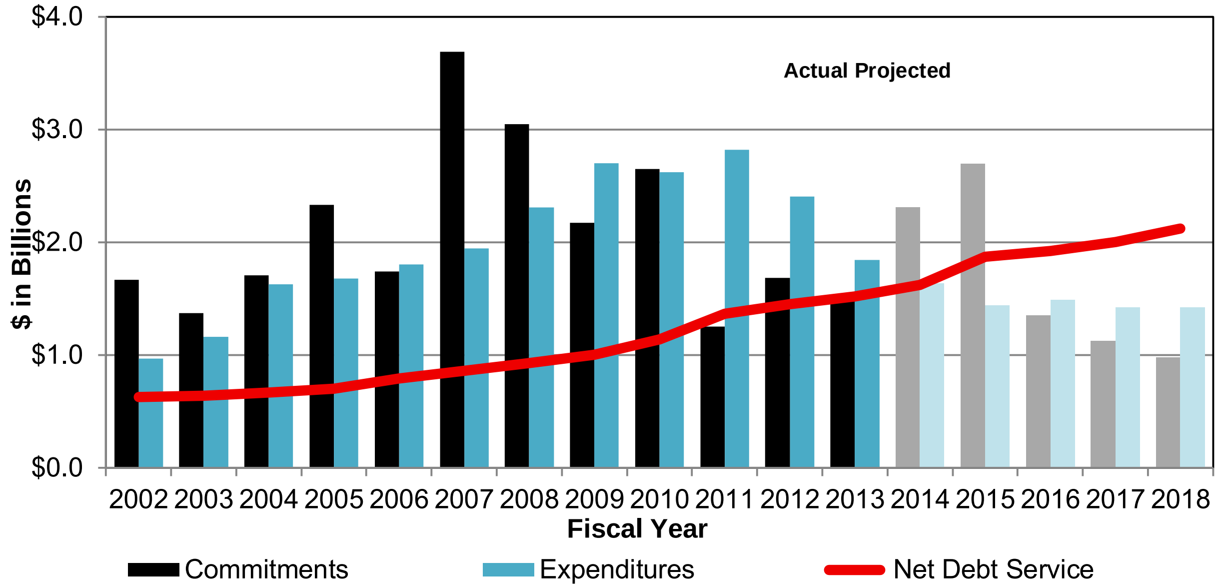


Figure 9-3. Past Costs and Debt Service

For FY15, most customers will be charged a uniform water rate of $0.49 per 100 gallons of water. Wastewater charges are levied at 159 percent of water charges ($0.79 per 100 gallons). There is a small percentage of properties that are billed a fixed rate. Under the Multifamily Conservation Program, some properties are billed at a fixed per-unit rate if they comply with certain conservation measures. Some nonprofit institutions are also granted exemption from water and wastewater charges on the condition that their consumption is metered and their consumption falls within specified consumption threshold levels. Select properties can also be granted exemption from wastewater charges (i.e., pay only for water services) if they can prove that they do not burden the wastewater system (e.g., they recycle wastewater for subsequent use onsite).

There are also currently a few programs that provide support and assistance for customers in financial distress. The Safety Net Referral Program uses an existing network of NYC agency and not-for-profit programs to help customers with financial counseling, low-cost loans, and legal services. The Water Debt Assistance Program (WDAP) provides temporary water debt relief for qualified property owners who are at risk of mortgage foreclosure. While water and wastewater charges are a lien on the property served, and NYC has the authority to sell these liens to a third party, or lienholder, in a process called a lien sale, DEP offers payment plans for customers who may have difficulty paying their entire bill at one time. The agency has undertaken an aggressive communications campaign to ensure customers know about these programs and any exclusions they may be qualified to receive, such as the Senior Citizens Homeowner's Exemption and the Disabled Homeowner's Exemption. DEP also just announced the creation of a Home Water Assistance Program (HWAP) to assist low-income homeowners. In this program, DEP will partner with the NYC Human Resources Administration (HRA), which administers the Federal Home Energy Assistance Program (HEAP), to identify homeowners who would be eligible to receive an annual credit on their DEP bill.

Figure 9-4 shows how water and sewer rates have increased over time and how that compares with system demand and population. Despite a modest rise in population, water consumption rates have been falling since the 1990s due to metering and increases in water efficiency measures. At the same time, rates have been rising to meet the cost of service associated with DEP's capital commitments. DEP operations are funded almost entirely through rates paid by our customers with less than two percent of spending supported by federal and state assistance over the past ten years. From FY 2002 to FY 2015, water and sewer rates have risen 173 percent. This is despite the fact that DEP has diligently tried to control operating costs. To mitigate rate increases, DEP has diligently managed operating expenses, and since 2011, the agency has had four budget cuts to be able to self-fund critical agency operating needs. Additionally, DEP has undertaken an agency-wide Operational Excellence (OpX) program to review and improve the efficiency of the agency's operations; to date initiatives have been implemented that result in a recurring annual benefit of $80M.

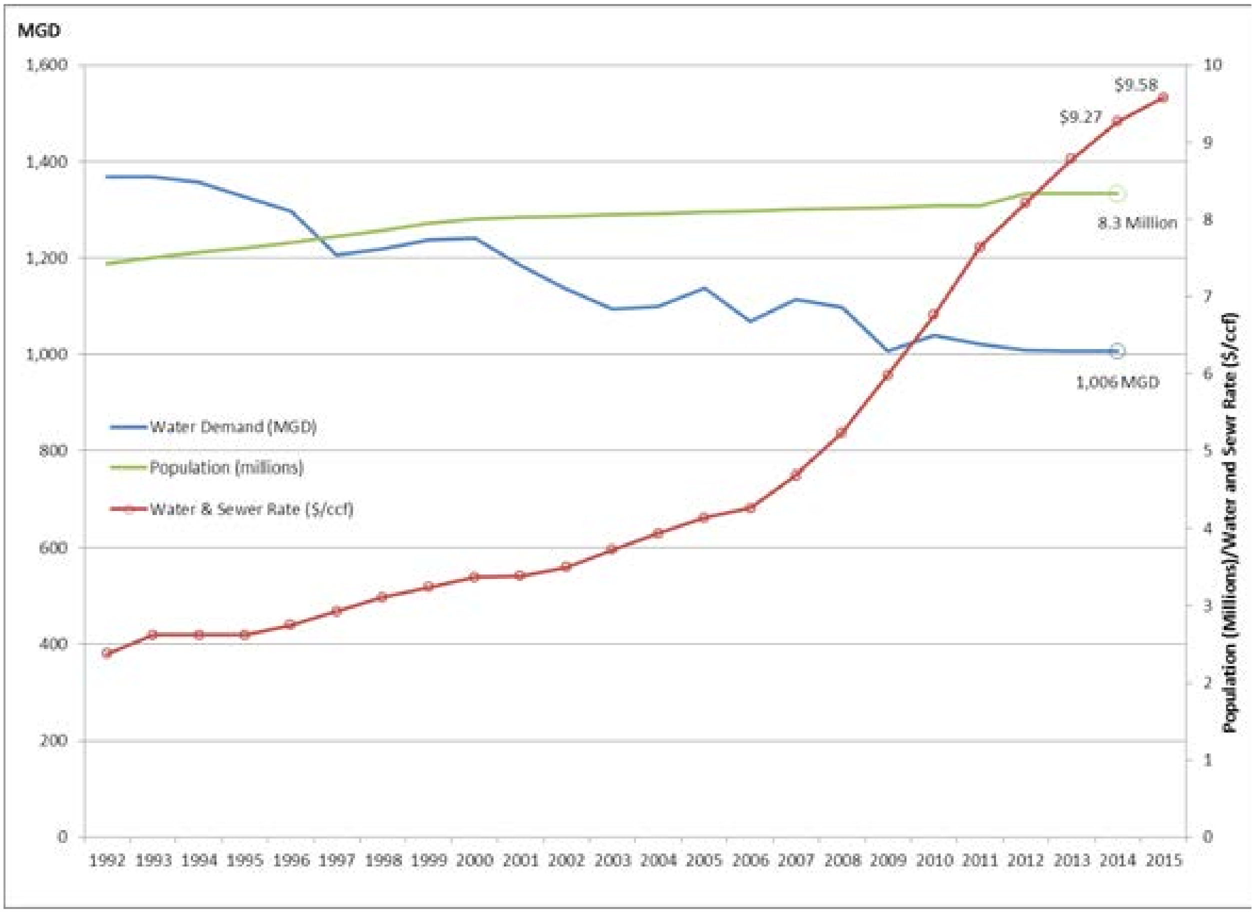


Figure 9-4. Population, Consumption Demand, and Water and Sewer Rates Over Time

9.6.c Residential Indicator

As discussed above, the first economic test as part of EPA's 1997 CSO guidance is the Residential Indicator (RI), which compares the average annual household water pollution control cost (wastewater and stormwater related charges) to the median household income of the service area. Average household wastewater cost can be estimated by approximating the residential share of wastewater treatment and dividing it by total number of households. Since the wastewater bill in NYC is a function of water consumption, average household costs are estimated based on consumption rates by household type in Table 9-2 below.

Table 9-1. Residential Water and Wastewater Costs compared to Median Household Income (MHI)

	Average Annual Wastewater Bill ($/year)	Wastewater RI (Wastewater Bill/MHI[(1)]) (%)	Total Water and Wastewater Bill ($/Year)	Water and Wastewater RI (Water and Wastewater Bill/MHI) (%)
Single Family[(2)]	629	**1.14**	1,025	**1.85**
Multi-family[(3)]	409	**0.74**	666	**1.20**
Average Household Consumption[(4)]	534	**0.97**	870	**1.57**
MCP	599	**1.08**	976	**1.76**

Notes:
(1) Latest MHI data is $50,895 based on 2012 ACS data, estimated MHI adjusted to present is $55,308.
(2) Based on 80,000 gallons/year consumption and FY 2015 Rates.
(3) Based on 52,000 gallons/year consumption and FY 2015 Rates.
(4) Based on average consumption across all metered residential units of 67,890 gallons/year and FY 2015 Rates.

As shown in Table 9-2, the RI for wastewater costs varies between 0.74 percent of MHI to 1.14 percent of MHI depending on household type. Since DEP is a water and wastewater utility and the ratepayers receive one bill for both charges, it is also appropriate to look at the total water and wastewater bill in considering the RI, which varies from 1.2 percent to 1.76 percent of MHI.

Based on this initial screen, current wastewater costs pose a low to mid-range economic impact according to the 1997 CSO Guidance. However, there are several limitations to using MHI in the context of a city like New York. NYC has a large population and more than three million households. Even if a relatively small percentage of households were facing unaffordable water and wastewater bills, there would still be a significant number of households experiencing this hardship. For example, more than 690,000 households in NYC (about 23 percent of NYC's total) earn less than $20,000 per year and have estimated wastewater costs well above 2 percent of their household income. Therefore, there are several other socioeconomic indicators to consider in assessing residential affordability, as described below.

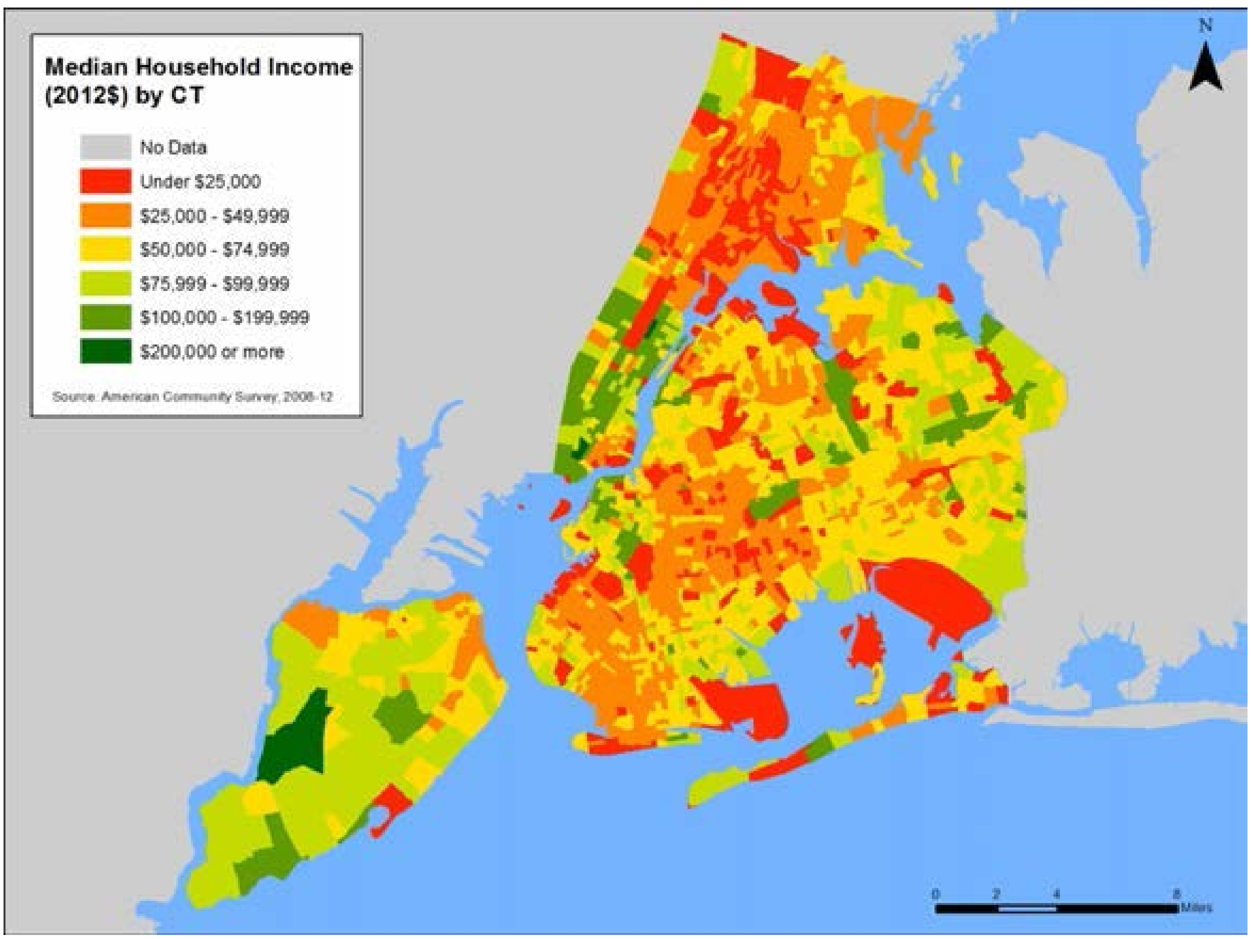
9.6.c.1 Income Levels

In 2012, the latest year for which Census data is available, the MHI in NYC was $50,895. As shown in Table 9-3, across the NYC boroughs, MHI ranged from $32,460 in the Bronx to $70,963 in Staten Island. Figure 9-5 shows that income levels also vary considerably across NYC neighborhoods, and there are several areas in NYC with high concentrations of low-income households.

Table 9-2. Median Household Income

Location	2012 (MHI)
United States	$51,371
New York City	$50,895
Bronx	$32,460
Brooklyn	$45,230
Manhattan	$67,099
Queens	$54,713
Staten Island	$70,963

Source: U.S. Census Bureau 2012 ACS 1-Year Estimates.



Source: U.S. Census Bureau 2008-2012 ACS 5-Year Estimates.

Figure 9-5. Median Household Income by Census Tract

As shown in Figure 9-6, after 2008, MHI in NYC actually decreased for several years, and it has just begun to recover to the 2008 level. At this same time, the cost of living continued to increase.

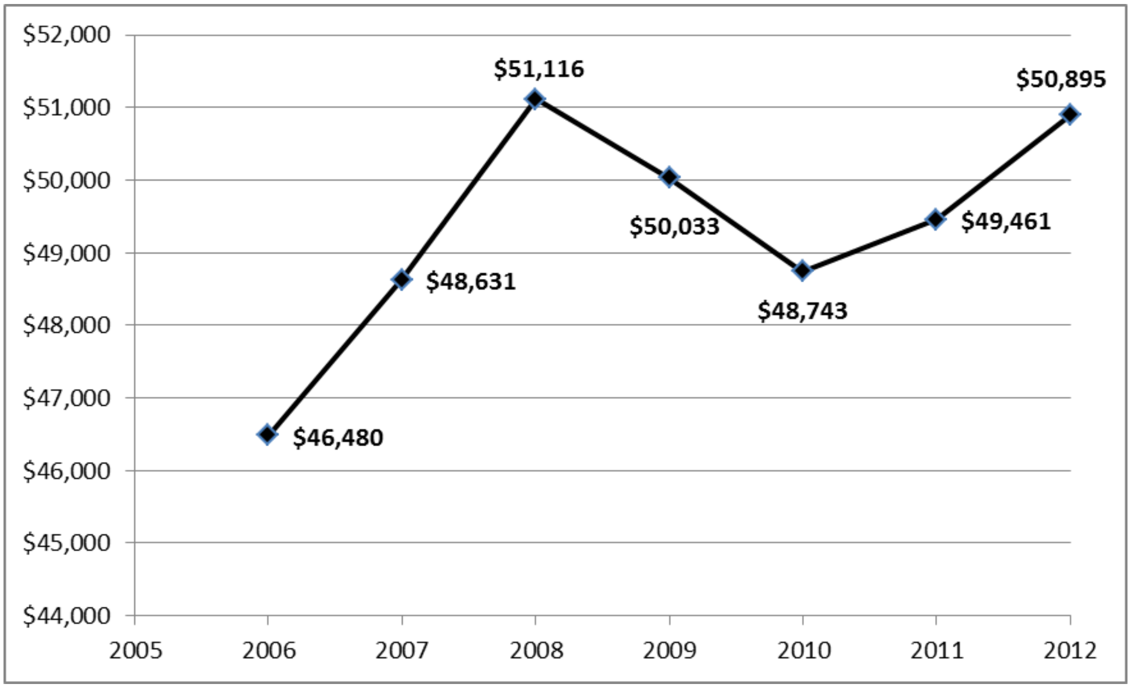


Figure 9-6. NYC Median Household Income Over Time

9.6.c.2 Income Distribution

NYC currently ranks as one of the most unequal cities in the United States (U.S.) in terms of income distribution. NYC's income distribution highlights the need to focus on metrics other than citywide MHI in order to capture the disproportionate impact on households in the lowest income brackets. It is clear that MHI does not represent "the typical household" in NYC. As shown in Figure 9-7, incomes in NYC are not clustered around the median, but rather there are greater percentages of households at both ends of the economic spectrum. Also, the percentage of the population with middle-class incomes between $20,000 and $100,000 is 11.5 percent less in NYC than in the U.S. generally.

Source: U.S. Census Bureau 2012 ACS 1-Year Estimates.

Figure 9-7. Income Distribution for NYC and U.S.

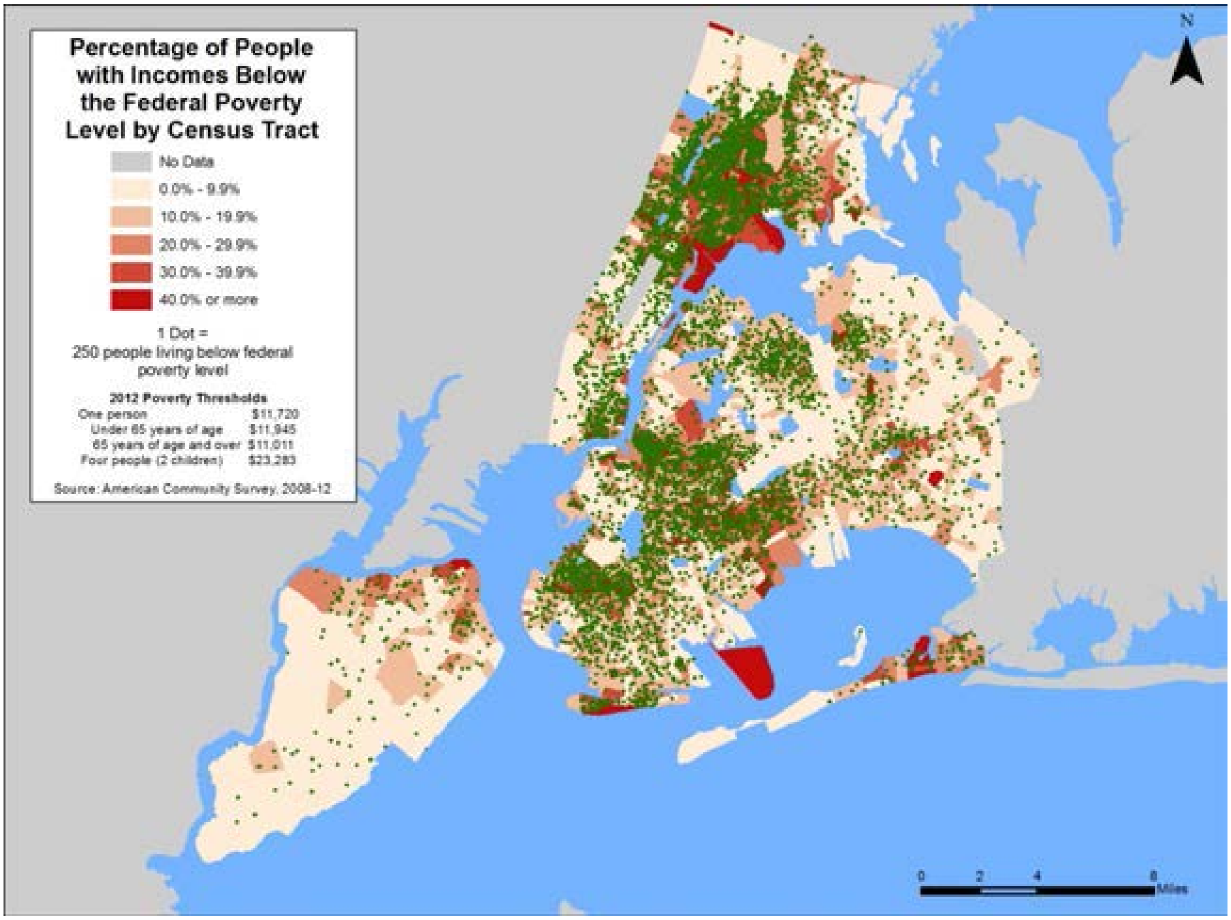
9.6.c.3 Poverty Rates

Based on the latest available census data, 21.2 percent of NYC residents are living below the federal poverty level (more than 1.7 million people, which is greater than the entire population of Philadelphia). This compares to a national poverty rate of 15.9 percent despite the similar MHI levels for NYC and the U.S. as a whole. As shown in Table 9-4, across the NYC boroughs, poverty rates vary from 11.6 percent in Staten Island to 31 percent in the Bronx.

Table 9-3. NYC Poverty Rates

Location	Percentage of Residents Living Below the Federal Poverty Level (%) (ACS 2012)
United States	15.9
New York City	21.2
Bronx	31.0
Brooklyn	24.3
Manhattan	17.8
Queens	16.2
Staten Island	11.6

Figure 9-8 shows that poverty rates also vary across neighborhoods, with several areas in NYC having a relatively high concentration of people living below the federal poverty level. Each green dot represents 250 people living in poverty. While poverty levels are concentrated in some areas, there are pockets of poverty throughout NYC. An RI that relies on MHI alone fails to capture these other indicators of economic distress. Two cities with similar MHI could have varying levels of poverty.



Source: U.S. Census Bureau 2008-2012 ACS 5-Year Estimates.

Figure 9-8. Poverty Clusters and Rates in NYC

The New York City Center for Economic Opportunity (CEO) has argued that the official (federal) poverty rate does not provide an accurate measure of the number of households truly living in poverty conditions (CEO, 2011). This is especially relevant in NYC, where the cost of living is among the highest in the nation. According to CEO, federal poverty thresholds do not reflect current spending patterns, differences in the cost of living across the nation, or changes in the American standard of living (CEO, 2011). To provide a more accurate accounting of the percentage of NYC's population living in poverty, CEO developed an alternative poverty measure based on methodology developed by the National Academy of Sciences (NAS).

The NAS-based poverty threshold reflects the need for clothing, shelter, and utilities, as well as food (which is the sole basis for the official poverty threshold). The threshold is established by choosing a point in the distribution of expenditures for these items, plus a small multiplier to account for miscellaneous expenses such as personal care, household supplies, and non-work-related transportation. CEO adjusted the NAS-based threshold to account for the high cost of living in NYC.

In addition, the NAS-based income measure uses a more inclusive definition of resources available to households compared to the federal measure, which is based on pre-tax income. Along with cash income after taxes, it accounts for the cash-equivalent value of nutritional assistance and housing programs (i.e., food stamps and Section 8 housing vouchers). It also recognizes that many families face the costs of commuting to work, child care, and medical out-of-pocket expenses that reduce the income available to meet other needs. This spending is accounted for as deductions from income. Taken together, these adjustments create a level of disposable income that, for some low-income households, can be greater than pre-tax cash income.

CEO's methodology shows that in NYC, poverty-level incomes are actually much higher than those defined at the federal level, which results in a higher percentage of NYC residents living in poverty than is portrayed by national measures. As an example, in 2008, CEO's poverty threshold for a two-adult, two-child household was $30,419. The federal poverty threshold for the same type of household was $21,834. In that year, 22.0 percent of NYC residents (about 1.8 million people) were living below the CEO poverty threshold income; 18.7 percent were living below the federal poverty threshold.

More recently, the U.S. Census Bureau developed a Supplemental Poverty Measure (SPM), reflecting the same general approach as that of CEO. The federal SPM factors in some of the financial and other support offered to low-income households (e.g., housing subsidies, low-income home energy assistance) and also recognizes some nondiscretionary expenses that such households bear (e.g., taxes, out-of-pocket medical expenses, and geographic adjustments for differences in housing costs) (U.S. Census Bureau, 2012).

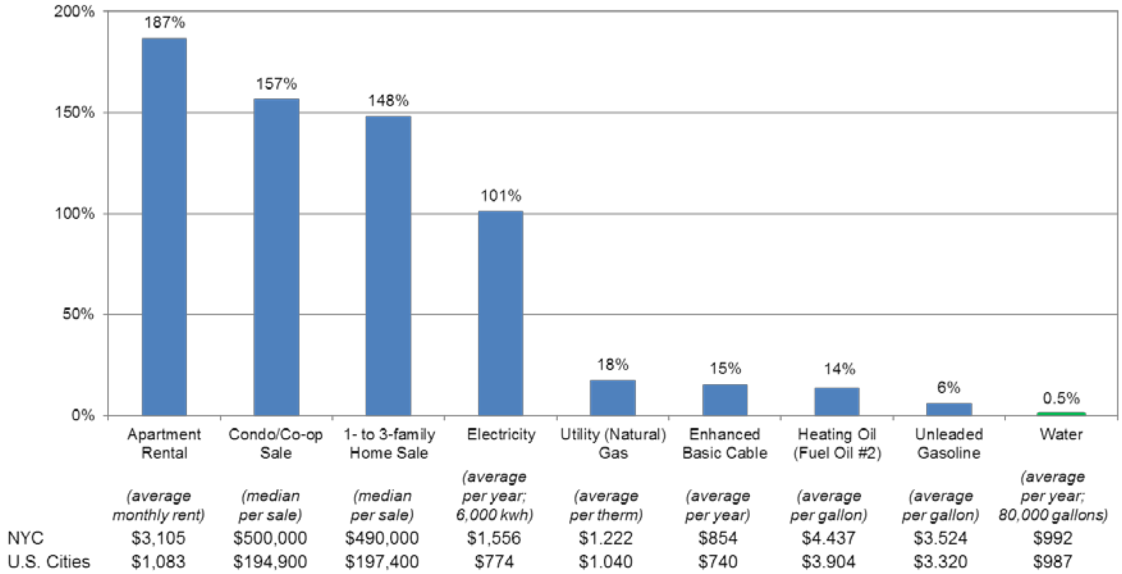
Nationwide, the SPM indicates that there are 5.35 percent more people in poverty than the official poverty threshold would indicate. The SPM also indicates that inside Metropolitan Statistical Areas the difference is 11.2 percent more people in poverty, and within "principal cities," the SPM-implied number of people in poverty is 5.94 percent higher than the official poverty measure indicates.

9.6.c.4 Unemployment Rates

In 2013 the annual average unemployment rate for NYC was 7.7 percent according to NYS Department of Labor, compared to a national average of 7.1 percent. Over the past two decades, NYC's unemployment rate has generally been significantly higher than the national average. Due to the recent recession, the national unemployment rate has increased significantly, moving closer to that of NYC.

9.6.c.5 Cost of Living and Housing Burden

NYC residents face relatively high costs for nondiscretionary items (e.g., housing, utilities) compared to individuals living almost anywhere else in the nation as shown in Figure 9-9. While water costs are comparable to other average U.S. cities, the housing burden is substantially higher.



Source: Wall Street Journal (Apartment Rental); The Real Estate Board of New York and National Association of Realtors (condo/coop and home sales); New York State Energy Research and Development Authority and Bureau of Labor Statistics (electricity and fuel oil #2); U.S. Bureau of Labor Statistics (natural gas and unleaded gasoline); FCC and company websites (enhanced basic cable); NYC FY 2014 Water and Wastewater Rate Survey (water)

Figure 9-9. Comparison of Costs Between NYC and other US Cities

Approximately 67 percent of all households in NYC are renter-occupied, compared to about 35 percent of households nationally. For most renter households in NYC, water and wastewater bills are included in the total rent payment. Rate increases may be passed on to the tenant in the form of a rental increase, or born by the landlord. In recent years, affordability concerns have been compounded by the fact that gross median rents have increased, while median renter income has declined as shown in Figure 9-10 (NYC Housing, 2014).

Figure 9-10. Median Gross Rent vs. Median Renter Income

Most government agencies consider housing costs of between 30 percent and 50 percent of household income to be a moderate burden in terms of affordability; costs greater than 50 percent of household income are considered a severe burden.

A review of Census data shows approximately 21 percent of NYC households (close to 645,000 households) spent between 30 percent and 50 percent of their income on housing, while about 25 percent (748,000 households) spent more than 50 percent. This compares to 20 percent of households nationally that spent between 30 percent and 50 percent of their income on housing and 16.2 percent of households nationally that spent more than 50 percent. This means that 46 percent of households in NYC versus 36.2 percent of households nationally spent more than 30 percent of their income on housing.

The NYC Housing Authority (NYCHA) is responsible for 172,223 affordable housing units (9 percent of the total renter households in NYC). The agency is estimated to pay about $186M for water and wastewater in FY15. This total represents about 5.9 percent of their $3.14B operating budget. Even a small increase in rates could potentially impact the agency's ability to provide affordable housing and/or other programs.

9.6.d Financial Capability Indicators

The second phase of the 1997 CSO Guidance develops the Permittee FCI, which are compared to national benchmarks and are used to generate a score that is the average of six economic indicators. Lower FCI scores imply weaker economic conditions. Table 9-5 summarizes the FCI scoring as presented in the 1997 CSO Guidance.

Table 9-4. Financial Capability Indicator Scoring

Financial Capability Metric	Strong (Score = 3)	Mid-range (Score = 2)	Weak (Score = 1)
Debt indicator			
Bond rating (GO bonds, revenue bonds)	AAA-A (S&P) Aaa-A (Moody's)	BBB (S&P) Baa (Moody's)	BB-D (S&P) Ba-C (Moody's)
Overall net debt as percentage of full market value	Below 2%	2–5%	Above 5%
Socioeconomic indicator			
Unemployment rate	More than 1 percentage point below the national average	+/- 1 percentage point of national average	More than 1 percentage point of national average
MHI	More than 25% above adjusted national MHI	+/- 25% of adjusted national MHI	More than 25% below adjusted national MHI
Financial management indicator			
Property tax revenues as percentage of FMPV	Below 2%	2–4%	Above 4%
Property tax revenue collection rate	Above 98%	94–98%	Below 94%

NYC's FCI score based on this test is presented in Table 9-6 and further described below.

Table 9-5. NYC Financial Capability Indicator Score

Financial Capability Metric	Actual Value	Score
Debt indicators		
Bond rating (GO bonds)	AA (S&P) AA (Fitch) Aa2 (Moody's)	Strong/3
Bond rating (Revenue bonds)	AAA (S&P) AA + (Fitch) Aaa-A (Moody's)	
Overall net debt as percentage of FMPV	4.5%	Midrange/2
GO		
Debt	$41.2B	
Market value	$917.7B	
Socioeconomic indicators		
Unemployment rate (2013 annual average)	0.6 percentage point above the national average	Mid-range/2
NYC unemployment rate	7.7%	
United States unemployment rate	7.1%	
MHI as percentage of national average	99%	Mid-range/2
Financial management indicators		
Property tax revenues as percentage of FMPV	2.2%	Mid-range/2
Property tax revenue collection rate	98.2%	Strong/3
Permittee Indicators Score		2.3

9.6.d.1 Bond Rating

The first financial benchmark is NYC's bond rating for both general obligation (G.O.) and revenue bonds. A bond rating performs the isolated function of credit risk evaluation. While many factors go into the investment decision-making process, bond ratings can significantly affect the interest that the issuer is required to pay, and thus the cost of capital projects financed with bonds. According to EPA's criteria – based on the ratings NYC has received from all three rating agencies [Moody's, Standard & Poor's (S&P), and Fitch Ratings] – NYC's financing capability is considered "strong." Specifically, NYC's G.O. bonds are rated AA by S&P and Fitch and Aa2 by Moody's; and MWFA's General Resolution revenue bonds are rated AAA by S&P, AA+ by Fitch, and Aa1 by Moody's, while MWFA's Second General Resolution revenue bonds (under which most of the Authority's recent debt has been issued) are rated AA+ by S&P, AA+ by Fitch, and Aa2 by Moody's. This results in a "strong" rating for this category.

Nonetheless, NYC's G.O. rating and MWFA's revenue bond ratings are high due to prudent fiscal management, the legal structure of the System, and the Water Board's historical ability to raise water and wastewater rates. However, mandates over the last decade have significantly increased the leverage of the System, and future bond ratings could be impacted by further increases to debt beyond what is currently forecasted.

9.6.d.2 Net Debt as a Percentage of Full Market Property Value (FMPV)

The second financial benchmark measures NYC's outstanding debt as a percentage of FMPV. Currently NYC has over $41.6B in outstanding G.O. debt, and the FMPV within NYC is $917.7B. This results in a ratio of outstanding debt to FMPV of 4.5 percent and a "mid-range" rating for this indicator. If $30.6B of MWFA revenue bonds that support the System are included, net debt as a percentage of FMPV increases to 7.8 percent, which results in a "weak" rating for this indicator. Furthermore, if NYC's $37.5M of additional debt that is related to other services and infrastructure is included, the resulting ratio is 8.6 percent net debt as a percentage of FMPV.

9.6.d.3 Unemployment rate

For the unemployment benchmark, the 2013 annual average unemployment rates for NYC were compared to those for the U.S. NYC's 2013 unemployment rate of 7.7 percent is 0.6 basis points (or 8.5 percent) higher than the national average of 7.1 percent. Based on EPA guidance, NYC's unemployment benchmark would be classified as "mid-range". However, it is important to note that over the past two decades, NYC's unemployment rate has generally been significantly higher than the national average. Due to the recession, the national unemployment is much closer to NYC's unemployment rate. Additionally, the unemployment rate measure identified in the 1997 financial guidance sets a relative comparison at a snapshot in time. It is difficult to predict whether the unemployment gap between the U.S. and NYC will once again widen, and it may be more relevant to look at longer term historical trends, of the service area.

9.6.d.4 Median Household Income (MHI)

The MHI benchmark compares the community's MHI to the national average. Using American Community Survey (ACS) 2012 single-year estimates, NYC's MHI is $50,895 and the nation's MHI is $51,371. Thus, NYC's MHI is 99 percent of the national MHI, resulting in a "mid-range" rating for this indicator. However, as discussed above in this section, MHI does not provide an adequate measure of affordability or financial capability. MHI is a poor indicator of economic distress and bears little relationship to poverty or other measures of economic need. In addition, reliance on MHI alone can be a very misleading indicator of the affordability impacts in a large and diverse city such as NYC.

9.6.d.5 Tax Revenues as a Percentage of Full Market Property Value

This indicator, which EPA also refers to as the "property tax burden", attempts to measure "the funding capacity available to support debt based on the wealth of the community," as well as "the effectiveness of management in providing community services". According to the NYC Property Tax Annual report issued in FY13, NYC had collected $20.1B in real property taxes against a $917.7B FMPV, which amounts to 2.2 percent of FMPV. For this benchmark, NYC received a "mid-range" score. Also, this figure does not include water and wastewater revenues. Including $3.5B of FY13 System revenues increases the ratio to 2.6 percent of FMPV.

However, this indicator (including or excluding water and wastewater revenues) is misleading because NYC obtains a relatively low percentage of its tax revenues from property taxes. In 2007, property taxes accounted for less than 41 percent of NYC's total non-exported taxes, meaning that taxes other than property taxes (e.g., income taxes, sales taxes) account for nearly 60 percent of the locally borne NYC tax burden.

9.6.d.6 Property Tax Collection Rate

The property tax collection rate is a measure of "the efficiency of the tax collection system and the acceptability of tax levels to residents". This NYC Property Tax Annual report issued in FY13 indicates NYC's total property tax levy was $20.1B, of which 98.2 percent was collected, resulting in a "mid-range" rating for this indicator.

It should be noted, however, that the processes used to collect water and wastewater charges and the enforcement tools available to water and wastewater agencies differ from those used to collect and enforce real property taxes. The New York City Department of Finance (DOF), for example, can sell real property tax liens on all types of non-exempt properties to third parties, who can then take action against the delinquent property-owners. DEP, in contrast, can sell liens on multi-family residential and commercial buildings whose owners have been delinquent on water bills for more than one year, but it cannot sell liens on single-family homes. The real property tax collection rate thus may not accurately reflect the local agency's ability to collect the revenues used to support water supply and wastewater capital spending.

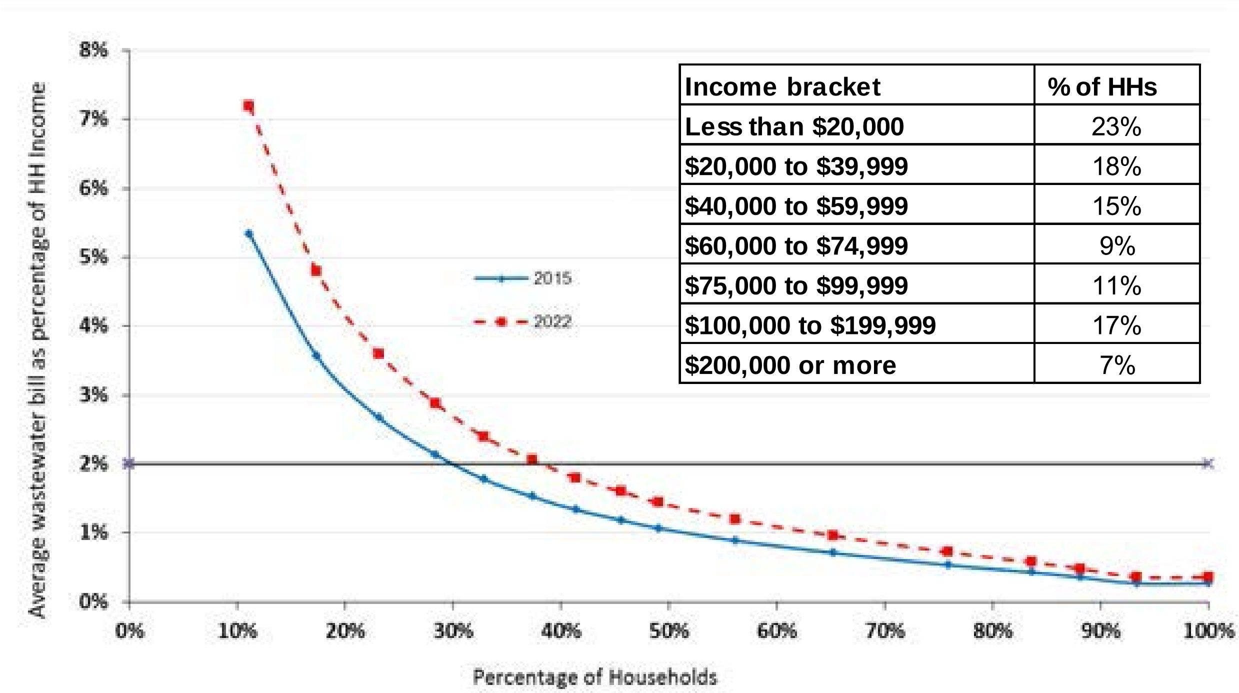
9.6.e Future Household Costs

For illustration purposes, Figure 9-11 shows the average estimated household cost for wastewater services compared to household income versus the percentage of households in various income brackets for the years 2015 and 2022. As shown, 50 percent of households are estimated to pay more than one percent of their income on wastewater service in 2015. Roughly 30 percent of households are estimated to pay two percent or more of their income on wastewater service alone in 2015. Estimating modest future rate and income increases (based on costs in the CIP and historic Consumer Price Index data, respectively), up to 37 percent of households could be paying more than two percent of their income on wastewater services by 2022. These projections are preliminary and do not include additional future wastewater spending associated with the programs outlined in Section 9.6.a.3 - Future System Investment. When accounting for these additional costs, it is likely that an even greater percentage of households could be paying well above two percent of their income on wastewater services in the future.

DEP, like many utilities in the nation, provides both water and wastewater service, and its rate payers see one bill. Currently the average combined water and sewer bill is around 1.6 percent of MHI, but 23 percent of households are estimated to be currently paying more than 4.5 percent of their income, and that could increase to about 30 percent of households in future years as shown in Figure 9-12 Again, this estimate does not include additional spending for the additional water and wastewater programs outlined in Section 9.6.a.3 - Future System Investment.

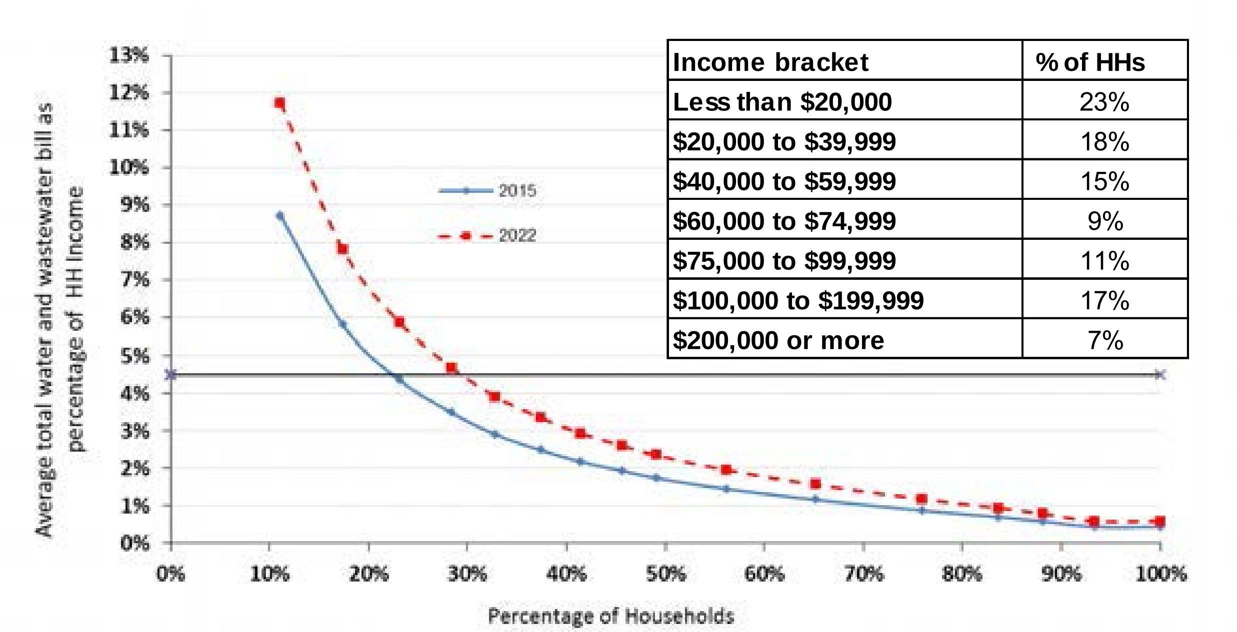
9.6.f Potential Impacts of CSO LTCPs to Future Household Costs

As previously discussed, DEP is facing significant future wastewater spending commitments associated with several regulatory compliance programs. This section presents the potential range of CSO LTCP implementation costs for NYC and describes the potential resulting impacts to future household costs for wastewater service. The information in this section reflects a simplified household impact analysis that will be refined in future LTCP waterbody submittals. All referenced Waterbody/Watershed Facility Plan (WWFP) costs presented in this section have been escalated to June 2014 dollars using the Engineering News-Record City Cost Index (ENRCCI) for New York for comparison purposes.



Income bracket	% of HHs
Less than $20,000	23%
$20,000 to $39,999	18%
$40,000 to $59,999	15%
$60,000 to $74,999	9%
$75,000 to $99,999	11%
$100,000 to $199,999	17%
$200,000 or more	7%

Figure 9-11. Estimated Average Wastewater Household Cost Compared to Household Income (FY15 & FY22)



Income bracket	% of HHs
Less than $20,000	23%
$20,000 to $39,999	18%
$40,000 to $59,999	15%
$60,000 to $74,999	9%
$75,000 to $99,999	11%
$100,000 to $199,999	17%
$200,000 or more	7%

Figure 9-12. Estimated Average Total Water and Wastewater Cost as a Percentage of Household Income (FY15 and FY22)

9.6.f.1 Estimated Costs for Waterbody CSO Preferred Alternative

As discussed in Section 8.8, the preferred LTCP alternative for the Hutchinson River is to provide Seasonal Disinfection in New Outfall HP-024 to reduce the human pathogens discharged during the recreational season. DEP is also committed to investigating and reducing the local sources of human-source pollution to improve water quality of the waterbodies. The preferred LTCP alternative also includes management of 158 acres of combined sewer impervious area by implemented GI in the Hutchinson River watershed by 2030. To date, approximately $3M has been committed to grey CSO control infrastructure, and approximately $625,000 has been committed to GI.

The total present worth cost for the grey component of the LTCP alternative which reflects capital costs and O&M costs over the projected useful life of the project is approximately $108M.

9.6.f.2 Overall Estimated Citywide CSO Program Costs

DEP's LTCP planning process was initiated in 2012 and will extend until the end of 2017 per the Consent Order schedule. Overall anticipated CSO program costs for NYC will not be known until all of the LTCPs have been developed and approved. However, DEP did develop CSO control costs as part of a previous WWFP effort. These costs are presented in Table 9-7, and they will be supplemented by LTCP preferred alternative costs in future waterbody LTCP affordability sections as new costs become available.

Costs for the preferred alternatives as well as 25 percent, 50 percent, and 100 percent CSO control are included in Table 9-7 to provide a possible range of future CSO control costs. Also, GI is a major component of the CSO Consent Order. The overall GI program cost is estimated at $2.4B, of which $1.5B will be spent by DEP. The GI program costs are in addition to the grey CSO control costs and are therefore presented as a separate line item. As shown in Table 9-7, overall future CSO control costs could range from $4.2B to $85.6B.

Table 9-7 also presents CSO control costs that have been committed from FY 2002 through FY 2013 and in DEP's FY2014-2024 CIP. When excluding these committed costs, the range of possible future CSO control costs is $0.8B to $82.3B.

9.6.f.3 Potential Impacts to Future Household Costs

To estimate the impact of the possible range of future CSO control costs to ratepayers, the annual household cost impact of the future citywide CSO control costs was calculated for the CSO spending scenarios. The cost estimates presented will evolve over the next few years as the LTCPs are completed for the ten waterbodies. The cost estimates will be updated as the LTCPs are completed.

Table 9-6. Range of Potential Future CSO Costs

Waterbody / Watershed[1]	Historical and Current CIP Commitments	Baseline Committed Grey Infrastructure Costs			Additional LTCP Preferred Alternative	LTCP Preferred Alternative Cost[2]	25% CSO Control Cost[2]	50% CSO Control Cost[2]	100% CSO Control Cost[2]
		Committed FY2002-FY2013	Committed in 2014-2024 CIP	Total Existing Committed					
Alley Creek and Little Neck Bay	CSO Abatement Facilities and East River CSO	$141,916,025	($3,085,000)[3]	$138,831,025	Disinfection in Existing CSO Retention Facility	$11,300,000	$113,000,000	$173,000,000	$569,000,000
Westchester Creek	Hunts Point WPCP Headworks	$7,800,000	$88,425,000	$96,225,000	Green Infrastructure Implementation and Post-Construction Monitoring	TBD	$200,000,000	$420,000,000	$731,400,000
Hutchinson River	Hunts Point WPCP Headworks	$3,000,000	$0	$3,000,000	Alternative 12 - 50 MGD Seasonal Disinfection in New Outfall HP-024	$108,000,000	$345,000,000	$437,000,000	$829,000,000
Flushing Creek	*Flushing Bay Corona Avenue Vortex Facility, Flushing Bay CSO Retention, Flushing Bay CSO Storage*	*$360,348,471*	*$46,334,000*	*$406,682,471*	*TBD*	*TBD*	*$169,672,037*	*$339,344,073*	*$6,628,747,129*
Bronx River	*Installation of Floatable Control Facilities, Hunts Point Headworks*	*$46,989,901*	*$106,000*	*$47,095,901*	*TBD*	*TBD*	*$36,165,246*	*$90,413,115*	*$1,218,286,583*
Gowanus Canal	*Gowanus Flushing Tunnel Reactivation, Gowanus Facilities Upgrade*	*$174,828,480*	*$3,139,000*	*$177,967,480*	*TBD*	*TBD*	*$249,182,401*	*$529,512,603*	*$1,148,481,688*
Coney Island Creek	*Avenue V Pumping Station, Force Main Upgrade*	*$199,749,241*	*$2,485,000*	*$202,234,241*	*TBD*	*TBD*	*$59,646,395*	*$119,292,789*	*$1,163,462,575*

Table 9-6. Range of Potential Future CSO Costs									
Waterbody / Watershed(1)	**Historical and Current CIP Commitments**	**Baseline Committed Grey Infrastructure Costs**			**Additional LTCP Preferred Alternative**	**LTCP Preferred Alternative Cost(2)**	**25% CSO Control Cost(2)**	**50% CSO Control Cost(2)**	**100% CSO Control Cost(2)**
		Committed FY2002-FY2013	**Committed in 2014-2024 CIP**	**Total Existing Committed**					
Jamaica Bay	*Improvements of Flow Capacity to Fresh Creek-26th Ward Drainage Area, Hendrix Creek Canal Dredging, Shellbank Destratification, Spring Creek AWCP Upgrade*	*$141,135,131*	*$323,733,000*	*$464,868,131*	*TBD*	*TBD*	*$180,881,883*	*$367,416,325*	*$4,142,534,281*
Flushing Bay(4)	*See Flushing Creek*	*$0*	*$0*	*$0*	*TBD*	*TBD*	*$222,270,368*	*$791,802,838*	*$4,787,918,645*
Newtown Creek	*English Kills Aeration, Newtown Creek Water Quality Facility, Newtown Creek Headworks*	*$160,099,445*	*$91,312,000*	*$251,411,445*	*TBD*	*TBD*	*$566,569,452*	*$1,586,394,467*	*$3,421,512,923*
East River and Open Waters	*Bowery Bay Headworks, Inner Harbor In-Harbor Storage Facilities, Reconstruction of the Port Richmond East Interceptor Throttling Facility, Outer Harbor CSO Regulator Improvements, Hutchinson River CSO*	*$153,145,476*	*$43,131,000*	*$196,276,476*	*TBD*	*TBD*	*$534,921,268*	*$7,016,829,726*	*$59,488,594,159*
Bergen and Thurston Basins(5)	*Pumping Station and Force Main Warnerville*	*$41,876,325*	($180,000)[3]	*$41,696,325*	NA	NA	NA	NA	NA
Paerdegat Basin(5)	*Retention Tanks, Paerdegat Basin Water Quality Facility*	*$397,605,260*	($4,609,000)[3]	*$392,996,260*	NA	NA	NA	NA	NA

Table 9-6. Range of Potential Future CSO Costs

Waterbody / Watershed[1]	Historical and Current CIP Commitments	Baseline Committed Grey Infrastructure Costs			Additional LTCP Preferred Alternative	LTCP Preferred Alternative Cost[2]	25% CSO Control Cost[2]	50% CSO Control Cost[2]	100% CSO Control Cost[2]
		Committed FY2002-FY2013	Committed in 2014-2024 CIP	Total Existing Committed					
Green Infrastructure Program[6]	*Miscellaneous Projects Associated with Citywide Green Infrastructure Program*	$24,200,000	$907,005,000	$931,205,000	Full Implementation of Green Infrastructure Program	$1,500,000,000	$1,500,000,000	$1,500,000,000	$1,500,000,000
TOTAL		*$1,852,693,755*	*$1,497,796,000*	*$3,350,489,755*		*$1,619,300,000*	*$4,177,309,050*	*$13,371,005,937*	*$85,628,937,983*

Notes:

(1) The shaded waterbody rows include current LTCP alternative and cost information. Other waterbody rows are presented in italics and will be updated in future waterbody LTCP affordability chapters as new alternatives and costs become available.
(2) 25%, 50%, and 100% CSO costs are estimated using knee-of-the-curve / cost vs. CSO control plots from WWFPs and LTCPs and do not subtract historic and currently committed costs, which are presented separately. All costs taken from the WWFPs have been escalated to June 2014 dollars for comparison purposes using the ENRCCI for New York.
(3) Negative values for Alley Creek and Little Neck Bay, Bergen and Thurston Basins, and Paerdegat Basin reflect a de-registration of committed funds.
(4) Committed costs for Flushing Bay are captured in the committed costs reported for Flushing Creek.
(5) Bergen and Thurston Basins and Paerdegat Basin are not part of the current LTCP effort; thus, no LTCP detail is provided for them.
(6) DEP's green infrastructure program costs are assumed to be the same regardless of the CSO control level.

A 4.75 percent interest rate was used to determine the estimated annual interest cost associated with the capital costs, and the annual debt service was divided by the FY 2015 Revenue Plan value to determine the resulting percent rate increase. This also assumes bonds are structured for a level debt service amortization over 32 years. Note that interest rates on debt could be significantly higher in the future. As Table 9-8 shows, the 25 percent CSO Control scenario would result in a one percent rate increase, the 50 percent CSO Control scenario would result in a double-digit rate increase of 18 percent, and the 100 percent CSO Control scenario would result in a substantial 144 percent rate increase. These rate increases translate into additional annual household costs of up to $1,475. Both the 50 percent and 100 percent CSO control scenarios represent a substantial increase in annual household costs, which only reflects possible future CSO control program costs. The cost of the additional future mandated and non-mandated programs discussed in Section 9.6.a.3 - Future System Investment, would further increase the annual burden to ratepayers. For illustrative purposes, estimates for future spending on TRC, Ammonia, MS4, Superfund and Hillview Cover have been assumed in Table 9-8 and Table 9-9, and these are subject to change.

Table 9-7. CSO Control Program Household Cost Impact

Capital Spending Scenario	Projected Capital Cost ($M)(1)	Annual Debt Service ($M)(2)	% Rate Increase from FY 2015 Rates	Additional Annual Household Cost	
				Single-family Home	Multi-family Unit
Current CIP	$13,664	$839	24	$245	$159
Future Potential Mandated Program Costs for MS4, TRC, Ammonia, Superfund, and Hillview Cover(3)	$7,000	$430	12	$125	$82
100% CSO Control	$82,279	$5,053	144	$1,475	$959
50% CSO Control	$10,021	$615	18	$180	$117
25% CSO Control	$827	$51	1	$15	$10
Citywide LTCP CSO Control Alternatives(4)	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*

Notes:
(1) CSO Capital costs have been reduced to reflect historic and currently committed costs for CSO control projects (see Table 9-7).
(2) Assumes bonds are structured for a level debt service amortization over 32 years at a 4.75% interest rate.
(3) DEP will face additional future wastewater mandated program costs. While these costs have not been finalized, the following estimated costs for select programs are included to represent potential future annual household cost on top of costs for the CSO control program: MS4 Permit Compliance - $2.5B, TRC - $560M, Ammonia $840M Superfund Remediation - $1.5B, and $1.8B for Hillview Cover.
(4) Projected capital cost for the citywide preferred LTCP CSO control alternatives is not currently available. This information will be included in the citywide LTCP following completion of the individual waterbody LTCPs.

Table 9-8. Total Estimated Cumulative Future HH Costs/MHI

Capital Spending Scenario	Total Projected Annual Household Cost(1)		Total Water and Wastewater HH Cost / MHI(2)		Total Wastewater HH Cost / MHI(2)	
	Single-family Home	Multi-family Unit	Single-family Home (%)	Multi-family Unit (%)	Single-family Home (%)	Multi-family Unit (%)
FY 2015 Rates	$1,025	$666	1.9	1.2	1.1	0.74
Current CIP	$1,270	$825	2.0	1.3	1.2	0.81
Other Future Potential Mandated Program Costs for MS4, TRC, Ammonia, Superfund, and Hillview Cover	$1,395	$907	2.2	1.5	1.4	0.89
100% CSO Control +CIP +Other	$2,870	$1,866	4.6	3.0	2.8	1.83
50% CSO Control+CIP+Other	$1,575	$1,024	2.5	1.6	1.5	1.01
25% CSO Control+CIP+Other	$1,410	$917	2.3	1.5	1.4	0.90
Citywide LTCP CSO Control Alternatives	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*

Notes:
(1) Projected household costs are estimated from rate increases presented in Table 9-8.
(2) Future costs were compared to assumed 2020 MHI projection ($62,511).

Table 9-9 presented above shows the potential range of future spending and its impact on household cost compared to MHI. While these estimates are preliminary, it should be noted (as discussed in detail earlier in this section) that comparing household cost to MHI alone does not tell the full story since a large percentage of households below the median could be paying a larger percentage of their income on these costs.

9.6.g Benefits of Program Investments

DEP has been in the midst of an unprecedented period of investment to improve water quality in New York Harbor. Projects worth $9.9B have been completed or are under way since 2002 alone, including projects for nutrient removal, CSO abatement, marshland restoration in Jamaica Bay, and hundreds of other projects. In-City investments are improving water quality in the Harbor and restoring a world-class estuary while creating new public recreational opportunities and inviting people to return to NYC's 578 miles of waterfront. A description of citywide water quality benefits resulting from previous and ongoing programs is provided below, followed by the anticipated benefits of water quality improvements to the Hutchinson River resulting from implementation of the preferred alternative.

9.6.g.1 Citywide Water Quality Benefits from Previous and Ongoing Programs and Anticipated Hutchinson River Water Quality Benefits

Water quality benefits have been documented in the Harbor and its tributaries from the almost $10B investment that NYC has already made in grey and green infrastructure. Approximately 95 percent of the

Harbor is available for boating and kayaking and 14 of NYC's beaches provide access to swimmable waters in the Bronx, Brooklyn, Queens and Staten Island.

Of the $9.9B already invested, almost 20 percent has been dedicated to controlling CSOs and stormwater. That investment has resulted in NYC capturing and treating over 70 percent of the combined stormwater and wastewater that otherwise would be directly discharged to our waterways during periods of heavy rain or runoff. Projects that have already been completed include GI projects in 26th Ward, Hutchinson River and Newtown Creek watersheds; area-wide GI contracts; Avenue V Pump Station and Force Main; and the Bronx River Floatables Control. Several other major projects are in active construction or design. The water quality improvements already achieved have allowed greater access of the waterways and shorelines for recreation as well as enhanced environmental habitat and aesthetic conditions in many of NYC's neighborhoods.

More work is needed, and DEP has committed to working with DEC to further reduce CSOs and make other infrastructure improvements to gain additional water quality improvements. The 2012 Order on Consent between DEP and DEC outlines a combined grey and green approach to reduce CSOs. This LTCP for the Hutchinson River is just one of the detailed plans that DEP is preparing by the year 2017 to evaluate and identify additional control measures for reducing CSO and improving water quality in the Harbor. DEP is also committed to extensive water quality monitoring throughout the Harbor which will allow better assessment of the effectiveness of the controls implemented.

As noted above, a major component of the Consent Order that DEP and DEC developed is GI stormwater control measures. DEP is targeting a 10 percent application rate for implementing GI in combined sewer areas citywide. The GI will take multiple forms including green or blue roofs, bioinfiltration systems, right-of-way bioswales, rain barrels, and porous pavement. These measures provide benefits beyond the associated water quality improvements. Depending on the measure installed, they can recharge groundwater, provide localized flood attenuation, provide sources of water for non-potable use such as watering lawns or gardens, reduce heat island effects on streets and sidewalks, improve air quality, enhance aesthetic quality, and provide recreational opportunities. These are all benefits that contribute to the overall quality of life for residents of NYC.

A detailed discussion of anticipated water quality improvements to the Hutchinson River is included in Section 8.0, and a UAA is included in Appendix D.

9.6.h Conclusions

As part of the LTCP process, DEP will continue to develop and refine the affordability and financial capability assessments for each individual waterbody as it works toward an expanded analysis for the citywide LTCP. In addition to what is outlined in the federal CSO guidance on financial capability, DEP has presented in this section a number of additional socioeconomic factors for consideration in the context of affordability and assessing potential impacts to our ratepayers. Furthermore, it is important to include a fuller range of future spending obligations and DEP has sought to present an initial picture of that here. Ultimately the environmental, social, and financial benefits of all water-related obligations should be considered when priorities for spending are developed and implementation of mandates are scheduled, so that resources can be focused where the community will get the most environmental benefit.

9.7 Compliance with Water Quality Goals

As noted above, the Hutchinson River does not currently attain the Existing WQ Criteria. The assessment of the waterbody indicates that the Hutchinson River cannot support primary contact water quality (Class SB), nor is it suitable for such uses. The UAA, described above and attached as Appendix D, was prepared to document these findings.

DEP proposes “Site-Specific Targets” to provide a feasible compliance target and also allow DEP to continue to improve water quality in the Hutchinson River. These site-specified targets are presented in Table 8-20 with the preferred alternative, Alternative 12. They are based on 10-year water quality model simulations that account for CSO and stormwater sources; and Seasonal Disinfection at New Outfall HP-024. They represent a reasonable range of targets that can be met the majority of the time through implementation of the actions identified in the LTCP. DEP anticipates that DEC will review and comment on the site-specific targets as part of the UAA review process.

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11.0 GLOSSARY

1.5xDDWF:	One and One-half Times Design Dry Weather Flow
2xDDWF:	Two Times Design Dry Weather Flow
AACE:	Advancement of Cost Engineering
AAOV:	Annual Average Overflow Volumes
AC:	Acre
ACS:	American Community Survey
B:	Billion
BACV:	Beach Activation Value
BEACH:	Beaches Environmental Assessment and Coastal Health
BEPA:	Bureau of Environmental Planning and Analysis
BGY:	Billon Gallons Per Year
BMPs:	Best Management Practices
BNR:	Biological Nutrient Removal
BOD:	Biochemical Oxygen Demand
BODR:	Basis of Design Report
BWSO:	Bureau of Water and Sewer Operations
CACs:	Citizens Advisory Committees
$CBOD_5$:	Carbonaceous Biochemical Oxygen Demand
CEO:	New York City Center for Economic Opportunity
CFR:	Code of Federal Regulation
CFS:	Cubic Feet Per Second
CFU:	Colony-Forming Unit
CIP:	Capital Improvement Plan
CMMS:	Computerized Maintenance and Management System

Conc:	Abbreviation for "Concentration".
CPK:	Central Park
CSO:	Combined Sewer Overflow
CS:	**(need to search for this and add in description)**
CSS:	Combined Sewer System
CWA:	Clean Water Act
DCIA:	Directly Connected Impervious Areas
DCP:	New York City Department of City Planning
DDC:	New York City Department of Design and Construction
DDWF:	Design Dry Weather Flow
DEC:	New York State Department of Environmental Conservation
DEP:	New York City Department of Environmental Protection
DO:	Dissolved Oxygen
DOB:	New York City Department of Buildings
DOE:	New York City Department of Education
DOF:	New York City Department of Finance
DOH:	New York State Department of Health
DOHMH:	New York City Department of Health and Mental Hygiene
DOT:	New York City Department of Transportation
DPR:	New York City Department of Parks and Recreation
DWF:	Dry Weather Flow
E:	Estuarine
E. Coli:	Escherichia Coli.
EBP:	Environmental Benefit Project
ECL:	New York State Environmental Conservation Law
ECM:	Energy Conservation Measure

EDC	New York City Economic Development Corporation
EMC:	Event Mean Concentration
ENRCCI:	Engineering News-Record City Cost Index
EPA:	United States Environmental Protection Agency
ERTM:	East River Tributaries Model
ET:	Evapotranspiration
EWR:	Newark Liberty International Airport
FAD:	Filtration Avoidance Determination
FAQ:	Frequently Asked Questions
FCI:	Financial Capability Indicators
FEMA:	Federal Emergency Management Agency
FM:	Force Main
FMPV:	Full Market Property Value
FOIA:	Freedom of Information Act
FSAP:	Field Sampling Analysis Plan
FT:	Abbreviation for "Feet"
FY:	Fiscal Year
GHG:	Greenhouse Gases
GI:	Green Infrastructure
GIS:	Geographical Information System
GM:	Geometric Mean
G.O.:	General Obligation
GRTA:	NYC Green Roof Tax Abatement
HEAP:	Home Energy Assistance Program
HGL:	Hydraulic Gradient Line
HLSS:	High Level Storm Sewers

HP:	Hunts Point
HRA:	New York City Human Resources Administration
HRC:	High Rate Clarification
HSM:	Harbor Survey Monitoring Program
HWAP:	Home Water Assistance Program
IEC:	Interstate Environmental Commission
in.:	Abbreviation for “Inches”.
IW:	InfoWorks CS™
JFK:	John F. Kennedy International Airport
KOTC:	Knee-of-the-Curve
lbs/day:	Pounds per day
LF:	Linear feet
LGA:	LaGuardia Airport
LT2:	Long Term 2
LTCP:	Long Term Control Plan
M:	Million
MCP:	Multifamily Conservation Program
mg/L:	milligrams per liter
MG:	Million Gallons
MGD:	Million Gallons Per Day
MI^2:	**(need to search for this and add in description)**
MHI:	Median Household Income
MLE:	Maximum Likelihood Estimate
MOU:	Memorandum of Understanding
MPN:	Most probable number
MS4:	Municipal Separate Storm Sewer Systems

MSS:	Marine Sciences Section
MT:	Metric Ton
MWFA:	New York City Municipal Water Finance Authority
NAS:	National Academy of Sciences
NEIWPCC:	New England Interstate Water Pollution Control Commission
NEXRAD:	Next Generation Radar
NMC:	Nine Minimum Control
NMFS:	National Marine Fisheries Service
NOAA:	National Oceanic and Atmospheric Administration
NPDES:	National Pollutant Discharge Elimination System
NPW:	Net Present Worth
NYC:	New York City
NYCDOB:	New York City Department of Buildings
NYCDOE:	New York City Department of Education
NYSDOH:	New York State Department of Health
NYCDPR:	New York City Department of Parks and Recreation
NYCHA:	New York City Housing Authority
NYCRR:	New York State Code of Rules and Regulations
NYMTC:	New York Metropolitan Transportation Council
NYS:	New York State
NYSDEC:	New York State Department of Environmental Conservation
NYTA:	New York Transit Authority
O&M:	Operation and Maintenance
OGI:	Office of Green Infrastructure
OLTPS:	Mayor’s Office of Long Term Planning and Sustainability
OMB:	Office of Management and Budget

ONRW:	Outstanding National Resource Waters
OpX:	Operational Excellence
Org:	Organism
PBC:	Probable Bid Cost
PCM:	Post-Construction Compliance Monitoring
POTW:	Publicly Owned Treatment Plant
PS:	Pump Station or Pumping Station
Q:	Symbol for Flow (designation when used in equations)
QA/QC:	Quality Assurance/Quality Control
RI:	Residential Indicator
RI/FS:	Remedial Investigation/Feasibility Study
ROW:	Right-of-Way
ROWBs:	Right-of-way bioswales
RTB:	Retention/Treatment Basin
RTC:	Real-Time Control
RWQC:	Recreational Water Quality Criteria
SCA:	New York City School Construction Authority
SCADA:	Supervisory Control and Data Acquisition
SIU:	Significant Industrial User
SPDES:	State Pollutant Discharge Elimination System
SPM:	Supplemental Poverty Measure
STV:	Statistical Threshold Value
SYNOP:	Statistical Rainfall Analysis Program
TAZ:	Transportation Analysis Zone
TBD:	To Be Determined
TMDL:	Total Maximum Daily Load

TOC:	Total Organic Carbon
TPL:	Trust for Public Land
TRC:	Total Residual Chlorine
TSS:	Total Suspended Solids
UAA:	Use Attainability Analysis
UER-WLIS:	Upper East River – Western Long Island Sound
USACE:	United States Army Corps of Engineers
USEPA:	United States Environmental Protection Agency
USFWS:	United States Fish and Wildlife Service
USGS:	United States Geological Survey
UV:	Ultraviolet Light
WDAP:	Water Debt Assistance Program
WLA:	Waste Load Allocation
WPCP:	Water Pollution Control Plant
WQ:	Water Quality
WQS:	Water Quality Standards
WWFP:	Waterbody/Watershed Facility Plan
WWOP:	Wet Weather Operating Plan
WWTP:	Wastewater Treatment Plant

Appendix A: Supplemental Tables

Annual CSO, Stormwater, Direct Drainage,
Local Source Baseline Volumes (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Hutchinson River	HP-023	15	131.6
Hutchinson River	HP-024	15A	170.1
Hutchinson River	HP-031	CSO-32	21.5
		Total CSO	**323.2**

Stormwater Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Discharge, (MG/Yr)**
Hutchinson River	HP—02	NA	557.5
Hutchinson River	HP--04	NA	366.2
Hutchinson River	HP-031*	NA	50.4
Hutchinson River	HP-641	NA	8.0
Hutchinson River	HP-640	NA	14.8
Hutchinson River	HP-638	NA	10.2
Hutchinson River	HP-636	NA	1.0
Hutchinson River	HP-627	NA	46.4
Hutchinson River	HP-626	NA	47.9
Hutchinson River	HP-899	NA	178.0
		Total Stormwater	**1,280.6**

*** Stormwater enters the HP-031 outfall below the regulator**

Direct Runoff Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Discharge, (MG/Yr)**
Hutchinson River	HP—50	NA	18.4
Hutchinson River	HP—51	NA	35.4
Hutchinson River	HP—52	NA	18.9
Hutchinson River	HP—53	NA	12.7
Hutchinson River	HP—54	NA	52.8
Hutchinson River	HP—55	NA	7.6
Hutchinson River	HP—56	NA	9.2
Hutchinson River	HP—57	NA	4.7
Hutchinson River	HP—58	NA	5.5
Hutchinson River	HP—59	NA	11.8
Hutchinson River	HP—96	NA	19.4
Hutchinson River	HP—98	NA	1.4
		Total Direct Runoff	**197.8**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Hutchinson River	Pelham Lake	Oakland Lake	2,018.3
		Total Dry Weather	**2,018.3**

Totals by Waterbody			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
Hutchinson River			3819.9

Totals by Source			
Waterbody	**Outfall**	**Regulator**	**Total Discharge (MG/Yr)**
CSO			323.2
Stormwater			1,280.6
Direct Runoff			197.8
Local Sources-Baseflows			2,018.3

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Discharge (MG/Yr)**
Hutchinson River	CSO	8	323.2
	Stormwater	34	1,280.6
	Direct Runoff	5	197.8
	Local Sources	53	2,018.3
		Total	**3,919.9**

**Annual CSO, Stormwater, Direct Drainage,
Local Sources Enterococci Loads (2008 Rainfall)**

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^13**
Hutchinson River	HP-023	15	93.1
Hutchinson River	HP-024	15A	71.3
Hutchinson River	HP-031	CSO-32	9.4
		Total CSO	**173.7**

Stormwater Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^13**
Hutchinson River	HP—02	NA	105.5
Hutchinson River	HP--04	NA	69.3
Hutchinson River	HP-031*	NA	9.5
Hutchinson River	HP-641	NA	1.5
Hutchinson River	HP-640	NA	2.8
Hutchinson River	HP-638	NA	1.9
Hutchinson River	HP-636	NA	0.2
Hutchinson River	HP-627	NA	8.8
Hutchinson River	HP-626	NA	9.1
Hutchinson River	HP-899	NA	33.7
		Total Stormwater	**242.4**

*** Stormwater enters the HP-031 outfall below the regulator**

Direct Runoff Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^13**
Hutchinson River	HP—50	NA	0.4
Hutchinson River	HP—51	NA	0.8
Hutchinson River	HP—52	NA	0.4
Hutchinson River	HP—53	NA	0.3
Hutchinson River	HP—54	NA	1.2
Hutchinson River	HP—55	NA	0.2
Hutchinson River	HP—56	NA	0.2
Hutchinson River	HP—57	NA	0.1
Hutchinson River	HP—58	NA	0.1
Hutchinson River	HP—59	NA	0.3
Hutchinson River	HP—96	NA	0.4
Hutchinson River	HP—98	NA	0.0
		Total Direct Runoff	**4.5**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{13}**
Hutchinson River	Pelham Lake	NA	19.6
		Total Dry Weather	**19.6**

Totals by Waterbody			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{13}**
Hutchinson River			440.2

Totals by Source			
Source	**Outfall**	**Regulator**	**Total Org.x10^{13}**
CSO			173.7
Stormwater			242.4
Direct Runoff			4.5
Local Sources			19.6

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Org.x10^{13}**
Hutchinson River	CSO	39	173.7
	Stormwater	55	242.4
	Direct Runoff	1	4.5
	Local Sources	4	19.6
		Total	**440.2**

Annual CSO, Stormwater, Direct Drainage,
Local Sources Fecal Coliform Loads (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{13}**
Hutchinson River	HP-023	15	338.4
Hutchinson River	HP-024	15A	236.8
Hutchinson River	HP-031	CSO-32	3.0
		Total CSO	**606.6**

Stormwater Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{13}**
Hutchinson River	HP—02	NA	211.0
Hutchinson River	HP--04	NA	138.6
Hutchinson River	HP-031*	NA	22.9
Hutchinson River	HP-641	NA	3.6
Hutchinson River	HP-640	NA	6.7
Hutchinson River	HP-638	NA	4.6
Hutchinson River	HP-636	NA	0.5
Hutchinson River	HP-627	NA	21.2
Hutchinson River	HP-626	NA	21.7
Hutchinson River	HP-899	NA	80.9
		Total Stormwater	**511.8**

*** Stormwater enters the HP-031 outfall below the regulator**

Direct Runoff Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{13}**
Hutchinson River	HP—50	NA	0.3
Hutchinson River	HP—51	NA	0.5
Hutchinson River	HP—52	NA	0.3
Hutchinson River	HP—53	NA	0.2
Hutchinson River	HP—54	NA	0.8
Hutchinson River	HP—55	NA	0.1
Hutchinson River	HP—56	NA	0.1
Hutchinson River	HP—57	NA	0.1
Hutchinson River	HP—58	NA	0.1
Hutchinson River	HP—59	NA	0.2
Hutchinson River	HP—96	NA	0.3
Hutchinson River	HP—98	NA	0.0
		Total Direct Runoff	**3.0**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{13}**
Hutchinson River	Pelham Lake	NA	48.6
		Total Dry Weather	**48.6**

Totals by Waterbody			
Waterbody	**Outfall**	**Regulator**	**Total Org.x10^{13}**
Hutchinson River			1168.1

Totals by Source			
Source	**Outfall**	**Regulator**	**Total Org.x10^{13}**
CSO			606.6
Stormwater			511.8
Direct Runoff			3.0
Local Sources			46.8

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Org.x10^{13}**
Hutchinson River	CSO	52	606.6
	Stormwater	44	511.8
	Direct Runoff	0	3.0
	Local Sources	4	46.8
		Total	**1168.1**

Annual CSO, Stormwater, Direct Drainage,
Local Sources BOD_5 Loads (2008 Rainfall)

Combined Sewer Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Hutchinson River	HP-023	15	31,469
Hutchinson River	HP-024	15A	29,882
Hutchinson River	HP-031	CSO-32	3,872
		Total CSO	**65,223**

Stormwater Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Hutchinson River	HP—02	NA	69,637
Hutchinson River	HP--04	NA	45,742
Hutchinson River	HP-031*	NA	6,295
Hutchinson River	HP-641	NA	999
Hutchinson River	HP-640	NA	1,849
Hutchinson River	HP-638	NA	1,274
Hutchinson River	HP-636	NA	125
Hutchinson River	HP-627	NA	5,821
Hutchinson River	HP-626	NA	5,983
Hutchinson River	HP-899	NA	22,234
		Total Stormwater	**159,958**

*** Stormwater enters the HP-031 outfall below the regulator**

Direct Runoff Outfalls			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Hutchinson River	HP—50	NA	2,298
Hutchinson River	HP—51	NA	4,422
Hutchinson River	HP—52	NA	2,361
Hutchinson River	HP—53	NA	1,586
Hutchinson River	HP—54	NA	6,595
Hutchinson River	HP—55	NA	949
Hutchinson River	HP—56	NA	1,149
Hutchinson River	HP—57	NA	587
Hutchinson River	HP—58	NA	687
Hutchinson River	HP—59	NA	1,474
Hutchinson River	HP—96	NA	2,423
Hutchinson River	HP—98	NA	175
		Total Direct Runoff	**24,707**

Local Sources			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Hutchinson River	Pelham Lake	NA	45,379
		Total Dry Weather	**45,379**

Totals by Waterbody			
Waterbody	**Outfall**	**Regulator**	**Total Lbs**
Hutchinson River			295,267

Totals by Source			
Source	**Outfall**	**Regulator**	**Total Lbs**
CSO			65,223
Stormwater			159,958
Direct Runoff			24,707
Local Sources			45,379

Totals by Source by Waterbody			
Waterbody	**Outfall**	**Percent**	**Total Lbs**
Hutchinson River	CSO	22	65,223
	Stormwater	54	159,958
	Direct Runoff	8	24,707
	Local Sources	15	45,379
		Total	**295,267**

Appendix B: Long Term Control Plan Hutchinson River Kickoff Meeting – Summary of Meeting and Public Comments Received

On March 26, 2014 DEP hosted a kickoff public meeting for the water quality planning process for long term control of combined sewer overflows in the portion of the Hutchinson River within the boundaries of New York City. The two-hour event, held at the Harry S. Truman High School in the Bronx, provided information about DEP's Long Term Control Plan (LTCP) development for Hutchinson River. DEP presented information on the Hutchinson River watershed characteristics and status of waterbody improvement projects, obtained public information on waterbody uses in the Hutchinson River, and provided opportunities for public input. The presentation can be found at http://www.nyc.gov/dep/ltcp.

Approximately fifteen people from the public attended the event as well as a representative from the Department of Environmental Protection and New York State Department of Environmental Conservation. The following summarizes the questions and comments from attendees as well as responses given.

- An attendee asked what was meant by primary contact recreation as used in the Water Quality Standards (WQS) and as reflected in the bacteria and dissolved oxygen (DO) criteria.
    - *DEP replied that according to the standard primary contact it is water appropriate for swimming, and the bacteria and DO criteria levels are meant to protect that use. DEP also stated that the NYC Department of Health (DOH) regulates beaches and swimming areas. It was also noted that there may be other factors besides water quality that prevent swimming as a use (currents, river bank slope, and commercial navigation).*
- An attendee asked whether the goal for the Hutchinson River was to protect aquatic life rather than swimming, as swimming wasn't really feasible given the commercial navigation. The attendee also mentioned that it would be nice not to have odors in low tide which has happened before.
    - *It was stated that the WQS is currently Class SB – fishable/swimmable - and that the goal of each LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific water quality standards, consistent with the Federal CSO Policy and water quality goals of the CWA.*
- An attendee asked whether someone could get sick if elevated indicator bacteria occurred due to natural conditions.
    - *DEP responded that bacteria can occur naturally due to contributions from wildlife and showed in the presentation the numbers found in sampling.*
- An attendee asked where the sample at Pelham Lake was taken.
    - *DEP responded that it was at the outlet of the third and last lake.*
- An attendee requested a copy of the Hutchinson River Sewer System and Water Quality Data Report.
    - *DEP stated that they would post it on their website.*

- A representative attending from Co-Op City expressed interest in the DEP's green infrastructure grant program.
    - *Mikelle Adgate from DEP offered to serve as a point of contact for green infrastructure related questions. She explained that the green infrastructure grant program is open for 2014 for private properties that are in the combined sewer areas in NYC.*
- An attendee questioned the graphic in the presentation showing pie charts of loadings to the Hutchinson River. He asked if Westchester County storm water was the largest loading.
    - *DEP confirmed that Westchester storm water showed the largest loadings in the data.*
- An attendee asked whether the Hutchinson River WQS could be downgraded to lower than B/SB.
    - *The goal of this LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific water quality standards, consistent with EPA's 1994 CSO Policy and subsequent guidance. Where existing water quality standards do not meet the Section 101(a)(2) goals of the Clean Water Act, or where the proposed alternative set forth in the LTCP will not achieve existing water quality standards or the Section 101(a)(2) goals, the LTCP will include a Use Attainability Analysis examining whether applicable waterbody classifications, criteria, or standards should be adjusted by the State.*
- An attendee noted an odor after the Barstow Rd. sewer project from a catch basin at a gas station. She had notified DEP and received a response that they would follow up.
    - *DEP offered to check on the status of this.*

Appendix C: Long Term Control Plan Hutchinson River Meeting #2 – Summary of Meeting and Public Comments Received[1]

On September 9, 2014 DEP hosted the second of three public meetings for the water quality planning process for long term control of combined sewer overflows (CSOs) in the portion of the Hutchinson River within the boundaries of New York City. The two-hour event, held at the Co-Op City Community Center on Dreiser Loop in the Bronx, provided information about DEP's Long Term Control Plan (LTCP) development for Hutchinson River. DEP presented information on the LTCP process, the Hutchinson River watershed characteristics, and the status of engineering alternatives evaluations, and provided opportunities for public input. The presentation can be found at http://www.nyc.gov/dep/ltcp.

Approximately fifteen people from the public attended the event as well as representatives from the Department of Environmental Protection and the New York State Department of Environmental Conservation. The following summarizes the questions and comments from attendees as well as responses given.

Q. An attendee asked what rain data DEP used for evaluating the impact of existing plans and green infrastructure implementation.

A. DEP replied that the NOAA meteorological station at LaGuardia Airport was closest to the Hutchinson River, but that the Baseline used 2008 rainfall data from JFK Airport as the standard for comparison among alternatives. To further expand: during the model calibration process, the best available rainfall information is used to reproduce the *actual* conditions, whereas a standard rainfall data set is used throughout the city for evaluating alternatives under *typical* conditions. For actual conditions, a temporary rain gauge was installed in the Hutchinson River drainage area and was used for calibration. Calibration is the process of adjusting a model to reasonably reproduce *actual* conditions so that it can provide assurance in its future projections. Typical conditions are then applied to the calibrated model for different alternatives to determine how these potential future systems would perform under the same circumstances. Two sets of typical conditions are used: a 10-year period from 2002 through 2011 from the local NOAA rain gage (in this case LGA), and the 2008 precipitation year measured at JFK airport. That particular single year of data was determined to be most representative of expected average conditions in the 2040s citywide from 30 years of data from the four NOAA gages around the city (Central Park, LaGuardia Airport, JFK Airport, and Newark Liberty Airport) and the Climate Risk Information Report by the New York City Panel on Climate Change (NPCC).

Q. A resident of Co-Op City asked what the DEP would be doing to reduce floatables present in the waterways around Co-Op City. (Slide 21)

A. DEP replied that DEP was considering floatables control technology as part of the LTCP Alternative process.

Q. An attendee asked for clarification on whether the estimated CSO reduction from green infrastructure and from the two storage tanks would be additive (i.e., 11% for one and 45% for the other would yield a 56% reduction combined).

1 These notes have been edited after the meeting to provide additional clarification to some of the questions.

A. DEP confirmed that this was the case, and noted that it would be necessary to evaluate the water quality impact of any CSO reduction to fully understand the benefit.

Q. An attendee observed that the water quality appears to improve as one progresses towards the mouth of the river but recalled that DEP stated that even complete elimination of CSO does not achieve water quality goals and asked why this might be the case.

A. DEP concurred with the premise of the question, and stated that this has to do with the physical characteristics of the river and tidal influence from the larger waterbody of the East River. DEP also noted that there is a balance that must be established between water quality goals and capital commitments in an era of tight budgets.

Q. An attendee asked what other sources were contributing to the non-attainment given the previous question.

A. DEP stated that all sources of pathogens are included in the modeling, including the inflow from Pelham Lake along with storm water and direct runoff loadings from both NYC and Westchester County. .

Q. An attendee asked whether DEP considered pollutants other than pathogens and dissolved oxygen (DO) in the LTCP.

A. DEP answered that only pathogens and DO are considered because the state water quality standards establish limits for these parameters. The attainment of protected uses is based on whether these limits are achieved, and the health of the waterbody is assessed based on whether it is protective of these uses.

Q. An attendee asked what month of the year experiences the most rainfall.

A. DEP explained that the long-term trends by month do not favor any particular month but in 2008 (the year used for alternatives evaluations) September was the wettest month.

Q. An attendee asked for the definition of an RTB.

A. DEP explained that an RTB is a retention treatment basin, a smaller tank that is used to remove floatables and settle out some of the larger particulates along with getting some CSO storage. Disinfection could also be included with these RTBs to reduce pathogen loadings.

Q. An attendee noted that the City of New Rochelle was forced to remove an RTB from service because it was not permitted.

A. DEP noted that nearly all alternatives rely on an existing, permitted outfall and that the SPDES permit would be updated to reflect a change in discharge characteristics if necessary.

Q. An attendee asked whether all disinfection alternatives include dechlorination.

A. DEP stated that they generally do, but that one alternative that relies on a long pipe to provide chlorine contact time was expected to not require dechlorination since the chlorine would naturally decay during the travel time within the pipe and we'd also be targeting lower chlorine residual concentrations.

Q. An attendee asked which of the outfalls on the Hutchinson River is a Tier 2 outfall.

A. DEP stated that HP-024 was listed as a Tier 2 outfall, and that it is the largest CSO outfall on the Hutchinson River.

Q. An attendee expressed concern regarding potential habitat impacts associated with the alternative that included the construction of a new outfall for HP-024.

A. DEP responded that environmental impacts are evaluated during the design stage, and that every effort to minimize these impacts through design modifications would be made at that time.

Q. An attendee asked what the benefit of the new long outfall for HP-024 was considering that it is not expected to have the same bacteria reduction of many of the other alternatives.

A. DEP stated that it is primarily its cost-effectiveness: cost of a long outfall is an order-of-magnitude lower than certain other alternatives discussed.

Q. An attendee asked whether floatables control facilities must be installed at the outfall or could be installed elsewhere.

A. DEP responded that floatables control facilities can be located right at the outfall, but they can also be installed upstream in the collection system, such as within a regulator chamber.

Q. An attendee asked whether the $20 million floatables control alternative was simply installing a boom.

A. DEP clarified that the $20 million concept was not a single boom, but two screening facilities, one each at HP-023 and HP-024.

Q. An attendee noted the large difference in cost between the RTB and disinfection options at HP-024 and asked whether all of that difference was pumping costs.

A. DEP stated that pumping costs are part of the difference, but the much larger portion of the difference is that the treatment pipe would have a much lower construction cost than the RTB.

Q. An attendee asked if an alternative did not achieve the forecasted goals, would DEP restart the process and identify a new alternative.

A. DEP stated that the process would not revert to the beginning, but design modifications would be considered that satisfy the requirements from DEC regarding CSO mitigation and address whatever problem was causing DEP to question the continuation of that alternative. DEP noted that anything they construct will likely be an improvement and will be subject to the environmental review process.

Q. An attendee asked about the basis of the delineation of the Hutchinson River downstream limit. The attendee noted that the Eastchester Bay beach clubs are thought of as being part of the Hutchinson River for some.

A. DEP stated that the CSO discharges in the Hutchinson River from the New York City line to roughly the Hutchinson River Parkway Bridge contribute to non-attainment of water quality standards in the waterbody, the mitigation of which is the goal of the CSO program. In Eastchester Bay, pathogen concentrations can trigger Health Department actions at the private beaches (e.g., beach closures, wet weather advisories) which have a different standard. In addition, the upper portion is confined and exhibits poor mixing characteristics and is more susceptible to non-attainment during wet weather. It was therefore appropriate for CSO planning purposes to define the Hutchinson River as DEP did, and include Eastchester Bay in the citywide LTCP phase with the ocean beaches where swimming will be the driving use for water quality goals.

Q. An attendee representing Save the Sound questioned the validity of the pathogen data presented and stated that her organization had found higher values at certain locations.

A. DEP requested that the attendee provide her data so that DEP may evaluate how they differ from DEP's. DEP data presented were geometric means, which contains a range of data values above and below the geometric mean, and would thus be likely to be lower than a single elevated value. Another way in which they may differ is that DEP data is taken at various depths and sampling locations in comparison to other data.

Q. An attendee asked how DEP planned to address floatables because this is the biggest water quality issue that residents experience. The attendee also suggested that the modeling should consider adding floatables, especially because the water quality as presented is otherwise not bad in the vicinity.

A. DEP acknowledged that these were valid concerns and reiterated that floatables control is being considered. However, it was noted that there are numeric standards that must be met for dissolved oxygen and pathogens, whereas the standard for floatables control is none in any amount. DEP also noted that there are other sources of floatables other than CSO, for example, trash on the streets gets washed into the catch basins or blows directly overland into the waterbody.

Q. An attendee noted that there is almost no access to the waterfront because of fences.

A. DEP stated that access issues do not fall within its purview and recommended that the local community reach out to their elected officials. It was also clarified that DEP's Green Infrastructure program works with the Parks Department, to incorporate green infrastructure in parkland where feasible.

Q. An attendee asked what occurs with the disinfection facility during the period of non-operation (i.e., outside the May-October window).

A. DEP stated that during this period there would be no disinfection during the period outside of the recreational season, and rain events would be untreated as they are presently.

Q. An attendee noted that New York City will be faced with meeting nutrient targets by 2017, and asked how the LTCP will be addressing nitrogen in particular.

A. DEP stated that nitrogen reduction is being addressed at several of the City's 14 waste water treatment plants (WWTP), and that the City is under consent decree to achieve nitrogen reduction targets on an enforceable schedule. In comparison to the 24/7 discharge of nitrogen from these plants, the episodic and comparatively small volume of CSO contributes a much less significant quantity of nitrogen to the surface waters of the Harbor and therefore for nitrogen, the focus has been on targeting the plant discharges.

Q. An attendee suggested that the CSO outfalls could be extended to below the marsh as a means of reducing the nutrient impact to the marshlands.

A. DEP stated this may be a good idea, but reiterated that non-CSO nitrogen load sources are much larger than the ones CSO discharges generate.

Q. An attendee asked why the ten planning areas are not in compliance.

A. DEP stated that the answers vary by waterbody, and are complicated by overlapping drainage areas and WWTP service areas (the Bronx River, Westchester Creek, and the Hutchinson River are all served by the Hunts Point WWTP). DEP indicated that they have already addressed the most cost-effective CSO reductions, such as Paerdegat Basin where all CSO from the Coney Island WWTP is discharged. DEP also pointed to urbanization, noting that Co-Op City itself was constructed on reclaimed marshland, so that the Hutchinson River no longer has the same ecological viability it once did regardless of CSO discharges.

Q. An attendee stated that research performed by the attendee indicates that wetland loss in the New York Harbor is driven by nitrogen, and that the Hutchinson River has lost 45% of its wetland area from 1974.

A. DEP noted that water quality is trending in the right direction and reiterated that CSO control would not reduce nitrogen in the system significantly. The NYCDEP is also under a nitrogen TMDL in which it is required to reduce all point and non-point sources (CSO and Storm Water) by 58.5%. To date the effluent nitrogen discharges into the East River and it's tributaries has been reduced by about 50%.

Q. An attendee asked how the ten waterbody planning areas are prioritized in DEP's capital planning, and how the public might influence that weighting.

A. The schedule for the LTCPs has been established by DEC in the CSO Consent Order. DEP stated that attending public meetings, writing to DEP, email, and data sharing, helps DEP align its priorities with the public's. DEP clarified that its capital program does not work as a fixed pot of money to be allocated among competing waterbodies; DEP identifies capital needs and raises money by issuing bonds. DEP does not receive federal money or other support, so these projects are ultimately funded by the rate payers.

DEP also announced that there will be a citywide public meeting at the end of the calendar year (and annually thereafter) to discuss prioritization of areas, among other topics. DEP also announced that the Bronx River LTCP public kickoff meeting will be held in January 2015 for a June 2015 LTCP submittal.

Q. An attendee asked whether talks have begun between DEP and Co-Op City regarding green infrastructure.

A. DEP stated that they had begun, and that in the conversation with River Corporation (operators of Co-Op City) it was mentioned that most of Co-Op City is not served by combined sewers and is thus not eligible for certain funding and prioritization of green infrastructure buildout. However, DEP noted that some of the buildings may be connected to storm sewers or otherwise influencing CSO discharges and may be good candidates for green infrastructure. DEP indicated that the discussions are ongoing.

OTHER NOTES FOR INTERNAL INFORMATION

- The Democratic Party primary election was being held at the time of the meeting. The polling place was in the same building.
- DEP Representatives: Lily Lee (engineering); Ryan Fleming (planning); Shane Ojar (public affairs); Mikelle Adgate (green infrastructure); Tim Groninger (Hazen and Sawyer, representing engineering consulting team).
- DEC Representative: Paul Kenline (regulatory enforcement)
- Minutes drafted by Tim Groninger.

Appendix D: Hutchinson River Use Attainability Analysis

EXECUTIVE SUMMARY

The New York City Department of Environmental Protection (DEP) has performed a Use Attainability Analysis (UAA) for the Hutchinson River in accordance with the 2012 CSO Order on Consent for the Hutchinson River. The Hutchinson River is a tributary of the Upper East River, currently designated as a Class SB waterbody along its tidal or marine reach downstream of the East Colonial Avenue Bridge. The river is designated as Class B along the upstream freshwater reach, from the East Colonial Avenue Bridge up to Pelham Lake, which is considered for purposes of this LTCP to be the upstream limit of the study area. The Hutchinson River then flows in a southerly direction toward the Upper East River (Figure 1). The Pelham Lake outflow, the stormwater from Westchester County and New York City (NYC) as well as the combined sewer overflows (CSOs) from NYC constitute the major source of freshwater flows into the Hutchinson River. The inter-jurisdictional character of the Hutchinson River waters, the various sources of pollutant loadings from both NYC and Westchester County, as well as their impacts on the water quality (WQ) conditions of the freshwater and tidal portions of the river, make this a complex waterbody with specific intricacies that were analyzed within the LTCP framework and which support this UAA.

According to Title 6 NYCRR, Chapter X, Part 935, the Hutchinson River saltwater front is at the East Colonial Avenue Bridge, also known as Pelham Bridge, in Westchester County. Therefore, this UAA refers exclusively to the tidal or marine portion of the Hutchinson River, which is within the jurisdiction of NYC.

Detailed analyses performed during the Hutchinson River LTCP concluded that the standards for the designated Class SB primary contact recreational uses in the Hutchinson River are not attained for the fecal coliform criterion and will not be attained even with the implementation of 100 percent CSO capture. Based on a technical assessment, the non-attainment is due, in part, to the bacteria loadings originating in Westchester County and carried downstream to the tidal reach of the Hutchinson River. However, it was found that the downstream-most portion of the tidal Hutchinson River close to the Upper East River complies with the Existing Primary Contact WQ Criteria. The inability to meet the primary contact standard throughout the majority of its extension is due to direct drainage and urban runoff impacts as well as physical and hydrological characteristics of the River. Based upon modeling, DEP projects that with the completion of the projects listed in this LTCP, there will be some modest improvement in WQ in the Hutchinson River. On the basis of these findings, DEP is requesting, through the UAA process, that the New York State Department of Environmental Conservation (DEC) consider site-specific water quality targets for the upper and lower tidal sections of the Hutchinson River.

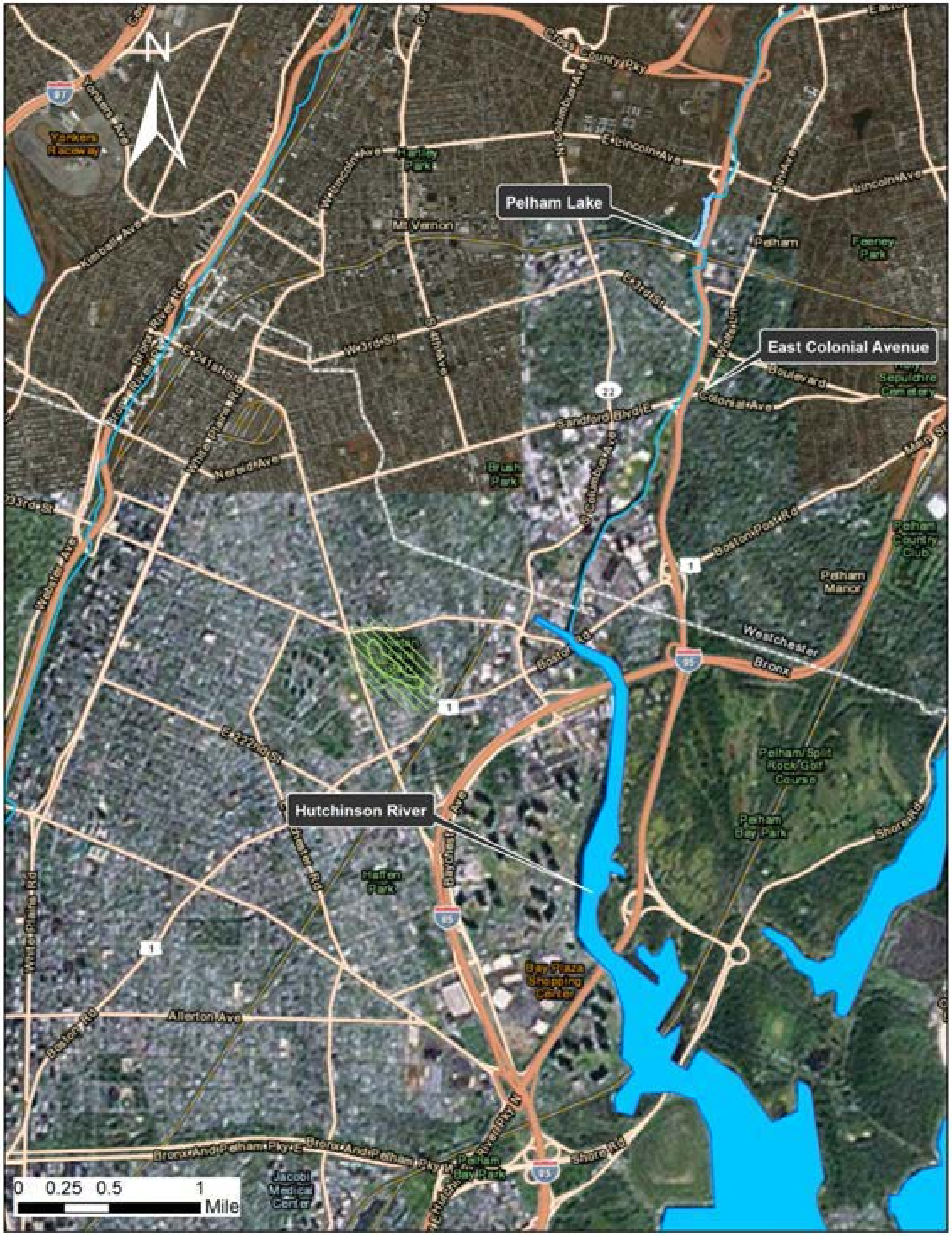

Figure 1. Aerial View of the Hutchinson River

INTRODUCTION

Regulatory Considerations

DEC has designated the tidal or marine portion of the Hutchinson River as a Class SB waterbody. The best usages of Class SB waters are *"primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival"* (6 NYCRR 701.11). DEC has indicated that the SB classification is equivalent to attaining the fishable and swimmable goals of the Clean Water Act (CWA).

Federal policy recognizes that the uses designated for a waterbody may not be attainable, and the UAA has been established as the mechanism to modify the water quality standards (WQS) in such a case. Here, the Hutchinson River does not meet the existing designated use classification. Furthermore, complete elimination of CSO discharges will not result in attainment of the designated classification of SB.

This UAA identifies the attainable and existing uses of the Hutchinson River and compares them to those designated by DEC, in order to provide data to establish appropriate WQ targets for this waterway. An examination of several factors related to the physical condition of the waterbody and the actual and possible uses suggests that the uses listed in the SB classification may not be attainable.

Under federal regulations (40 CFR 131.10), six factors may be considered in conducting a UAA:

1. Naturally occurring pollutant concentrations prevent the attainment of the use; or
2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the waterbody to its original conditions or to operate such modification in a way that would result in the attainment of the use; or
5. Physical conditions related to the natural features of the waterbody, such as the lack of proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
6. Controls more stringent than those required by Sections 301(b) and 306 of the Act [CWA] would result in substantial and widespread economic and social impact.

Identification of Existing Uses

The waterfront area surrounding the Hutchinson River is dominated by industry to the north and natural undeveloped parkland in the central and southern reaches of the eastern shore. No formal river access facilities exist along the Hutchinson River. Informal areas of access to the waterfront are shown in Figure 2. The two principal areas are near Co-op City North and Co-op City South. At Co-op City North, the section of the River north of Bellamy Loop South is part of the park area for Co-op City North. The park includes walking paths and two ball fields just north of Bellamy Loop North. Although the Hutchinson River is accessible here, bathing or canoe/kayak launching would be difficult due to rip-rap along the shoreline as illustrated in Figure 3a.

Figure 2. Hutchinson River Access Areas

Figure 3a. Hutchinson River Shoreline (Western)

The Hutchinson River is not suitable for bathing and as such there are no NYC Department of Health and Mental Hygiene (DOHMH) certified bathing beaches anywhere within the waterbody. However, because of the parkland partially surrounding the western shoreline of the waterbody, composed primarily of marshlands, there are opportunities for fishing and kayaking (see Figure 3b). There are no areas designated for wading or bathing, although, at a public meeting, comment was provided that at an area upstream of Interstate 95 there have been reported instances of body immersion (Figure 4). Other uses identified by the public included fishing and wading. The bulk of the waterbody is not conducive to primary contact uses.

Figure 3b. Hutchinson River Shoreline (Eastern)

Figure 4. Uses Identified by the Public

ATTAINMENT OF DESIGNATED USES

The tidal or marine portion of the Hutchinson River is a Class SB waterbody. This classification is suitable for primary contact recreation. As noted previously, the Hutchinson River is not suitable for primary contact recreation, and although at the public meeting there were reports of limited full body immersion, primary contact is not a frequent common or supported use.

Water quality modeling and observed data indicate that the existing Class SB bacteria criterion is not being achieved. With respect to the Class SB WQS, the attainment of the fecal coliform numeric criterion throughout the entirety of Hutchinson River is not possible 100 percent of the time primarily due to non-CSO sources of bacteria contamination, namely, the Pelham Lake outflows, direct drainage and urban stormwater. With complete removal of CSOs, attainment is still not possible due to these non-CSO sources of bacteria contamination. The analyses also indicate that the waterbody would not fully attain the SB fecal coliform (monthly median) numeric criteria during the recreational season.

Furthermore, an analysis was conducted during the development of the LTCP using 10 years of water quality model projections from 2002 through 2011 to predict the time to recover in the Hutchinson River following a rain event, an approach consistent with DEC direction. As primary contact uses during the recreational season require attainment a high percent of the time, DEP used a primary contact fecal coliform target of 1,000 counts/100mL from the New York State Department of Health (DOH) guidelines and an enterococcus target of 110 counts/100mL based on the 2012 U.S. Environmental Protection Agency (EPA) Recreational Water Quality Criteria (RWQC) recommendations in this analysis. The result of the analysis is summarized in Section 8 of the Hutchinson River LTCP report. As noted, the duration of time after a rainfall event within which bacteria concentrations are expected to be higher than DOH considers safe for primary contact varies based on the size of the rainfall event. Generally, a value of around 60 hours after rainfall appears to be the length of time for the Hutchinson River waterbody within NYC to recover from the influence of the rainfall.

DEP has been using model projections in various waterbodies and near beaches to assist with advisories that are typically issued twice a day. The recovery time is essentially the timeline that the waterbody will not support primary contact. It is intended to advise the water users of the potential health risk associated with this use during the recovery period.

CONCLUSIONS

The Hutchinson River does not attain existing Class SB WQS based on fecal coliform on an annual or recreational season basis. However, the analyses show that primary contact water quality criteria can be attained throughout portions of the recreational season with the caveat that during and after rain events, bacteria levels will be elevated for a period of time. As indicated by the public, the Hutchinson River is not commonly used for primary contact recreation, so the non-attainment of fishable/swimmable standards during and after rainfall or during the non-recreational season would not significantly impact existing waterbody uses. Non-attainment of primary contact water quality criteria are attributable to the following UAA factors:

- Human caused conditions (direct drainage and urban runoff) create high bacteria levels that prevent the attainment of the use and that cannot be fully remedied for large storms (UAA factor #3).

- Naturally-occurring (tidal) low water levels in the receiving water at the majority of the marshland along the eastern shoreline (UAA factor #2).

- Changes to the shoreline to channelize it and protect it created bulkheads and steep rip-rap lined banks limiting access to the Hutchinson River along the majority of the western shoreline (UAA factor #4).

RECOMMENDATIONS

The Hutchinson River does not attain the existing Class SB criterion for fecal coliform bacteria. Protecting primary contact water quality criteria in the Hutchinson River is possible on a limited basis, hence DEP has identified seasonal site-specific water quality targets as set forth below.

DEP believes DEC could adopt site-specific bacteria targets for the Hutchinson River during the recreational season to help make incremental improvements towards the Existing WQ Criteria. DEP notes that these targets are based on projections and may require adjustment based upon post-construction monitoring results. Projection conditions assume Westchester County municipalities will remove its illicit sources between Pelham Lake and the NYC border, 14 percent GI has been incorporated into the Hunts Point WWTP drainage area, and seasonal disinfection is being applied at HP-024 for CSO flows up to 50 MGD. Targets were developed by calculating the 95th percentile recreation period and non-recreation period geometric means (GMs) for fecal coliform and the 95th percentile 30-day rolling GM concentration for enterococci during the recreation period during the projection years 2002-2011 at station HR06. DEP has identified the following site-specific bacteria targets:

During the Recreational Season Site-Specific Targets (May 1st through October 31st), DEP has identified that the following numerical site-specific targets be established for the river for the recreational season against which continual water quality improvements can be measured:

Upper Hutchinson River tidal section – Interstate 95 north to East Colonial Avenue

Maximum rolling 30-day GM enterococci value of 150 cfu/100mL

Monthly fecal coliform GM concentration of 400 cfu/100mL

Lower Hutchinson River tidal section – south of Interstate 95

Maximum rolling 30-day GM enterococci value of 100 cfu/100mL

Monthly fecal coliform GM concentration of 200 cfu/100mL

During the Non-Recreational Season, DEP has identified the following numerical site-specific targets:

Upper Hutchinson River tidal section – Interstate 95 north to East Colonial Avenue

Monthly fecal coliform GM concentration of 600 cfu/100mL

Lower Hutchinson River tidal section – south of Interstate 95

Monthly fecal coliform GM concentration of 400 cfu/100mL

With anticipated reductions in CSO overflows resulting from grey and green infrastructure, the Hutchinson River could be protective of infrequent primary contact during the Recreational Season should it occur, as long as it did not occur during or following rainfall events. Toward that end, DEP believes that a wet weather advisory would be appropriate for the waterbody:

- 48 hours for rainfall up to 1 inch; and
- 60 hours for rainfall greater than 1 inch.