Massachusetts Water Resources Authority

Combined Sewer Overflow Control Plan

CSO Post Construction Compliance Monitoring Program Scope of Work

May 1, 2017

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1. INTRODUCTION

1.1. Purpose and Objectives

The purpose of the Post Construction Compliance Monitoring Program (the "PCCMP") is to verify attainment of the levels of combined sewer overflow (CSO) control set forth in the Massachusetts Water Resources Authority's (MWRA) $910 million Long-Term Control Plan (LTCP) approved and mandated by the Federal District Court in the Boston Harbor Case (U.S. v. M.D.C., et al., No. 85-0489-RGS). The levels of CSO control in MWRA's LTCP are based on CSO discharge volume and activation at each CSO outfall in the Typical Year.[1] MWRA's LTCP was developed in conjunction with the United States Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (DEP), the Court Parties, and the MWRA member communities with permitted CSOs (the "CSO communities")[2], as well as with input from the various stakeholders. The LTCP was approved by the Federal District Court and incorporated into the Court Schedule in the Boston Harbor Case.

The development of MWRA's LTCP began in 1987 and included several phases. During the development stage, which conformed to the requirements of the National CSO Policy and EPA CSO-related guidelines, MWRA gathered information relating to the regional sewer system and the water quality of the receiving waters. Information gathered included baseline data and pollution contributions to the receiving waters from various sources. MWRA used this information to develop levels of CSO control in its LTCP based on Typical Year activations that, when complete, would comply with Massachusetts Surface Water Quality Standards Class B or SB (CSO elimination) in sensitive fresh or marine waters, respectively or Class B_{CSO} and SB_{CSO} (remaining CSO discharges comply with Class B or SB greater than 95% of the time). This approach was approved by EPA and DEP.

With the completion of construction of the last CSO project in MWRA's LTCP in December 2015, MWRA has completed all of the milestones in the Court Schedule in the Boston Harbor Case (including 182 CSO control related milestones), with the exception of the last two milestones which require that MWRA commence a Post Construction Compliance Monitoring Program to verify that the current levels of CSO control are consistent with the levels of CSO control set forth in the approved LTCP. MWRA must commence the PCCMP by January 2018 and complete the PCCMP and submit the results to EPA and DEP by December 2020.

Remaining Schedule Seven Milestones	
Jan 2018	*MWRA to commence three-year performance assessment of its Long-Term CSO Control Plan. The assessment shall include post-construction monitoring in accordance with EPA's Combined Sewer Overflow (CSO) Policy, 59 Fed. Reg. 18688 (Apr. 19, 1994).*
Dec 2020	*MWRA to submit results of its three-year performance assessment of its Long-Term CSO Control Plan to the EPA and DEP. MWRA to demonstrate that it has achieved compliance with the levels of control (including as to frequency of CSO activation and as to volume of discharge) specified in its Long-Term CSO Control Plan.*

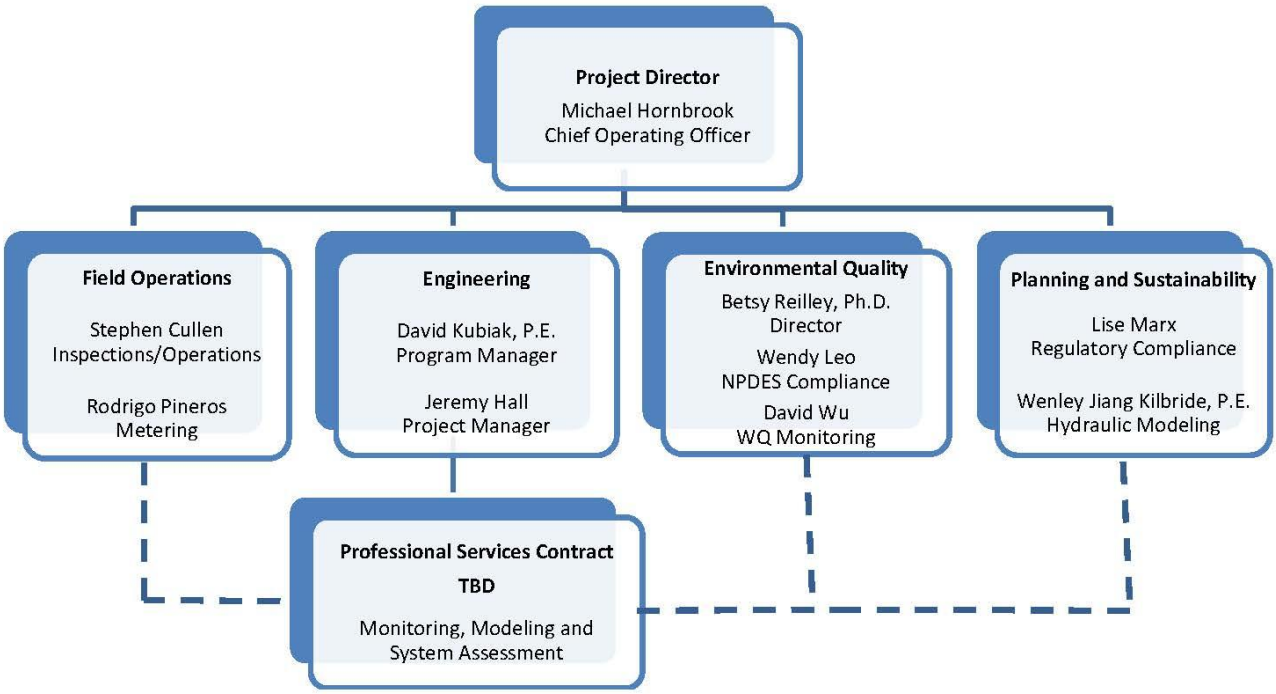
[1] "Typical Year" rainfall has been the basis for development, recommendation and approval of MWRA's LTCP, establishment of the federal court mandated levels of control, and assessment of system performance. Typical Year rainfall is defined in Attachment A.

MWRA plans to use the PCCMP to verify attainment of the Typical Year CSO discharge frequencies and volumes goals in its approved LTCP to meet its remaining requirements under the Court Order in the Boston Harbor Case. The PCCMP utilizes a combination of updated hydraulic model predictions and metering data. MWRA's hydraulic model, which incorporates its entire system (interceptor pipe sizes, the location and configuration of regulators, existing siphon structures, special structures, and connections to the interceptors) and key components of the CSO communities' systems, will be used to verify that the current Typical Year CSO discharge activations and volumes are consistent with the long-term CSO control goals. MWRA will use validated meter data to supplement the hydraulic model results.

MWRA will commence the PCCMP by January 2018 and complete it in December 2020 in compliance with the Court Order.

1.2. MWRA Project Team and Resources

The organizational chart below shows the management approach to undertaking and providing quality control of the PCCMP work. The team members are assigned specific activities, but also form a multi-departmental team that will have regular coordination and oversight. The Project Director is the primary point of contact and leadership. A professional services contract will provide a broad range of consultant support that will include meter data design and management, modeling, system performance assessments, and reporting, all further described in sections 3.0 and 4.0 of this scope. The consultant contract, which will encompass all PCCMP metering services, will be managed by MWRA's Engineering Unit with regular oversight by the full team. In order to meet the federal court milestone for commencement of the PCCMP (January 2018), MWRA must finalize the contract scope of services and advertise the contract no later than August 2017 and award the contract to the selected consultant no later than November 2017.



[2] Boston Water and Sewer Commission and the cities of Cambridge, Chelsea and Somerville. Town of Brookline does not have CSOs, but as a participant in LTCP implementation is also included in the term "CSO communities."

In addition to general oversight, each MWRA department or unit will provide specific input, review and quality control. Field Operations will provide all field assistance, including system inspections, operations and oversight of the consultant's metering work, including regular review of data management and QA/QC. Engineering will provide input relative to MWRA's 30-year CSO control program and projects, as well as management and review of the consultant's work especially to ensure that the PCCMP objectives are met and that the work and outputs conform to the performance objectives of MWRA's CSO program. MWRA's Environmental Quality Department (ENQUAL) will manage and perform receiving water quality monitoring and water quality data management (not included in the consultant contract). The Planning and Sustainability Department will provide input to and review of the consultant's modeling activities and model results, as well as oversee the entire PCCMP for regulatory compliance.

1.3. Progress Communication

PCCMP progress updates will be distributed and be publicly available through MWRA's continuing federal court reporting requirements. The court schedule requires MWRA to file a Compliance and Progress Reports every six months, which MWRA will continue to do on June 15 and December 15 of each year through the three year PCCMP. The court reports will continue to focus on the remaining compliance obligations in the court schedule, now limited to the PCCMP. Each court report will describe activities conducted and completed, particularly the progress made in post construction monitoring, model updates, and system performance tracking, along with reporting the next steps toward completing the PCCMP. MWRA's Compliance and Progress Reports are posted to MWRA's web site immediately following filing with the Court.

By April 30th each year, MWRA submits CSO discharge estimates for the previous calendar year to EPA and DEP in accordance with requirements in the CSO variances for the Lower Charles River/Charles Basin and the Alewife Brook/Upper Mystic River. The CSO communities submit similar annual discharge reports for their respective CSO outfalls. The MWRA report describes changes or updates to MWRA and CSO community system conditions – from project as-built information or field surveys – which may affect CSO discharges and thus have been incorporated into MWRA's collection system model. Using validated meter data and/or model predictions, each annual report presents estimated CSO discharge activations, duration and volume at all CSO outfalls during the previous calendar year.

The annual report also presents Typical Year model predictions of CSO activation frequency and volume for the updated system conditions and compares the Typical Year results at each outfall with the level of control in MWRA's approved LTCP. To be able to assess the performance of the system and CSO discharge estimates for the previous calendar year against Typical Year model results and the LTCP levels, in each report MWRA also compares actual rainfall and rainfall characteristics in the previous calendar year to Typical Year rainfall. Looking forward, the MWRA and community annual discharge reports, while prepared to satisfy conditions in the CSO variances or in NPDES discharge permits, will utilize data collected for the PCCMP and will continue to provide an assessment of CSO discharges against LTCP levels. MWRA understands that DEP may hold public meetings at critical junctures in the data collection and system performance assessment activities, and MWRA will provide requested support.

In accordance with requirements in the CSO variances, MWRA also submits to EPA and DEP by July 15 an annual report on the receiving water quality monitoring program in the CSO variance waters of the Lower Charles River/Charles Basin and Alewife Brook/Upper Mystic River conducted during the previous calendar year. More information about the receiving water quality monitoring program and reporting is presented in Section 3.4.

2. CSO CONTROL GOALS

2.1. MWRA's Approved LTCP and Court Mandated Levels of Control

MWRA's CSO control program began in 1987, when through a stipulation entered in the Boston Harbor Case (U.S. v. M.D.C., et al., No. 85-0489 MA) (the "First CSO Stipulation"), MWRA accepted responsibility for developing and implementing a region-wide plan to control CSOs hydraulically related to its wastewater system, including CSO discharges from its own outfalls and the outfalls permitted to and operated by BWSC, Cambridge, Chelsea and Somerville. Since then, MWRA, with the cooperation of the CSO communities, has achieved more than 180 CSO related milestones in the court ordered schedule.

Throughout the period during which MWRA implemented early CSO controls and developed a final LTCP (1986-2006), MWRA held frequent meetings and workshops with the public and a full complement of involved stakeholders, including the federal court parties, federal and state regulatory agencies, elected officials, and local and regional advocacy groups. MWRA's CSO efforts included development and implementation of projects to eliminate dry weather overflows and development of a first recommended CSO control plan (the Deep Rock Storage Tunnel Plan[3]) (1987 to 1991); development and implementation of more than 100 system optimization improvements that reduced average annual CSO discharge volume by nearly 25% (1992-96); development of the Long-Term CSO Control Plan (1992-97); reassessment and refinement of several CSO projects recommended in the 1997 plan, including the addition of several CSO projects to increase level of control for the Charles River (2006); and design and construction of the 35 CSO projects (1996-2015) in compliance with the court schedule. MWRA's efforts also included additional system optimization strategies that further reduced CSO discharges, including enhancements to the operational protocols for the Cottage Farm, Prison Point and Somerville Marginal CSO treatment facilities (2007-08). Through all of this, MWRA has continuously tracked the effect of these improvements on system performance and CSO discharges.

EPA and DEP issued approvals of MWRA's revised LTCP in March 2006 (see "Key 2006 Agreement," Section 5.1.2). With these approvals, the United States (EPA and the Department of Justice) and MWRA agreed to withdraw the 1987 First CSO Stipulation and replace it with a Second Stipulation that requires MWRA to implement the revised LTCP on the Court's schedule and to meet the agreed upon levels of CSO control. In July 2006, the Court accepted the schedule revisions, incorporated a new court schedule, and mandated that MWRA attain long-term levels of control, that is, activation frequency and discharge volume in the Typical Year, at each outfall, which are appended to the Second Stipulation. These mandated levels of control are shown in Table 1 on the following page and in Exhibit B to the Second Stipulation, a copy of which can be found in Attachment B of this scope. Table 1 lists the 81 CSO outfalls and LTCP levels of control that are included in the Second Stipulation's Exhibit B. MWRA's LTCP documentation has consistently referred to 84 CSO outfalls. The three outfalls not included in Exhibit B are permanently closed, and include SOM006 (Upper Mystic River), which was closed prior to 1997, and SOM009, which is an in-system regulator that directs its overflows to the MWRA Prison Point treatment facility (Outfall MWR203). The listed outfall "BOS088/BOS089" (South Dorchester Bay) refers to two related outfalls that discharged treated overflows from the former MWRA Fox Point facility, prior to MWRA decommissioning the facility in 2007 following completion of South Dorchester sewer separation and its elimination of CSOs.

[3] In 1990, MWRA recommended a Deep Rock Storage Tunnel for CSO control, at an estimated capital cost of $1.2 billion in 1990 dollars (approx. $2.5 billion today), that conformed to the 1989 EPA CSO Strategy. In 1992, with the prospect of a more flexible EPA CSO policy (the 1994 National CSO Policy), MWRA began a new planning effort that culminated in the current Long-Term CSO Control Plan.

Table 1

FEDERAL COURT MANDATED LONG-TERM LEVELS OF CONTROL, TYPICAL-YEAR RAINFALL

Outfall	Activation Frequency	Volume (MG)
ALEWIFE BROOK		
CAM001	5	0.19
CAM002	4	0.69
MWR003	5	0.98
CAM004	Closed	N/A
CAM400	Closed	N/A
CAM401A	5	1.61
CAM401B	7	2.15
SOM001A	3	1.67
SOM001	Closed	N/A
SOM002A	Closed	N/A
SOM003	Closed	N/A
SOM004	Closed	N/A
TOTAL		**7.29**
UPPER MYSTIC RIVER		
SOM007A/MWR205A	3	3.48
SOM007	Closed	N/A
TOTAL		**3.48**
MYSTIC/CHELSEA CONFLUENCE		
MWR205 (Somerville Marginal Facility)	39	60.58
BOS013	4	0.54
BOS014	0	0.00
BOS015	Closed	N/A
BOS017	1	0.02
CHE002	4	0.22
CHE003	3	0.04
CHE004	3	0.32
CHE008	0	0.00
TOTAL		**61.72**
UPPER INNER HARBOR		
BOS009	5	0.59
BOS010	4	0.72
BOS012	5	0.72
BOS019	2	0.58
BOS050	Closed	N/A
BOS052	Closed	N/A
BOS057	1	0.43
BOS058	Closed	N/A
BOS060	0	0.00
MWR203 (Prison Point)	17	243.00
TOTAL		**246.04**

Outfall	Activation Frequency	Volume (MG)
LOWER INNER HARBOR		
BOS003	4	2.87
BOS004	5	1.84
BOS005	1	0.01
BOS006	4	0.24
BOS007	6	1.05
TOTAL		**6.01**
CONSTITUTION BEACH		
MWR207	Closed	N/A
TOTAL		**N/A**
FORT POINT CHANNEL		
BOS062	1	0.01
BOS064	0	0.00
BOS065	1	0.06
BOS068	0	0.00
BOS070		
BOS070/DBC	3	2.19
MWR215 (Union Park)	17	71.37
BOS070/RCC	2	0.26
BOS072	0	0.00
BOS073	0	0.00
TOTAL		**73.89**
RESERVED CHANNEL		
BOS076	3	0.91
BOS078	3	0.28
BOS079	1	0.04
BOS080	3	0.25
TOTAL		**1.48**
NORTHERN DORCHESTER BAY		
BOS081	0 / 25 year	N/A
BOS082	0 / 25 year	N/A
BOS083	0 / 25 year	N/A
BOS084	0 / 25 year	N/A
BOS085	0 / 25 year	N/A
BOS086	0 / 25 year	N/A
BOS087	Closed	N/A
TOTAL		**0.00**

Outfall	Activation Frequency	Volume (MG)
SOUTHERN DORCHESTER BAY		
BOS088/BOS089 (Fox Point)	Closed	N/A
BOS090 (Commercial Point)	Closed	N/A
TOTAL		**N/A**
UPPER CHARLES		
BOS032	Closed	N/A
BOS033	Closed	N/A
CAM005	3	0.84
CAM007	1	0.03
CAM009	2	0.01
CAM011	0	0.00
TOTAL		**0.88**
LOWER CHARLES		
BOS028	Closed	N/A
BOS042	Closed	N/A
BOS049	Closed	N/A
CAM017	1	0.45
MWR010	0	0.00
MWR018	0	0.00
MWR019	0	0.00
MWR020	0	0.00
MWR021	Closed	N/A
MWR022	Closed	N/A
MWR201 (Cottage Farm)	2	6.30
MWR023	2	0.13
SOM010	Closed	N/A
TOTAL		**6.88**
NEPONSET RIVER		
BOS093	Closed	N/A
BOS095	Closed	N/A
TOTAL		**N/A**
BACK BAY FENS		
BOS046	2	5.38
TOTAL		**5.38**
Total Treated		**381**
Total Untreated		**23**
GRAND TOTAL		**404**

2.2. Compliance with Water Quality Standards

When EPA and DEP issued their initial approvals of MWRA's 1997 recommended CSO plan in early 1998, DEP also issued water quality standards determinations for the CSO affected water segments to bring the plan into compliance with state Water Quality Standards. With all of the projects now complete, MWRA's LTCP has eliminated CSO discharges to Class B and SB waters, where CSO discharges are prohibited primarily to protect beaches and shellfish beds. The LTCP also meets standards for waters that DEP designated Class B_{CSO} or SB_{CSO}, where CSO discharges must meet Class B or SB standards at least 95% of the time and in accordance with the CSO discharge limits (activation frequency and volume at each outfall in the Typical Year) in the approved LTCP, which predicts 98% compliance or greater in all water segments affected by CSO.

Table 2 identifies the current water quality standards for Boston Harbor related waters addressed in the LTCP. Implementation of the LTCP projects has closed outfalls and eliminated CSO discharges to all Class B and SB waters (Constitution Beach, North Dorchester Bay, South Dorchester Bay and Neponset River), attaining compliance with the water quality standard.

Table 2: State Water Quality Standards and Required Levels of CSO Control

Water Quality Standard Classification	Receiving Water Segment	Required Level of CSO Control
Class B	Neponset River	CSO prohibited/eliminated (25-year storm control for the South Boston beaches)
Class SB	North Dorchester Bay South Dorchester Bay Constitution Beach	
Class B_{CSO}	Back Bay Fens (Muddy River)	>95% compliance with Class B or SB Must meet level of control for CSO activation and frequency in approved Long-Term Control Plan
Class SB_{CSO}	Mystic/Chelsea Rivers Confluence Upper and Lower Boston Inner Harbor Fort Point Channel Reserved Channel	
Class B (CSO Variance)	Alewife Brook and Upper Mystic River Charles River	Class B standards sustained w/temporary authorizations for CSO discharges as the LTCP is implemented and verified (1998-2020)

For B_{CSO} and SB_{CSO} waters, including Boston Upper Inner Harbor, Lower Inner Harbor, Fort Point Channel, Reserved Channel, Mystic/Chelsea Confluence and Back Bay Fens, attainment of the LTCP levels of control in Table 1 (page 5) would bring the CSOs into compliance with the B_{CSO} and SB_{CSO} water quality standards.

DEP did not change the Class B designations for the Charles River and the Alewife Brook/Upper Mystic River in 1998, but instead made the determination that it would issue temporary variances to Class B standards for CSO, only. DEP has since issued a series of 3-year CSO variances that allow MWRA and the CSO communities to continue to discharge CSO to these waters. In accordance with the agreement MWRA reached with EPA and DEP in 2006, DEP will continue to reissue, and EPA will continue to approve, the Charles River and Alewife Brook/Upper Mystic River CSO variances through 2020. The current variances are in effect to August 31, 2019. See Section 5.2.2 for more information.

3. POST CONSTRUCTION MONITORING AND DATA COLLECTION

3.1. Program and Schedule

The following sections describe MWRA's approach to collecting the sewer system, CSO and receiving water quality data that will be used to assess system performance and receiving water quality conditions; validate the collection system model predictions; quantify remaining CSO discharge frequency and volume though a combination of model predictions and meter data during the monitoring period; regularly update Typical Year model simulations; and verify compliance with the court mandated LTCP levels of control.

The proposed PCCMP schedule is shown in Figure 1 on the following page.

3.2. Sewer System Performance Monitoring

3.2.1. CSO Outfall Meters

Most of the planned field monitoring program focuses on the active CSO outfalls, with the primary goal to improve existing model calibration which is used for estimating CSO discharge activation, duration and volume. The PCCMP field monitoring program will collect existing meter data, as well as data from proposed new meter locations. The data, once validated, will be used to supplement the InfoWorks model predictions. The goal is to obtain site-specific data at most of the active outfalls and CSO regulators over a broad range of storm types (i.e. storm characteristics, including rainfall duration, rainfall depth and average and peak intensities). This goal necessitates that 1) meter setups for each outfall be effectively designed for the conditions at each CSO regulator, 2) meters be in place, operational and well-maintained over a substantial period of time (most of the 3-year PCCMP period), and 3) meter data be frequently collected, evaluated and compiled in part to regularly confirm continuing meter performance, including calibration. Figure 2 on page 9 shows an example of a multiple sensor meter setup installed at Chelsea's Outfall CHE008. The three sensors labeled "FA" measure depths over and on either side of the overflow weir and are permanently maintained by the City of Chelsea. The two sensors labeled "EST" measure incoming flow and flow in the dry weather connection to MWRA's system and were temporary installations in 2016.

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Figure 1: Program Schedule

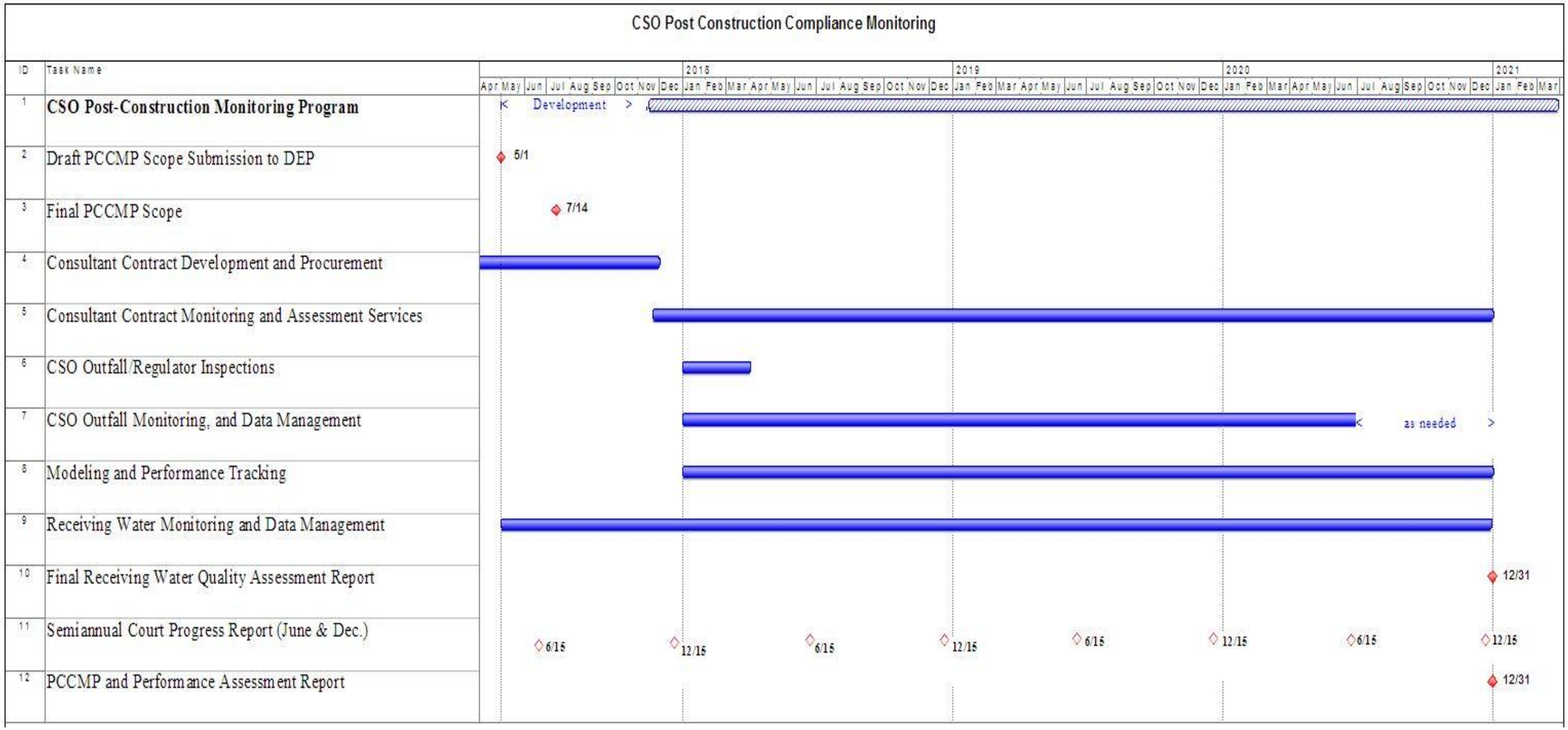
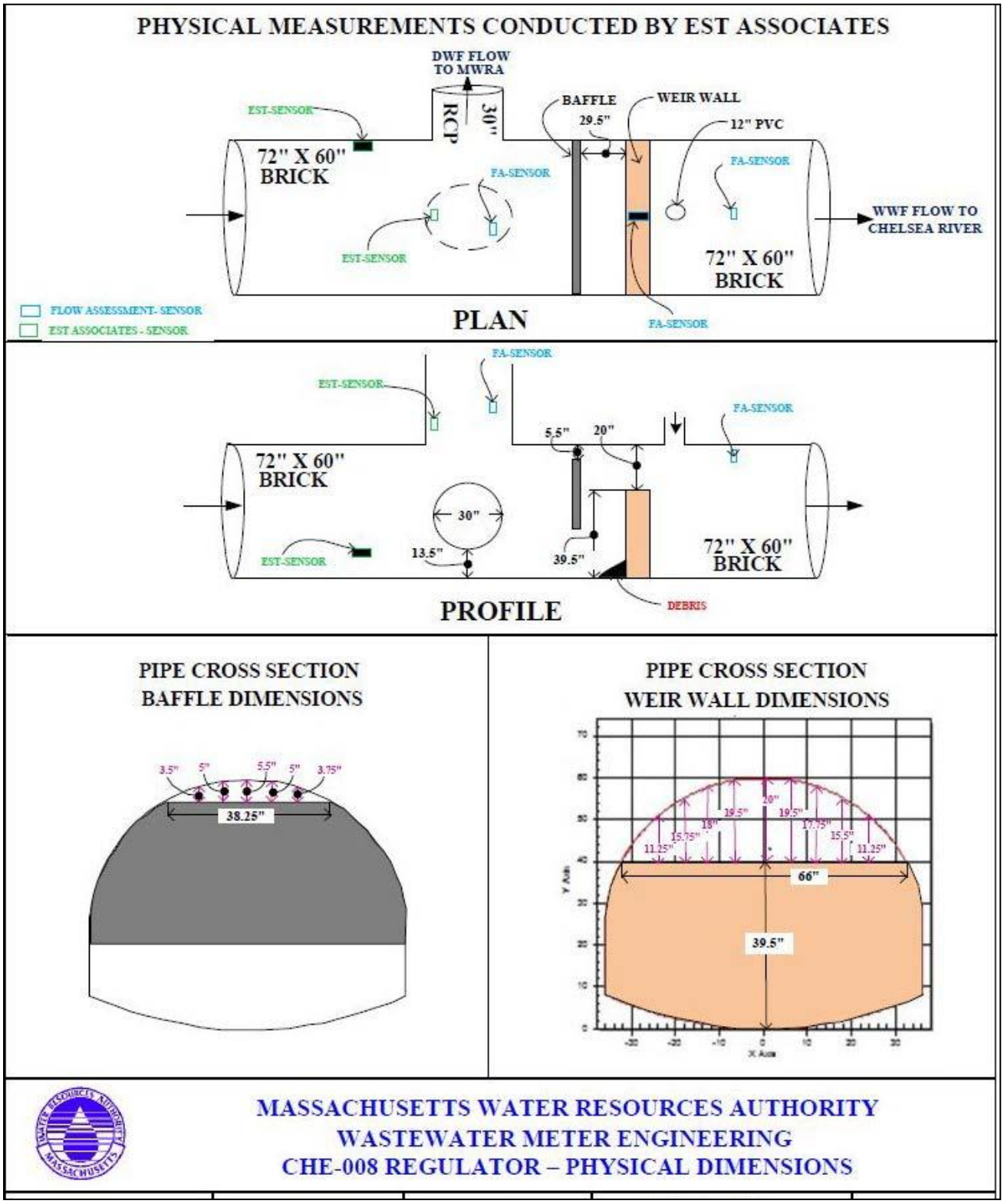


Figure 2: Multiple Sensor Meter Setup at CHE008



MWRA's outfall metering plan is presented in Table 3 on the following page (see Figure 3 on page 12 for outfall locations and respective receiving water segments). Table 3 identifies the outfalls and regulators where existing meters owned and operated by MWRA, BWSC, Cambridge, Chelsea or Somerville will be used, and where MWRA recommends installing new outfall and regulator meter setups for the PCCMP period.

In developing a metering plan, each outfall and regulator's activation potential was evaluated by reviewing the past ten years of storm by storm model simulations. Where the model predicted that a presently unmetered outfall or regulator was active in storms smaller than a 2-year storm, MWRA is proposing to install a new meter setup. Where the model predicted that a presently unmetered outfall or regulator was not active in larger storms (>2-year storm), MWRA does not recommend metering that location. Locations that are selected for new meters represent the active CSO outfalls and regulators and are located in areas where the data may aid in model verification.

Several related outfalls may be adequately covered by one set of existing or new meters, such as outfalls MWR018, MWR019 and MWR020 at the Charles River Basin where existing MWRA meters upstream and downstream of these outfalls are expected to provide adequate information to estimate discharge duration and volume. Outfalls that are known to activate only in extreme storms (>2-year storm), such as Outfall MWR010 at the Charles River Basin, BOS017 and CHE003 at the Mystic/Chelsea Confluence, and BOS062 at Fort Point Channel, are not recommended to be metered. And discharges at several outfalls can be quantified using associated operational data, such as Outfall BOS019 at the Little Mystic Channel, associated with the BOS019 Storage Conduit depth sensor, and outfalls BOS081, 082, 084, 085 and 086 along the South Boston beaches associated with the South Boston CSO storage tunnel and related diversion structures and pumping station. Most outfalls discharge the overflows from a single upstream CSO regulator, while several of the outfalls have multiple upstream regulators, as listed in Table 3. For example, Outfall MWR023 at the Charles River Basin is the outlet for overflows that enter the BWSC Stony Brook Conduit at several upstream CSO regulators, shown in Figure 4 on page 13. Based on the activation review discussed above, MWRA proposes to install meters at four of these regulators, including, RE046-30, RE046-100, RE046-105 and RE046-381.

The plan calls for outfall meters to be in place and operational during most or all of the 3-year post construction monitoring period. MWRA intends to have the full complement of meters in place and operational beginning no later than April 2018 (many are already in place and operational, as indicated in Table 3), and to ensure that the meters are maintained and the data are collected and managed through at least June 2020, assuming adequate data are collected by then. MWRA will utilize the data collected by the CSO communities at outfalls where community meter setups are already in place or planned to be in place during the 3-year monitoring period.

The MWRA's PCCMP consultant contract scope of services will include field inspections, a detailed assessment of each of the existing meter setups, recommendations for improving or supplementing the existing meters, and detailed meter recommendations and site plans where new meters will be installed. The services will also include data collection, QA/QC, meter maintenance and management plans, as well as explanations of how the data will be incorporated into the various other tasks of the PCCMP, including model verification. New meter installations are scheduled to be complete by April 2018.

Table 3: CSO Outfall Meter Plan

OUTFALL	REGULATORS	ACTIVATION* FREQUENCY	VOLUME* (MG)	PROPOSED METERING APPROACH
ALEWIFE BROOK				
CAM001	RE011	1	0.03	EXISTING CAMBRIDGE METER
CAM002	RE021	1	0.22	PROPOSED METER
MWR003	RE-031	2	0.48	EXISTING MWRA METER
CAM004	CLOSED			
CAM400	CLOSED			
CAM401A	RE-401	2	0.49	PROPOSED METER
CAM401B	RE-401B	2	0.21	PROPOSED METER
SOM001A	RE-01A	5	4.00	PROPOSED METER
SOM001	CLOSED			
SOM002A	CLOSED			
SOM003	CLOSED			
SOM004	CLOSED			
TOTAL			**5.43**	
UPPER MYSTIC RIVER				
SOM007A/MWR205A		3	1.99	EXISTING SOMERVILLE METER
SOM007	CLOSED			
TOTAL			**1.99**	
MYSTIC/CHELSEA CONFLUENCE				
MWR205 (Somerville Marginal Facility)		22	71.68	EXISTING MWRA METER
BOS013	RE013-1	4	0.13	PROPOSED METER
BOS014	RE014-2	4	0.45	PROPOSED METER
BOS015	CLOSED			
BOS017	RE017-3	0	0.00	NO METER RECOMMENDED
CHE002	CLOSED			
CHE003	RE-031	0	0.00	EXISTING CHELSEA METER
CHE004	RE-041	1	0.10	EXISTING CHELSEA METER
CHE008	RE-081	7	1.83	EXISTING CHELSEA METER
TOTAL			**74.19**	
UPPER INNER HARBOR				
BOS009	RE009-2	3	0.10	PROPOSED METER
BOS010	RE010-2	6	0.46	PROPOSED METER
BOS012	RE012-2	7	0.55	PROPOSED METER
BOS019	RE019-2	2	0.30	EXISTING MWRA METER
BOS050	CLOSED			
BOS052	CLOSED			
BOS057	RE057	2	0.57	EXISTING BWSC METER
BOS058	CLOSED			
BOS060	RE060-7	0	0.00	NO METER RECOMMENDED
	RE060-20	1	0.02	PROPOSED METER
MWR203 (Prison Point)		18	286.29	EXISTING MWRA METER
TOTAL			**288.29**	

(*) TYPICAL YEAR, 2016 SYSTEM CONDITION

OUTFALL	REGULATORS	ACTIVATION* FREQUENCY	VOLUME* (MG)	PROPOSED METERING APPROACH
LOWER INNER HARBOR				
BOS003	RE003-2	1	0.04	PROPOSED METER
	RE003-7	6	0.79	PROPOSED METER
	RE003-12	17	10.93	EXISTING BWSC METER
BOS004	RE004-6	5	0.28	PROPOSED METER
BOS005	RE005-1	0	0.00	NO METER RECOMMENDED
BOS006	CLOSED			
BOS007	CLOSED			
TOTAL			**12.04**	
CONSTITUTION BEACH				
MWR207/BOS002?	CLOSED			
FORT POINT CHANNEL				
BOS062		0	0.00	NO METER RECOMMENDED
BOS064	RE064-4	0	0.00	PROPOSED METER
	RE064-5	0	0.00	PROPOSED METER
BOS065	RE065-2	1	0.52	EXISTING BWSC METER
BOS068	RE068-2	0	0.00	PROPOSED METER
BOS070/DBC	RE070/8-3	4	0.48	PROPOSED METER
	RE070/8-6	0	0.00	NO METER RECOMMENDED
	RE070/8-7	0	0.00	NO METER RECOMMENDED
	RE070/8-8	0	0.00	NO METER RECOMMENDED
	RE070/8-13	0	0.00	NO METER RECOMMENDED
	RE070/8-15	0	0.00	PROPOSED METER
	RE070/9-4	2	0.44	PROPOSED METER
	RE070/10-5	0	0.00	NO METER RECOMMENDED
	RE070/11-2	0	0.00	NO METER RECOMMENDED
	RE070/7-2	1	2.07	PROPOSED METER
MWR215 (Union Park)		11	32.72	EXISTING MWRA METER
BOS070/RCC	RE070/5-3	0	0.00	NO METER RECOMMENDED
	RE070/6-1	6	0.87	PROPOSED METER
BOS072	CLOSED			
BOS073	RE073-4	0	0.00	EXISTING BWSC METER
TOTAL			**37.10**	
RESERVED CHANNEL				
BOS076	RE076/2-3	2	0.16	PROPOSED METER
	RE076/4-3	6	1.03	PROPOSED METER
BOS078	BOS078	0	0.00	PROPOSED METER
BOS079	RE079-3	0	0.00	PROPOSED METER
BOS080	RE080	7	0.24	PROPOSED METER
TOTAL			**1.43**	
NORTHERN DORCHESTER BAY				
BOS081	RE081-2	0	0.00	NO METER RECOMMENDED
BOS082	RE082-2	0	0.00	NO METER RECOMMENDED
BOS83	CLOSED			
BOS084	RE084-3	0	0.00	NO METER RECOMMENDED
BOS085	RE085-5	0	0.00	NO METER RECOMMENDED
BOS086	RE086-1	0	0.00	NO METER RECOMMENDED
BOS087	CLOSED			
TOTAL			**0.00**	
SOUTHERN DORCHESTER BAY				
BOS088/BOS089 (Fox Point)	CLOSED			
BOS090 (Commercial Point)	CLOSED			

OUTFALL	REGULATORS	ACTIVATION* FREQUENCY	VOLUME* (MG)	PROPOSED METERING APPROACH
UPPER CHARLES				
BOS032	CLOSED			
BOS033	CLOSED			
CAM005	CAM005	3	1.36	PROPOSED METER
CAM007	CAM007	2	0.26	PROPOSED METER
CAM009	CLOSED			
CAM011	CLOSED			
TOTAL			**1.62**	
LOWER CHARLES				
BOS028	CLOSED			
BOS042	CLOSED			
BOS049	CLOSED			
CAM017	CAM017	1	1.32	EXISTING CAMBRIDGE METER
MWR010	RE101	0	0.00	NO METER RECOMMENDED
MWR018		0	0.00	EXISTING MWRA METER
MWR019		0	0.00	NO METER RECOMMENDED
MWR020		0	0.00	EXISTING MWRA METER
MWR021	CLOSED			
MWR022	CLOSED			
MWR201 (Cottage Farm)	RE042	3	10.49	EXISTING MWRA METER
MWR023	RE046-19	0	0.00	NO METER RECOMMENDED
	RE046-30	0	0.00	PROPOSED METER
	RE046-50	0	0.00	NO METER RECOMMENDED
	RE046-55	0	0.00	NO METER RECOMMENDED
	RE046-62A	0	0.00	NO METER RECOMMENDED
	RE046-80	0	0.00	NO METER RECOMMENDED
	RE046-90	0	0.00	NO METER RECOMMENDED
	RE046-100	1	0.02	PROPOSED METER
	RE046-105	0	0.00	PROPOSED METER
	RE046-110	0	0.00	NO METER RECOMMENDED
	RE046-381	0	0.00	PROPOSED METER
	RE046-192	0	0.00	NO METER RECOMMENDED
SOM010	CLOSED			
TOTAL			**11.83**	
NEPONSET RIVER				
BOS093	CLOSED			
BOS095	CLOSED			
TOTAL			**N/A**	
BACK BAY FENS				
BOS046		1	1.56	PROPOSED METER
TOTAL			**1.56**	

Figure 3: CSO Outfall Locations and Receiving Water Segments

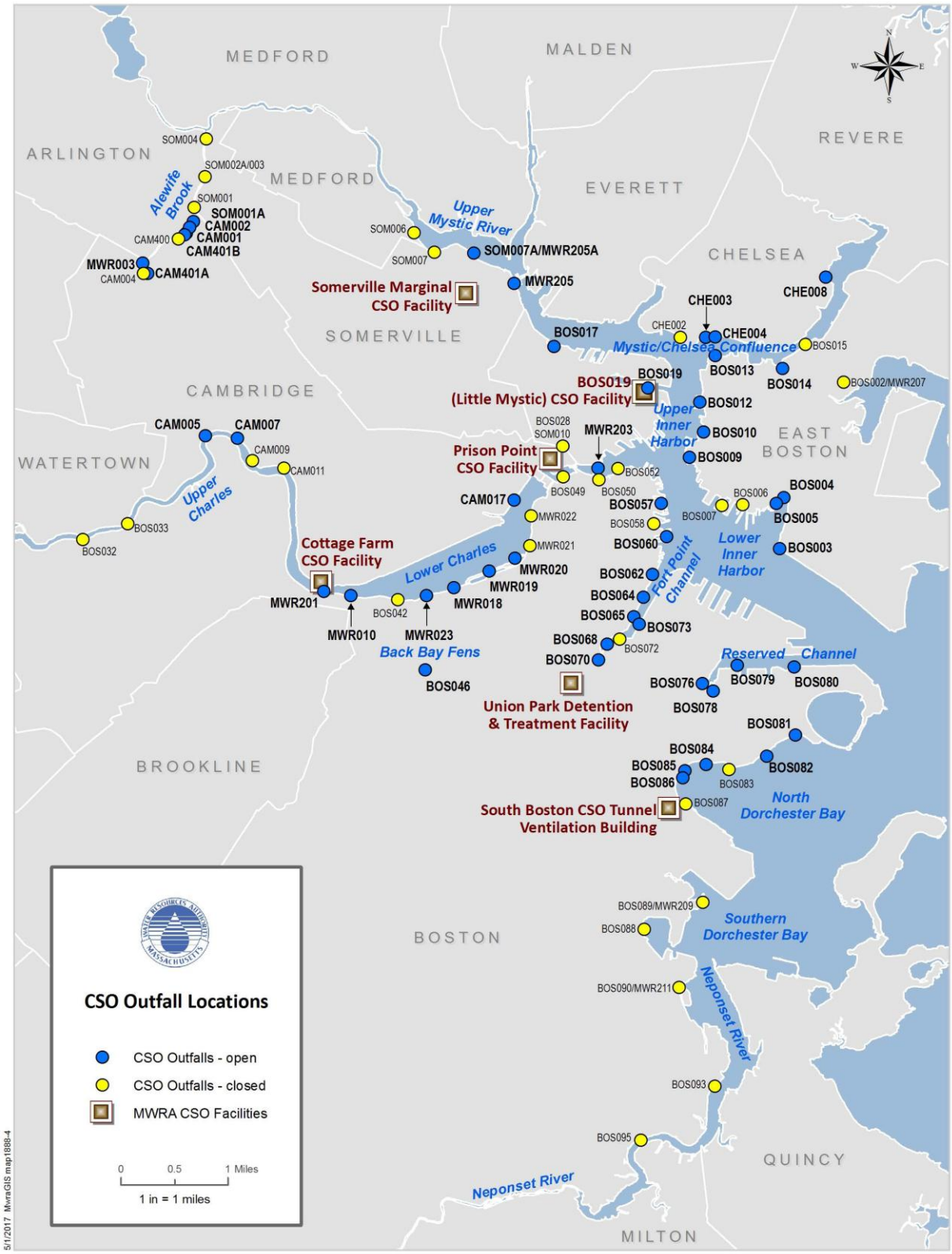
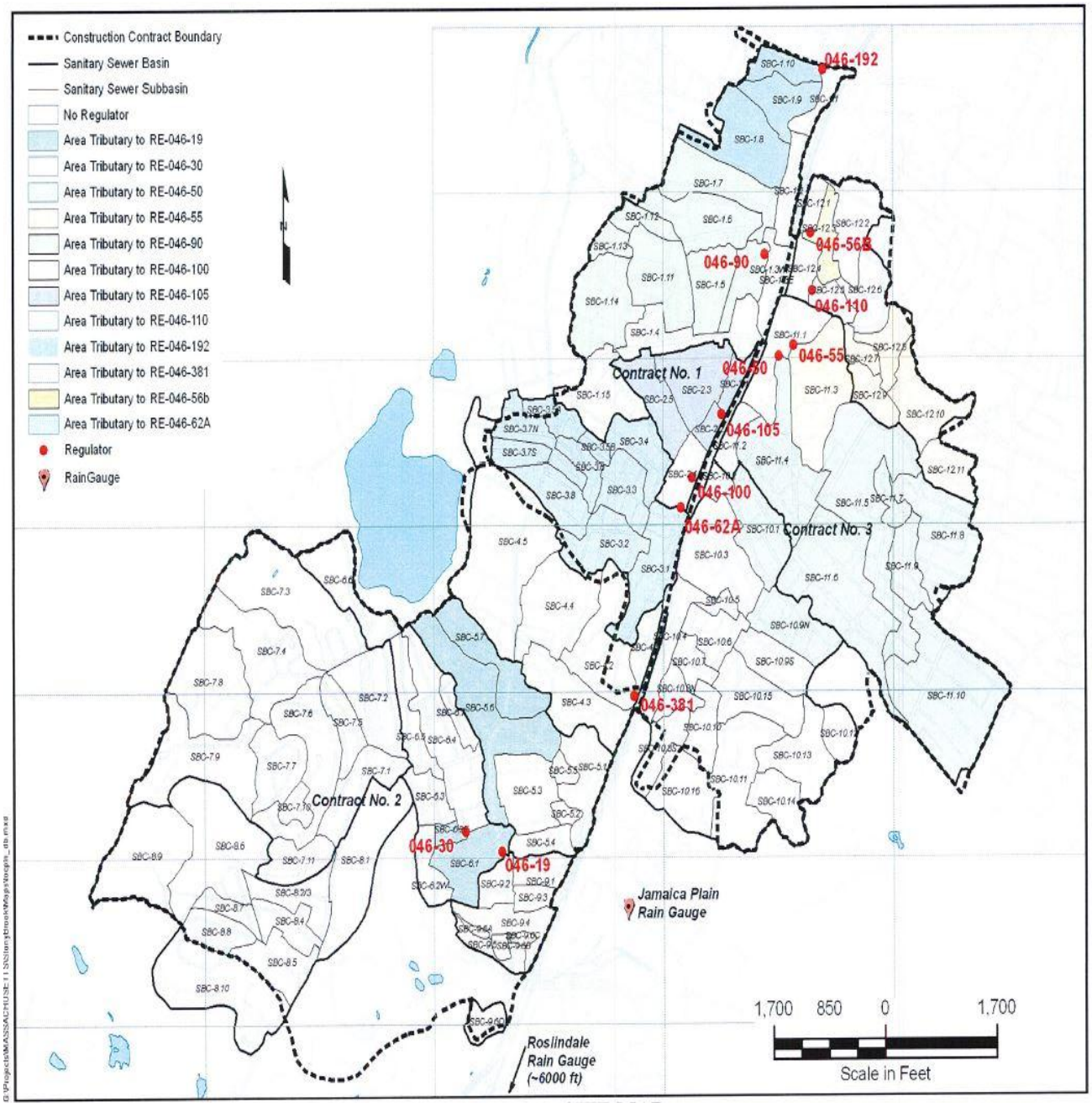


Figure 4: Stony Brook Conduit/Outfall MWR023 Multiple Regulators



3.2.2. Facility Meters and Operational Records

The MWRA has existing, permanent meters throughout its CSO system and CSO facilities, Prison Point, Cottage Farm, Somerville Marginal and Union Park. System meters used for flow survey are located at Ward Street Headworks, Columbus Headworks, Chelsea Creek Headworks and the Charlestown Branch Sewer. The rest of the system meters are listed in Table 4 on the following page.

Table 4: Interceptor and Facility Data Sources

MWRA CSO AREA PERMANENT METERS	
Meters at East Boston	
BOCH1ADS	East Boston Branch Sewer to Caruso P.S.
BOCH2CAM	East Boston Low Level Sewer to Caruso P.S.
Meters at Brookline	
BK-6C/BK6CADS	Brookline connections to MWRA interceptors
BK-BO-6C/BKBO6ADS	
BK-BO-7C/BKBO7ADS	
Meters at Cottage Farm/Charles River	
CBBO1ADS	North Charles Relief Sewer - West Branch
CB-BO-2	North Charles Relief Sewer - East Branch
NT-BO-3	South Charles Relief Sewer
NT-BO-4	Charles River Valley Sewer
Meters at Chelsea/Revere:	
CH-BO-3	Chelsea Branch Sewer
CH-BO-4C	Chelsea Branch Sewer Relief
CH-6C	CHE004 dry weather connection
CH-7	CHE008 30" DWF Connection
CH-8CADS	18" Chelsea Crecents Ave. Sanitary Sewer
RV-CH-1	Revere Extension Sewer
Meters at Alewife Brook:	
AR-SO-1/ARSO1ADS	Met. Sewer, Sec.52, U/S of Alewife Brook PS
AR-SO-3C/ARSO3CADS	Community sewer to Alewife Brook Conduit, D/S of MWR003, RE031
CB1CADS	Incoming pipe to CAM401B regulator
CB2ADS	Alewife Brook Conduit, U/S of MWR003, RE031
CB-4C	Cambridge 48" Ridge Ave. Sewer
SO-3C/SO3CADS	Somerville CS to Cambridge Branch Sewer
SO-4C	Somerville CS to Alewfie Brook Sewer
MF-SO-1	Met. Sewer, Sec.188, U/S of Alewife Brook PS
CB-6C	CAM001, DWF Connection
BM-CB-1	Belmont flow
Meters at Cambridge Branch Sewer/SOM009:	
CBSO1ADS	Cambridge Branch Sewer, U/S of SOM009
SO1C	Somerville 84"SD U/S of SOM009
SO2C	Somerville CS/SS
SO-BO-1	Cambridge Branch Sewer, btw SOM009 & Charlestown Branch Sewer
CSO Facilities	
Prison Point	
Cottage Farm	
Somerville Marginal	
Union Park	

3.2.3. System Inspections

As required by MWRA's NPDES permit and in accordance with Massachusetts Department of Environmental Protection regulations, MWRA's Wastewater Pipeline and Structure Inspections and Maintenance division performs monthly inspections of each of its CSO structures/regulators, pumping stations and tide gates. The inspections ensure that these are in good working condition and adjusted to minimize combined sewer discharges and tidal surcharging. Inspectors maintain records of the inspections and of any maintenance, and certify annually to DEP and EPA that the previous calendar year's monthly inspections were conducted, results recorded, and records maintained.

MWRA also inspects a portion of its sewer pipelines each month, inspecting approximately 13% of the system each year and performing routine and as-needed cleaning and maintenance of pipelines and siphons. Progress on inspections and maintenance is reported monthly to MWRA senior management ("Yellow Notebook") and quarterly to the MWRA Board of Directors ("Orange Notebook" available at http://www.mwra.com/quarterly/orangenotebook/orangenotebook.htm.)

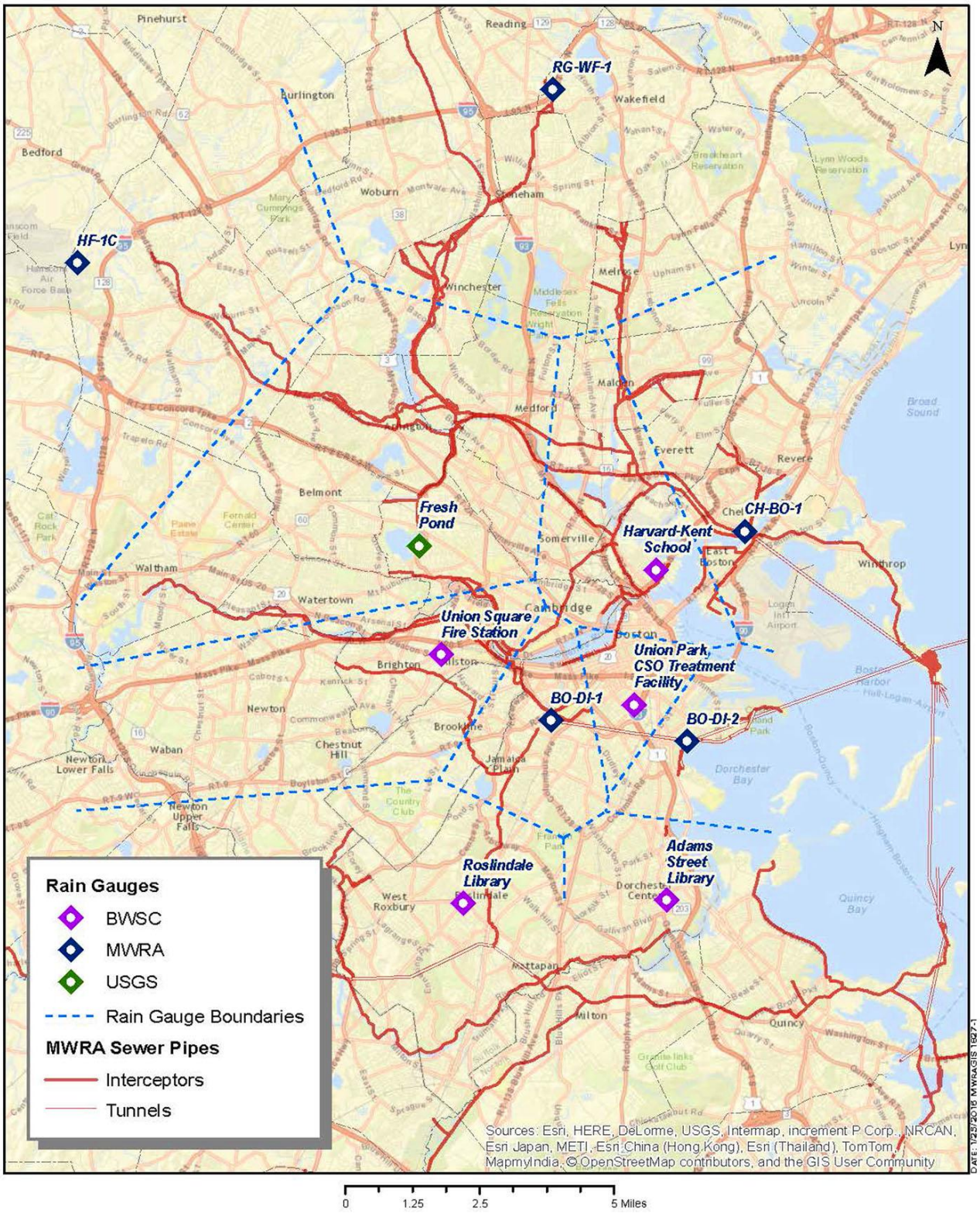
3.2.4. Rainfall Data

Rainfall data are collected at MWRA, BWSC and USGS rain gauges. The rain gauges used in the MWRA's North System InfoWorks model are listed in Table 5 and shown on the map of Figure 5, on the following page. For the PCCMP, MWRA proposes to add a rain gauge in Somerville, at or near its Somerville-Marginal CSO facility. The rainfall data are applied to respective areas shown in Figure 4 that are created automatically by the InfoWorks model using the Thiessen Polygon Method, which defines the area closest to each gauge.

Table 5: Rain Gauges

MWRA Rain Gauge BODI1 at Ward Street Headworks
MWRA Rain Gauge BODI2 at Columbus Park Headworks
MWRA Rain Gauge CHBO1 at Chelsea Creek Headworks
MWRA Rain Gauge RG-WF-1 in Reading/Wakefield
MWRA Rain Gauge HF-1C at Hanscom Field
BWSC Rain Gauge at Union Square Fire Station, Allston
BWSC Rain Gauge at Roslindale Library, Roslindale
BWSC Rain Gauge at Adams Street Library, Dorchester
BWSC Rain Gauge at Union Park Pumping Station
BWSC Rain Gauge at Harvard-Kent School, Charlestown
USGS Rain Gauge at Fresh Pond, Cambridge

Figure 5: Rain Gauge Locations



3.2.5. Meter Data Quality Assurance and Quality Control

Ensuring the accuracy of meter data requires a Quality Assurance (QA)/Quality Control (QC) meter data validation process that starts with the selection of reliable sensor types, proper installation at locations that will provide the most accurate and useful information, and identification of the number of sensors to be used per CSO monitoring location. MWRA's consultant will be expected to employ a rigorous meter maintenance plan and provide sensor redundancy in meter configuration at most critical meter sites. Setting up the best meter configuration for a site, with a combination of sensors such as depth and velocity, will require a preliminary meter data analysis. This analysis will determine whether sensor placement and installation was done properly and if sensor adjustments, relocation and possible replacement will provide more accurate data to quantify the duration and volume of CSO events.

The QA of meter data will include preventative measures and activities to minimize inaccuracies in the meter data. The proposed types of meters should have been previously used in harsh sewer environment and for CSO metering applications. Standardized documentation with procedures for field testing will be established for meter maintenance, as well as procedures for instrument verification and calibration which shall be conducted during either non-critical times (dry weather) or just prior to major wet weather events in order to anticipate sensor failures and avoid missing data or recording questionable data.

The QC of meter data will be established through procedures for conducting data timestamps cross-checking against predetermined standards and separate concurrently-collected data streams. Meter data will be evaluated near real-time using software algorithms and trend analysis to determine sensor abnormalities and resolving suspected problems by manual inspection. Suspect data will be flagged. The procedures will have data quality checks such as point to point evaluation, timestamp integrity, persistence, spike detection, internal consistency, and spatial consistency. In addition, establishing data qualifiers (data flags) for meter data evaluation and reporting will be part of the QC process in order to identify erroneous or problematic data (invalid values out of range or below detection level) or site specific problems (low battery voltage, an icing or other event or site condition, or notification of a due date for sensor calibration) which need to be flagged and dealt with internally before meter data is used.

The installation of level sensors at strategic locations within the MWRA sewer system to monitor High Level Alarms (HLA) will be considered. Using the HLA level data in conjunction with meter data recorded at CSO monitoring locations to corroborate meter data recorded at a CSO monitoring location prior to and during CSO events may provide a record of hydraulic progression from normal to surcharge flow conditions. In addition, rainfall intensity data is critical when evaluating meter data and sensor performance. The time stamp of a rainfall event recorded by the closest rain gauge to a CSO monitoring site will be useful to determine whether the sensor data (either level or velocity) recorded in a continuous flow pattern from normal flow to surcharge conditions, and to check if the high rainfall intensity corresponds to peak flows conditions recorded at a CSO monitoring location.

As part of the QA/QC meter data validation process the selected consultant will provide to the MWRA a complete description of the depth sensor and velocity sensor used by the meters selected. The use of specific meter types will be approved by the MWRA and the selected consultant upon review of the meter and sensor operation prior to their use. All velocity sensors must employ Doppler technology, and depth sensors must use ultrasonic measurement.

The selected consultant will develop and provide standard reports of meter set up, calibration and site location which will include plan and profile views showing sensor location, pipe dimensions, and all sewer manhole or regulator structure dimensions. Reports will include time stamp of meter installation, confirmations conducted during entire monitoring period and the final meter removal. The selected meter

must be capable of recording depth, velocity and calculating the volume flow rate using the continuity equation with the area of depth of flow for circular and noncircular pipe shapes and silt if present. The meter must store these values in one- or five- minute time intervals for a period of one month. Meters that use pressure sensors as a primary means of determining depth level will not be permitted. Meters may not use electromagnetic sensors for velocity measurement. Each meter will be uniquely identified. The identification (serial number) of each meter installed at a location will be recorded on the calibration report, the site location report, and the flow data records. The format for the metering data output will be in inches for depth, feet per second for velocity; and million gallons per day (MGD) for flow.

The meter sites are identified in Table 3 (page 11). The meter configuration and recording time interval will be approved by the selected consultant and the MWRA. The raw sensor data and final flow data will be plotted and evaluated by the selected consultant and made available to the MWRA via a secure share file system or by providing access to web-based hosting site. No editing of data is permitted.

The selected consultant will develop a QA/QC meter data validation that uses the QA/QC procedures previously discussed and a check list report (per meter site) which includes at the minimum the following information:

1. Meter Site Name
2. Date and Time of Installation
3. Date and Time of Meter Confirmations
4. Date and Time of Last Confirmation
5. Metering data Start date and Time
6. Metering data End date and Time
7. Pipe Shape: Circular, Elliptical, STD Egg, Ovoid, Extended Circle, Basket Handle, Other
8. Precision Pipe Measurements: Yes, No
9. Non Circular Pipe: Pipe table Attached, Yes , No
10. Pipe Sizes: Vertical and Horizontal dimensions
11. Silt Level: Yes, No, Average Silt
12. Level used to calculate flow rate in MGD: Ultrasonic Level sensor 1 or Level sensor 2
13. Data missing and time period: No, Yes and WHY

The final check list report will be filled out and signed by the consultant who is carefully generating the flow rate. The consultant will then use this report as a QA/QC of the meter data validation when reviewing metering data.

3.3. Sewer System Model

3.3.1. Description of the Model

MWRA's detailed hydraulic model incorporates its entire system along with key components of community systems. MWRA uses InfoWorks CS as its model platform. CSO related system performance runs are conducted with the MWRA Northern Collection System portion of the model, where all of the CSOs are located, which includes extensive portions (mostly the major lines) of the CSO community collection systems. The North System model's current configuration includes approximately 7,800 links and 7,400 nodes.

3.3.2. Model Verification, Use and Management

The model is regularly updated to incorporate new information about the current system from completed MWRA system improvements, completed CSO-related community system improvements, and MWRA and community system inspections. Using this information, the modeler verifies interceptor pipe sizes and the location and configuration of regulators, existing siphon structures, other special structures, and community connections to the MWRA interceptors. The model is then used to perform model verification runs using the data from existing meter locations.

3.4. Receiving Water Quality Monitoring

MWRA has been performing water quality monitoring of Boston Harbor and the harbor's tributary rivers dating back to 1989. The purpose of the monitoring is to demonstrate the effectiveness of CSO controls implemented in those watersheds, and not to identify, remediate or monitor the impacts of other pollution sources, such as separate stormwater. More recently, MWRA has been intensively monitoring the variance waters (Alewife Brook/Upper Mystic River and the Lower Charles River/Charles Basin).

3.4.1. Goal

The goal of this task is to use these data to evaluate water quality in the Alewife Brook, Mystic and Charles Rivers, as well as Boston Inner Harbor, Fort Point Channel, and Reserved Channel. MWRA's consultant will work in close collaboration with MWRA staff in order to build upon existing data analysis efforts, using data collected under the existing receiving water quality monitoring program.

3.4.2. Analyses

MWRA and its selected consultant will analyze, interpret, and draw together various types of information to describe status and trends of post-construction water quality conditions in CSO receiving waters. An assessment report will build upon, rather than duplicate, analyses conducted for the annual variance reports for the Lower Charles River/Charles River Basin and the Alewife Brook/Upper Mystic River.

One of the primary goals of the analysis will be to attempt to distinguish water quality based on dry conditions, wet conditions with no CSO discharges, and wet conditions with CSO discharges. The focus will be on bacteria.

There is particular interest in understanding the duration of elevated bacteria counts after a storm, both with and without CSO discharges. MWRA has extended the sampling program to include selected weekends, allowing MWRA to develop a picture not only of dry and wet weather conditions, but also the transitions between them, including possible differences in water quality between storms that result in CSO discharges and those that do not.

The analysis will include evaluating and analyzing water quality conditions using available data sets, correlating precipitation, precipitation intensity, CSO discharges/activations, and proxies for non-CSO sources with duration of elevated bacterial levels following precipitation events, and differences between wet and dry conditions.
Additionally, the analysis will compare baseline, pre-LTCP conditions and current, post-LTCP water quality using MWRA's extensive historical data set, including MWRA's 1994 Baseline WQ Assessment. This comparison can determine improvements in water quality conditions and perhaps identify areas

where non-CSO impacts to receiving water quality may be especially important or prevalent, as well as compare expected outcomes with actual outcomes.

3.4.3. Receiving Water Data for the Analyses

Since 1989, MWRA has been monitoring water quality in the rivers and harbor under a number of projects. The CSO-RW project collects data relevant to CSO impacts to receiving waters, including bacteria, dissolved oxygen, temperature, and salinity. Monitoring locations are located both near and far from CSO outfalls to measure near- and far-field effects of any discharge. CSO-RW currently concentrates on the Charles River and Mystic River/Inner Harbor – both regions with potentially active CSOs and portions of which are covered by DEP-issued water quality variances. Data is still collected in the Neponset River/Dorchester Bay region, but this area is of lower priority since the LTCP has either closed or minimized to a 25-year storm standard all CSO outfalls in that region. Samples are generally collected every weekday from early April to mid-October, rotating through each region.

The BHWQM and BHWQMR projects focus on nutrients and eutrophication, and include all of Boston Harbor (BHWQM) and its tributary rivers (BHWQMR); several locations are potentially impacted by CSO discharges. These projects measure water quality changes as wastewater quality was improved and discharges were transferred offshore from Boston Harbor to Massachusetts Bay, as well as measuring nutrient loadings from tributaries to the harbor. Bacteria samples are also collected. Samples are collected biweekly, year-round.

The receiving water data from the CSO-RW, BHWQM, and BHWQMR projects are collected using rigorous quality assurance procedures which are documented in approved Quality Assurance Project Plans.[4,5]

Rainfall data. Rainfall data are available from NOAA's gauge at Logan Airport as well as 15-minute rainfall data from rain gauges maintained by MWRA, USGS, and BWSC located throughout the MWRA service area as detailed in Section 3.2.4.

CSO discharges. Information about untreated combined sewer overflows (activations and volumes) will be available from MWRA's InfoWorks regional wastewater system model, as well as metering data collected as part of the post-construction assessment. Discharge durations and volumes are metered at the CSO treatment facilities, and are available from both the model and the MWRA database system.

[4] Coughlin K. 2005. Combined work/quality assurance project plan for combined sewer overflow receiving water monitoring and nutrient effects monitoring in the lower Charles River Basin. Boston: Massachusetts Water Resources Authority. Report 2005-13. 17 p. http://www.mwra.state.ma.us/harbor/enquad/pdf/2005-13.pdf

[5] Coughlin K. 2005. Combined work/quality assurance project plan for combined sewer overflow receiving water monitoring and nutrient effects monitoring in Alewife Brook/Upper Mystic River. Boston: Massachusetts Water Resources Authority. Report 2005-12. 17 p. http://www.mwra.state.ma.us/harbor/enquad/pdf/2005-12.pdf

3.4.4. Reporting

MWRA publishes an annual water quality report in July for the variance waters of the Lower Charles River/Charles Basin and Alewife Brook/Upper Mystic River as a condition of the variances in those waters (see section 5.2.2). The raw monitoring data for the previous year are also available on the MWRA website in March or April of the following year.[6]

A final Post Construction Water Quality Assessment (December 2020) will document the change in water quality corresponding with the implementation of the LTCP and associated CSO reductions..

4. PERFORMANCE ASSESSMENT AND REPORT

The Typical Year levels of CSO control mandated in the federal court order were generated from model simulations of system conditions representing completion of the LTCP projects. MWRA will continue to use its collection system model and the approved Typical Year to produce updated overflow estimates to verify compliance with the mandated levels of control. MWRA intends to use meter data and validated meter generated CSO discharges to the extent that the meter information can improve the model predictions.

4.1. Validation of Meter Generated and Model Predicted CSO Discharges

During the 3-year PCCMP period, MWRA's consultant will regularly collect data from meters located at CSO regulators, in MWRA interceptors and at MWRA pumping stations, headworks and CSO treatment facilities, as described in Section 3.2. Existing community meters (see Table 3) will continue to be maintained by the communities, and the communities will continue to collect data from their meters and generate CSO discharge duration and volume estimates using their data. MWRA's consultant will collect raw data from all meters, including community meters, and will separately generate CSO discharge duration and volume estimates. Meters do not measure overflows, but provide hydraulic data used to estimate the overflows. MWRA's consultant will also perform model simulations of all rainfall events in each year of the PCCMP period to generate model predicted CSO discharge durations and volumes at the outfalls.

Comparisons will be developed of the meter generated and model predicted discharges. Meter data (measured depths, velocities, pressures and flows) can be accurate with a rigorous QA/QC program, up to the equipment's intrinsic margin of error and the calibration tolerance range. Model inputs that characterize the collection system and its operational triggers and protocols are also accurate to the extent that the current physical and operational conditions of the system are field verified. MWRA regularly updates its modeled system parameters as new information becomes available in part from field inspections or changes to operational protocols. In addition to physical features and their dimensions, such as pipe size and structure configuration, aging systems typically are subject to additional hydraulic head loss that can reduce conveyance capacity. Model parameters such as a pipe's friction factor may also be modified in the model based on visual and TV inspection. There are, of course, limits to the level of system detail that can be field verified and represented in the model, especially in very large sewer systems built over a century or more.

CSO discharge estimates produced from the meter data and from the model depend on analytical methods and processes that cannot capture all of the intricate hydraulic factors that affect whether a CSO discharge

[6] http://www.mwra.state.ma.us/harbor/html/wq_data.htm

occurs. The results (CSO discharges) from meter and model methods and processes that are always evolving and improving are approximations, only. The meter generated and model predicted discharges can be very different, dependent in part on the unique hydraulic conditions within each CSO regulatory structure and the extents to which these detailed conditions can be represented in the meter data processing and in the model.

To validate the estimated discharges from meters and from the model and understand the differences between them that may occur, and to make decisions from the results, MWRA will perform validation analyses. For instance, graphical plots of the metered and modeled discharges against rainfall characteristics, including rainfall depth and average and peak rainfall intensities, can provide information regarding the size and type of storms that trigger CSO activations using the meter data or the model. The plots also allow the evaluation of a correlation between the magnitude of the CSO discharge estimates (again, duration and volume) with storm size. Generally, larger storms should produce larger overflows. MWRA expects that the consultant it selects to perform metering, modeling and performance assessment services may recommend and conduct other types of validation analyses. For each CSO activation from the validated meter and model results, MWRA will compare the rainfall characteristics to the rainfall characteristics of storms in the Typical Year, to verify that each discharge conforms to the Typical Year predictions.

If significant differences between the meter generated and model predicted CSO discharges remain after validation analyses, MWRA will conduct further investigation. This may include additional field surveys, further checks on meter and model calibration, validation of rainfall data input to the model, and/or confirmation of operational conditions during the rainfall events. For example, because of differences between meter generated discharges and model results at outfalls CHE004 and CHE008, MWRA and the City of Chelsea have been coordinating further investigations. Additional inspections were conducted in 2015 to confirm CSO regulator conditions and the model parameters. In 2016, MWRA installed temporary meters to supplement the data from the City's permanent meters at the CHE008 regulator. From the temporary meter data, MWRA was able to recalibrate its model with respect to flows entering the regulators and hydraulic head losses within the regulators. The calibration adjustments brought the model predictions closer to the metered discharges.

At outfalls where the validated discharge estimates indicate that CSO discharge frequency and volume in the Typical Year may be significantly greater than the LTCP levels of control, MWRA, in coordination with the CSO communities, will investigate whether minor structural modifications or changes to operating protocols can reduce the overflows. Recently, MWRA and BWSC coordinated an investigation of the feasibility of raising the overflow weir at Outfall BOS080 at the Reserved Channel, where Typical Year model predicted discharge was greater than the LTCP level of control after completion of the Reserved Channel sewer separation project. In April 2017, BWSC raised the elevation of the overflow weir by 20 inches, which brought the modeled discharges into compliance. Similarly, MWRA has modified the operation of its influent gates that allow overflows from its North Charles Metropolitan sewer interceptors to enter the Cottage Farm CSO treatment facility. Specifically, MWRA now closes the gates near the end of an activation at a higher influent flow elevation, taking greater advantage of in-system storage and reducing the amount of flow that enters the facility. This operational change reduced the model predicted treated discharges from the facility to the Charles River Basin from 5 activations and 12.8 million gallons to 3 activations and 10.5 million gallons in the Typical Year.

4.2. Sewer System and CSO Performance Tracking

For more than a decade, MWRA has conducted annual CSO performance assessments and CSO discharge tracking. These have included the annual collection and review of facility operation records, meter data and other system performance indicators, updates to the MWRA collection system hydraulic model with new information about system conditions, and the estimation, using model predictions and facility records, of CSO activations and discharge volume at all active outfalls during the previous calendar year, as well as an updated simulation of CSO discharges from Typical Year rainfall. These updates and discharge estimates are performed to satisfy or assist in satisfying annual tracking and reporting requirements in the MWRA's and CSO communities' NPDES permits and in the CSO variances for the Charles River and Alewife Brook/Upper Mystic River. These annual updates and assessments have also allowed MWRA to measure and track system performance as it continued to implement the Long-Term Control Plan. MWRA and the CSO communities are required to submit their annual CSO discharge reports by April 30th for the previous calendar year.

MWRA has incorporated completed sewer system improvements, such as completed CSO projects, other significant system or operational changes, and any other new information about system conditions into the model. Information from facility records is used to configure the facility operational assumptions in the model for each modeled storm event. Meter data and other system performance indicators are used to compare measured conditions to the model results for actual storms in the previous calendar year, allowing MWRA to validate model results or determine that model adjustment (e.g., calibration adjustment) is warranted.

Data from MWRA and community rainfall gauges are used to create geographical (polygon) rainfall area inputs to the model, as shown in Figure 5, on page 16. The discharge estimates reported to EPA and DEP are based on the model predictions, except at CSO treatment facilities, where MWRA uses measured flows in the facility records in lieu of the model predictions.

In addition to modeling all of the actual rainfall events for the previous calendar year, MWRA has also modeled the Typical Year rainfall with end-of-year updated system conditions. This has allowed MWRA to compare the updated system performance against the levels of control in the Long-Term Control Plan and to track progress toward the CSO control goals, which are based on the Typical Year rainfall that was approved by EPA and DEP for CSO performance goals and measurement. To be able to understand and explain the estimated discharges for each calendar year, which can vary greatly from Typical Year predictions, MWRA performs a detailed review and comparison of the characteristics of the year's actual storms to the characteristics of the storms in the Typical Year.

MWRA will continue to perform these annual performance updates, and along with presentations of the meter and model generated discharges and discharge evaluations discussed in Section 4.l, will submit a report to EPA and DEP on April 30th for the previous calendar year rainfall. MWRA will also post the report to its website.

4.3. CSO Assessment Report (December 2020)

MWRA will submit a Final CSO Post Construction Monitoring Program and Performance Assessment Report to EPA and DEP in December 2020, in compliance with the court schedule. The report will include the following presentations and information:

- A demonstration of compliance with the levels of control (including as to frequency of CSO activation and as to volume of discharge) specified in its Long-Term CSO Control Plan, by comparing updated Typical Year model predictions with the LTCP levels of control at each outfall.

- An updated review of collection system conditions, the performance of the LTCP projects and wet weather operational protocols.

- The results of the post-construction metering program, including updated meter mapping and meter setup descriptions, meter data and operational records, along with descriptions of the metering QA/QC program, including meter maintenance and calibration and data collection and management.

- Rainfall data, data sources, mapping and rainfall analyses.

- Quantification of CSO activations and volumes at all remaining active CSO outfalls using existing flow metering equipment, additional outfall or system metering employed during the post-construction monitoring period, and modeling of the sewer system.

- Comparisons of the meter generated and model predicted discharge estimates, along with descriptions of the meter and model validation analyses and validation conclusions.

- Comparison and evaluation of the rainfall characteristics related to meter generated or model predicted activations with the rainfall characteristics of Typical Year storms.

- A record of physical and operational adjustments to the collection system and the CSO performance effect of each adjustment.

- An updated description of the collection system model, including confirmation of LTCP project implementation conditions, a record of model adjustments made during the post-construction monitoring period, and the system or meter data supporting each adjustment.

- Meter/model verification comparisons and plots, using data from system and overflow meters and facility records.

- Final Post-Construction Water Quality Assessment Report.

5. REGIONAL CSO CONTROL ACCOMPLISHMENTS – A COMPREHENSIVE OVERVIEW

The following information reviews MWRA's compliance with CSO related federal court and regulatory obligations and the projects and measures it and its CSO communities have implemented since the late 1980's, and continue to perform, to achieve effective CSO control and associated water quality benefits. This information also provides a baseline for relating improved system conditions and greatly reduced CSO discharges, as of 2016, to the performance objectives of the Long-Term Control Plan and MWRA's remaining federal court obligations for which this plan has been developed and will be implemented through December 2020.

5.1. MWRA's LTCP

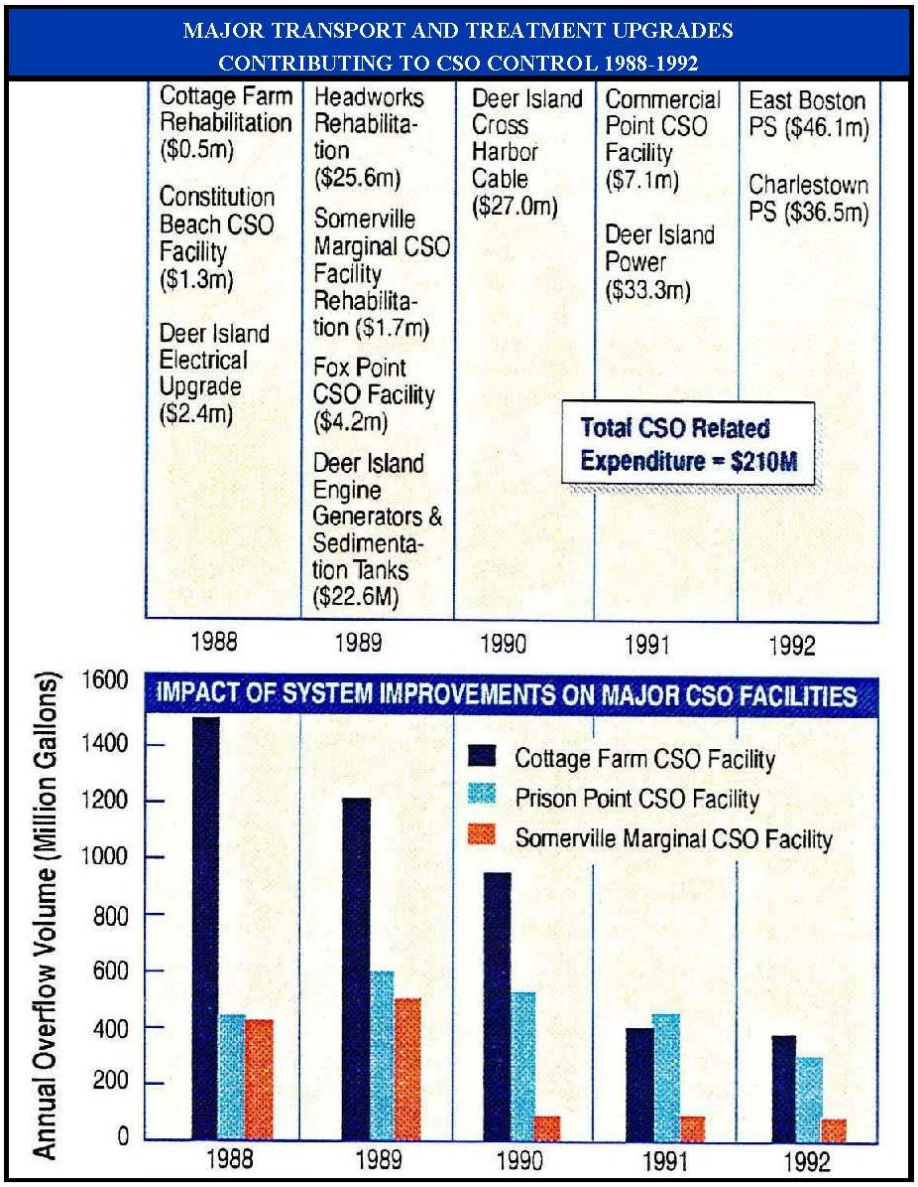
5.1.1. Long-Term Control Plan Description and Benefits

Development and implementation of the Long-Term Control Plan closely followed and conformed to the requirements of the National CSO Policy and EPA CSO-related guidelines, as well as Massachusetts Department of Environmental Protection CSO Policy and CSO Guidance, even as these federal and state CSO policies were evolving. Major elements of MWRA's CSO control efforts included:

- characterization of the regional sewer system, assessment of system performance and quantification of CSO discharges at every outfall, accomplished with MWRA and community system inspections, CSO regulator inspections, flow metering, and development and use of a detailed hydraulic model of MWRA's entire system along with key components of community systems;
- watershed-based water quality evaluations, including the characterization of baseline water quality conditions and identification of the contributions of various pollution sources, CSO and non-CSO, to water quality degradation in 14 receiving water segments affected by CSO;
- water quality monitoring within all 14 water segments and annual water quality assessments to track changes to water quality conditions as MWRA implemented its Boston Harbor Cleanup projects and the communities along these waters implemented their own sewer and storm drain system improvements;
- a CSO master planning framework that included build-out of the Deer Island secondary treatment plant and planned transport to treatment system improvements and the potential for reducing system demands with infiltration and inflow ("I/I") removal;
- evaluation of a full range and mix of CSO control strategies that considered levels of CSO control including elimination, attainment of water quality standards and designated uses, water quality improvement, various CSO control technologies, and cost-benefit and affordability analyses;
- site-specific facilities planning and environmental review of the recommended CSO control plan and CSO control alternatives;
- collection or development of information necessary to support DEP water quality standards determinations and EPA and DEP plan approvals;
- reassessment of recommended improvements as the plan was developed and regulatory approvals were obtained, and even later as new information arose during implementation; and
- design and construction of the recommended projects on an aggressive, 20-year schedule, in compliance with project specific design and construction milestones in the court schedule.

Through extensive inspections, system monitoring and modeling beginning in 1992-93, MWRA conducted a detailed performance assessment of its existing collection and treatment system, along with major capital improvements already planned. This performance assessment established a planned baseline from which MWRA could understand the remaining CSO conditions and system causes of those conditions, in advance of developing a long-term CSO control plan. The 1992 performance assessment incorporated major capital investments in the sewer system already underway or planned by MWRA, including upgrades to the transport system, pumping stations, headworks and Deer Island treatment plant (see Figure 6 on the following page).

Figure 6



Together with MWRA's and the CSO communities' efforts in the late 1980's and the 1990's to operate and maintain their respective systems more efficiently, these improvements were shown to effectively maximize the system's capacity to control wet weather flows and markedly reduce CSO discharges system-wide. In the period 1988 through 1992, total annual CSO discharge predicted for the Typical Year Rainfall dropped from 3.3 billion gallons to 1.5 billion gallons, with approximately 51% of the remaining discharge treated at five MWRA CSO screening and disinfection facilities. The Charles River especially benefited from these early system improvements.

EPA's National CSO Policy requires CSO permittees to develop and implement system optimization measures and reporting procedures intended in part to quantify, minimize and report CSO discharges in the short term, ahead of the implementation of a long-term control plan, as well as for the long term. These include detailed system characterization, easily implemented and less expensive system

improvements that can reduce CSO, and optimized operations and maintenance. In compliance with the policy, MWRA submitted its Nine Minimum Controls ("NMC") compliance documentation by January 1, 1997, as required by the Policy. While most of the NMC measures involve operations, maintenance and regulatory functions of MWRA that are funded through the Current Expense Budget, the system characterization and hydraulic optimization measures referenced below were funded through MWRA's Capital Improvement Program. In 1993-1994, MWRA completed a System Optimization Plan ("SOP"), which recommended approximately 160 low cost, easily implemented system modifications to maximize wet weather storage and conveyance. The SOP projects, which were fully implemented by MWRA and the CSO communities by 1997, further reduced CSO discharge by about 20 percent from the 1992 level.

MWRA's CSO planning culminated in the recommendation of an extensive set of larger projects covering a range of control technologies to achieve long-term, site-specific CSO control goals using watershed-based assessments of receiving water impacts and uses. MWRA presented a conceptual plan of these improvements in 1994 and refined the recommendations in a facilities plan and environmental impact report it issued in 1997. The long-term plan received initial federal and state approvals in early 1998, allowing MWRA to move the projects into design and construction.

As MWRA proceeded with implementation of the projects, it evaluated and recommended several adjustments and additions to the long-term plan in the period 1998 through 2006. These adjustments and additions responded to regulatory inquiries seeking higher levels of control (Charles River) or to new information about construction requirements, cost or CSO control performance (North Dorchester Bay, Reserved Channel, East Boston, and Alewife Brook). A final, comprehensive long-term control plan was approved by EPA and DEP in March 2006 and accepted by the Federal Court in April 2006. This plan and its predicted level of CSO control for each outfall was formally amended in May 2008 to revise the long-term CSO discharges at the Prison Point Facility, based on hydraulic optimization MWRA incorporated into the operations of the facility in response to federal and state regulators' requests and in compliance with related milestones in the court schedule. The final approved plan called for reducing total annual CSO discharge in the Typical Year to 0.4 billion gallons (an 88% reduction from the 1988 level), with 93% of the remaining discharge to be treated at four MWRA screening and disinfection/ dechlorination facilities.

MWRA began design and construction of the CSO projects in 1996 in compliance with milestones in the federal court schedule and with cooperation from its member communities with permitted CSO outfalls. MWRA executed memoranda of understanding ("MOUs") and financial assistance agreements with CSO communities in 1996 by which each municipality agreed to implement the projects within the Long-Term Control Plan involving facilities that would be owned and operated by each community, such as the new storm drain systems that would be constructed in sewer separation projects. MWRA agreed to fund the "eligible" costs, the costs of work to construct the facilities necessary to attain the long-term level of CSO control at each outfall.

Within a timeframe of only 20 years, MWRA and the CSO communities completed the design and construction of all 35 projects (see Table 6 on page 29). The capital cost of these projects ranged from less than $100,000 (for Prison Point CSO Facility Optimization) to $228.4 million (for the North Dorchester Bay CSO Tunnel). Most of the projects were major undertakings involving the construction of new wastewater facilities or extensive new storm drain or sewer systems, all in historical, densely-developed residential and commercial areas. In addition to the design and construction work, the projects also required extensive coordination with landowners, permitting agencies, transportation authorities and neighborhood residents. In some of the project areas, construction impacts were significant and unavoidable, and the collaboration, support and patience of residents and business owners should not be

overlooked in understanding the effort borne by many parties to bring these projects to completion and achieve their benefits.

The MWRA and community CSO efforts included the management of 125 contracts, including 82 construction contracts, 33 engineering contracts and 10 planning and technical support contracts, as well as financial assistance agreements with the five CSO communities that assisted in designing and constructing the plan at a total award value of $425 million, 47% of the total $910 million MWRA budget for CSO control. MWRA and the CSO communities installed nearly 100 miles of new storm drain and sewer pipe with the sewer separation, interceptor relief, hydraulic relief and storage projects in the Long-Term Control Plan. The sewer separation projects involved street-by-street separate storm drain and/or sewer construction that removed more than 4,300 acres of stormwater runoff from sewer systems in Boston, Brookline and Cambridge.

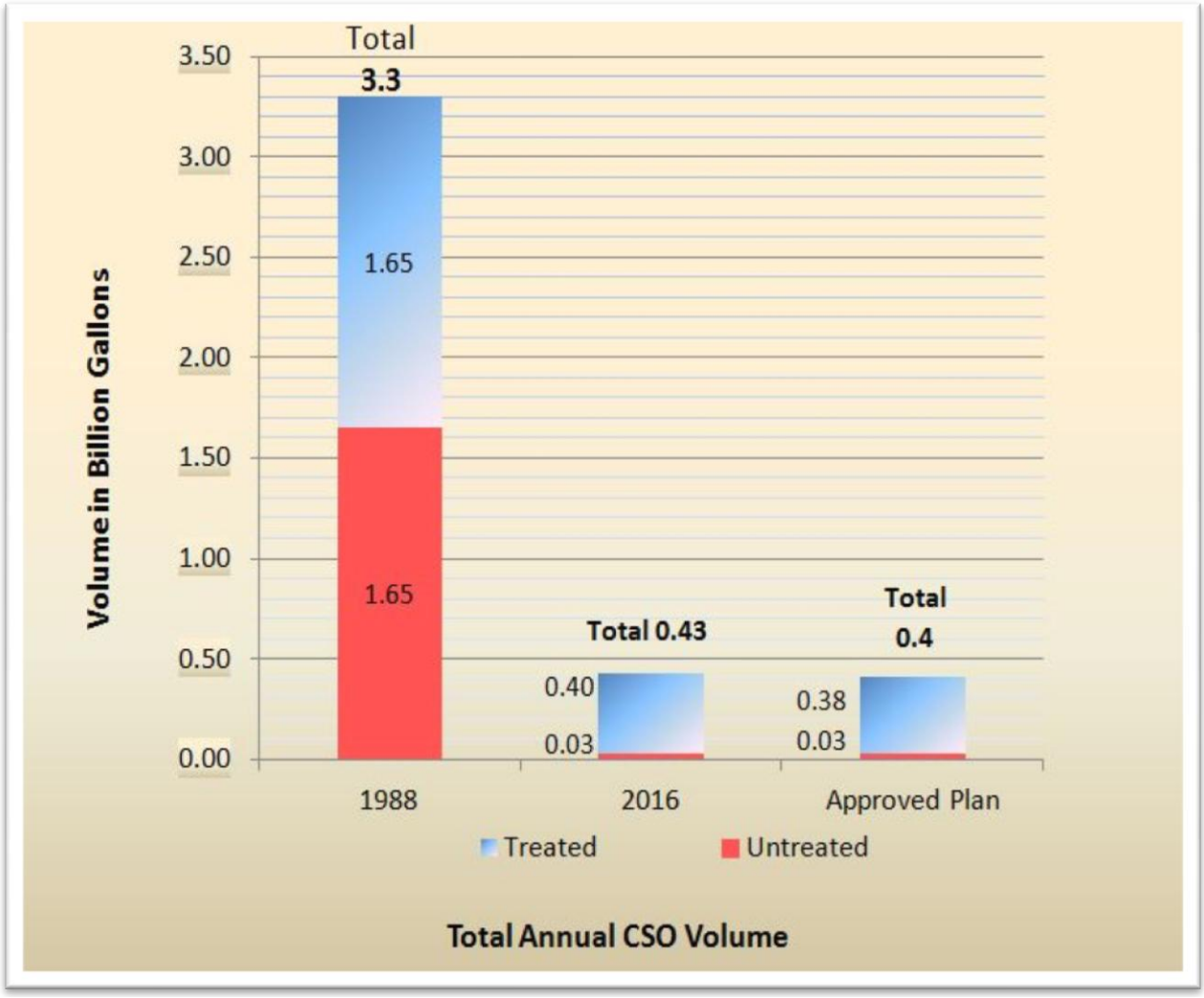
Prior to 1988, treated and untreated CSO discharges occurred in every rainfall event, approximately 100 times a year. Today, untreated CSO discharges occur zero to 7 times a year in a typical rainfall year, depending on the outfall. The plan reduces total CSO discharge volume in a typical rainfall year by approximately 88%, from 3.3 billion gallons a year to 0.4 billion gallons, and 93% (0.38 million gallons) of this remaining discharge volume is treated at MWRA's four new or upgraded CSO treatment facilities. Figure 7 on page 30 shows the estimated current level of control based on MWRA's modeling of end-of-year 2016 system conditions. Table 7, on page 31, presents, for each receiving water segment, the mandated levels of CSO control, the LTCP projects intended to attain those levels of control, and implementation cost. Figure 8 on page 32 shows CSO reduction over time for each of these receiving water segments, which are shown in the Figure 9 map, also on page 32.

Long-term levels of control will be maintained or improved upon with the continuing efforts by MWRA, its member communities with permitted CSO outfalls (BWSC, Cambridge, Chelsea and Somerville) and all of its other member communities to improve wastewater system management, remove stormwater flows through continuing CSO community-initiated sewer separation and "green infrastructure" programs, and control groundwater infiltration and stormwater inflow that can enter the several-thousand miles of sewers and individual property sewer service connections in the MWRA district.

Table 6: Long-Term CSO Control Plan Project Implementation Schedules

Project		Commence Design	Commence Construction	Complete Construction
North Dorchester Bay Storage Tunnel and Related Facilities		Aug-97	Aug-06	May-11
Pleasure Bay Storm Drain Improvements		Sep-04	Sep-05	Mar-06
Hydraulic Relief Projects	CAM005 Relief	Aug-97	Jul-99	May-00
	BOS017 Relief		Jul-99	Aug-00
East Boston Branch Sewer Relief		Mar-00	Mar-03	Jul-10
BOS019 CSO Storage Conduit		Jul-02	Mar-05	Mar-07
Chelsea Relief Sewers	Chelsea Trunk Sewer Relief	Jun-97	Sep-99	Aug-00
	Chelsea Branch Sewer Relief		Dec-99	Jun-01
	CHE008 Outfall Repairs		Dec-99	Jun-01
Union Park Detention/Treatment Facility		Dec-99	Mar-03	Apr-07
CSO Facility Upgrades and MWRA Floatables Control	Cottage Farm Upgrade	Jun-96	Mar-98	Jan-00
	Prison Point Upgrade		May-99	Sep-01
	Commercial Point Upgrade		Nov-99	Sep-01
	Fox Point Upgrade		Nov-99	Sep-01
	Somerville-Marginal Upgrade		Nov-99	Sep-01
	MWRA Floatables Control and Outfall Closings		Mar-99	Mar-00
Brookline Connection and Cottage Farm Overflow Interconnection and Gate		Sep-06	Jun-08	Jun-09
Prison Point Facility Optimization		Mar-06	Mar-07	Apr-08
South Dorchester Bay Sewer Separation		Jun-96	Apr-99	Jun-07
Stony Brook Sewer Separation		Jul-98	Jul-00	Sep-06
Neponset River Sewer Separation			Apr-96	Jun-00
Constitution Beach Sewer Separation		Jan-97	Apr-99	Oct-00
Fort Pt Channel Conduit Sewer Separation and System Optimization		Jul-02	Mar-05	Mar-07
Morrissey Boulevard Storm Drain		Jun-05	Dec-06	Jul-09
Reserved Channel Sewer Separation		Jul-06	May-09	Dec-15
Bulfinch Triangle Sewer Separation		Nov-06	Sep-08	Jul-10
Brookline Sewer Separation		Nov-06	Nov-08	Apr-13
Somerville Baffle Manhole Separation			Apr-96	Dec-96
Cambridge/Alewife Brook Sewer Separation	CAM004 Stormwater Outfall and Detention Basin		Apr-11	Apr-13
	CAM004 Sewer Separation	Jan-97	Jul 98/Sep 12	Dec-15
	CAM400 Manhole Separation	Oct-08	Jan-10	Mar-11
	Interceptor Connection Relief/Floatables Control at Outfalls CAM002, CAM401B and CAM001	Oct-08	Jan-10	Oct-10
	MWR003 Gate and Rindge Ave. Siphon Relief	Mar-12	Aug-14	Oct-15
	Connection Relief/Floatables Control at SOM01A	Mar-12	Sep-13	Dec-13
Region-wide Floatables Control and Outfall Closings		Sep-96	Mar-99	Dec-07

Figure 7: Region-wide CSO Discharge Volume Reduction



5.1.2. Regulatory Compliance and Approvals

In 1998, the U.S. Environmental Protection Agency and the Massachusetts Department of Environmental Protection approved MWRA's 1997 recommended CSO control plan, which then included 25 CSO control projects, and DEP issued water quality standards determinations that effectively brought the plan into compliance with state Water Quality standards. DEP issued the classification B_{CSO} (for fresh waters) or SB_{CSO} (for marine waters) for most of the water segments affected by CSO. Class B_{CSO} and SB_{CSO} require attainment of the levels of CSO control in an approved facilities plan, in this case, MWRA's LTCP. DEP did not change the Class B designations for the Charles River and Alewife Brook/Upper Mystic River, which would prohibit CSO discharges in the absence of relief by way of a variance. DEP has instead issued a series of temporary variances to the Class B standards for CSO only, that allow MWRA and the CSO communities to continue to discharge CSO to these waters.

Table 7: LTCP by Receiving Water Segment

Receiving Water	CSO Discharge Goals (Typical Year Rainfall) Activations	Volume (million gallons)	Projects*	Capital Cost* (millions)
Alewife Brook/Upper Mystic River	7 untreated and 3 treated @ Somerville Marginal	7.3 3.5	• Cambridge/Alewife Sewer Separation • MWR003 Gate and Rindge Siphon Relief • Interceptor Connections Upgrades • Connection/Floatables at Outfall SOM01A • Somerville Baffle Manhole Separation • Cambridge Floatables Control (portion)	$ 108.3
Mystic River/Chelsea Creek Confluence and Chelsea Creek	4 untreated and 39 treated @ Somerville Marginal	1.1 57.1	• Somerville Marginal CSO Facility Upgrade • Hydraulic Relief at BOS017 • BOS019 Storage Conduit • Chelsea Trunk Sewer Replacement • Chelsea Branch Sewer Relief • CHE008 Outfall Repairs • East Boston Branch Sewer Relief (portion)	92.0
Charles River (including Stony Brook and Back Bay Fens)	3 untreated and 2 treated @ Cottage Farm	6.8 6.3	• Cottage Farm CSO Facility Upgrade • Stony Brook Sewer Separation • Hydraulic Relief at CAM005 • Cottage Farm Brookline Connection and Inflow Controls • Brookline Sewer Separation • Bulfinch Triangle Sewer Separation • MWRA Outfall Closings and Floatables Control • Cambridge Floatables Control (portion)	88.8
Inner Harbor	6 untreated and 17 treated @ Prison Point	9.1 243.0	• Prison Point CSO Facility Upgrade • Prison Point Optimization • East Boston Branch Sewer Relief (portion)	47.5
Fort Point Channel	3 untreated and 17 treated @ Union Park	2.5 71.4	• Union Park Treatment Facility • BOS072-073 Sewer Separation and System Optimization • BWSC Floatables Control • Lower Dorchester Brook Sewer Modifications	62.4
Constitution Beach	Eliminate		• Constitution Beach Sewer Separation	3.7
North Dorchester Bay	Eliminate		• N. Dorchester Bay Storage Tunnel and Related Facilities • Pleasure Bay Storm Drain Improvements • Morrissey Blvd Storm Drain	253.8
Reserved Channel	3 untreated	1.5	• Reserved Channel Sewer Separation	70.6
South Dorchester Bay	Eliminate		• Fox Point CSO Facility Upgrade (interim) • Commercial Pt. CSO Facility Upgrade (interim) • South Dorchester Bay Sewer Separation	126.8
Neponset River	Eliminate		• Neponset River Sewer Separation	2.5
Regional			• Planning, Technical Support and Land Acquisition	50.3
TOTAL Treated Portion		410 381		$ 906.6

*Floatables controls are recommended at remaining outfalls and are included in the listed projects and capital budgets.

Figure 8: CSO Volume Reduction by Receiving Water

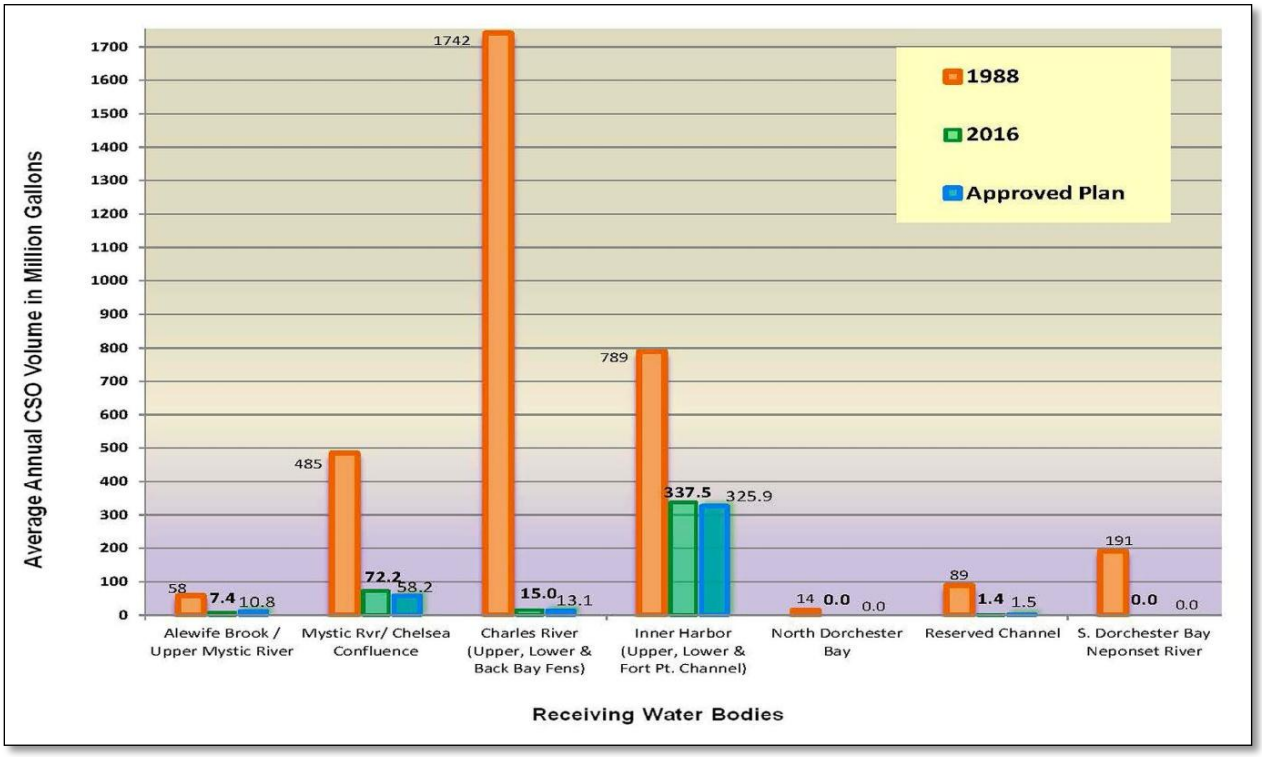


Figure 9: Boston Harbor and its Tributaries

Following the 1998 regulatory approvals, MWRA recommended several changes to the plan. MWRA revised its projects and schedules for Alewife Brook Sewer Separation (2001), East Boston Branch Sewer Relief (2003), North Dorchester Bay CSO Storage Tunnel (2004) and Reserved Channel Sewer Separation (2004) based on new information gained during the design phases of these projects. During this same period, MWRA filed variance-required reports that evaluated higher levels of CSO Control for the Charles River/Cottage Farm Facility (2004) and the Alewife Brook/Upper Mystic River (2003). The only additional CSO control recommended in these reports was inflow control and operational optimization at the Cottage Farm facility.

Key 2006 Agreement

In April 2006, the Court allowed a joint motion (MWRA, EPA, and Department of Justice) and issued an Order (July 2006) incorporating changes to the Long-Term Control Plan and schedule. This Order was the result of extensive negotiations and eventual agreement by the parties that resolved remaining outstanding issues associated with the Long Term Control Plan. The 2006 agreement resulted in: increased CSO control for the Charles River Basin; a revised recommended plan for CSO control for North Dorchester Bay (South Boston Beaches CSO Control); and a five-year period after achievement of the last construction milestone (December 2015) during which MWRA would have no additional construction responsibilities and would conduct a three-year post-construction assessment due in 2020. This was in keeping with MWRA's Advisory Board and Board of Directors' requirement that, in exchange for the additional Charles River CSO projects, MWRA would be allowed a five-year period (2015-2020) of no additional CSO obligations or related capital project spending. With this agreement and associated approvals and court orders, MWRA gained greater, necessary certainty in managing its capital program and rate increases over the 15-year period through 2020.

Prior to the 2006 agreement, MWRA and EPA had differences over the appropriate level of CSO control and related additional investment for the Charles River. EPA's proposed position on the Charles River controls had put significant risk on the scope of MWRA's obligations for CSO control and cost to MWRA ratepayers, which MWRA determined did not result in significant environmental benefits. To reach agreement on its recommended changes and secure a higher level of certainty of its long-term CSO obligations, MWRA offered and EPA agreed with, new, additional capital construction projects (Bulfinch Triangle Sewer Separation, Brookline Sewer Separation, and Cottage Farm Brookline Connection and Inflow Control) that would increase the level of CSO control for the Charles River.

MWRA's CSO control plan for the South Boston Beaches also had hit roadblocks with local resident opposition to the siting and construction of a proposed large treatment and pump facility (400 million gallons per day) included in the originally approved plan. MWRA proposed enlarging the tunnel component of the project and replacing the large pump and treatment facility with a relocated smaller CSO pumping facility at Massport's Conley Terminal. In addition, DEP and EPA agreed upon the level of CSO control (25-year or "virtual elimination") provided by MWRA's recommended project for the South Boston Beaches.

Under the Order, MWRA has five years following construction of the last CSO project in 2015 to complete, by December 2020, post-construction monitoring and a performance assessment to verify that the approved long-term levels of CSO control are achieved. Also as part of the agreement, DEP agreed to continue to reissue, and EPA agreed to continue to approve, the Charles River and Alewife Brook/Upper Mystic River CSO variances through 2020 without additional CSO controls beyond the approved plan. The current variances end on August 31, 2019.

The United States and MWRA also agreed to withdraw the 1987 First CSO Stipulation and replace it with a Second Stipulation that requires MWRA to implement the CSO requirements on the Court's schedule and to meet the agreed upon levels of CSO, as to annual activation frequency and volume of discharge at each CSO outfall, which are appended to the Second Stipulation. In July 2006, the Court accepted the schedule revisions and incorporated a new schedule (Schedule Seven).

5.2. Ongoing CSO Control Related Programs

The following sections briefly describe ongoing compliance measures and initiatives beyond the LTCP that also contribute to minimizing CSO discharges and/or their impacts.

5.2.1. NPDES Permits

MWRA's NPDES permit for the Deer Island Treatment Plant (permit MA0103284, issued July 10, 2000) allows CSO discharges during wet weather from six treated outfalls and six untreated outfalls. Of the six treated outfalls, two have been closed, leaving only the Cottage Farm, Prison Point, and Somerville Marginal (which has two outfalls) CSO treatment facilities currently operational.

The CSO treatment facilities must meet effluent limits for pH, total suspended solids, biochemical oxygen demand, total chlorine residual, and fecal coliform while discharging. MWRA is required to sample for these parameters four times per year. Additionally, whole effluent toxicity testing is required on the effluent twice a year. This testing exposes aquatic organisms to varying dilutions of effluent to determine if the effluent has any acute toxicity effects.

The permit also requires the implementation of the Nine Minimum Controls, as detailed in Section 5.2.3. Section 3.2.3 covers MWRA's permit-required maintenance and inspection program for CSO related facilities and structures.

Additionally, MWRA and BWSC are co-permittees for the Union Park CSO facility (permit MA0101192, issued April 2007), which is attached to the BWSC CSO permit, which is described below. The Union Park facility is a CSO treatment facility and as such has similar permit limits to MWRA's other CSO treatment facilities. There are permit limits for total suspended solids, biochemical oxygen demand, total chlorine residual, fecal coliform, and *Enterococcus* – all of which must be sampled four times a year. Whole effluent toxicity testing is required twice a year. Implementation of the Nine Minimum Controls is also required.

The CSO communities of Boston, Cambridge, Chelsea, and Somerville also have NPDES permits (MA0101192, MA0101974, MA0101877, and MA0101982, respectively) for CSO outfalls. Boston's permit, as the oldest, requires only the implementation of the Nine Minimum Controls, inspection of CSO structures, quantification of CSO discharges, and the installation of identification signs at CSO outfalls, similar to the MWRA permit. The newer Chelsea, Cambridge, and Somerville permits have numerous public notice provisions in addition to the conditions found in the MWRA and Boston permits. Many of these notification conditions are applied to the MWRA in the variances for the Lower Charles and Alewife Brook/Upper Mystic CSO Variances (see Section 5.2.2).

5.2.2. CSO Variances

On August 31, 2016, DEP issued Final Determinations to continue to extend the CSO-related variances to the water quality standards for Alewife Brook/Upper Mystic River and the Lower Charles River/Charles River Basin, which were subsequently approved by EPA. The variance extensions have three-year terms through August 31, 2019. The variances apply only to the permitted CSO outfalls to these receiving waters and do not otherwise modify Class B water quality standards. In accordance with the variances, CSO discharges from permitted outfalls are not required to meet effluent limits based on the Class B criteria when flow in the collection system exceeds the system's conveyance capacity as a result of precipitation or snow melt. Through its continued implementation of the Nine Minimum Controls, MWRA maintains the conveyance capacity of its collection system and has improved the handling of wet weather flows through system optimization efforts. The variances require continued implementation of CSO long term control measures consistent with MWRA's Long-Term Control Plan and compliance with other requirements referenced herein.

Each variance extension, including the variances currently in effect (2016-2019), acknowledges that it would not be feasible to fully attain the Class B bacteria criteria and associated recreational uses for these receiving waters within that three-year period. The agreement reached by EPA, DEP and MWRA in March 2006 included an understanding that DEP would reissue, and that EPA would approve, a series of three-year variance extensions effective through 2020. This agreement was based in part on the determination that implementation of controls necessary for full attainment of the Class B bacteria criteria and associated use (i.e., elimination of CSO) would result in substantial and widespread economic and social impact.

The variances include conditions that MWRA and the CSO communities have complied with for these waters, including implementation of the Long-Term Control Plan, continued implementation of operation and maintenance measures that can minimize CSO discharges and impacts, dissemination of public information on CSO discharges and potential public health impacts, 12-hour public notification of a treated CSO discharge to the Charles River from the Cottage Farm CSO Facility, continuation of MWRA's water quality monitoring program, and annual reporting of rainfall events and estimates of CSO activations and discharge volumes at each outfall.

MWRA continues to comply with the CSO-related requirements and conditions in its NPDES Permit and in the CSO variances for the Alewife Brook/Upper Mystic River and the Lower Charles River Basin. Examples of MWRA's compliance responses to the permit and variance requirements include:

- By April 15th each year, in compliance with the Alewife Brook/Upper Mystic River variance, MWRA and the cities of Cambridge and Somerville issue a joint press release that is also distributed to watershed advocacy groups, local health agents, and the owners of property in the Alewife Brook flood plain. The press release includes updated information describing CSOs, potential health risks of exposure to CSO discharges, locations of CSO discharges, and the status of MWRA's CSO abatement program for the Alewife Brook. The 2017 release is available at http://www.mwra.com/01news/2017/041117-alewife-cso-jrelease.html.

- In compliance with the Alewife Brook/Upper Mystic River CSO variance and the City of Cambridge NPDES permit, Cambridge publicly issues a notice of CSO discharge to the Alewife Brook within 12 hours of each discharge, as measured by a city-owned meter at the most active outfall (CAM002). The notices can be found on the Cambridge DPW News and Events page (http://www.cambridgema.gov/theworks/newsandevents).

- In compliance with the Lower Charles River Basin variance, MWRA issues notice of each CSO discharge at its Cottage Farm facility to local regulatory agencies, health agents, community rowing and boat houses within 12 hours of the start of discharge.

- For the Charles River, MWRA created a large-format poster that describes CSOs, potential health risks of exposure to CSO discharges, the locations of CSO discharges to the river, and the status of MWRA's CSO abatement program.

- MWRA continues to conduct its harbor and river water quality sampling and testing program in all waters affected by CSO throughout the year. MWRA reports the results in the variance waters to EPA and DEP in an annual water quality monitoring report. This report is submitted by July 15 of each year, and is available for public download on www.mwra.com.

- By April 30th each year, MWRA reports its estimates of CSO discharge at every active outfall for all storms in the previous calendar year.

5.2.3. Nine Minimum Controls Compliance

In accordance with the National CSO Policy and in compliance with its NPDES permit, MWRA, BWSC, Cambridge, Chelsea and Somerville each have CSO Nine Minimum Controls Compliance Documentation approved by EPA that include routinely implemented operations, maintenance, monitoring and reporting measures to minimize CSO discharges and impacts, monitor discharges, and provide public information. The Nine Minimum Controls are the minimum technology requirement of the National CSO Policy that must be met by each CSO permittee. They include:

1) Proper operation and regular maintenance programs for the sewer system and the combined sewer overflows.
2) Maximum use of the collection system for storage.
3) Review and modification of the pretreatment program to assure CSO impacts are minimized.
4) Maximization of flow to the POTW for treatment.
5) Prohibition of dry weather overflows from CSOs.
6) Control of solid and floatable materials in the CSOs.
7) Pollution prevention programs that focus on contaminant reduction activities.
8) Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts.
9) Monitoring to effectively characterize CSO and the efficacy of CSO controls.

5.2.4. Public Notification of CSO Discharges

A variety of methods are in use to inform the public about CSO discharges. This includes general information about CSOs and the status of control efforts, as well as notifications when CSOs discharge. Many of these education efforts and notifications are required in NPDES permits and/or by the water quality standards variances for the Lower Charles River/Charles Basin and the Alewife Brook/Upper Mystic River.

General information

On MWRA and community websites, users can find general information regarding CSOs, including their potential health impacts, locations of CSO discharges, and the status of CSO control efforts. Examples include:

- MWRA: http://www.mwra.com/03sewer/html/sewcso.htm
- Somerville: http://www.somervillema.gov/cso
- BWSC: http://www.bwsc.org/about_bwsc/systems/outfall_maps/outfall_maps.asp
- Cambridge: https://www.cambridgema.gov/theworks/ourservices/stormwatermanagement/combinedseweroverflows1/combinedseweroverflowcsodata
- Chelsea: http://www.chelseama.gov/sites/chelseama/files/uploads/combinedseweroverflow.cityofchelsea.pdf

More comprehensive information is also available at key locations such as waterfront parks and boathouses (see for example MWRA's poster http://www.mwra.com/cso/mainimages/charlesposter-2010-1500.jpg.

MWRA and the CSO communities report annually (by April 30) on the number of CSO discharges and the volume discharged. During the 3-year PCCMP period, MWRA will post these reports to its web site.

MWRA and the CSO communities also maintain signage at CSO outfalls, including (as appropriate) universal symbology or languages other than English, to inform the public about the potential for wet-weather discharges at those locations.

Wet-Weather Notifications

In key areas, MWRA or the communities have put into place or are developing systems for public notification of CSO discharges. These systems may rely on model predicted or metered results, and may include the CSO outfall(s) that are the most active in the respective receiving water segment, which can serve as proxy for possible discharges from other nearby CSOs. For example, the Cottage Farm CSO treatment facility is the most active CSO in the Lower Charles River/Charles Basin, and MWRA sends out a public notification within 12 hours of a Cottage Farm facility discharge, with a public health impact statement that applies to the entire receiving water segment.

Notices include web postings of discharges from MWRA CSO facilities, including the Cottage Farm, Prison Point, Somerville-Marginal and Union Park CSO treatment facilities (http://www.mwra.com/harbor/html/cso_reporting.htm), the South Boston CSO storage tunnel (which provides a 25-year storm level of CSO control) and the BOS019 Little Mystic Channel Storage Conduit (which provides an approximately 1-year storm level of control). For Cottage Farm, the variance also requires email notifications to regulatory and public health agencies, watershed associations, and other interested parties (archived at http://www.mwra.com/harbor/html/cso_variance.htm). Similarly, Cambridge reports if CAM002 discharges (https://www.cambridgema.gov/theworks/newsandevents), Somerville posts a notification if SOM001A discharges (http://www.somervillema.gov/cso), and Boston Water & Sewer is developing a notification system for its outfalls. Notifications are generally made within 12 hours or within 24 hours of the onset of discharge, depending on the applicable regulatory requirement.

It is important for the public to understand that the absence of CSO does not mean that contact with the water is safe. Public information disseminated by MWRA about the public health impacts of CSO discharges notes that non-CSO sources of bacteria, including urban stormwater, which runs off into receiving waters much more frequently than CSO, and can pose public health risks even in the absence of CSO and cause water quality standards violations.

5.2.5. MWRA and Community Capital Improvement Programs

MWRA and the CSO communities - BWSC, Cambridge, Chelsea and Somerville - continue to make substantial investments to maintain and improve their wastewater collection systems, with direct or indirect CSO control benefits. MWRA's Capital Improvement Program includes scheduled spending of more than $240 million on Wastewater System improvements in the immediate 5-year period July 2016 through June 2021 to rehabilitate or upgrade major pipelines, pumping stations, headworks facilities and the Deer Island wastewater plant. All of these improvements contribute to effective and reliable conveyance and treatment of dry weather and wet weather flows generated in combined sewer areas as well as in separate sewer areas. These improvements ensure a reliable system that can continue to provide the level of service and system performance necessary to maintain CSO control levels in the long term.

The CSO communities' capital improvement programs also include scheduled investments to maintain the integrity of their wastewater systems, and include major investments in sewer separation projects, the management of stormwater flows that enter combined sewer systems, and the reduction of infiltration and inflow that can enter their systems. In addition, MWRA and the CSO communities continue to implement and maintain long-term sewer system monitoring equipment and SCADA (real-time reporting and operational control) systems in their outfall systems and operating facilities, in part to meet the Nine Minimum Controls requirements described above. Each year, MWRA incorporates completed MWRA and community system improvements into its collection system model to be able to measure and track their effect on system performance and CSO discharges.

5.2.6. Infiltration/Inflow Reduction

Extraneous water from infiltration/inflow (I/I) sources reduces the capacity and life of sewer systems and treatment facilities, which transport and treat domestic and industrial wastewaters. **Infiltration** enters a sewer system through defective sewer pipe joints, breaks, manhole defects, and when sewer lines are poorly designed and constructed. **Inflow** normally occurs when rainfall enters the sewer system through direct connections such as roof leaders, yard drains, catch basins, sump pumps, defective manhole covers and frame seals, or indirect connections with storm sewers.

The mitigation of I/I by sewer system rehabilitation and inflow source removal, combined with an on-going operation and maintenance program is essential to protect the significant capital investment in sewers and wastewater treatment facilities made by cities, towns and the Commonwealth, to reduce system overflows and prevent increases in overflows, and protect the environment.

<u>MWRA Regional I/I Reduction Plan</u>

MWRA submitted its Regional I/I Reduction Plan (the "I/I Plan") to EPA and DEP in June 2001 as required under MWRA's NPDES Permit, and DEP approved the plan in a letter dated November 19, 2002. The Regional I/I Reduction Plan is available at http://www.mwra.com/comsupport/community supportmain.html. Implementation of the I/I Plan focuses on the cooperative efforts of member communities, DEP, EPA and MWRA to develop and implement I/I reduction and sewer system

rehabilitation projects. As required by its NPDES permit, MWRA submits an Annual I/I Reduction Report each year (see http://www.mwra.state.ma.us/harbor/pdf/infinf.pdf).

Under the I/I Plan, MWRA has full legal and fiscal responsibility for implementation of operation, maintenance, and I/I reduction programs for the MWRA-owned interceptor system. Each member community retains full legal and fiscal responsibility for implementation of operation, maintenance and I/I reduction programs for community-owned sewers. MWRA provides technical and financial assistance to member communities and works cooperatively with DEP, EPA and other stakeholders to help solve local and regional sewer problems.

Operation and maintenance of the 278 mile MWRA-owned collection system includes physical inspection of sewer manholes and other structures, internal CCTV inspection of interceptors, sonar inspection of siphon barrels, and scheduling of maintenance work (sewer cleaning, cover replacement, etc.) via an electronic maintenance database (MAXIMO). Potential structural problems and infiltration sources identified during the inspection process are referred to engineering staff for follow-up review and analysis of cost-effective repairs. Sewer rehabilitation projects are prioritized and scheduled as part of MWRA's annual Capital Improvement Program (CIP) and the Water/Wastewater Master Plan.

MWRA's work with member communities centers on four key items: regional wastewater metering; flow-based sewer rate methodology; technical assistance to member communities; and financial assistance for local projects. MWRA completed construction of a comprehensive wastewater metering system in 1994 and implemented a flow-based methodology for wholesale sewer charges in FY96. The flow-based sewer rate methodology provides a direct incentive for communities to reduce wastewater flow via I/I reduction projects. MWRA analyzes the wastewater metering data for both sewer charge purposes and to provide monthly estimates of wastewater flow components to its member communities. MWRA also provides technical assistance to help communities interpret metering data and target appropriate I/I reduction projects.

MWRA's $461 million community I/I Local Financial Assistance (grant/loan) Program is a critical component for successful completion of local sewer system rehabilitation projects. The I/I Local Financial Assistance Program began in FY93 and, through FY17, over $322 million has been distributed to fund local I/I reduction and sewer system rehabilitation projects. Details on the Program are online at: http://www.mwra.com/comsupport/ii/iiprogram.html. The program budget of $461 million includes the most recent addition of $160 million in new Phase 9 and 10 funds approved with increased grant funding at 75 percent and interest-free loan funding at 25 percent. MWRA's assistance to communities to implement effective collection system repair/replacement is intended to prevent a net increase in regional I/I. In the long-term, system rehabilitation should result in lower I/I, which will allow for future increases in sanitary flow without a net increase in total wastewater flow to the Deer Island Treatment Plant.

MWRA and Community Support of DEP I/I Regulation

In April 2014, DEP promulgated new regulations regarding wastewater. 314 CMR 12.00, section 12.04(2)(d) requires all new sewer connections, such as connections from new development projects, with design flows exceeding 15,000 gallons per day to mitigate the impacts of the new connection by removing four gallons of I/I for each new gallon of wastewater flow. The 4:1 offset requirement is required to be achieved by the community and/or the developer prior to the occupancy of the development or expansion and the activation of water service.

MWRA coordinates with DEP and its member communities by routinely reviewing the planning documents of new development or expansion projects, i.e., Massachusetts Environmental Policy Act (MEPA) filings, including Environmental Notification Forms. MWRA regularly submits written comments to the MEPA Office describing the potential wet weather impacts of new wastewater flows, including the potential for greater surcharging of the local and MWRA sewer systems and increased CSO or sanitary sewer overflow (SSO) discharges, and promoting compliance with the DEP regulation to ensure mitigation of the new flows with I/I reduction. When warranted, especially on very large projects, MWRA, which does not have direct regulatory jurisdiction, has worked with DEP and the host community, which do have regulatory or other legal jurisdiction, to ensure compliance. The MWRA goal is to ensure that new wastewater flows added to its system do not compromise long-term levels of CSO (or SSO) control or environmental benefit.

Attachment A

Typical Year Rainfall

A primary basis for the evaluation, selection, approval and performance measurement of MWRA's approved Long-Term CSO Control Plan is annual frequency and volume of CSO discharge at each outfall based on a "typical year" rainfall. MWRA's approved Typical Year rainfall was a specifically constructed rainfall series primarily using a single year (1992) and evaluated against a nearly 40-year rainfall record at Logan Airport, 1949-1987. Year 1992 rainfall was determined to be close to the average in total rainfall and distribution of rainfall events of different sizes. The rainfall series was adjusted by adding and subtracting certain storms to make the series closer to the actual averages in annual precipitation, number of storms within different ranges of depth and storm intensities. The Typical Year rainfall consists of 93 storms (shown in the attached table) with a total precipitation of 46.8 inches.

The Typical Year simulations provide a consistent assessment of system performance; cover a range of events or sets of circumstances, such as seasonal variations and back to back storms, which would not be covered by individual events; and provide means of evaluation relative to certain performance measures, such as the four event per year criterion contained in the EPA CSO Control Policy. The court-mandated LTCP levels of control and MWRA's tracking of system performance are based on Typical Year rainfall simulations.

Typical Year Rainfall Characteristics

Min. Interevent Time = 12 hours

Event No.	Date Mo Da Yr	Start Hour	Dura-tion hours	Volume inches	Avg Inten in/hr	Max Inten in/hr	Inter-event hours
1	1/4/1992	10	21	1.15	0.05	0.25	Undef
2	1/9/1992	14	5	0.16	0.03	0.04	103
3	1/14/1992	4	11	0.49	0.04	0.21	105
4	1/17/1992	9	3	0.03	0.01	0.02	66
5	1/20/1992	10	2	0.02	0.01	0.01	70
6	1/23/1992	6	27	1.38	0.05	0.19	66
7	1/28/1992	11	6	0.02	0	0.01	98
8	2/1/1992	7	1	0.01	0.01	0.01	86
9	2/1/1992	22	1	0.01	0.01	0.01	14
10	2/4/1992	17	4	0.09	0.02	0.06	66
11	2/7/1992	16	14	0.04	0	0.02	67
12	2/8/1992	18	6	0.06	0.01	0.02	12
13	2/14/1992	0	8	0.15	0.02	0.04	120
14	2/15/1992	18	11	0.87	0.08	0.15	34
15	2/18/1992	19	13	0.2	0.02	0.06	62
16	2/22/1992	22	1	0.01	0.01	0.01	86
17	2/25/1992	8	26	0.84	0.03	0.14	57
18	2/29/1992	1	5	0.04	0.01	0.01	63
19	3/3/1992	1	4	0.07	0.02	0.03	67
20	3/6/1992	14	35	1.86	0.05	0.2	81
21	3/8/1992	13	8	0.02	0	0.01	12
22	3/11/1992	1	13	0.97	0.07	0.33	52
23	3/19/1992	6	12	0.42	0.04	0.06	184
24	3/22/1992	20	10	0.27	0.03	0.05	74
25	3/26/1992	21	11	0.67	0.06	0.14	87
26	3/28/1992	4	19	0.42	0.02	0.06	20
27	4/7/1992	22	10	0.02	0	0.01	239
28	4/9/1992	23	1	0.01	0.01	0.01	39
29	4/11/1992	5	22	0.52	0.02	0.17	29
30	4/16/1992	16	31	1.02	0.03	0.14	109
31	4/18/1992	19	4	0.09	0.02	0.04	20
32	4/22/1992	16	3	0.13	0.04	0.09	89
33	4/24/1992	15	38	0.88	0.02	0.16	44
34	5/1/1992	22	8	0.1	0.01	0.04	137
35	5/2/1992	18	7	1.14	0.16	0.63	12
36	5/4/1992	4	1	0.01	0.01	0.01	27
37	5/8/1992	17	10	0.27	0.03	0.1	108
38	5/14/1992	12	1	0.02	0.02	0.02	129
39	5/16/1992	8	2	0.07	0.04	0.06	43
40	5/24/1992	21	11	0.07	0.01	0.03	203
41	5/31/1992	17	30	2.24	0.07	0.37	153
42	6/5/1992	18	18	1.34	0.07	0.44	91
43	6/8/1992	17	2	0.07	0.04	0.05	53
44	6/20/1992	3	14	0.45	0.03	0.23	272
45	6/22/1992	1	3	0.03	0.01	0.01	32
46	6/24/1992	11	22	0.56	0.03	0.12	55
47	7/3/1992	23	2	0.03	0.02	0.02	206
48	7/6/1992	5	4	0.38	0.1	0.23	52

Min. Interevent Time = 12 hours

Event No.	Date Mo Da Yr	Start Hour	Dura-tion hours	Volume inches	Avg Inten in/hr	Max Inten in/hr	Inter-event hours
49	7/11/1992	3	1	0.22	0.22	0.22	114
50	7/12/1992	23	1	0.01	0.01	0.01	43
51	7/14/1992	17	5	0.16	0.03	0.08	41
52	7/15/1992	14	16	0.5	0.03	0.23	16
53	7/23/1992	8	21	0.42	0.02	0.19	170
54	7/29/1992	20	1	0.2	0.2	0.2	135
55	7/31/1992	14	20	0.59	0.03	0.25	41
56	8/4/1992	21	1	0.04	0.04	0.04	83
57	8/11/1992	16	11	0.87	0.08	0.75	162
58	8/14/1992	3	8	0.4	0.05	0.11	48
59	8/15/1992	16	72	2.91	0.04	0.66	29
60	8/29/1992	2	2	0.04	0.02	0.03	250
61	9/3/1992	11	13	1.19	0.09	0.51	127
62	9/8/1992	8	5	0.19	0.04	0.11	104
63	9/9/1992	18	1	0.57	0.57	0.57	29
64	9/11/1992	1	8	0.38	0.05	0.16	30
65	9/19/1992	6	3	0.11	0.04	0.08	189
66	9/22/1992	4	7	0.09	0.01	0.04	67
67	9/22/1992	23	23	2.76	0.12	0.65	12
68	9/26/1992	13	10	0.74	0.07	0.29	63
69	10/9/1992	16	65	2.04	0.03	0.42	305
70	10/16/1992	1	28	0.07	0	0.01	88
71	10/19/1992	4	15	0.14	0.01	0.05	47
72	10/20/1992	8	1	0.01	0.01	0.01	13
73	10/21/1992	10	5	0.12	0.02	0.07	25
74	10/23/1992	0	4	1.18	0.29	1.08	33
75	10/24/1992	18	18	0.38	0.02	0.13	38
76	10/30/1992	3	2	0.03	0.02	0.02	111
77	10/31/1992	10	1	0.01	0.01	0.01	29
78	11/3/1992	3	29	0.94	0.03	0.16	64
79	11/5/1992	15	13	0.31	0.02	0.11	31
80	11/11/1992	3	6	0.02	0	0.01	119
81	11/17/1992	13	8	0.15	0.02	0.04	148
82	11/19/1992	8	3	0.06	0.02	0.03	35
83	11/21/1992	22	84	2.39	0.03	0.31	59
84	11/26/1992	10	15	0.51	0.03	0.11	24
85	12/3/1992	1	9	0.82	0.09	0.19	144
86	12/5/1992	0	9	0.1	0.01	0.03	38
87	12/11/1992	4	50	3.89	0.08	0.2	139
88	12/16/1992	11	1	0.01	0.01	0.01	77
89	12/17/1992	8	15	0.58	0.04	0.13	20
90	12/20/1992	2	10	0.08	0.01	0.03	51
91	12/25/1992	20	1	0.01	0.01	0.01	128
92	12/29/1992	15	12	0.37	0.03	0.06	90
93	12/30/1992	20	10	0.44	0.04	0.1	17
	Total			**46.77**			

Attachment B

Second CSO Stipulation

UNITED STATES DISTRICT COURT
for the
DISTRICT OF MASSACHUSETTS

UNITED STATES OF AMERICA, Plaintiff, v. METROPOLITAN DISTRICT COMMISSION, et al., Defendants.	CIVIL ACTION No. 85-0489-RGS
CONSERVATION LAW FOUNDATION OF NEW ENGLAND, INC., Plaintiff, v. METROPOLITAN DISTRICT COMMISSION, Defendants.	CIVIL ACTION No. 83-1614-RGS

SECOND STIPULATION OF THE UNITED STATES
AND THE MASSACHUSETTS WATER RESOURCES AUTHORITY
ON RESPONSIBILITY AND LEGAL LIABILITY FOR
COMBINED SEWER OVERFLOW CONTROL

The Massachusetts Water Resources Authority ("Authority") and the United States, on behalf of the Environmental Protection Agency ("EPA"), hereby agree and stipulate as follows:

1. The purpose of this Second Stipulation of the United States and the Massachusetts Water Resources Authority on Responsibility and Legal Liability for Combined Sewer Overflow Control ("Second Stipulation") is to terminate the February 27, 1987, Stipulation of the United States and the Massachusetts Water Resources Authority on Responsibility and Legal Liability for Combined Sewer Overflows (the "1987 Stipulation") and replace it with this Second Stipulation that reflects developments and progress in the control of combined sewer overflow ("CSO") discharges to Boston Harbor and its tributaries that have taken place since 1987. The 1987 Stipulation shall remain in effect until this Second Stipulation goes into effect. This Second Stipulation shall take effect, and the 1987 Stipulation shall terminate, upon approval by the Court in the above-captioned action of the Joint Motion of the United States and the Massachusetts Water Resources Authority To Amend Schedule Six with Respect to The Charles River, Alewife Brook and East Boston.

2. The Authority's Long-Term Combined Sewer Overflow ("CSO") Control Plan ("LTCP") presently consists of the Authority's July 31, 1997, Final Combined Sewer Overflow Facilities Plan and Environmental Impact Report (the "1997 Facilities Plan"), as modified by the planning documents identified in the attached Exhibit "A," entitled, MWRA Long-Term CSO Control Plan Facilities Planning Documentation.

3. The CSO outfalls that are the subject of the Authority's LTCP include the outfalls listed in Exhibit "B" hereto, entitled, "Summary of Typical

Year CSO Activation Frequency and Volume." The CSO outfalls identified with the prefix "MWR" are owned or operated by the Authority. The CSO outfalls identified with a prefix "BOS," "CAM," "CHE," or "SOM," are owned and operated by member municipalities (Boston, Cambridge, Chelsea, or Somerville, respectively), except that the Union Park Pump Station ("UPPS") is jointly operated by the Authority and the City of Boston.

4. With respect to all of the CSO outfalls within or hydraulically connected to the Authority's sewer system, including the outfalls identified in Exhibit "B" hereto, the Authority accepts legal liability to undertake such corrective action as may be necessary to implement the CSO control requirements set forth in Schedule Six and related orders of the Court in the above-captioned action, and to meet the levels of CSO control (including as to frequency of CSO activation and as to volume of CSO discharge) described in the Authority's Long-Term CSO Control Plan. Whether the Authority has met the levels of CSO control in its Long-Term CSO Control Plan shall be determined by the EPA and the Massachusetts Department of Environmental Protection. With respect to all CSO outfalls owned or operated by the Authority, including the CSO outfalls identified in Exhibit "B" identified with the prefix "MWR," and including the Union Park Pump Station, the Authority also accepts legal liability to undertake such future corrective action as may be necessary to meet the CSO control requirements of the Clean Water Act, 33 U.S.C. § 1251 et seq. The Authority does not accept liability for alleged past

violations of the CSO provisions of NPDES Permit No. MA0102351 (issued in 1976 and transferred to the Authority in 1985) prior to February 27, 1987.

5. This stipulation is not intended to and does not limit the Court's power to find, or any party's right to seek, liability for past or continuing violations of federal law or to enforce compliance with that law.

By its attorneys,

Massachusetts Water Resources Authority

By its attorneys,

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Dated: March 15, 2006

B3131253.1

Exhibit A
to Second Stipulation

MWRA Long-Term CSO Control Plan Facilities Planning Documentation

Planning Document	Project	Receiving Water
Final Combined Sewer Overflow Facilities Plan and Environmental Impact Report, July 31, 1997	Hydraulic Relief for CAM005	Upper and Lower Charles River Basin
	Stony Brook Sewer Separation	
	Floatables Control at CAM007, CAM009, CAM011 and CAM017	
	Baffle Manhole Separation at SOM 001 and SOM 006-007	Alewife Brook/Upper Mystic River
	Hydraulic Relief for BOS 017[(1)]	Mystic/Chelsea Confluence
	Chelsea Branch Relief Sewer	
Minor modifications were addressed in Notice of Project Change, March 1999	Trunk Sewer Relief for CHE 002-004	
	Outfall Repairs and Floatables Control at CHE 008	
	Storage Conduit for BOS 019	Upper Inner Harbor
	Detention/Treatment Facility at Union Park Pump Station	Fort Point Channel
	South Dorchester Bay Sewer Separation	South Dorchester Bay
	Constitution Beach Sewer Separation	Constitution Beach
	Neponset River Sewer Separation	Neponset River
The following reports <u>supplement</u> information in the Final CSO Facilities Plan and Environmental Impact Report, July 31, 1997		
Upgrades to Existing CSO Facilities, Supplemental Environmental Impact Report, September 30, 1998	Cottage Farm Facility Upgrade	Upper Charles River Basin
	Prison Point Facility Upgrade	Upper Inner Harbor
	Somerville Marginal Facility Upgrade	Upper Mystic River; Mystic/Chelsea Confluence
	Commercial Point Facility Upgrade	South Dorchester Bay
Upgrades to the Fox Point CSO Treatment Facility, Supplemental Environmental Impact Report, December 31, 1998	Fox Point Facility Upgrade	South Dorchester Bay
Fort Point Channel CSO Storage Conduit Notice of Project Change, June 2003, and MWRA Long Term CSO Control Plan, Fort Point Channel Sewer Separation and System Optimization Project, Level of Control at CSO Outfalls BOS072 and BOS073, June 7, 2004.	Sewer Separation for BOS072 and BOS073	Fort Point Channel

Exhibit A
to Second Stipulation

MWRA Long-Term CSO Control Plan Facilities Planning Documentation

Planning Document	Project	Receiving Water
Re-Assessing Long Term Floatables Control for Outfalls MWR018, 019 and 020, February 2001 Report on Re-Assessment of CSO Activation Frequency and Volume for Outfall MWR010, April 2001, and supplemental letter report (Metcalf & Eddy, Inc.), May 31, 2001	Regionwide Floatables Controls and Outfall Closing Projects	Regionwide
Final Variance Report for Alewife Brook and the Upper Mystic River, July 2003, and supplemental letter report (Metcalf & Eddy, Inc.), July 8, 2003	Sewer Separation at CAM004 and CAM400	Alewife Brook
	Interceptor Connection Relief and Floatables Control at CAM002, CAM401B and SOM01A, and Floatables Control at CAM001 and CAM401A	
	Control Gate/Floatables Control at Outfall MWR003 and MWRA Rindge Avenue Siphon Relief	
East Boston Branch Sewer Relief Project Reevaluation Report, February 2004 Recommendations and Proposed Schedule for Long-Term CSO Control for the Charles River, Alewife Brook and East Boston, August 2, 2005	Interceptor Relief For BOS003-014	Mystic/Chelsea Confluence; Upper and Lower Inner Harbor
Supplemental Facilities Plan and Environmental Impact Report on the Long-term CSO Control Plan for North Dorchester Bay and Reserved Channel, April 27, 2004	North Dorchester Bay Storage Tunnel and Related Facilities	North Dorchester Bay
	Pleasure Bay Storm Drain Improvements	
	Morrissey Boulevard Storm Drain	
	Reserved Channel Sewer Separation	Reserved Channel
Recommendations and Proposed Schedule for Long-Term CSO Control for the Charles River, Alewife Brook and East Boston, August 2, 2005, and MWRA Revised Recommended CSO Control Plan for the Charles River, Typical Year CSO Discharge Activations and Volumes, November 15, 2005	Brookline Connection, Cottage Farm Overflow Chamber Interconnection and Cottage Farm Gate Control	Upper and Lower Charles River Basin
	Brookline Sewer Separation	
	Bulfinch Triangle Sewer Separation	
	Charles River Valley/South Charles Relief Sewer Gate Controls	
	Evaluation of Additional Charles River Interceptor Interconnection Alternatives	

Exhibit A
to Second Stipulation

MWRA Long-Term CSO Control Plan Facilities Planning Documentation

Prison Point Optimization Study, March 30, 2007 Proposed Modification of Long-Term Level of Control for the Prison Point CSO Facility, April 2008	Prison Point CSO Facility Optimization	Upper Inner Harbor

(1) Also "MWRA Long-Term CSO Control Plan Target CSO Activation Frequency and Volume by Outfall," letter dated December 9, 2005.

Exhibit B
to Second Stipulation

SUMMARY OF TYPICAL YEAR CSO ACTIVATION FREQUENCY AND VOLUME

OUTFALL	TYPICAL YEAR		REFERENCE (*)
	LONG TERM CONTROL PLAN 2005 (*)		
	Activation Frequency	Volume (MG)	
ALEWIFE BROOK(1)			
CAM001	5	0.19	5
CAM002	4	0.69	5
MWR003	5	0.98	5
CAM004	To be closed	N/A	5
CAM400	To be closed	N/A	5
CAM401A	5	1.61	5
CAM401B	7	2.15	5
SOM001A	3	1.67	5
SOM001	Closed	N/A	
SOM002A	Closed	N/A	
SOM003	Closed	N/A	
SOM004	Closed	N/A	
TOTAL		**7.29**	
UPPER MYSTIC RIVER			
SOM007A/MWR205A (Somerville Marginal)	3	3.48	
SOM007	Closed	N/A	
TOTAL		**3.48**	
MYSTIC / CHELSEA CONFLUENCE			
MWR205 (Somerville Marginal)	39	60.58	
BOS013	4	0.54	6
BOS014	0	0.00	6
BOS015	Closed	N/A	6
BOS017	1	0.02	9
CHE002	4	0.22	
CHE003	3	0.04	
CHE004	3	0.32	
CHE008	0	0.00	
TOTAL		**61.72**	
UPPER INNER HARBOR			
BOS009	5	0.59	6
BOS010	4	0.72	6
BOS012	5	0.72	6
BOS019	2	0.58	
BOS050	Closed	N/A	
BOS052	Closed	N/A	
BOS057	1	0.43	
BOS058	Closed	N/A	
BOS060	0	0.00	
MWR203 (Prison Point)	17	243.00	10
TOTAL		**246.04**	
LOWER INNER HARBOR			
BOS003	4	2.87	6
BOS004	5	1.84	6
BOS005	1	0.01	6
BOS006	4	0.24	6
BOS007	6	1.05	6
TOTAL		**6.01**	

Exhibit B
to Second Stipulation

SUMMARY OF TYPICAL YEAR CSO ACTIVATION FREQUENCY AND VOLUME

OUTFALL	TYPICAL YEAR		REFERENCE (*)
	LONG TERM CONTROL PLAN 2005 (*)		
	Activation Frequency	Volume (MG)	
CONSTITUTION BEACH			
MWR207	Closed	N/A	
TOTAL		**0.00**	
FORT POINT CHANNEL			
BOS062	1	0.01	
BOS064	0	0.00	
BOS065	1	0.06	
BOS068	0	0.00	
BOS070			
BOS070/DBC	3	2.19	3
UPPS	17	71.37	
BOS070/RCC	2	0.26	
BOS072	0	0.00	4
BOS073	0	0.00	4
TOTAL		**73.89**	
RESERVED CHANNEL			
BOS076	3	0.91	7
BOS078	3	0.28	7
BOS079	1	0.04	7
BOS080	3	0.25	7
TOTAL		**1.48**	
NORTHERN DORCHESTER BAY			
BOS081	0 / 25 year	N/A	
BOS082	0 / 25 year	N/A	
BOS083	0 / 25 year	N/A	
BOS084	0 / 25 year	N/A	
BOS085	0 / 25 year	N/A	
BOS086	0 / 25 year	N/A	
BOS087	0 / 25 year	N/A	
TOTAL		**0.00**	
SOUTHERN DORCHESTER BAY			
BOS088	To be closed	N/A	
BOS089 (Fox Point)	To be closed	N/A	
BOS090 (Commercial Point)	To be closed	N/A	
TOTAL		**0.00**	
UPPER CHARLES			
BOS032	Closed	N/A	
BOS033	Closed	N/A	
CAM005	3	0.84	8
CAM007	1	0.03	8
CAM009	2	0.01	8
CAM011	0	0.00	8
TOTAL		**0.88**	

Exhibit B
to Second Stipulation

SUMMARY OF TYPICAL YEAR CSO ACTIVATION FREQUENCY AND VOLUME

OUTFALL	TYPICAL YEAR LONG TERM CONTROL PLAN 2005 (*)		REFERENCE (*)
	Activation Frequency	Volume (MG)	
LOWER CHARLES			
BOS028	Closed	N/A	
BOS042	Closed	N/A	
BOS049	To be closed	N/A	
CAM017	1	0.45	8
MWR010	0	0.00	2
MWR018	0	0.00	1
MWR019	0	0.00	1
MWR020	0	0.00	1
MWR021	Closed	N/A	
MWR022	Closed	N/A	
MWR201 (Cottage Farm)	2	6.30	8
MWR023	2	0.13	
SOM010	Closed	N/A	
TOTAL		**6.88**	
NEPONSET RIVER			
BOS093	Closed	N/A	
BOS095	Closed	N/A	
TOTAL		**0.00**	
BACK BAY FENS			
BOS046	2	5.38	
TOTAL		**5.38**	

(*) Long-term Control Plan activation frequency and volumes were established in the 1997 CSO Facilities Plan and Enviromental Impact Report or as noted in the "Reference" column.

1- Re-assessing Long Term Floatables Control for Outfalls MWR018, 019 and 020, February 2001.

2- Report on Re-Assessment of CSO Activation Frequency and Volume for Outfall MWR010, April 2001, and supplemental letter report (Metcalf & Eddy, Inc.), May 31, 2001.

3- Report on Re-Assessment of CSO Activation Frequency and Volume to Dorchester Brook Conduit and Outfall BOS086, January 2001 and supplemental letter report (Metcalf & Eddy, Inc.), June 28, 2001.

4- MWRA Long Term CSO Control Plan, Fort Point Channel Sewer Separation and System Optimization Project, Level of Control at CSO Outfalls BOS072 and BOS073, June 7, 2004.

5- Final Variance Report for Alewife Brook and the Upper Mystic River, July 2003, and supplemental letter report (Metcalf &Eddy, Inc.), July 8, 2003.

6- East Boston Branch Sewer Relief Project Reevaluation Report, February 2004.

7- Supplemental Facilities Plan and Environmental Impact Report on the Long-term CSO Control Plan for North Dorchester Bay and Reserved Channel, April 27, 2004.

8- Recommendations and Proposed Schedule for Long-Term CSO Control for the Charles River, Alewife Brook and East Boston, August 2, 2005; MWRA Revised Recommended CSO Control Plan for the Charles River, Typical Year CSO Discharge Activations and Volumes, November 15, 2005; MWRA Long-Term CSO Control Plan, Response to Additional EPA Questions Reagarding Prison Point Discharges, January 9, 2005 (2006).

9- MWRA Long Term CSO Control Plan Target CSO Activation Frequency and Volume by Outfall, December 9, 2005.

10- Prison Point Optimization Study, March 30, 2007; Proposed Modification of Long-Term Level of Control for the Prison Point CSO Facility, April 2008