
Massachusetts Water Resources Authority
CSO Control and
Performance Assessment
DEP Public Hearing
CSO Variances
July 18, 2019

MWRA CSO Control Timeline

1987: MWRA accepts responsibility for region-wide CSO control in the Boston Harbor Case (First CSO Stipulation)

1996: MWRA issues draft long-term CSO control plan (Facilities Plan/EIR) and begins to design/construct CSO control projects

1997: MWRA issues long-term CSO control plan (Facilities Plan/EIR)

1998: DEP approves CSO plan and issues Water Quality Standards determinations, including decision to issue CSO variances for the Charles River and Alewife Brook/Upper Mystic River

2006: EPA and DEP approve revised MWRA CSO plan (the "LTCP") and agree to issue variances through LTCP completion and assessment (Second CSO Stipulation replaces the First CSO Stipulation)

2015: MWRA and its CSO communities complete construction of the last of the 35 projects in the LTCP

Since 2015: MWRA has complied with the current variances (2016-2019) and is conducting the CSO performance assessment

CSO Control Accomplishments

MWRA and its CSO communities have achieved CSO reduction and related water quality improvement continuously since 1987:

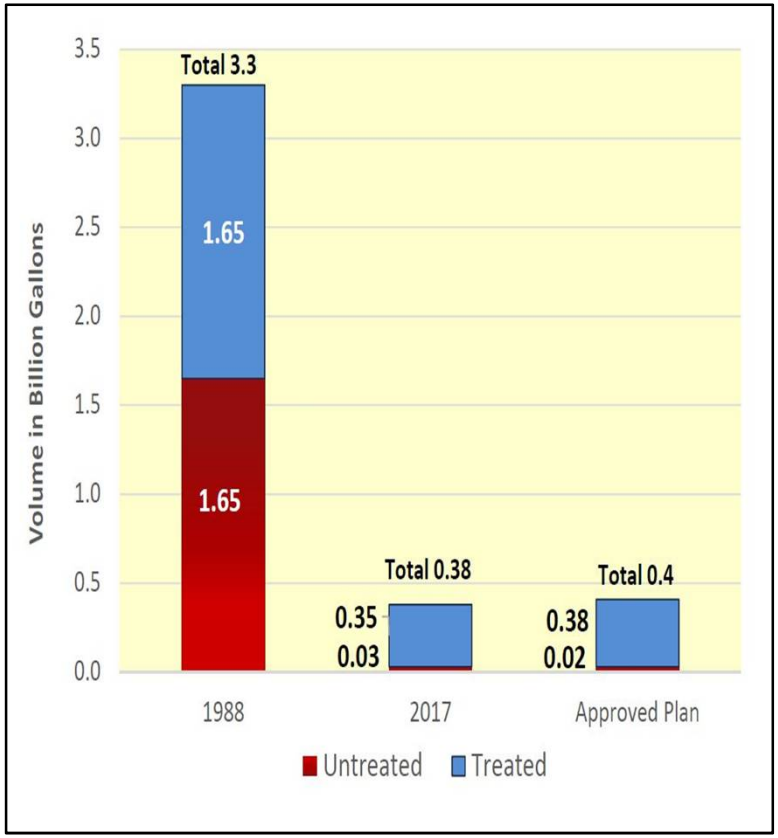
- Many outfalls were closed by the communities in the late 1980's and early 1990's
- Elimination of dry weather overflows by 1990
- Completion of Deer Island transport upgrades by 1992
- >100 CSO system optimization measures 1993-97
- Construction of 35 CSO projects 1996-2015
- Ongoing community sewer separation projects
- MWRA facility rehabilitation projects and optimization measures.

Long-Term CSO Control Plan Benefits

The LTCP addresses 84 CSO outfalls:

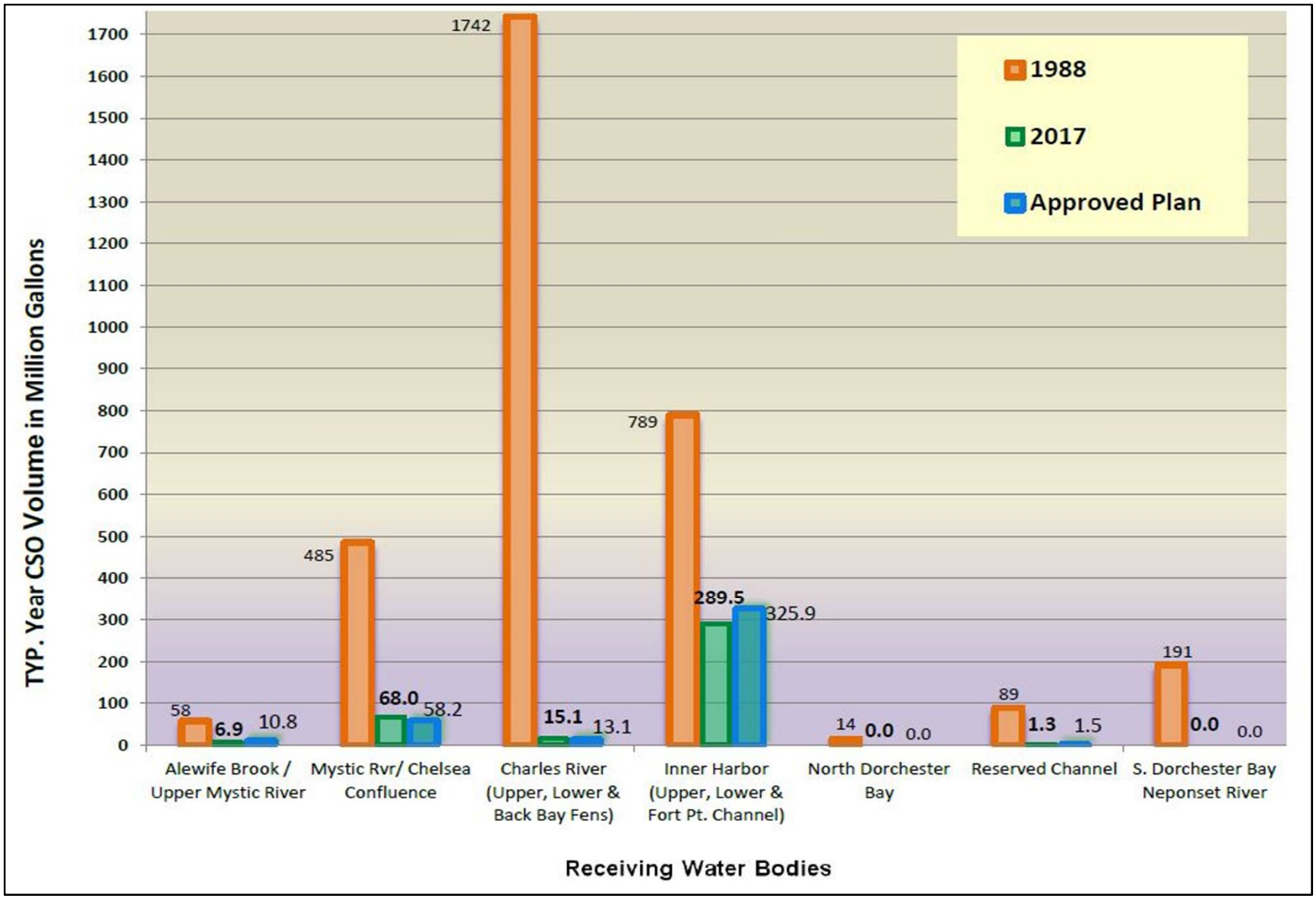
- 35* outfalls are closed to CSO discharges, including 10* outfalls along the Charles and 8 outfalls along the Alewife and Upper Mystic.
- 5 outfalls along the South Boston beaches have 25-year storm level of control.
- 5 outfalls have upgraded wet weather treatment at CSO facilities, including the Cottage Farm facility (Charles R.) and the Somerville-Marginal facility (Mystic R.).
- Discharge frequency and volume are greatly reduced at remaining outfalls.

*Outfalls CAM009 and CAM011 (Charles Basin) are temporarily closed pending additional Cambridge evaluation.

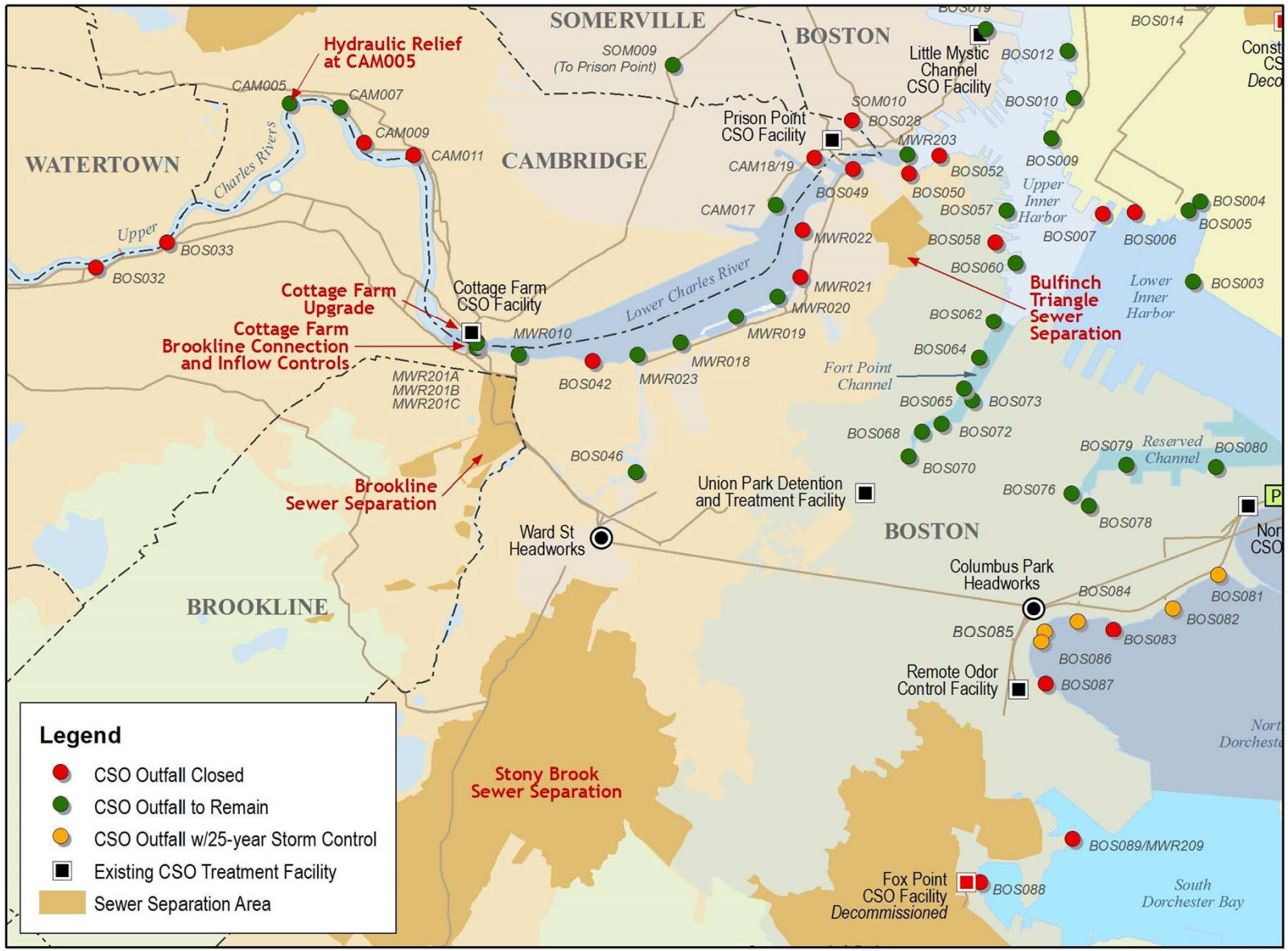


Reduces system-wide CSO discharge volume in the Typical Year by 88%, with 93% of remaining volume treated at MWRA's CSO facilities.

CSO Reduction by Receiving Water



Charles River CSO Outfalls and Projects



LTCP Projects - Charles River Basin

1,300 combined sewer acres separated (Stony Brook, Bulfinch Triangle, Brookline)	$78.0 M
Cottage Farm CSO Facility upgraded, including disinfection improvements and dechlorination	$5.7 M
Cottage Farm CSO discharges reduced with improved wet-weather flow conveyance, in-system storage and improved facility operation	$3.0 M
Outfall CAM005 discharges reduced with relief of a Cambridge connection	$1.1 M
Floatables control	$0.3M
10* (of 19) CSO outfalls closed	
	Total $88.1 M

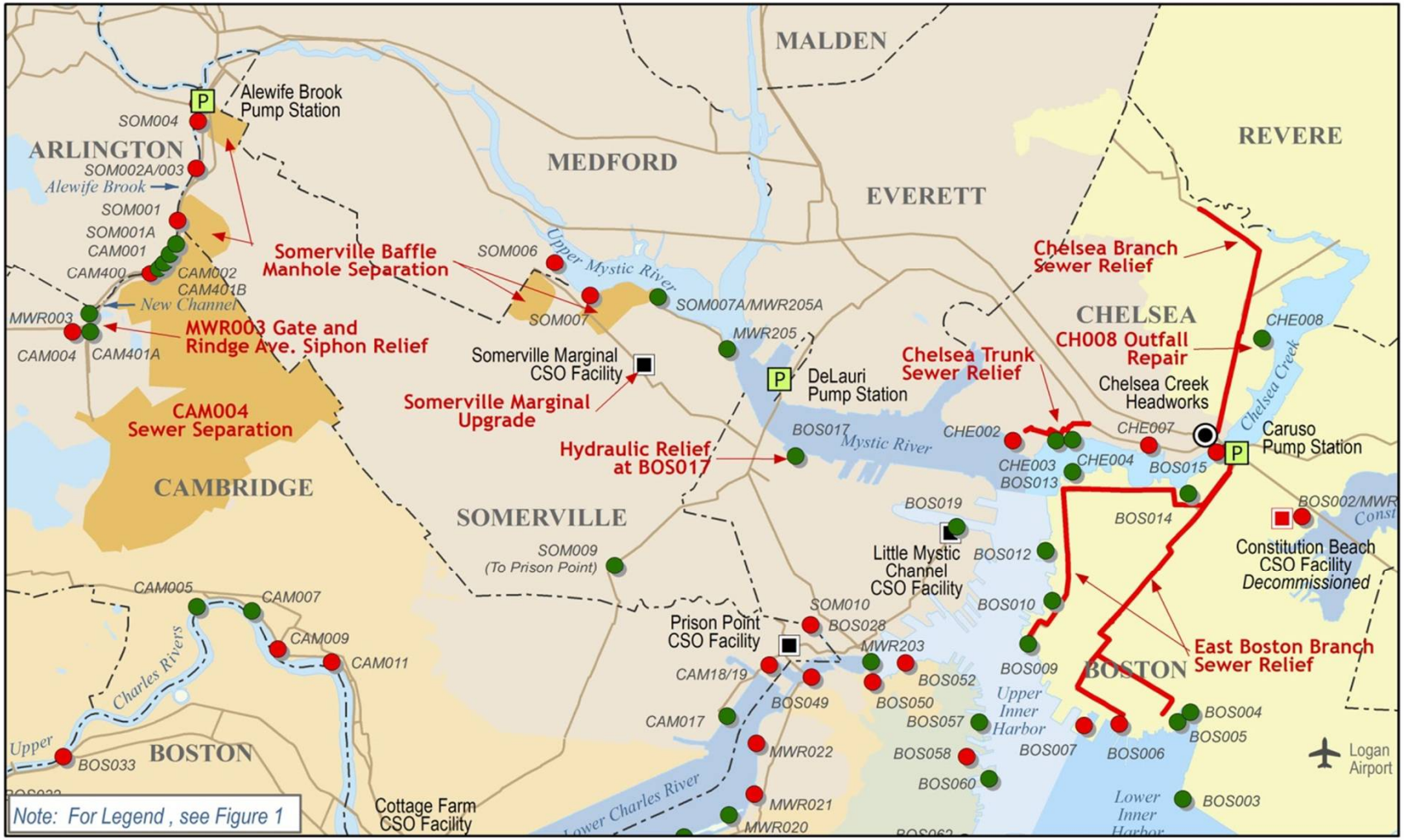
*Outfalls CAM009 and CAM011 are temporarily closed pending additional Cambridge evaluation.

Charles River CSO Control

		No. of CSO Outfalls	In the Typical Rainfall Year[1]		
			Frequency of Most Active Outfall	Total Discharge Volume (million gallons)	Treated Discharge Volume[2] (million gallons)
Charles River Basin[3]	1992	19	39	389.0	214.1 (55%)
	2017	9[5]	3	13.5	10.6 (79%)
	LTCP	11	3	7.8	6.3 (81%)
Back Bay Fens[4]	1992	1	2	5.3	N/A
	2017	1	1	1.6	N/A
	LTCP	1	2	5.4	N/A

(1) From past MWRA hydraulic model predictions
(2) From Cottage Farm CSO Facility
(3) CSO component of discharges from Outfall MWR023 (Stony Brook Conduit)
(4) Outfall BOS046; includes CSO and stormwater from Stony Brook Conduit
(5) Not including outfalls CAM009 and CAM011, which are temporarily closed pending additional Cambridge evaluation.

Alewife Brook and Mystic River CSO Outfalls and Projects



LTCP Projects - Alewife Brook and Upper Mystic

More than 300 combined sewer acres separated (CAM004 sewer separation; baffled manhole separations)	$98.5 M
Somerville Marginal CSO Facility upgraded, including disinfection improvements and dechlorination	$4.0 M
Sewer connections upgraded; floatables control at outfalls along Alewife Brook	$3.7 M
CSO/flood controls at Outfall MWR003	$3.8 M
8 (of 15) CSO outfalls closed	
Total	**$110.0 M**

Alewife Brook and Mystic River CSO Control

		No. of CSO Outfalls	In the Typical Rainfall Year[1]		
			Frequency of Most Active Outfall	Total Discharge Volume (million gallons)	Treated Discharge Volume[2] (million gallons)
Alewife Brook/Upper Mystic River	1992	15	63	57.6	7.6 (13%)
	2017	7	5	6.9	1.8 (26%)
	LTCP	7	7	10.8	3.5 (32%)
Mystic/Chelsea Confluence	1992	9	76	186.0	120.4 (65%)
	2017	7	22[2]	69.8	67.3 (96%)
	LTCP	8[3]	39[2]	61.7	60.6 (98%)

(1) From past MWRA hydraulic model predictions

(2) From Somerville Marginal CSO Facility (Upper Mystic Outfall MWR205A; Lower Mystic Outfall MWR205)

(3) The LTCP called for Outfall CHE002 to remain active. City of Chelsea permanently closed this outfall in 2014.

CSO Post-Construction Monitoring and Performance Assessment

In November 2017, MWRA issued Notice to Proceed on a $3 million study to comply with the last two milestones in the Federal Court schedule:

Jan 2018:	Commence CSO post-construction monitoring and Performance assessment. Conduct in accordance with EPA's Combined Sewer Overflow (CSO) Policy.
Dec 2020:	Submit results of performance assessment to EPA and DEP demonstrating compliance with the levels of control, including frequency of CSO activation and volume of discharge specified in the Long-Term CSO Control Plan.

Assessment Goals:

- Evaluate remaining CSO Typical Year activations and volumes relative to the levels of control in the approved Long Term Control Plan.
- Evaluate water quality impacts of remaining CSO discharges.

CSO Performance Assessment Scope of Work

- Ø CSO inspections
- Ø Extensive CSO and wastewater system metering
- Ø Rainfall data collection (20 gauges)
- Ø Quantification and validation of CSO discharges
- Ø Site-specific CSO discharge investigations
- Ø Hydraulic model updates and improved calibration
- Ø Receiving water modeling
- Ø Coordination with CSO communities

Massachusetts Water Resources Authority

Combined Sewer Overflow Control Plan

CSO Post Construction Compliance Monitoring Program Scope of Work

May 1, 2017

Completed and Ongoing Work

- Inspection of >200 CSO regulator structures (closed or remaining active) complete. Closures confirmed. Detailed measurements at active regulators.
- Since April 15, 2018, data collected from temporary CSO meters, permanent CSO and wastewater system meters, and facility records.
- Rainfall data collected from 20 area gauges; rainfall analyses performed.
- Where possible CSO discharges are quantified from overflow data and validated against storm characteristics and system conditions.
- Semiannual progress reports 1 and 2 issued Nov 2018 and May 2019.

Completed and Ongoing Work (cont.)

- Site-specific investigations underway where metered CSO discharges differ from historical predictions.
- Hydraulic model updates and calibration are underway.
- Receiving water monitoring continues. Stormwater and CSO sampling plans being finalized. Development of receiving water models has commenced.

MWRA's Hydraulic Model – Updates and Improved Calibration

Current hydraulic model activities

- Model updates to incorporate field inspections, sediment inspections and additional community information.
- Model calibration using extensive CSO and wastewater system data collected in 2018.

Planned hydraulic model uses

- Compare model predictions to meter data and metered discharges
- Perform storm and Typical Year simulations
- Assess attainment of Long-Term Control Plan levels of control (Typical Year)
- Provide CSO inputs to receiving water modeling

Results To-Date: Charles River Basin

- All 28 former or remaining CSO regulator structures were inspected. Closures confirmed. Detailed measurements at active regulators.
- Inspections have yielded updated information (examples).

Location	Result
RE046-54	Regulator status changed to open
RE046-80	Regulator status changed to closed
RE-046-110	Regulator status changed to closed

- Site-specific investigations are underway for several regulators where overflow measurements from meter data collected in 2018 differ from past model predictions.
  - Confirm metering approach and CSO quantification methodology
  - Confirm system conditions/perform additional inspections
  - Confirm model configuration
  - Make system modifications where warranted
- Metered CSO discharges are reported in semiannual progress reports No. 1 (April 15-June 30, 2018) and No. 2 (July 1-December 31, 2018).

Results To-Date: Alewife Brook/Upper Mystic River

- All 15 former or remaining CSO regulator structures were inspected. Closures confirmed. Detailed measurements at active regulators.
- Site-specific investigations are underway for several regulators where overflow measurements from meter data collected in 2018 differ from past model predictions.

Outfall SOM01A Modifications

- Obstruction and restricting orifice plate removed
- Evaluation of overflow weir elevation

Connection to interceptor at SOM01A

- Metered CSO discharges are reported in semiannual progress reports No. 1 (April 15-June 30, 2018) and No. 2 (July 1-December 31, 2018).

Water Quality Assessment Activities

Consultant Services (Receiving Water Modeling)

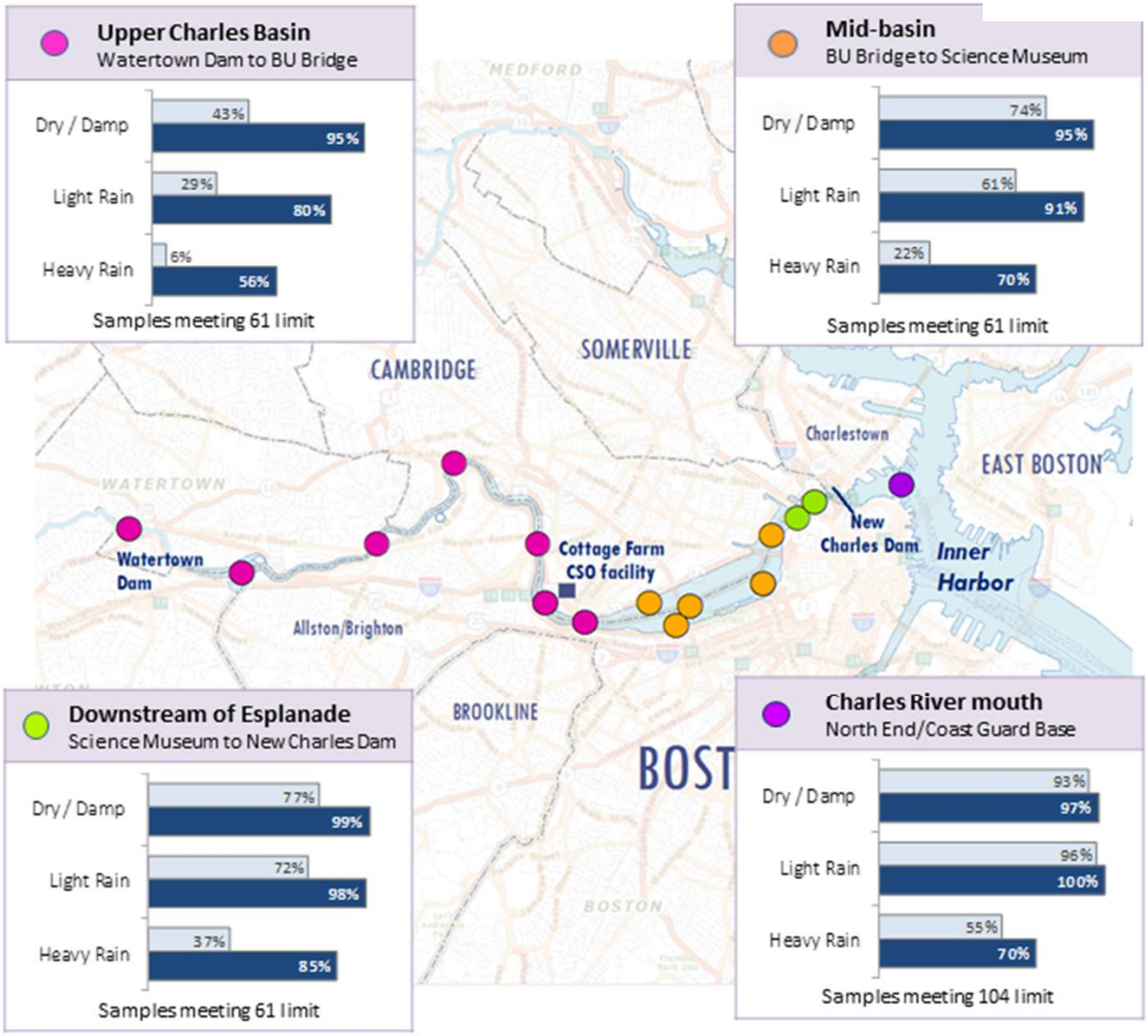
- Update and calibrate receiving water quality models
- Assess updated water quality conditions, including remaining CSO impacts
- Run model simulations of CSO control scenarios

MWRA In-House Activities (WQ Data Collection)

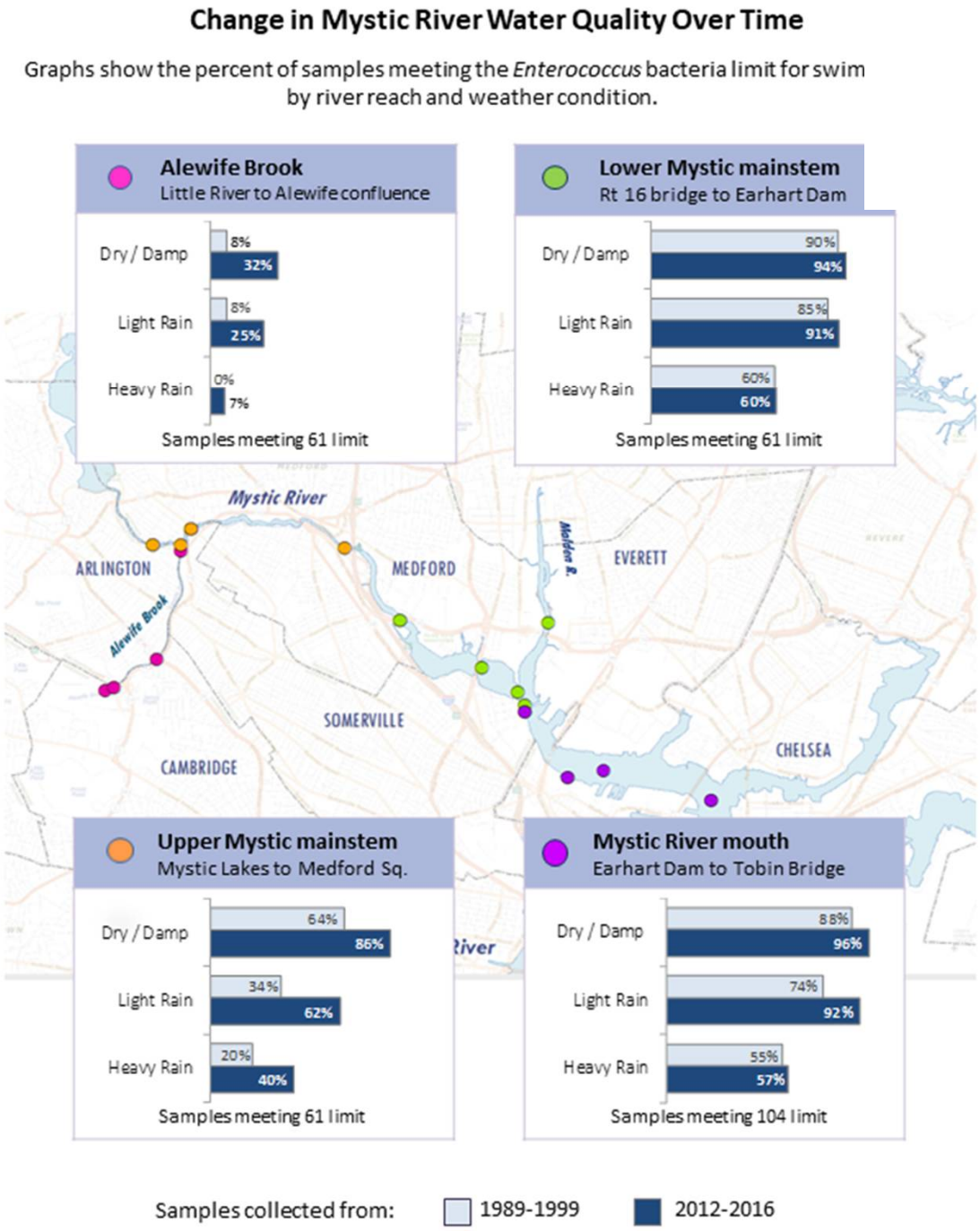
- Continue in-stream sampling, with emphasis in Charles and Alewife/Upper Mystic
- Conduct updated CSO and stormwater sampling
- Coordinate data collection with communities

Change in Lower Charles River Water Quality Over Time

Graphs show the percent of samples meeting the *Enterococcus* bacteria limit for swim by river reach and weather condition.



- Water quality improvements under all weather conditions, especially in heavy rain conditions.
- Water quality impairment apparent at the upstream boundary (Watertown Dam).



- Water quality improvements in dry and damp conditions.
- Mixed improvement under rain conditions.
- Alewife Brook WQ impaired under all conditions – but minimal impact on Mystic River WQ.

Modified Monitoring Program

- Long Term Program: MWRA collecting samples in Lower Charles River (16 sites), Alewife Brook (7 sites), and Upper Mystic River (9 sites) - many since 1989. Samples collected approx. weekly, 20 sample events per year minimum.

- In 2016, MWRA added sampling after rain events for 5 days (excluding weekends) to capture duration of impacts. Expanded in 2017 to include weekends.

Sampling period	Dry[1]	Damp[1]	Wet[1]	Total
2013 - 2017	29% 734 station visits	35% 749 station visits	36% 885 station visits	100% 2,710 station visits (avg 542/yr)
2018[2]	18% 162 station visits	21% 191 station visits	61% 557 station visits	100% 910 station visits

[1] Dry: no rainfall for previous 3 days; Wet: at least 0.5 inches in previous 2 days; Damp is everything in between.

[2] A lower proportion of 2018 samples were collected in dry conditions than the previous five years, with increased focus on tracking rain events.

Alewife/Upper Mystic River Samples

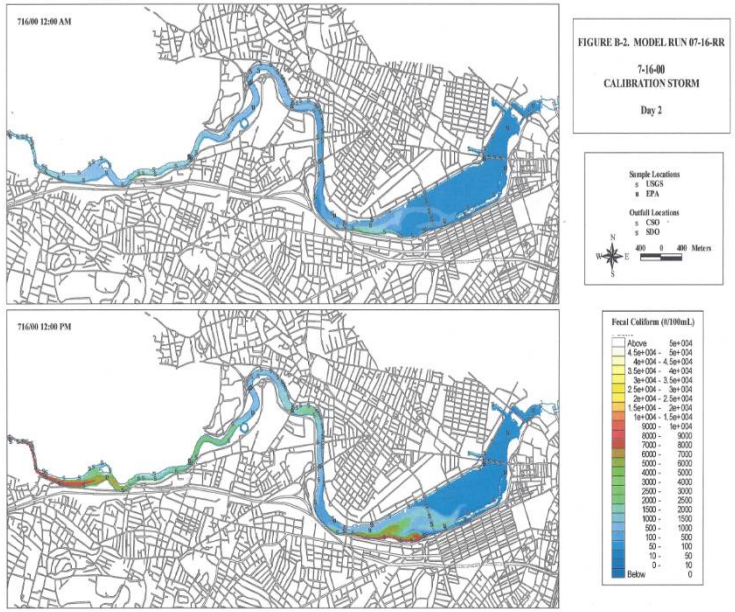
Storm Based Sampling - 2018

Charles River
8 storms, ~ 1,200 bacteria samples tested
• 4 storms with Cottage Farm activations
• 1 storm with other CSO activations
• 3 storms with no CSO

Alewife/ Mystic River
8 storms, ~ 1,200 bacteria samples tested
• 7 storms with CSO activations in Alewife Brook
• 1 storm with no CSO activations

Consultant Receiving Water Modeling

- Update prior models to more current platforms
- Update with current information.
- Calibrate with updated information on stormwater and CSO sources and loads. Calibrate with current in-stream WQ data (a calibration report will be provided)
- Perform model simulations
- Provide WQ Assessment Report
  - The model will allow for the assessment of remaining CSO (vs non-CSO) impacts on water quality in the variance areas.



Model Parameters and Inputs

	Alewife Brook / Upper Mystic	Charles River
Modeling Software	InfoWorks ICM (1-dimensional)	Delft3D (2-dimensional)
Model extent	Outlet of Lower Mystic Lake to Amelia Earhart Dam, including the Alewife Brook	Watertown Dam to Charles River Dam
Upstream Boundary flow	InfoWorks ICM Mystic River Basin Model (from Cambridge)	Waltham USGS Gauge
Upstream Boundary quality	MWRA monitoring for both the Lower Mystic Lake and Alewife Brook	Boundary conditions model from prior AECOM work, calibrated to new data
CSO flows	Calibrated and verified hydraulic model	Calibrated and verified hydraulic model
CSO quality	MWRA sampling Somerville Marginal CSO Facility NPDES effluent sampling	CSO facilities influent sampling Cottage Farm CSO facility NPDES effluent sampling
Stormwater Flows	InfoWorks ICM Mystic River Basin Model (from Cambridge) InfoWorks ICM Stormwater Model (from Somerville)	BWSC Drain Model USGS Charles River Stormwater Model
Stormwater Quality	MWRA sampling Community sampling	BWSC Drain Model Community sampling

Stormwater and CSO Sampling Plan

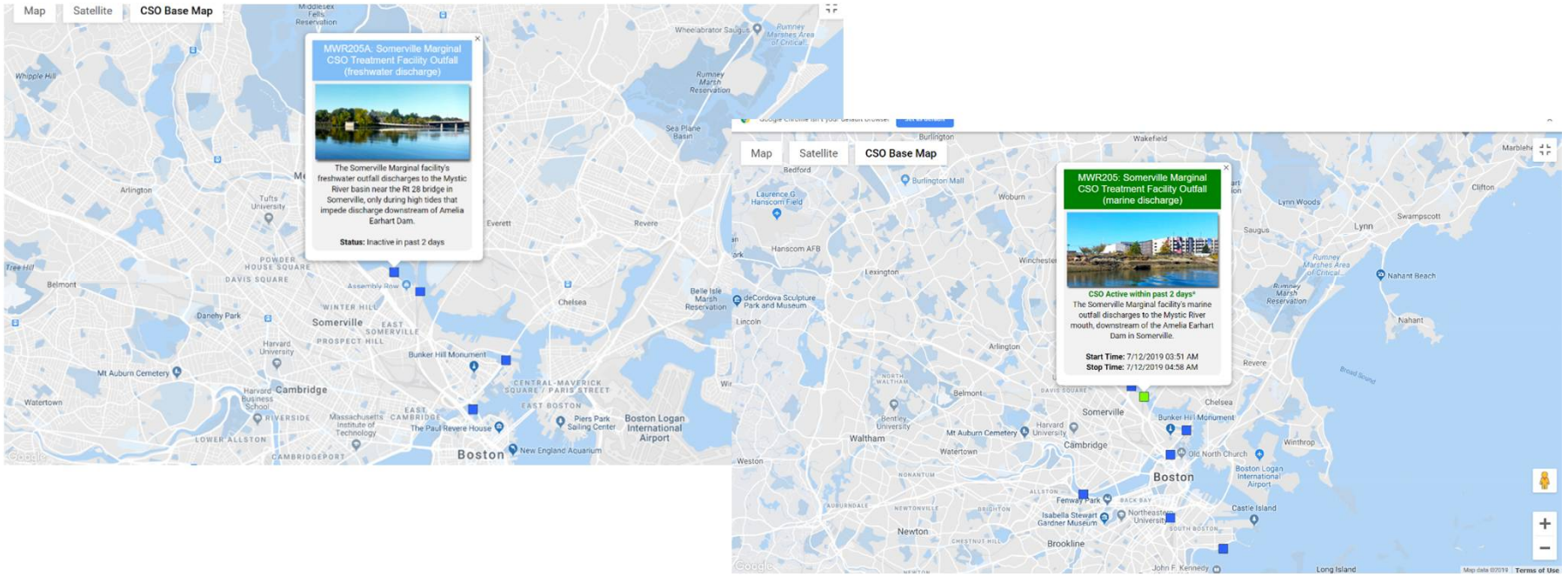
- MWRA, Cambridge and Somerville will collect stormwater samples to provide inputs to the model:
  - MWRA will collect SW samples from 3 sites in Medford and 2 sites in Arlington
  - Cambridge will collect SW samples from 2 or more sites.
  - Somerville will collect SW samples from 5 sites.

- MWRA also collecting samples of untreated CSO:
  - Two locations are targeted in Alewife Brook
  - Influent samples from 2 CSO treatment facilities have been collected since 2017 and is on-going (6 sample events each facility to date, ~37 samples)

CSO Notification

- MWRA posts the time and duration of discharge from each of its four CSO treatment facilities, the Little Mystic (BOS019) storage conduit and the South Boston tunnel.

- http://www.mwra.com/harbor/html/cso_reporting.htm



Public Information

- MWRA will continue to post the following reports on the progress of its CSO Performance Assessment:
  - Semiannual progress reports on post-construction monitoring, receiving water modeling and performance assessments (No. 1 and No. 2 posted; No. 3 in October 2019)
  - Semiannual court compliance and progress reports: mid-June and mid-December
  - Annual CSO discharge estimates by April 30
  - Annual Water Quality Monitoring report by July 15
- MWRA plans to hold annual public briefings in May on the progress and results of the Performance Assessment.