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**Subject: CSO Discharge Estimates and Rainfall Analyses for Calendar Year 2020**

Dear Mr. Brander and Mr. Borci:

The purpose of this letter report is to document and report the Massachusetts Water Resources Authority's (MWRA) estimates of combined sewer overflow (CSO) discharges during calendar year 2020 from its outfalls and other permitted outfalls in its service area. This information is submitted - and posted to MWRA's web site, as well - in part to comply with a condition in the variances to Massachusetts Water Quality Standards for CSO discharges to the Alewife Brook/Upper Mystic River and the Lower Charles River/Charles Basin, issued by the Massachusetts Department of Environmental Protection on August 30, 2019. The variances require MWRA and the cities of Cambridge and Somerville to establish and maintain respective public websites that include, among other required content, annual lists of the permittees' CSO outfalls within the variance waters with information compiled on duration and volume of discharges from each outfall, as well as cumulative discharge volume from all CSOs. Each calendar year summary shall be updated and posted on the website no later than April 30th of the following year. MWRA's CSO discharge estimates presented in this report include activation frequency, total discharge duration, and total discharge volume in 2020 from each of the remaining active outfalls addressed in MWRA's approved CSO Long-Term Control Plan (LTCP), including but not limited to the outfalls discharging to the Alewife Brook/Upper Mystic River and the Lower Charles River/ Charles Basin.

This report, like similar annual reports MWRA has submitted for nearly two decades, also compares the estimated outfall-by-outfall discharges in 2020 with estimates of the current system's Typical Year CSO performance and the LTCP activation and volume goals. This report also includes a summary analysis of rainfall in 2020 compared with Typical Year rainfall to understand and explain the differences between the discharge estimates for the actual storms in 2020 and the discharge predictions for a Typical Year with the same system physical conditions.

## CSO Post-Construction Monitoring and Performance Assessment

In compliance with the Federal District Court Order in the Boston Harbor Case (U.S. v. M.D.C. et al, No. 85-0489 MA) and milestones in the Court's Schedule Seven, MWRA is undertaking an extensive program of CSO inspections, overflow metering, rainfall analyses, hydraulic model improvements and calibration, site-specific CSO performance investigations, and water quality impact assessments. These activities, which MWRA commenced in November 2017, will culminate in a report to the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection in December 2021, in compliance with Schedule Seven.

MWRA issues semiannual reports on the progress of its performance assessment work. The first six of seven planned semiannual reports, including the most recent report (No. 6) issued on April 30, 2021, are posted to MWRA's website at http://www.mwra.com/cso/pcmapa.html. These progress reports document rainfall data and analyses, overflow meter data and analyses, site-specific CSO overflow activity investigations, hydraulic model updates, updated forecasts of LTCP activation and volume attainment by outfall, and the evaluation of CSO reduction strategies where CSO discharges may exceed the LTCP goals. The progress reports also document the development, calibration and use of receiving water models for the Lower Charles River/Charles Basin and the Alewife Brook/Upper Mystic River and water quality assessments, including the water quality impacts of remaining CSO and non-CSO pollution sources, utilizing these models.

The semiannual progress reports document site-specific investigations at the regulators and outfalls where meter generated and/or model predicted CSO discharge estimates indicate higher CSO activity than the LTCP goals. MWRA has closely coordinated these investigations with its CSO communities: Boston Water and Sewer Commission (BWSC) and the cities of Cambridge, Chelsea and Somerville. The investigations include identification of the site-specific wastewater system conditions that may be contributing to higher overflow activity and the evaluation and recommendation of maintenance activities or system improvements that can reduce CSO discharges.

From the site-specific investigations, certain maintenance activity and system improvements have already been implemented, and these measures have been incorporated into MWRA's hydraulic model to update the assessment of system performance relative to the LTCP activation and volume goals. Site-specific evaluations by MWRA and the CSO communities continue, as documented in Semiannual Progress Report No. 6, and MWRA expects to recommend additional system improvements to reduce CSO discharges where needed and feasible to attain LTCP goals.

## CSO Metering

On April 15, 2018, as part of its CSO post-construction monitoring program and performance assessment, MWRA began collecting data from temporary metering equipment it installed at 57 potentially active CSO regulators. The instrumentation included 81 meters collecting data from 106 depth and velocity sensors, 20 level sensors and 16 tide gate inclinometers. Data from MWRA's temporary meters supplemented the data from its permanent meters at CSO treatment facilities (Cottage Farm, Prison Point, Somerville-Marginal, and Union Park), the BOS019 storage facility in Charlestown, the South Boston CSO Storage Tunnel, Alewife Brook Outfall MWR003, and the Boston Marginal Conduit to estimate discharges at Charles River Basin outfalls MWR018, MWR019 and MWR020.

MWRA's temporary metering program had the primary objective of improving the calibration of MWRA's hydraulic model to have confidence in the model's predictions of CSO discharges and the system's Typical Year CSO performance relative to the LTCP goals. With the determination that it had collected ample data since April 2018 to improve model calibration, MWRA took temporary meters out of service at 21 of the 57 CSO regulators on February 28, 2019. Temporary meters remained in service to support site-specific investigations at 36 regulators, including all regulators associated with outfalls along the Charles River, the Alewife Brook, and the Upper Mystic River, which also supported development and calibration of the receiving water quality models. On June 30, 2020, the remaining temporary meters were removed except where MWRA converted them to permanent status in order to support MWRA's CSO public notification program. Permanent MWRA meters are now located where necessary to notify the public of discharges from MWRA outfalls (treated and untreated) and MWRA CSO storage facilities. For locations, see Table 1 and Figure 1.

## MWRA's Hydraulic Model

Early in the CSO performance assessment, MWRA updated its hydraulic model to incorporate the information it had collected from extensive CSO inspections it conducted in 2018 and other information it obtained through its coordination efforts with the CSO communities. With the model updated to 2018 system conditions, MWRA calibrated the model using temporary and permanent meter data collected from April 15, 2018 through September 30, 2018.

Calibration of the model was substantially complete by November 2019, and MWRA then updated the 2018 conditions model to 2019 conditions by incorporating adjustments to the wastewater system made in 2019, including regulator modifications performed by MWRA and the City of Cambridge to lower CSO discharges at Alewife Brook outfalls SOM001A and CAM002 in the spring of 2019. MWRA then compared CSO discharge activations and volumes predicted by the 2018 and 2019 models to meter data collected from April 15, 2018 through most of 2019 and concluded that the model and meter results were not sufficiently or consistently close at 10 of the 40 active CSO outfalls. To improve the calibration, MWRA conducted detailed investigations for each of the 10 locations, which resulted in additional model adjustments. In January 2020, MWRA determined the model to be well calibrated.

MWRA continues to update the hydraulic model as it obtains new information about system conditions and wet weather performance. All model changes are described in MWRA's semiannual CSO performance assessment progress reports. The following describes recent model updates and each updated model's use in producing the year 2020 and Typical Year discharges presented in this report.

Mid-2020 System Conditions Model: This version of the model represented system conditions in the first half of 2020 and was used to estimate CSO discharges in the rainfall events that occurred in the period January 1, 2020 through June 30, 2020. Updates to produce this model and the CSO discharge estimates for the first half of 2020 are presented in Semiannual Progress Report No. 5.

Q3/Q4-2020 System Conditions Model: This version of the model reflected system conditions in the second half of 2020 and was used to estimate CSO discharges in the rainfall events that occurred in the period July 1, 2020 through December 31, 2020. Updates to produce this model

and the CSO discharge estimates for the second half of 2020 are presented in Semiannual Progress Report No. 6.

The results of modeling rainfall events in the first half of 2020 with the Mid-2020 System Conditions Model and in the second half of 2020 with the Q3/Q4-2020 System Conditions Model were added to produce the CSO discharge estimates for 2020 presented in this report.

Q1-2021 System Conditions Model: This version of the model represents current system conditions in order to perform an updated Typical Year simulation and compare the results with the LTCP activation and volume goals. Updates to produce this model are summarized in Table 2 and described further in Semiannual Progress Report No. 6.

## Coordination with CSO Communities

MWRA has worked closely with its CSO communities during the CSO post-construction monitoring and performance assessment. BWSC and the cities of Cambridge, Chelsea and Somerville have joined MWRA in field inspections, modeling, and the reevaluation of system conditions to explain and attempt to mitigate higher CSO activity. These communities are also making progress with their own wastewater plans and programs, including the development or continuous improvement of GIS maps and hydraulic models of their systems, preparation of master plans, enhancements to their inspection and maintenance protocols, and their continuing progress with the design and construction of sewer separation plans. MWRA has received the hydraulic models developed by all four communities, and has used these models to confirm or enhance MWRA's model. MWRA continues to track the communities' efforts for their potential beneficial impact on CSO performance.

Like MWRA, all four CSO communities are preparing reports of their CSO discharge estimates for 2020. Cambridge plans to report its own meter and model results. Chelsea and Somerville plan to report the discharges measured by their meters, as required by their NPDES CSO discharge permits. BWSC plans to report the MWRA's estimates while it continues to implement its metering program and develop its hydraulic model. MWRA and the CSO communities work together to understand and compare their respective meter and model results, with the objectives of reporting similar estimates or being able to explain differences. Different metering approaches and the margins of error inherent in both metering and modeling can contribute to differences in the estimates.

## 2020 CSO Discharge Estimates

Table 3: Summary of 2020 and Typical Year Model Simulation Results, and Comparison to Typical Year Long Term Control Plan
Table 4: Comparison of MWRA Metered and Modeled CSO Discharges in 2020

Table 3 presents CSO activations, total discharge duration, and total discharge volume at each CSO outfall during calendar year 2020, as estimated with MWRA's hydraulic model as updated to represent changing system conditions during 2020 or improved model configuration, as discussed above. Table 3 also presents the results of the Typical Year simulation for current (Q1-2021) system conditions. Differences between the model predictions for calendar year 2020 rainfall and the Typical Year simulation results for current (Q1-2021) system conditions are due

to differences in the storm events in 2020 from those within the Typical Year, as discussed below ("2020 Rainfall Analyses"), but also due to the model changes mentioned above and listed in Table 2 that reflected physical system changes (e.g., sediment removal, sewer separation, overflow weir elevation adjustments) and operational changes (e.g., Alewife Brook Pumping Station modified controls) that occurred during 2020 or in the first quarter of 2021.

As presented in past annual reports, the Typical Year simulation for current (Q1-2021) system conditions is compared with the LTCP activation and volume goals. Current Typical Year activations and volumes that are numerically greater than the corresponding LTCP goal are shaded in Table 3. At many of these outfall locations, MWRA and the CSO communities have recommended and plan to implement system improvements that will reduce discharges to the LTCP levels. At other locations, MWRA and the CSO communities continue to coordinate the investigation and evaluation of system adjustments that may improve CSO performance. Descriptions of these site-specific recommendations and evaluations, as well as progress made, are presented in Semiannual Annual Progress Report No. 6.

Table 4 compares metered and modeled estimates of CSO activation and volume at MWRA metered locations. These locations include the MWRA outfalls associated with CSO treatment facilities, untreated MWRA outfalls MWR010, MWR023 on the Charles River and MWR003 on the Alewife Brook, and the BWSC outfalls associated with MWRA storage facilities at Charlestown/Little Mystic Channel (Outfall BOS019) and along the South Boston beaches (outfalls BOS081-086).

The model was able to replicate the system responses for the majority of storm events in 2020. However, it is not possible to match all of the modeled and metered activations for every meter and every storm event due to rainfall data quality and rainfall spatial variation, unknown transient conditions in the collection system, and the accuracy of metering data. For example, the November 30 - December 1, 2020, storm event had significant rainfall variation that was not fully captured by the rain gauge coverage and, therefore, the model. As a result, in some locations the model over-predicted the activations, while in other locations the model did not predict activations where the meter indicated activations occurred. Table 4 includes explanations where there is greater difference between the meter and model results.

## Comparison of MWRA and Community CSO Discharge Estimates for 2020

Table 5: Comparison of CSO Discharge Estimates Reported by the Communities and by MWRA

As noted previously, MWRA and its CSO communities coordinated closely as they prepared their respective annual CSO discharge reports for 2020. These interactions include comparison of MWRA and community meter installations and their methodologies for quantifying CSO discharge activations and volumes from the data. Because MWRA and the City of Cambridge report model results, coordination also includes comparisons of model configurations, rainfall data inputs, real-time (operational) controls in their storm-by-storm model simulations, and model platforms, which can also affect results. Table 5 compares the discharge estimates reported by each community for 2020 rainfall with the discharges estimated by MWRA. BWSC outfalls are not included in Table 5 because BWSC reports MWRA's estimates as it continues to implement its metering program and further develop its hydraulic model.

**2020 Rainfall Analyses**

Table R-1: Comparison of Frequency of Rain Events within Selected Ranges of Total Rainfall, Typical Year vs. 2020

Table R-2: Comparison of Rain Events with Greater than 2 Inches of Total Rain, Typical Year vs. 2020

Table R-3: Comparison of Rain Events with Peak Intensities Greater than 0.40 Inch/Hour, Typical Year vs. 2020

Figure R-1: Rainfall Intensity Distribution Comparison, Typical Year vs. 2020

In the period January 1, 2020 through December 31, 2020, MWRA continued to collect and analyze rainfall data from 17 gauges within the MWRA wastewater service area it has utilized for the CSO performance assessment since the beginning of the data collection efforts in April 2018. Three temporary project gauges MWRA had utilized in previous performance assessment periods were decommissioned on June 30, 2020. Most of the 17 gauges are located in or near areas served by combined sewers. Among other purposes, the rainfall data are necessary inputs to the hydraulic model to produce storm-by-storm model-predicted CSO discharges.

The rainfall data are analyzed to assess the rainfall characteristics of each storm in the collection period, including storm duration, total volume/depth of rain, average rainfall intensity, peak rainfall intensities and storm recurrence interval (e.g., 3-month storm, 1-year storm, etc.). The rainfall characteristics support comparisons of the storms in 2020 to the storms in the Typical Year. These rainfall comparisons help to explain the magnitude of the estimated CSO discharges caused by 2020 rainfall relative to the model predicted discharges for the Typical Year for current system conditions. The comparisons also help to understand whether actual CSO discharges and their associated impacts are in line with the predictions that supported regulatory approvals of MWRA's LTCP.

The comparison in Table R-1 shows that 2020 had 6% fewer number of storms and 14% less total rainfall than the Typical Year. Rain gauges measured an average of 86 storms with total rainfall volume of 40.5 inches in 2020, compared with 93 storms and 46.8 inches in the Typical Year. Storm frequencies for the 0.5 to 1.0-inch and 1.0 to 2.0-inch ranges were equal to the Typical Year, while the numbers of storms in the >2-inch range were less than the Typical Year. Significantly fewer storm events occurred in the <0.25-inch range in 2020 as compared with the Typical Year, while slightly more storm events in the 0.25 to 0.5-inch range occurred in 2020 as compared with the Typical Year. Storms in these two lower accumulation ranges would not be expected to contribute much CSO discharge volume unless a storm had an unusually high, though short, peak intensity. In terms of potential impact on CSO activations and volume, the key finding from this analysis was that 2020 had fewer storms in the >2-inch range than the Typical Year.

Table R-2 identifies and compares storms with greater than 2.0 inches of total rainfall at the Ward Street, Columbus Park, Chelsea Creek Headworks, and USGS Fresh Pond rain gauges to storms with greater than 2.0 inches of total rainfall in the Typical Year. It is the larger and more intense storms that often account for a disproportionately large volume of CSO. The various gauge data showed that 2020 had less than half the number of storms greater than 2.0 inches than the Typical

Year (2-3 storms in 2020 vs. 6 storms in the Typical Year). The largest rainfall accumulation measured at the gauges at Ward Street Headworks, Columbus Park Headworks, Chelsea Creek Headworks, and Fresh Pond was 2.2 inches. The largest accumulations at other gauges were less than 2.2 inches. The Typical Year, in comparison, had five storms with greater than 2.2 inches, including one storm with 3.89 inches.

Storms with peak rainfall intensities greater than 0.40 inch/hour at the Ward Street, Columbus Park, Chelsea Creek Headworks, and USGS Fresh Pond rain gauges were identified and compared with storms with greater than 0.40 inch/hour of peak intensity in the Typical Year storms. As shown in Table R-3, at most gauge locations, 2020 had fewer storms of peak hourly intensity greater than 0.40 inch/hour than the Typical Year. Intensities greater than 0.4 inch/hour are of importance because higher intensity storms have been found to produce more CSO activations and volumes than lower intensity storms, because the rapidly produced stormwater can overwhelm the capacities of combined sewer pipes and connections. The Typical Year has nine storm events with intensities greater than 0.40 inch per hour, while the 2020 monitoring period had five to ten storms with intensities greater than 0.40 inches per hour, depending on gauge location. Significantly, while the Typical Year had five storms with greater than 0.60 inch/hour or greater peak intensity, only 1 to 4 storms of this higher intensity were measured in 2020 at the various gauges.

Figure R-1 shows probability distributions of peak intensities from rainfall measurements in 2020 compared with the Typical Year. For up to 90% of the storms, 2020 peak intensity was equal to or greater than Typical Year peak intensity (where the Ward Street, Columbus Park and Chelsea Creek headworks lines lie at or above the Typical Year line). However, these were for storms of peak intensity less than 0.30 inch/hour. The graphs in Figure R-1, like Table R-3, show the smaller percentage of storms in 2020 greater than 0.60 inch/hour peak intensity compared with the percentage of Typical Year storms.

The findings from these rainfall comparisons include a smaller number of storms, a lower total rainfall, and a smaller number of large storms and high intensity storms in 2020 compared with the Typical Year. The lower rainfall in 2020 contributes to an explanation of the lower estimates of CSO discharge at most outfalls in 2020 compared with the Typical Year and the lower total discharge volume of 265 million gallons among all active outfalls compared with the total estimated discharge volume of 421 million gallons in the Typical Year, as presented in Table 3.

Should you have questions about MWRA's CSO discharge estimates or MWRA's continued efforts implementing the LTCP, please feel free to contact me, at 617-788-4359, or Brian Kubaska at 617-756-8464.

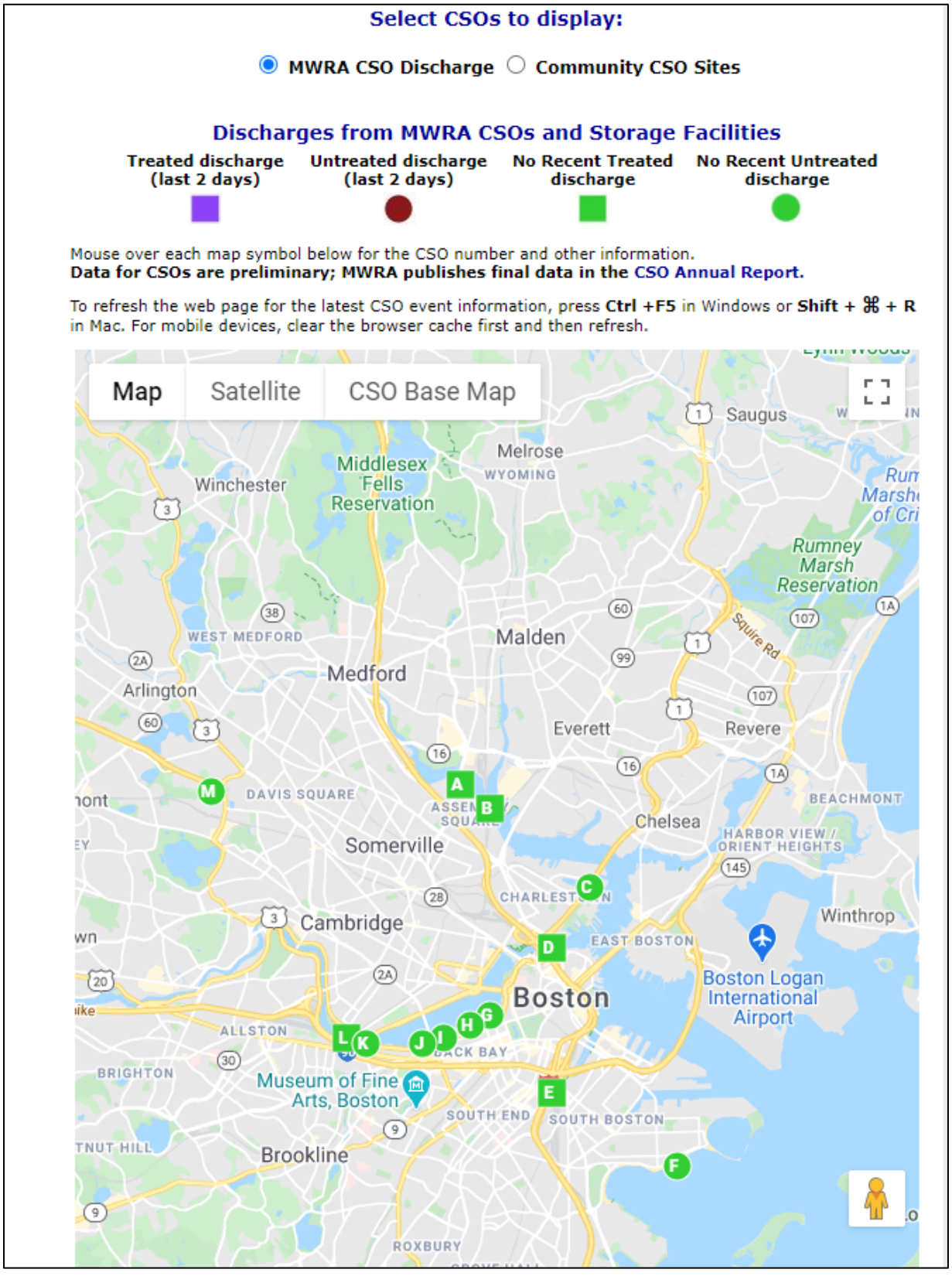
Very truly yours,

David W. Coppes
Chief Operating Officer

## Table 1: MWRA Monitored CSOs in the MWRA Public Notification Program

| CSO Outfall | Outfall Location | Potentially Affected Area | Location (Figure 1) |
|---|---|---|---|
| SOM007A/ MWR205A | Baxter Park/Assembly Row, just downstream of Rte. 28 Bridge | Upper Mystic River (basin) | A |
| MWR205 | Somerville-Marginal CSO Treatment Facility, Draw Seven Park | Lower Mystic River (marine) | B |
| BOS019 | BOS019 Storage Conduit capacity exceedance discharge, Charlestown, under Tobin Bridge | Little Mystic Channel and confluence of Mystic and Chelsea rivers | C |
| MWR203 | Prison Point CSO Storage and Treatment Facility discharge, between Charles River Dam and Charlestown Bridge | Upper Inner Harbor | D |
| MWR215 | Union Park CSO Storage and Treatment Facility discharge, Head of Fort Point Channel near the Broadway Street Bridge | Fort Point Channel | E |
| BOS081-086 | South Boston Storage Tunnel capacity exceedance discharge | South Boston beaches, North Dorchester Bay | F |
| MWR020 | Charles River Esplanade, near Fiedler Field | Charles River Basin | G |
| MWR019 | Charles River Esplanade | Charles River Basin | H |
| MWR018 | Charles River Esplanade, near Stoneman Playground | Charles River Basin | I |
| MWR023 | Adjacent to Muddy River outlet to Charles River Basin | Charles River Basin | J |
| MWR010 | Charles River, along Storrow Dr., near the “BU Beach” | Charles River Basin | K |
| MWR201 | Cottage Farm CSO Storage and Treatment Facility discharge, between Magazine Park and BU Bridge | Charles River Basin | L |
| MWR003 | Alewife Brook Reservation near Alewife T station | Little River and Alewife Brook | M |

**Figure 1: Location of MWRA Monitored CSO Outfalls and Storage Facilities**



## Table 2: Recent MWRA Hydraulic Model Updates

| Location | Summary of Change | Date of System Modification |
|---|---|---|
| Inner Harbor/Fort Point Channel Outfalls BOS060, BOS062, BOS064, and BOS065 | Minor adjustments were made to the physical configuration of the regulators based on record drawings and inspections, and subsequent minor calibration adjustments were made. | N/A* |
| Alewife Brook Pump Station | MWRA modified its wet weather pumping operation strategy. | Jan 2021 |
| East Boston Outfalls | BWSC completed Sewer Separation Contract 1. | Aug 2020 |
| | MWRA incorporated new information from BWSC's hydraulic model updates received on February 4, 2021. | N/A |
| East Boston Outfall BOS010 | BWSC raised the overflow weir by 3 inches at RE010-2. | Feb 2021 |
| Alewife Brook Outfall CAM401A | City of Cambridge removed sediment in the CAM401A system | Dec 2020 |
| Chelsea Outfall CHE004 | City of Chelsea raised the weir at CHE004 by 1.5 feet. | Dec 2020 |
| Chelsea Outfall CHE008 | Recalibrated the model to better reflect system hydraulics and account for MWRA's removal of the protrusion of the dry weather flow connection into the regulator. | Oct 2020 |
| Charlestown Outfall BOS017 | Updated the model with information from GIS mapping and recent BWSC field inspections. | N/A |
| Cottage Farm CSO Facility | City of Cambridge completed Cambridgeport Partial Sewer Separation improvements. | Aug 2020 |
| Charles River Outfalls MWR018, MWR019 and MWR020 | Updated the model with information from recent MWRA field surveys and internal inspections. | N/A |
| Charles River Outfall CAM017 | Removed second dry weather pipe that the City of Cambridge indicated did not exist. The calibration was reviewed and confirmed. | N/A |
| Prison Point CSO Facility | Corrected/increased the size of a section of pipe upstream of Prison Point/downstream of Boston Marginal Conduit Siphon, as confirmed by MWRA field inspection. | N/A |
| | Pumping operation settings were adjusted to better correlate with observed flows following updates to regulators MWR018, 019, 020 and RE0017-3. | N/A |
| Somerville Marginal/ Ten Hills Stormwater | Adjusted the model to match meter data collected from a stormwater area upstream of Somerville Marginal and incorporate information provided by the City of Somerville on highway drainage. | N/A |

*NA: Not Applicable - Model change, only, from new information about existing system conditions.

## Table 3: Summary of 2020 and Typical Year Model Simulation Results, and Comparison to Typical Year Long Term Control Plan (1 of 3)

**Shaded values are greater than the corresponding LTCP goal.**

| Outfall | JANUARY 1, 2020 - DECEMBER 31, 2020[1] | | | TYPICAL YEAR RAINFALL | | | |
|---|---|---|---|---|---|---|---|
| | | | | Q1-2021 SYSTEM CONDITIONS | | LONG TERM CONTROL PLAN [2] | |
| | Activation Frequency | Duration (Hours) | Volume (MG) | Activation Frequency | Volume (MG) | Activation Frequency | Volume (MG) |
| **ALEWIFE BROOK** | | | | | | | |
| CAM001 | 1 | 0.33 | 0.02 | 1 | 0.02 | 5 | 0.19 |
| CAM002 | 0 | 0.00 | 0.00 | 0 | 0.00 | 4 | 0.69 |
| MWR003 | 1 | 0.61 | 0.29 | 3 | 0.61 | 5 | 0.98 |
| CAM004 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| CAM400 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| CAM401A | 6 | 7.15 | 0.75 | 5 | 0.66 | 5 | 1.61 |
| CAM401B | 2 | 1.58 | 0.24 | 4 | 0.50 | 7 | 2.15 |
| SOM001A | 2 | 0.63 | 0.98 | 8 | 4.47 | 3 | 1.67 |
| SOM001 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| SOM002 | Closed | N/A | N/A | Closed | N/A | N/I[3] | N/I[3] |
| SOM002A | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| SOM003 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| SOM004 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| **TOTAL** | | | **2.28** | | **6.26** | | **7.29** |
| **UPPER MYSTIC RIVER** | | | | | | | |
| SOM007A/MWR205A[4] | 3 | 6.96 | 9.43 | 5 | 4.50 | 3 | 3.48 |
| SOM006 | Closed | N/A | N/A | Closed | N/A | N/I[3] | N/I[3] |
| SOM007 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| **TOTAL** | | | **9.43** | | **4.50** | | **3.48** |
| **MYSTIC/CHELSEA CONFLUENCE** | | | | | | | |
| MWR205 (Somerville-Marginal Facility)[5] | 32 | 106.79 | 71.18 | 30 | 100.58 | 39 | 60.58 |
| BOS013 | 8 | 5.58 | 0.12 | 8 | 0.27 | 4 | 0.54 |
| BOS014 | 16 | 12.97 | 0.53 | 8 | 1.45 | 0 | 0.00 |
| BOS015 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| BOS017 | 3 | 1.70 | 0.04 | 6 | 0.34 | 1 | 0.02 |
| CHE002 | Closed | N/A | N/A | Closed | N/A | 4 | 0.22 |
| CHE003 | 0 | 0.00 | 0.00 | 0 | 0.00 | 3 | 0.04 |
| CHE004 | 5 | 3.08 | 0.78 | 3 | 0.30 | 3 | 0.32 |
| CHE008 | 7 | 15.62 | 1.20 | 6 | 1.95 | 0 | 0.00 |
| **TOTAL** | | | **73.85** | | **104.89** | | **61.72** |
| **UPPER INNER HARBOR** | | | | | | | |
| BOS009 | 26 | 39.28 | 0.35 | 10 | 0.73 | 5 | 0.59 |
| BOS010 | 6 | 5.87 | 0.25 | 7 | 0.44 | 4 | 0.72 |
| BOS012 | 7 | 2.51 | 0.32 | 0 | 0.00 | 5 | 0.72 |
| BOS019 | 0 | 0.00 | 0.00 | 1 | 0.07 | 2 | 0.58 |
| BOS050 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| BOS052 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| BOS057 | 3 | 1.59 | 0.03 | 2 | 1.32 | 1 | 0.43 |
| BOS058 | Closed | N/A | N/A | Closed | - | Closed | N/A |
| BOS060 | 2 | 1.55 | 0.11 | 2 | 0.47 | 0 | 0.00 |
| MWR203 (Prison Point Facility) | 12 | 98.95 | 157.55 | 17 | 253.66 | 17 | 243.00 |
| **TOTAL** | | | **158.62** | | **256.69** | | **246.04** |

## Table 3: Summary of 2020 and Typical Year Model Simulation Results, and Comparison to Typical Year Long Term Control Plan (2 of 3)

**Shaded values are greater than the LTCP goal.**

| Outfall | JANUARY 1, 2020 - DECEMBER 31, 2020[1] | | | TYPICAL YEAR RAINFALL | | | |
|---|---|---|---|---|---|---|---|
| | | | | Q1-2021 SYSTEM CONDITIONS | | LONG TERM CONTROL PLAN [2] | |
| | Activation Frequency | Duration (Hours) | Volume (MG) | Activation Frequency | Volume (MG) | Activation Frequency | Volume (MG) |
| **LOWER INNER HARBOR** | | | | | | | |
| BOS003 | 7 | 21.60 | 2.95 | 9 | 6.40 | 4 | 2.87 |
| BOS004 | 5 | 2.85 | 0.01 | 2 | 0.06 | 5 | 1.84 |
| BOS005 | 0 | 0.00 | 0.00 | 0 | 0.00 | 1 | 0.01 |
| BOS006 | Closed | N/A | N/A | Closed | N/A | 4 | 0.24 |
| BOS007 | Closed | N/A | N/A | Closed | N/A | 6 | 1.05 |
| **TOTAL** | | | **2.96** | | **6.46** | | **6.01** |
| **CONSTITUTION BEACH** | | | | | | | |
| MWR207 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| **TOTAL** | | | **0.00** | | **0.00** | | **0.00** |
| **FORT POINT CHANNEL** | | | | | | | |
| BOS062 | 8 | 9.87 | 0.12 | 5 | 1.26 | 1 | 0.01 |
| BOS064 | 5 | 1.00 | 0.04 | 1 | 0.01 | 0 | 0.00 |
| BOS065 | 5 | 12.05 | 0.11 | 1 | 0.62 | 1 | 0.06 |
| BOS068 | 0 | 0.00 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| BOS070 | | | | | | | |
| BOS070/DBC | 26 | 45.36 | 2.19 | 7 | 6.14 | 3 | 2.19 |
| MWR215 (Union Park Facility) | 8 | 25.26 | 19.95 | 10 | 26.62 | 17 | 71.37 |
| BOS070/RCC | 1 | 0.25 | 0.05 | 0 | 0.00 | 2 | 0.26 |
| BOS072 | Closed | N/A | N/A | Closed | N/A | 0 | 0.00 |
| BOS073 | 0 | 0.00 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| **TOTAL** | | | **22.46** | | **34.66** | | **73.89** |
| **RESERVED CHANNEL** | | | | | | | |
| BOS076 | 1 | 0.03 | <0.01 | 1 | 0.10 | 3 | 0.91 |
| BOS078 | 0 | 0.00 | 0.00 | 0 | 0.00 | 3 | 0.28 |
| BOS079 | 0 | 0.00 | 0.00 | 0 | 0.00 | 1 | 0.04 |
| BOS080 | 0 | 0.00 | 0.00 | 0 | 0.00 | 3 | 0.25 |
| **TOTAL** | | | **<0.01** | | **0.10** | | **1.48** |
| **NORTHERN DORCHESTER BAY** | | | | | | | |
| BOS081 | 0 | 0.00 | 0.00 | 0 / 25 year | N/A | 0 / 25 year | N/A |
| BOS082 | 0 | 0.00 | 0.00 | 0 / 25 year | N/A | 0 / 25 year | N/A |
| BOS083 | Closed | N/A | N/A | Closed | N/A | 0 / 25 year | N/A |
| BOS084 | 0 | 0.00 | 0.00 | 0 / 25 year | N/A | 0 / 25 year | N/A |
| BOS085 | 0 | 0.00 | 0.00 | 0 / 25 year | N/A | 0 / 25 year | N/A |
| BOS086 | 0 | 0.00 | 0.00 | 0 / 25 year | N/A | 0 / 25 year | N/A |
| BOS087 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| **TOTAL** | | | **0.00** | | **0.00** | | **0.00** |
| **SOUTHERN DORCHESTER BAY** | | | | | | | |
| BOS088 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| BOS089 (Fox Pt.) | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| BOS090 (Commercial Pt.) | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| **TOTAL** | | | **0.00** | | **0.00** | | **0.00** |

## Table 3: Summary of 2020 and Typical Year Model Simulation Results, and Comparison to Typical Year Long Term Control Plan (3 of 3)

**Shaded values are greater than the LTCP goal.**

| Outfall | JANUARY 1, 2020 - DECEMBER 31, 2020[1] | | | TYPICAL YEAR RAINFALL | | | |
|---|---|---|---|---|---|---|---|
| | | | | Q1-2021 SYSTEM CONDITIONS | | LONG TERM CONTROL PLAN [2] | |
| | Activation Frequency | Duration (Hours) | Volume (MG) | Activation Frequency | Volume (MG) | Activation Frequency | Volume (MG) |
| **UPPER CHARLES** | | | | | | | |
| BOS032 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| BOS033 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| CAM005 | 6 | 2.49 | 0.36 | 7 | 0.66 | 3 | 0.84 |
| CAM007 | 1 | 0.50 | 0.68 | 2 | 0.45 | 1 | 0.03 |
| CAM009 | Closed | N/A | N/A | Closed[6] | N/A | 2 | 0.01 |
| CAM011 | Closed | N/A | N/A | Closed[6] | N/A | 0 | 0.00 |
| **TOTAL** | | | **1.04** | | **1.11** | | **0.88** |
| **LOWER CHARLES** | | | | | | | |
| BOS028 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| BOS042 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| BOS049 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| CAM017 | 0 | 0.00 | 0.00 | 0 | 0.00 | 1 | 0.45 |
| MWR010 | 0 | 0.00 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| MWR018 | 0 | 0.00 | 0.00 | 2 | 1.14 | 0 | 0.00 |
| MWR019 | 0 | 0.00 | 0.00 | 2 | 0.51 | 0 | 0.00 |
| MWR020 | 0 | 0.00 | 0.00 | 2 | 0.57 | 0 | 0.00 |
| MWR021 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| MWR022 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| MWR201 (Cottage Farm Facility) | 3 | 7.70 | 3.48 | 2 | 8.95 | 2 | 6.30 |
| MWR023[7] | 1 | 0.33 | 0.03 | 1 | 0.14 | 2 | 0.13 |
| SOM010 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| **TOTAL** | | | **3.51** | | **11.31** | | **6.88** |
| **NEPONSET RIVER** | | | | | | | |
| BOS093 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| BOS095 | Closed | N/A | N/A | Closed | N/A | Closed | N/A |
| **TOTAL** | | | **0.00** | | **0.00** | | **0.00** |
| **BACK BAY FENS** | | | | | | | |
| BOS046[6] | 0 | 0.00 | 0.00 | 0 | 0.00 | 2 | 5.38 |
| **TOTAL** | | | **0.00** | | **0.00** | | **5.38** |
| **Total Treated**[8] | | | **252** | | **390** | | **381**[9] |
| **Total Untreated**[8] | | | **13** | | **31** | | **23**[9] |
| **GRAND TOTAL**[8] | | | **265** | | **421** | | **404**[9] |

(1) Values at all outfalls are from MWRA hydraulic model simulations of rainfall events in 2020 and storm-specific facility operations.

(2) From Exhibit B to the Second CSO Stipulation, Boston Harbor Case.

(3) Outfall was closed prior to 1996 and is not included in Exhibit B to the Second CSO Stipulation.

(4) Includes a portion of CSO flow treated at Somerville-Marginal Facility and separate stormwater entering the Somerville-Marginal Conduit (outfall) downstream of the facility.

(5) Includes all CSO flow treated at Somerville-Marginal Facility.

(6) Outfalls CAM009 and CAM011 have been closed since November 2007, pending additional hydraulic impact evaluations by City of Cambridge.

(7) Includes all CSO flow entering the Stony Brook Conduit at upstream regulators, and does not include separate stormwater.

(8) Includes a portion of the mix of CSO flow and separate stormwater entering the Stony Brook Conduit upstream of Outfall MWR023

(9) System-wide volume totals do not include discharge volumes from Outfall SOM007A/MWR205A or Outfall BOS046, which are accounted for in the discharge volumes from Outfall MWR205 and Outfall MWR023, respectively.

**(10)** These volume totals are not included in Exhibit B to the Second CSO Stipulation.

## Table 4: Comparison of MWRA Metered and Modeled CSO Discharges in 2020

| Outfall | JANUARY 1, 2020 - DECEMBER 31, 2020 | | | | Comments |
|---|---|---|---|---|---|
| | Meter | | Model | | |
| | Activation Frequency | Volume (MG) | Activation Frequency | Volume (MG) | |
| **ALEWIFE BROOK** | | | | | |
| MWR003 | 1 | 0.01 | 1 | 0.29 | |
| **UPPER MYSTIC RIVER** | | | | | |
| SOM007A/MWR205A | 7 | 12.47 | 3 | 9.43 | The metered activations occurred on 3/23/20, 4/3/20, 6/29/20, 08/23/2020, 11/30/2020, 12/4/2020 and 12/25/2020. The model results show activations on the larger of these storms, namely 6/29/20, 08/23/20 and 12/5/20.<br>The model predicted less discharge volume mostly tied to missing the activation for the 11/30/2020 storm due to the rainfall's high spatial variation.<br>The accuracy of the model's representation of separate City of Somerville stormwater that enters the MWR205 outfall downstream of the treatment facility cannot be confirmed. |
| **MYSTIC/CHELSEA CONFLUENCE** | | | | | |
| MWR205 (Somerville-Marginal Facility) | 25 | 73.19 | 32 | 71.18 | The model predicted less discharge volume due to rainfall variability mostly tied to the 11/30/20 storm event. |
| **UPPER INNER HARBOR** | | | | | |
| BOS019 | 2 | 1.07 | 0 | 0.00 | The two metered activations occurred on 12/5/20 and 12/25/20. The rainfall on the 12/5/20 storm was highly variable.<br>For the both events in the model water entered the storage tanks but it was not enough to cause and overflow. |
| MWR203 (Prison Point Facility) | 12 | 151.80 | 12 | 157.55 | |
| **FORT POINT CHANNEL** | | | | | |
| MWR215 (Union Park Facility) | 8 | 14.34 | 8 | 19.95 | |
| **NORTHERN DORCHESTER BAY** | | | | | |
| BOS081 | 0 | 0.00 | n/a | n/a | The South Boston CSO Storage Tunnel and the discharges from BWSC outfalls BOS081-086 are not included in MWRA's collection system hydraulic model. MWRA regularly tracks tunnel performance using data from meters in the BOS081-086 CSO diversion structures (which monitor discharge activation to the beaches), in the tunnel itself, and at the dewatering pump station. The hydraulic model does include the CSO regulators that direct overflow to the tunnel. |
| BOS082 | 0 | 0.00 | n/a | n/a | |
| BOS084 | 0 | 0.00 | n/a | n/a | |
| BOS085 | 0 | 0.00 | n/a | n/a | |
| BOS086 | 0 | 0.00 | n/a | n/a | |
| **LOWER CHARLES** | | | | | |
| MWR010 | 0 | 0.00 | 0 | 0.00 | |
| MWR018 | 0 | 0.00 | 0 | 0.00 | |
| MWR019 | 0 | 0.00 | 0 | 0.00 | |
| MWR020 | 0 | 0.00 | 0 | 0.00 | |
| MWR201 (Cottage Farm Facility) | 3 | 6.07 | 3 | 3.48 | |
| MWR023 | 0 | 0.00 | 1 | 0.03 | |

## Table 5: Comparison of 2020 CSO Discharge Estimates Reported by MWRA and the CSO Communities*

| Outfall | MWRA | | Community | | Remarks |
|---|---|---|---|---|---|
| | Activation Frequency | Volume (MG) | Activation Frequency | Volume (MG) | |
| **MWRA estimates are from its hydraulic model simulations.** | | | | | |
| **Cambridge's estimates are from its hydraulic model simulations, not overflow measurements.** | | | | | |
| CAM001 | 1 | 0.02 | 1 | 0.11 | |
| CAM002 | 0 | 0.00 | 1 | 0.01 | |
| CAM401A | 6 | 0.75 | 8 | 2.50 | MWRA's model was updated to reflect the City's removal of sediments from sewers downstream of CAM401A. Cambridge's model includes the sediment and its hydraulic impact. |
| CAM401B | 2 | 0.24 | 1 | 0.51 | |
| CAM005 | 6 | 0.36 | 5 | 1.22 | MWRA's model includes the extensive observed sediment in the CAM005 outfall pipe, which limits outfall and overflow capacity. Cambridge's model does not include the outfall restriction. |
| CAM007 | 1 | 0.68 | 1 | 0.23 | |
| CAM017 | 0 | 0.00 | 1 | 0.30 | |
| **Chelsea's estimates are from its meter data.** | | | | | |
| CHE003 | 0 | 0.00 | 0 | 0.00 | |
| CHE004 | 5 | 0.78 | 6 | 1.19 | |
| CHE008 | 7 | 1.20 | 10 | 0.62 | The activation and volume differences are likely due in part to rainfall spatial variation not captured by the rain gauge coverage and rain data input to MWRA's model, and due in part to the margins of error in both the MWRA model results and Chelsea's metering. |
| **Somerville's estimates are from its meter data at SOM001A and from MWRA meter data at SOM007A.** | | | | | |
| SOM001A | 2 | 0.98 | 3 | 0.85 | |
| SOM007A/ MWR205A | 3 | 9.43 | 7 | 12.47 | See comments in Table 4. |

*BWSC continues to report MWRA's discharge estimates.

## Table R-1: Comparison of Frequency of Rain Events within Selected Ranges of Total Rainfall, Typical Year vs. 2020

| Rain Gauge | Total Rainfall (inches) | Total Number of Storms | Number of Storms by Depth | | | | |
|---|---|---|---|---|---|---|---|
| | | | Depth < 0.25 inches | Depth 0.25 to 0.5 inches | Depth 0.5 to 1.0 inches | Depth 1.0 to 2.0 inches | Depth ≥2.0 inches |
| Typical Year | 46.8 | 93 | 49 | 14 | 16 | 8 | 6 |
| **January- December 2020 Metering Data** | | | | | | | |
| **Average of Rain Gauges** | | | | | | | |
| Average | 40.5 | 87 | 41 | 17 | 17 | 8 | 3 |
| **MWRA Rain Gauges** | | | | | | | |
| Ward Street | 40.3 | 89 | 44 | 16 | 20 | 6 | 3 |
| Columbus Park | 37.93 | 84 | 39 | 16 | 20 | 7 | 2 |
| Chelsea Creek | 35.41 | 92 | 51 | 16 | 16 | 6 | 3 |
| Hanscom Air | 38.54 | 77 | 36 | 14 | 17 | 6 | 4 |
| Hayes PS | 36.77 | 84 | 42 | 13 | 19 | 10 | 0 |
| **BWSC Rain Gauges** | | | | | | | |
| Allston | 38.71 | 89 | 45 | 18 | 16 | 8 | 2 |
| Charlestown | 39.47 | 85 | 38 | 18 | 17 | 10 | 2 |
| Dorchester-Adams | 43.3 | 85 | 35 | 22 | 14 | 9 | 5 |
| Dorchester-Talbot | 43.3 | 85 | 38 | 19 | 14 | 9 | 5 |
| Hyde Park | 50.32 | 99 | 48 | 21 | 16 | 7 | 7 |
| East Boston | 40.08 | 86 | 40 | 17 | 18 | 9 | 2 |
| Longwood | 40.24 | 89 | 44 | 16 | 20 | 7 | 2 |
| Roslindale | 47.17 | 92 | 43 | 21 | 13 | 10 | 5 |
| Roxbury | 42.95 | 88 | 39 | 21 | 15 | 9 | 4 |
| Union Park | 40.79 | 84 | 38 | 17 | 17 | 10 | 2 |
| **USGS Rain Gauge** | | | | | | | |
| Fresh Pond | 38.45 | 79 | 37 | 13 | 19 | 8 | 2 |
| **MWRA Rain Gauges** | | | | | | | |
| Lexington Farm | 40.07 | 82 | 39 | 13 | 17 | 11 | 2 |
| Spot Pond | 37.95 | 91 | 46 | 19 | 13 | 12 | 1 |
| Somerville | 36.04 | 92 | 48 | 19 | 17 | 6 | 2 |
| Waltham Farm | 41.6 | 81 | 36 | 18 | 14 | 9 | 4 |

## Table R-2: Comparison of Rain Events with Greater than 2 Inches of Rain Typical Year vs. 2020

| Rain Gauge | Date | Duration (hr) | Total Rainfall (in) | Average Intensity (in/hr) | Peak Intensity (in/hr) | Storm Recurrence Interval (24-hr) |
|---|---|---|---|---|---|---|
| Typical Year | 12/11/1992 | 50 | 3.89 | 0.08 | 0.20 | 1y |
| | 8/15/1992 | 72 | 2.91 | 0.04 | 0.66 | 3m |
| | 9/22/1992 | 23 | 2.76 | 0.12 | 0.65 | 1y |
| | 11/21/1992 | 84 | 2.39 | 0.03 | 0.31 | 3m |
| | 5/31/1992 | 30 | 2.24 | 0.07 | 0.37 | 3m-6m |
| | 10/9/1992 | 65 | 2.04 | 0.03 | 0.42 | < 3m |
| **January-December 2020 Gauge Data** | | | | | | |
| Ward Street | 6/28/2020 | 48.5 | 2.04 | 0.04 | 1.09 | 3m |
| | 12/4/2020 | 23 | 2.01 | 0.09 | 0.25 | 3m |
| Columbus Park | 3/23/2020 | 23.25 | 2.15 | 0.09 | 0.55 | 3m-6m |
| | 10/16/2020 | 19.5 | 2.11 | 0.11 | 0.31 | 3m-6m |
| Chelsea Creek | 6/28/2020 | 48.25 | 2.11 | 0.04 | 0.7 | 3m |
| | 10/16/2020 | 20 | 2.20 | 0.11 | 0.32 | 3m-6m |
| | 12/5/2020 | 18.5 | 2.10 | 0.11 | 0.32 | 3m-6m |
| Fresh Pond (USGS) | 11/30/2020 | 14.25 | 2.08 | 0.15 | 0.34 | <3m |
| | 12/5/2020 | 17.5 | 2.03 | 0.12 | 0.22 | 3m |

## Table R-3: Comparison of Rain Events with Peak Intensities Greater than 0.40 Inch/Hour Typical Year vs. 2020

| Rain Gauge | Date | Duration (hours) | Total Rainfall (inches) | Average Intensity (inch/hour) | Peak Hourly Intensity (inch/hour) | Storm Recurrence Interval (1-hour) |
|---|---|---|---|---|---|---|
| Typical Year | 10/23/1992 | 4 | 1.18 | 0.29 | 1.08 | 1-2y |
| | 8/11/1992 | 11 | 0.87 | 0.08 | 0.75 | 6m-1y |
| | 8/15/1992 | 72 | 2.91 | 0.04 | 0.66 | 3m-6m |
| | 9/22/1992 | 23 | 2.76 | 0.12 | 0.65 | 3m-6m |
| | 5/2/1992 | 7 | 1.14 | 0.16 | 0.63 | 3m-6m |
| | 9/9/1992 | 1 | 0.57 | 0.57 | 0.57 | 3m |
| | 9/3/1992 | 13 | 1.19 | 0.09 | 0.51 | < 3m |
| | 6/5/1992 | 18 | 1.34 | 0.07 | 0.44 | < 3m |
| | 10/9/1992 | 65 | 2.04 | 0.03 | 0.42 | < 3m |
| **January-December 2020 Metering Data** | | | | | | |
| Ward Street Headworks (BO-DI-1) | 3/23/2020 14:30 | 15 | 2 | 0.13 | 0.50 | < 3m |
| | 6/6/2020 14:30 | 6.5 | 0.69 | 0.11 | 0.60 | 3m |
| | 6/11/2020 12:15 | 5.75 | 0.67 | 0.12 | 0.47 | < 3m |
| | 6/28/2020 12:30 | 48.5 | 2.04 | 0.04 | 1.09 | 1-2y |
| | 7/23/2020 15:30 | 0.75 | 0.49 | 0.65 | 0.49 | <3m |
| | 7/31/2020 8:30 | 0.25 | 0.69 | 2.76 | 0.69 | 6m |
| | 8/23/2020 15:45 | 4 | 0.62 | 0.16 | 0.50 | <3m |
| | 9/30/2020 1:45 | 8.25 | 0.98 | 0.12 | 0.47 | <3m |
| | 10/13/2020 4:30 | 17.5 | 1.69 | 0.10 | 0.41 | <3m |
| | 11/23/2020 4:00 | 9 | 1.80 | 0.05 | 0.44 | <3m |
| Columbus Park Headworks (BO-DI-2) | 3/23/2020 14:30 | 23.25 | 2.15 | 0.09 | 0.55 | 3m |
| | 6/6/2020 14:30 | 6.75 | 0.67 | 0.10 | 0.62 | 3m-6m |
| | 6/11/2020 12:15 | 5.5 | 0.57 | 0.10 | 0.43 | < 3m |
| | 6/28/2020 12:30 | 48.5 | 1.33 | 0.03 | 0.60 | 3m |
| | 7/23/2020 15:45 | 0.5 | 0.72 | 1.44 | 0.72 | 6m |
| | 8/23/2020 16:00 | 4 | 0.82 | 0.21 | 0.70 | 6m |
| | 11/23/2020 0:45 | 9 | 1.76 | 0.05 | 0.50 | <3m |
| | 12/25/2020 2:45 | 15.75 | 1.37 | 0.02 | 0.41 | <3m |
| Chelsea Creek Headworks (CH-BO-1) | 3/23/2020 14:30 | 14.5 | 1.78 | 0.12 | 0.49 | < 3m |
| | 6/28/2020 12:30 | 48.25 | 2.11 | 0.04 | 0.70 | 6m |
| | 7/14/2020 9:45 | 18.25 | 1.10 | 0.06 | 0.90 | 1y |
| | 8/23/2020 15:45 | 4 | 0.97 | 0.24 | 0.93 | 1-2y |
| | 12/25/2020 3:00 | 20.5 | 1.45 | 0.02 | 0.42 | <3m |
| Fresh Pond (USGS) | 3/23/2020 14:30 | 15 | 1.96 | 0.13 | 0.48 | < 3m |
| | 6/11/2020 12:15 | 22.75 | 0.68 | 0.03 | 0.50 | < 3m |
| | 6/28/2020 12:15 | 29.25 | 1.32 | 0.05 | 1.05 | 1y-2y |
| | 7/23/2020 15:00 | 0.75 | 0.61 | 0.81 | 0.61 | 3m-6m |
| | 8/23/2020 16:00 | 4 | 0.54 | 0.14 | 0.46 | <3m |
| | 9/30/2020 1:30 | 8 | 0.56 | 0.07 | 0.43 | <3m |
| | 11/23/2020 4:15 | 8.75 | 1.77 | 0.05 | 0.43 | <3m |

**Figure R-1: Rainfall Intensity Distribution Comparison**
**Typical Year vs. 2020**