CSO Annual Report – January 1 to December 31, 2025:
MWRA CSO Discharge Estimates and Rainfall Statistics

April 29, 2026

Prepared for the:
Massachusetts Water Resources Authority

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1. Introduction

The Massachusetts Water Resources Authority (MWRA) is required to submit an Annual Combined Sewer Overflow (CSO) Discharge Report in accordance with Section C.2 in both the *2024 Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin* (Alewife/Mystic Variance) and the *2024 Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Lower Charles River/Charles Basin* (Charles River Variance). The Annual CSO Discharge Reports are to be submitted to the Massachusetts Department of Environmental Protection (MassDEP) and the U.S. Environmental Protection Agency (EPA) beginning April 30, 2025. This is the second of five Annual CSO Discharge Reports required by the Variances, which expire on August 31, 2029, as presented in Table 1-1 below.

Table 1-1. Annual Reports Required by the 2024 Variances

Annual Report Number	Date to be Submitted
1	April 30, 2025
2	April 30, 2026
3	April 30, 2027
4	April 30, 2028
5	April 30, 2029

The Variances require that the annual report include "…estimates of CSO activations and volumes for all permitted CSO outfalls within the Variance waterbodies, for those owned and operated by MWRA, for the prior calendar year. MWRA shall include data from the MWRA CSO metering program, which may be supplemented by estimates generated using calibrated sewer system modeling. For each CSO event, MWRA shall also provide rainfall data associated with the CSO discharge, including the depth, duration, and intensity of the rain event, and an estimate of the storm recurrence interval, based on National Oceanic and Atmospheric Association (NOAA) Atlas 14, Volume 10, or as updated."[1]

Exhibit A Item 5 in both the Alewife/Mystic Variance and the Charles River Variance also requires MWRA to provide a progress report on the three projects listed in Exhibit A of the Alewife/Mystic Variance (*i.e.*, Somerville Marginal CSO Facility - New Connection and gate structure; Somerville Marginal CSO Facility Rehab Design; and CAM401A Metering and Model Calibration Update) and the one project listed in Exhibit A of the Charles River Variance (*i.e.*, CAM005 Weir Raising and Lengthening). These progress reports are to be submitted "…[a]t the same time MWRA submits the Annual CSO Discharge Reports required by C.2.(ii)…".

This report is organized into the following chapters:

Chapter 1: Introduction

Chapter 2: 2025 CSO Discharges and Rainfall Events. Presents the following:

- A summary of the rainfall data collected for 2025; and
- Estimated CSO activation frequencies and discharge volumes calculated based on MWRA meter data[2] and rainfall statistics[3] for corresponding events for each of the MWRA CSO outfalls tributary to the Variance waters.

[1] *2024 Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin*, and *2024 Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Lower Charles River/Charles Basin* Section C.2.
[2] Outfall discharge are estimates calculated using MWRA metered data from sensors, taking into account physical configurations and constraints.
[3] Rainfall statistics are calculated using data collected from MWRA, BWSC, and USGS rain gages.

Chapter 3: Project Progress Report. Presents updates on the following projects:

- Somerville Marginal CSO Facility - New Connection and gate structure;
- Somerville Marginal CSO Facility Rehabilitation Design;
- CAM401A Metering and Model Calibration Update; and
- CAM005 Weir Raising and Lengthening.

Chapter 4: Next Steps

Appendix A: Rainfall Data Collection and Analyses January 1, 2025 to December 31, 2025. Presents the following:

- A summary of the rainfall data collected for 2025 and characterization of the return period for each storm.

2. 2025 CSO Discharges and Rainfall Events

This section presents estimates of CSO activations and volumes for the permitted CSO outfalls within the Variance waterbodies owned and operated by MWRA, for the period of January 1, 2025 to December 31, 2025, based on monitoring data. These CSO outfalls are listed by receiving water in Table 2-1. For each CSO event, the rainfall data associated with the CSO discharge, including the depth, duration, intensity of the rain event, and an estimate of the storm recurrence interval based on NOAA Atlas 14, Volume 10 is provided in Table 2-2.

Table 2-1. MWRA CSO Outfalls that Discharges to Variance Waters

Receiving Water	Outfall
Alewife Brook	MWR003
Upper Mystic River	SOM007A/MWR205A (Somerville Marginal CSO Treatment Facility)
Lower Charles River	MWR010
	MWR018
	MWR019
	MWR020
	MWR201 (Cottage Farm CSO Treatment Facility)
	MWR023

2.1 Rainfall Analyses

The rainfall for the period of January 1, 2025 to December 31, 2025, was analyzed to support the understanding of the metered CSO discharges for the 2025 period. The recurrence intervals for each storm event were estimated by comparing rainfall depths and intensities to intensity-duration-frequency (IDF) curves in *Atlas-14*.[4] Refer to Appendix A for the rainfall analysis including Figure A-1 with the rain gauge locations and Table A-1 for a list of the rain gauges analyzed.

Atlas 14 IDF values for Boston were extracted from NOAA's data server[5] on April 12, 2022. The Atlas 14 partial duration curves were used to assign recurrence intervals. The smallest storm that the partial duration curves address is the 1-year storm, so the partial duration IDF curves for the 3-month and 6-month frequencies were extrapolated. The storm recurrence intervals identified in the text and sections below are based on the 2019 edition of Atlas 14 referenced above.

Appendix A includes the following tables that were prepared in support of this analysis:

- Table A-4. Summary of Storm Events at Ward Street Headworks Rain Gauge (BO-DI-1) for January 1, 2025 to December 31, 2025;
- Table A-5. Frequency of Events within Selected Ranges of Total Rainfall for January 1, 2025 to December 31, 2025;
- Table A-6. Storms between January 1, 2025 to December 31, 2025, with Greater Than 2 Inches of Total Rainfall.[6]; and
- Table A-7. Storms Between January 1, 2025 to December 31, 2025, with Peak Intensities Greater than 0.40 inches/hour.[6]

[4] Atlas 14 Volume 10 report : https://www.weather.gov/media/owp/oh/hdsc/docs/Atlas14_Volume10.pdf
[5] NOAA's Data server for MA: https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ma
[6] Storms greater than 2 inches total depth or greater than 0.4 inches/hour peak intensity were identified for further analysis because storms of those sizes tend to be associated with more significant CSO discharge volumes.

The findings from those tables are summarized below.

- 2025 averaged 88 storm events across the assessed rain gauges with an average annual rainfall depth of 40.08 inches (Table A-5);
- The distribution of storms by rainfall depth categories for 2025 was as follows (Table A-5):
    - 46 storms with total depths less than 0.25 inches;
    - 13 storms with total depths between 0.25 and 0.5 inches;
    - 18 storms with total depths between 0.5 and 1.0 inches;
    - 9 storms with total depths between 1.0 and 2.0 inches; and
    - 2 storms with total depths greater than 2.0 inches.
- In terms of larger storms, for the four gauges shown in Table A-6, the number of storms with greater than 2 inches of total rainfall in 2025 ranged from one to two, for an average of 1.75 storms. Two storm events were recorded to have a depth greater than 2 inches at Ward St (BO-DI-1), Columbus Park (BO-DI-2), and Chelsea Creek (CH-BO-1), and one storm recorded a depth greater than 2 inches at United States Geological Survey (USGS) Fresh Pond. For the four gauges shown in Table A-6, the largest storm in 2025 with respect to total depth was measured by the Columbus Park (BO-DI-2) gauge on May 22, 2025 with a total depth of 4.36 inches. (Table A-6).
- For the four gauges shown in Table A-7, the number of storms with peak intensities greater than 0.40 inches per hour ranged from six to ten. On October 8, 2025, the USGS Fresh Pond gauge measured a storm with a peak intensity of 0.89 inches per hour which is equivalent to a 1-year, 1-hour event. The other three gauges presented in Table A-7 had individual storms with maximum peak intensities between 0.70 and 0.72 inches per hour.

Appendix A presents the rainfall data measured during the period of January 1, 2025 to December 31, 2025. It also describes the analysis of the rainfall data used to characterize the return period of each storm event. Further detail regarding the rainfall data collection and processing can be found in Chapter 9 of the *December 2021 CSO Report*.

2.2 Estimates of CSO Discharges to Variance Waters for 2025

Table 2-2 below presents the volume of each CSO discharge to the Variance waters for MWRA-owned CSO outfalls based on meter data and the rainfall statistics at the nearest rain gauge for each event (Refer to Figure A-1 for rain gauge locations). These data were collected by MWRA and supplemented with monitoring data from the Boston Water and Sewer Commission (BWSC) for regulators tributary to outfall MWR023. MWRA and the CSO communities (Boston, Cambridge, Chelsea, and Somerville) have been collecting meter data used to report the CSO discharges at each of the outfalls tributary to the Variance waters as part of the CSO Notification Program. The MassDEP regulations set forth at *314 CMR 16.00: Notification Requirements to Promote Public Awareness of Sewage Pollution* require MWRA and CSO communities to notify the public of CSO activations within two hours and estimate volumes within five business days. CSO volumes are posted for individual storm events on MWRA's website at Combined Sewer Overflow (CSO) Notifications | MWRA.

Table 2-2. 2025 MWRA Metered CSO Discharges to Variance Waters and Rainfall Statistics for Corresponding Events

MWRA Metered[1] CSO Discharge Estimates			Rainfall Statistics[3]					
Outfall/ Receiving Water	**Date**	**Volume (MG)**	**Rain Gauge**	**Duration (hr)**	**Depth (in)**	**Peak Intensity (in/hr)**	**NOAA Atlas 14 - 1hr Recurrence Interval**	**NOAA Atlas 14 - 24hr Recurrence Interval**
Alewife Brook								
MWR003	-	-	-	-	-	-	-	-
Total	**-**	**-**						
Upper Mystic								
SOM007A/ MWR205A (treated)[2]	3/6/2025	0.37	Somerville	20.25	1.02	0.33	3m	3m
	3/17/2025	0.05		15.25	1.43	0.55	6m	3m-6m
	5/22/2025	7.33		40.00	2.93	0.36	3m	1-2y
	10/8/2025	0.04		4.50	0.96	0.69	6m-1y	3m
	10/13/2025	0.59		60.50	1.99	0.17	<3m	6m
Total	**5**	**8.38**						
Lower Charles								
MWR010	-	-	-	-	-	-	-	-
Total	**-**	**-**						
MWR018	-	-	-	-	-	-	-	-
Total	**-**	**-**						
MWR019	-	-	-	-	-	-	-	-
Total	**-**	**-**						
MWR020	-	-	-	-	-	-	-	-
Total	**-**	**-**						
MWR201 (Cottage Farm) (treated)	5/22/2025	15.02	Allston	21	3.42	0.46	3m-6m	2y
Total	**1**	**15.02**						
MWR023	-	-	-	-	-	-	-	-
Total	**-**	**-**						

(1) Metered data are estimates of outfall discharge calculated using data from sensors, taking into account physical configurations and constraints.
(2) The SOM007A/MWR205A volume includes a fraction of the flow treated at Somerville Marginal facility plus separate stormwater that enters the Somerville Marginal Conduit (outfall) downstream of the facility.
(3) Rainfall statistics are calculated using data collected from MWRA, BWSC, and USGS rain gages.

3. Project Progress Report

Exhibit A Item 5 in both the Alewife/Mystic Variance and the Charles River Variance requires MWRA to provide a progress report on the three projects listed below in Table 3-1 and the one project listed below in Table 3-2.

Table 3-1. Alewife Brook/Upper Mystic River Project Progress Updates

Project Name	Potentially Impacted Variance Water Outfall	Project Description (From 2024 Variance)	Project Progress Update
Somerville Marginal CSO Facility - New Connection and Gate Structure	MWR205A/SOM007A	• Design and installation of gate structure from Somerville Marginal CSO facility influent line to MWRA Section 35 to maximize flows within interceptor. • Anticipated date of completion: December 2026	• MWRA entered into a Contract with RJV Construction Corp (Contract 7985). • The construction phase Notice to Proceed was issued October 26, 2024. • RJV mobilized to the Project site in July 2025 but was delayed several times given conflicting traffic management conditions with other contractors performing work on MassDOT's I-93 projects. As excavation for the new gate chamber progressed, issues arose with traffic management, creating traffic incidents and safety concerns in the Project area. MassDOT required MWRA to cease construction until a revised traffic management plan could be prepared and implemented resulting in further delays to the construction schedule and limited construction progress before MassDOT's Winter Moratorium on Roadway Construction. Prior to this pause, MWRA's contractor was able to structurally line an adjacent Somerville vitrified sewer as a prerequisite for supportive excavation installation, installed sheet and sheeting/piles as part of the supportive excavation, and began excavating the chamber site. Given these unavoidable delays MWRA now anticipates the completion of the Project by December 31, 2026. RJV resumed construction in April 2025. • Challenges: Deep excavation to construct chamber within onramp to Interstate 93. Modifications to MassDOT permit in fall 2025 required construction to be postponed until April 2026.
Somerville Marginal CSO Facility Rehabilitation Design	MWR205A/SOM007A	• Complete Design of Facility Rehab to ensure reliable treatment of remaining CSO discharges. • Anticipated date of completion: February 2028	• A request for qualification and proposals was advertised in November 2025 to procure Professional Services to design and provide engineering services during construction (ESDC) and resident engineering and resident inspection services (REI) for the Somerville Marginal Facility Rehabilitation. • The MWRA Board of Directors awarded contract 8689 to HDR Engineering Inc. in March 2026. • A notice to proceed on Contract 8689 is for design/ESDC services is anticipated spring of 2026.
CAM401A Metering and	CAM401A	• Working with the City of Cambridge,	• The metering program and model calibration are complete.

Model Calibration Update		perform further system metering and hydraulic model calibration to improve CAM401A system understanding and address differences in current hydraulic models. • Date of completion: October 2024	• Refer to December 27, 2024, Supplement to the Post Construction Monitoring Program for additional details. https://www.mwra.com/media/file/supplementaltofinal122724

Table 3-2. Charles River Project Progress Update

Project Name	Potentially Impacted Outfall	Project Description (From 2024 Variance)	Project Progress Update
CAM005 Weir Raising and Lengthening	CAM005	• Further investigate through internal survey all physical dimensions in the CAM005 Regulator to determine if the CAM005 weir can be raised to reduce activations but also increased in length to minimize increases to upstream wastewater levels. • Anticipated date of completion: December 2026	• MWRA issued a Task Order to Kleinfelder to evaluate and design weir improvements within the CAM005 regulator in summer 2024. • Kleinfelder completed the internal survey in September 2024, a Preliminary Design Report in March 2025, followed by a Final Design of Construction Contract 8188 in August 2025. • Contract 8188 was bid in January 2026 and was awarded to MAS Building and Bridge in April 2026. • A notice to proceed on Contract 8188 is anticipated in spring 2026.

4. Next steps

MWRA, Cambridge, and Somerville continue to progress forward the work required by the Variances and to develop draft Updated CSO Control Plans. In addition, MWRA, Cambridge, and Somerville continue to pursue the development of projects that will further reduce CSO discharges.

Appendix A
Rainfall Processing and Analyses January 1, 2025 – December 31, 2025

A.1 Rainfall Analyses

This section presents the rainfall data measured from 17 gauges within the MWRA wastewater service area during the period of January 1, 2025 to December 31, 2025. It also describes the analysis of the rainfall data used to characterize the return period of each storm event and an assessment of measured rainfall for the 2025 period.

Intensity-Duration-Frequency (IDF) curve values for Atlas 14 for Boston (x-y coordinates: 42.3590, -71.0586) were extracted from NOAA's data server on April 12, 2022. The Atlas 14 partial duration curves were used to assign the recurrence intervals. The smallest storm the partial duration curves addresses is the 1-year storm, so the partial duration IDF curves for the 3-month and 6-month frequencies were extrapolated. The storm recurrence intervals identified in the report sections above and in Appendix A are based on the 2019 edition of Atlas 14 referenced above.

A.1.1 Rainfall Data Collection and Processing

Rainfall was quantified for this analysis using 15-minute rainfall data collected at rain gauges distributed over the MWRA system. The rain gauges are listed in Table A-1 and the locations are shown in Figure A-1.

Table A-1. Rain Gauges

Gauge Code	Name	Owner	Gauge Code	Name	Owner
BO-DI-1	Ward St.	MWRA	BWSC006	Dorchester -Talbot	BWSC
BO-DI-2	Columbus Park	MWRA	Rox	Roxbury	BWSC
BWSC001	Union Park Pump Sta.	BWSC	CH-BO-1	Chelsea Ck.	MWRA
BWSC002	Roslindale	BWSC	FRESH_POND	USGS Fresh Pond	USGS
BWSC003	Dorchester Adams St.	BWSC	HF-1C	Hanscom AFB	MWRA
BWSC004	Allston	BWSC	RG-WF-1	Hayes Pump Sta.	MWRA
BWSC007	Charlestown	BWSC	SOM	Somerville Remote	MWRA
EB	East Boston	BWSC	Lex	Lexington Farm	Project (1)
BWSC008	Longwood Medical	BWSC	SP	Spot Pond	Project (1)
BWSC005	Hyde Park	BWSC	WF	Waltham Farm	Project (1)

Notes:

(1) Project gauges were removed as of July 1, 2020. For modeling purposes project gauge data has been replaced with the nearest rain gauge, following the methodology described in the December 2021 CSO Report and closest rain gauges substitution table.

The rainfall data was reviewed based on geographic location, comparing total rainfall depth and rainfall intensity values by month and for individual storm events. The shape of the rainfall hyetographs was reviewed for irregularities. Rain gauges with significantly higher or lower total rainfall depths than other gauges, and unusual hyetograph shapes, were flagged as suspect and further reviewed.

Suspect or missing rain gauge data were replaced with data from the rain gauge in closest linear proximity. If the closest gauge also had suspect data, the second closest rain gauge was used. Table A-2 identifies the two closest rain gauges to each of the rain gauges. Replacement of suspect data was recorded in Table A-3.

Additional information on the methodologies for rainfall data collection and processing can be found in Chapter 9 of the *December 2021 CSO Report.*

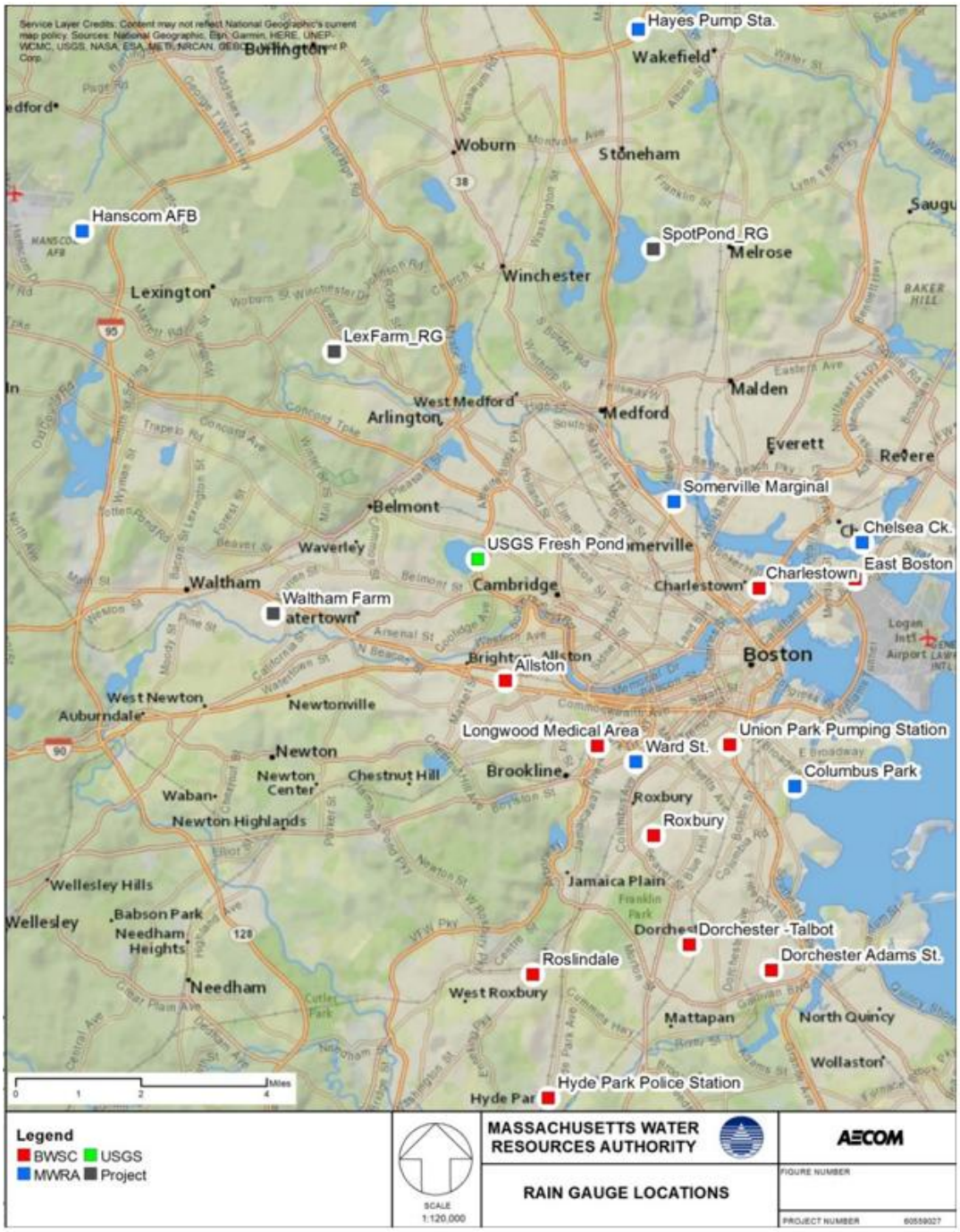

Figure A-1. Rain Gauge Location Plan

Table A-2. Closest Rain Gauges for Data Substitution

Origin Gauge		Closest Gauge		Second Closest Gauge	
Gauge Name	**Gauge Code**	**Gauge Code**	**Distance (mi)**	**Gauge Code**	**Distance (mi)**
Ward Street	BO-DI-1	BWSC008	0.66	Rox	1.23
Columbus Park	BO-DI-2	BWSC001	1.24	Rox	2.39
Union Park Pumping Station	BWSC001	BO-DI-2	1.24	BO-DI-1	1.52
Roslindale	BWSC002	BWSC005	2.02	BWSC006	2.54
Dorchester - Adams	BWSC003	BWSC006	1.37	Rox	2.88
Allston	BWSC004	BWSC008	1.81	FRESH_POND	2.03
Hyde Park Police Station	BWSC005	BWSC002	2.02	BWSC006	3.36
Dorchester - Talbot	BWSC006	BWSC003	1.37	Rox	1.86
Charlestown	BWSC007	EB	1.53	CH-BO-1	1.80
Longwood Medical Area	BWSC008	BO-DI-1	0.67	Roxbury	1.71
Chelsea Creek	CH-BO-1	EB	0.60	BWSC007	1.80
East Boston	EB	CH-BO-1	0.60	BWSC007	1.53
USGS Fresh Pond	FRESH_POND	BWSC004	2.21	SOM	3.26
Hanscom AFB	HF-1C	FRESH_POND	8.11	RG-WF-1	9.43
Lexington Farm	Lex	FRESH_POND	4.08	BWSC004	5.85
Hayes Pump Sta.	RG-WF-1	SOM	7.51	FRESH_POND	8.79
Roxbury	Rox	BO-DI-1	1.23	BWSC008	1.71
Somerville Remote	SOM	BWSC007	1.95	CH-BO-1	3.07
Spot Pond	SP	RG-WF-1	3.55	SOM	4.12
Waltham Farm	WF	FRESH_POND	3.37	BWSC004	3.86

Table A-3. Summary of Rainfall Data Replacement, January 1, 2025 to December 31, 2025

Rain Gauge	Replacement Data Start Time	Replacement Data End Time	Replacement Rain Gauge
Union Park Pumping Station (BWSC001)	1/19/2025 12:00	1/27/2025 23:45	Columbus Park
	2/2/2025 20:00	2/3/2025 15:00	Columbus Park
Roslindale (BWSC002) [1]	1/10/2025 0:00	3/6/2025 12:00	Dorchester-Talbot
Dorchester-Adams (BWSC003)	1/11/2025 0:00	1/17/2025 23:45	Columbus Park
	1/19/2025 12:00	1/27/2025 23:45	Columbus Park
	2/2/2025 20:00	2/3/2025 15:00	Columbus Park
Allston (BWSC004)	1/11/2025 0:00	1/17/2025 23:45	USGS Fresh Pond
	1/19/2025 12:00	1/27/2025 23:45	USGS Fresh Pond
	2/2/2025 20:00	2/3/2025 15:00	USGS Fresh Pond
Hyde Park (BWSC005)	1/11/2025 0:00	1/17/2025 23:45	Ward St.
	1/19/2025 12:00	1/27/2025 23:45	Ward St.
	2/2/2025 20:00	2/3/2025 15:00	Ward St.
Dorchester-Talbot (BWSC006) [1]	1/11/2025 0:00	1/17/2025 23:45	Ward St.
	1/19/2025 12:00	1/27/2025 23:45	Ward St.
	2/2/2025 20:00	2/3/2025 15:00	Ward St.
	10/10/2025 0:00	11/20/2025 23:45	Dorchester-Adams
Charlestown (BWSC007)	1/11/2025 0:00	1/17/2025 23:45	Somerville Remote
	1/19/2025 12:00	1/27/2025 23:45	Somerville Remote
	2/2/2025 20:00	2/3/2025 15:00	Somerville Remote
Longwood Medical Area (BWSC008)	1/11/2025 0:00	1/17/2025 23:45	Ward St.
	2/2/2025 20:00	2/3/2025 15:00	Ward St.
Chelsea Ck. (CH-BO-1)	1/11/2025 0:00	1/17/2025 23:45	Somerville Remote
	2/2/2025 20:00	2/3/2025 15:00	Somerville Remote
	8/25/2025 8:15	8/25/2025 8:15	East Boston
East Boston (EB)	1/11/2025 0:00	1/17/2025 23:45	Somerville Remote
	1/19/2025 12:00	1/27/2025 23:45	Somerville Remote
	2/2/2025 20:00	2/3/2025 15:00	Somerville Remote
USGS fresh pond (FRESH_POND) [2]	4/5/2025 19:30	4/26/2025 4:00	Allston
	5/5/2025 12:00	5/21/2025 12:00	Allston
	7/21/2025 10:15	7/21/2025 11:00	Allston
	08/28/25 15:00:00	08/28/25 15:00:00	Allston
Hanscom AFB (HF-1C) [2]	1/1/2025 0:00	12/31/2025 23:45	USGS Fresh Pond
Lex-Farm (Lex) [2]	1/1/2025 0:00	12/31/2025 23:45	USGS Fresh Pond
Hayes Pump Station (RG-WF-1) [3]	1/11/2025 0:00	1/17/2025 23:45	Somerville Remote
	1/19/2025 12:00	1/27/2025 23:45	Somerville Remote
	2/2/2025 20:00	2/3/2025 15:00	Somerville Remote
	7/25/2025 8:15	7/25/2025 8:15	Somerville Remote
	8/25/2025 16:30	8/25/2025 16:45	Somerville Remote
Roxbury (Rox)	1/11/2025 0:00	1/17/2025 23:45	Ward St.
	1/19/2025 12:00	1/27/2025 23:45	Ward St.

Table A-3. Summary of Rainfall Data Replacement, January 1, 2025 to December 31, 2025

Rain Gauge	Replacement Data Start Time	Replacement Data End Time	Replacement Rain Gauge
	2/2/2025 20:00	2/3/2025 15:00	Ward St.
Somerville Remote (SOM)	12/23/2025 0:00	12/31/2025 22:45	Charlestown
Spot pond (SP) (3)	1/1/2025 0:00	12/31/2025 23:45	RG-WF
Waltham Farm (WF) (2)	1/1/2025 0:00	12/31/2025 23:45	USGS Fresh Pond

Notes:
(1) Dorchester–Talbot was replaced with Ward St before Roslindale was replaced with Dorchester–Talbot
(2) USGS Fresh Pond was replaced with Allston before Hanscom AFB, Lex Farm, and Waltham Farm were replaced with USGS Fresh Pond
(3) Hayes Pump Station was replaced with Somerville Remote before Spot Pond was replaced with Hayes Pump Station

A.1.2 Monitored Storms

For the period of January 1, 2025 to December 31, 2025, the rainfall data at each rain gauge were analyzed and summarized, providing the date and time, duration, volume, average intensity, peak 1-hour, 24-hour, and 48-hour intensities and storm recurrence intervals for each storm. An inter-event time of 12-hours between storm events was used for this analysis. The storm recurrence intervals were assigned values of less than 3 months, 3 months, 3-6 months, 6 months, 1 year, 1-2 year, or the nearest 6-month interval for recurrence intervals greater than 2-year, based on comparison to the IDF values from Atlas 14. Table A-4 presents the summary of storm events for Ward Street Headworks for the period of January 1, 2025 to December 31, 2025. These data show that 92 storm events occurred in the year long period at the Ward Street Headworks rain gauge (BO-DI-1). The majority of events had a less than 3-month recurrence interval at 1-hour, 24-hour or 48-hour durations.

Table A-4. Summary of Storm Events at Ward Street Headworks Rain Gauge (BO-DI-1) for January 1, 2025 to December 31, 2025

Event	Date & Start Time	Duration (hr)	Volume (in)	Average Intensity (in/hr)	Peak 1hr Intensity (in/hr)	Peak 24hr Intensity (in/hr)	Peak 48hr Intensity (in/hr)	Atlas-14 Recurrence Interval(1)		
								1-hr	24-hr	48-hr
1	1/1/25 1:30	8.75	0.62	0.07	0.29	0.03	0.01	<3m	<3m	N/A
2	1/11/25 7:15	8.75	0.08	0.01	0.03	0.00	0.00	<3m	<3m	N/A
3	1/18/25 17:00	5.00	0.27	0.05	0.10	0.01	0.01	<3m	<3m	N/A
4	1/19/25 17:45	12.25	0.41	0.03	0.08	0.02	0.01	<3m	<3m	N/A
5	1/29/25 3:15	7.00	0.03	0.00	0.01	0.00	0.00	<3m	<3m	N/A
6	1/31/25 12:00	16.75	0.79	0.05	0.16	0.03	0.02	<3m	<3m	N/A
7	2/2/25 22:45	5.75	0.14	0.02	0.06	0.01	0.00	<3m	<3m	N/A
8	2/6/25 9:30	6.00	0.19	0.03	0.06	0.01	0.00	<3m	<3m	N/A
9	2/7/25 9:30	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
10	2/9/25 0:30	17.25	0.39	0.02	0.05	0.02	0.01	<3m	<3m	N/A
11	2/13/25 2:00	11.50	0.46	0.04	0.11	0.02	0.01	<3m	<3m	N/A
12	2/15/25 19:15	25.00	1.90	0.08	0.27	0.08	0.04	<3m	6m	6m
13	2/27/25 5:45	4.25	0.06	0.01	0.03	0.00	0.00	<3m	<3m	N/A
14	3/1/25 16:45	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
15	3/5/25 8:45	20.00	1.04	0.05	0.37	0.04	0.02	3m	3m	N/A
16	3/6/25 17:00	11.75	0.28	0.02	0.13	0.01	0.01	<3m	<3m	N/A
17	3/16/25 23:15	17.50	1.65	0.09	0.56	0.07	0.03	6m	6m	N/A
18	3/20/25 5:30	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
19	3/21/25 0:45	7.25	0.41	0.06	0.12	0.02	0.01	<3m	<3m	N/A
20	3/24/25 9:15	8.75	0.84	0.10	0.28	0.03	0.02	<3m	<3m	N/A
21	3/25/25 9:45	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A

Table A-4. Summary of Storm Events at Ward Street Headworks Rain Gauge (BO-DI-1) for January 1, 2025 to December 31, 2025

Event	Date & Start Time	Duration (hr)	Volume (in)	Average Intensity (in/hr)	Peak 1hr Intensity (in/hr)	Peak 24hr Intensity (in/hr)	Peak 48hr Intensity (in/hr)	Atlas-14 Recurrence Interval[1]		
								1-hr	24-hr	48-hr
22	3/29/25 3:15	12.50	0.05	0.00	0.03	0.00	0.00	<3m	<3m	N/A
23	3/31/25 4:30	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
24	3/31/25 22:45	4.25	0.63	0.15	0.36	0.03	0.01	3m	<3m	N/A
25	4/2/25 21:30	13.00	0.26	0.02	0.08	0.01	0.01	<3m	<3m	N/A
26	4/5/25 13:00	22.25	0.79	0.04	0.15	0.03	0.02	<3m	<3m	N/A
27	4/7/25 4:45	30.75	0.18	0.01	0.04	0.01	0.00	<3m	<3m	<3m
28	4/11/25 1:15	4.50	0.14	0.03	0.04	0.01	0.00	<3m	<3m	N/A
29	4/11/25 20:45	14.00	0.48	0.03	0.11	0.02	0.01	<3m	<3m	N/A
30	4/13/25 16:45	2.00	0.03	0.01	0.02	0.00	0.00	<3m	<3m	N/A
31	4/15/25 7:45	10.25	0.13	0.01	0.10	0.01	0.00	<3m	<3m	N/A
32	4/22/25 1:45	2.75	0.30	0.11	0.22	0.01	0.01	<3m	<3m	N/A
33	4/25/25 7:15	2.50	0.08	0.03	0.04	0.00	0.00	<3m	<3m	N/A
34	4/26/25 6:00	11.25	0.62	0.06	0.26	0.03	0.01	<3m	<3m	N/A
35	5/2/25 3:45	1.25	0.21	0.17	0.19	0.01	0.00	<3m	<3m	N/A
36	5/3/25 19:15	0.50	0.05	0.10	0.05	0.00	0.00	<3m	<3m	N/A
37	5/4/25 18:45	51.50	0.90	0.02	0.21	0.02	0.02	<3m	<3m	3m
38	5/7/25 13:45	0.25	0.02	0.08	0.02	0.00	0.00	<3m	<3m	N/A
39	5/8/25 19:45	2.00	0.03	0.01	0.02	0.00	0.00	<3m	<3m	N/A
40	5/9/25 13:15	22.75	1.29	0.06	0.31	0.05	0.03	3m	3m	N/A
41	5/15/25 5:30	8.50	0.52	0.06	0.29	0.02	0.01	<3m	<3m	N/A
42	5/22/25 6:15	21.75	3.61	0.17	0.47	0.15	0.08	3m-6m	3y	N/A
43	5/23/25 16:45	20.00	0.15	0.01	0.04	0.01	0.00	<3m	<3m	N/A
44	5/29/25 1:00	3.00	0.05	0.02	0.03	0.00	0.00	<3m	<3m	N/A
45	5/30/25 12:30	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
46	5/31/25 3:15	18.75	0.22	0.01	0.11	0.01	0.00	<3m	<3m	N/A
47	6/6/25 2:45	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
48	6/7/25 12:00	5.50	1.47	0.27	0.69	0.06	0.03	6m-1y	3m-6m	N/A
49	6/10/25 3:15	9.25	0.12	0.01	0.09	0.00	0.00	<3m	<3m	N/A
50	6/14/25 11:00	1.25	0.02	0.02	0.01	0.00	0.00	<3m	<3m	N/A
51	6/17/25 16:00	1.00	0.03	0.03	0.03	0.00	0.00	<3m	<3m	N/A
52	6/22/25 6:00	5.25	0.03	0.01	0.02	0.00	0.00	<3m	<3m	N/A
53	6/28/25 7:15	2.00	0.04	0.02	0.03	0.00	0.00	<3m	<3m	N/A
54	7/1/25 19:15	2.75	0.24	0.09	0.17	0.01	0.00	<3m	<3m	N/A
55	7/8/25 21:15	10.75	0.79	0.07	0.27	0.03	0.02	<3m	<3m	N/A
56	7/9/25 21:15	14.25	1.39	0.10	0.36	0.06	0.03	3m	3m-6m	N/A
57	7/15/25 5:30	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
58	7/20/25 18:15	0.75	0.53	0.71	0.53	0.02	0.01	3m-6m	<3m	N/A
59	7/25/25 13:45	3.25	0.12	0.04	0.08	0.00	0.00	<3m	<3m	N/A
60	7/27/25 10:00	2.00	0.08	0.04	0.04	0.00	0.00	<3m	<3m	N/A
61	7/31/25 9:45	21.50	1.33	0.06	0.30	0.06	0.03	<3m	3m-6m	N/A
62	8/14/25 17:15	1.00	0.71	0.71	0.71	0.03	0.01	6m-1y	<3m	N/A
63	8/17/25 16:30	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
64	8/20/25 8:00	15.25	0.37	0.02	0.10	0.02	0.01	<3m	<3m	N/A
65	8/27/25 13:45	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
66	8/29/25 6:00	8.50	0.23	0.03	0.17	0.01	0.00	<3m	<3m	N/A
67	9/5/25 3:00	1.75	0.10	0.06	0.08	0.00	0.00	<3m	<3m	N/A
68	9/6/25 16:30	23.25	1.45	0.06	0.45	0.06	0.03	3m-6m	3m-6m	N/A
69	9/18/25 0:00	6.50	0.40	0.06	0.29	0.02	0.01	<3m	<3m	N/A
70	9/24/25 2:00	38.75	1.76	0.05	0.65	0.07	0.04	6m	3m-6m	6m

Table A-4. Summary of Storm Events at Ward Street Headworks Rain Gauge (BO-DI-1) for January 1, 2025 to December 31, 2025

Event	Date & Start Time	Duration (hr)	Volume (in)	Average Intensity (in/hr)	Peak 1hr Intensity (in/hr)	Peak 24hr Intensity (in/hr)	Peak 48hr Intensity (in/hr)	Atlas-14 Recurrence Interval[1]		
								1-hr	24-hr	48-hr
71	10/8/25 7:00	4.75	1.03	0.22	0.66	0.04	0.02	6m	3m	N/A
72	10/12/25 14:30	57.00	3.22	0.06	0.23	0.10	0.07	<3m	1y	1-2y
73	10/20/25 9:15	6.00	0.71	0.12	0.33	0.03	0.01	3m	<3m	N/A
74	10/22/25 5:45	4.25	0.60	0.14	0.26	0.02	0.01	<3m	<3m	N/A
75	10/30/25 4:30	21.50	0.97	0.05	0.22	0.04	0.02	<3m	3m	N/A
76	11/3/25 21:30	1.00	0.06	0.06	0.06	0.00	0.00	<3m	<3m	N/A
77	11/4/25 11:30	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
78	11/5/25 20:45	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
79	11/7/25 22:30	9.00	0.09	0.01	0.03	0.00	0.00	<3m	<3m	N/A
80	11/9/25 17:00	36.25	0.38	0.01	0.07	0.01	0.01	<3m	<3m	<3m
81	11/13/25 16:45	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
82	11/15/25 21:15	6.75	0.64	0.09	0.17	0.03	0.01	<3m	<3m	N/A
83	11/22/25 7:15	3.00	0.11	0.04	0.06	0.00	0.00	<3m	<3m	N/A
84	11/25/25 20:15	14.00	0.23	0.02	0.06	0.01	0.00	<3m	<3m	N/A
85	11/30/25 13:00	7.75	0.25	0.03	0.10	0.01	0.01	<3m	<3m	N/A
86	12/2/25 11:45	14.50	0.71	0.05	0.11	0.03	0.01	<3m	<3m	N/A
87	12/10/25 18:45	3.00	0.05	0.02	0.03	0.00	0.00	<3m	<3m	N/A
88	12/14/25 7:15	4.50	0.06	0.01	0.02	0.00	0.00	<3m	<3m	N/A
89	12/19/25 3:45	16.50	0.50	0.03	0.13	0.02	0.01	<3m	<3m	N/A
90	12/23/25 18:30	6.50	0.20	0.03	0.07	0.01	0.00	<3m	<3m	N/A
91	12/27/25 1:00	11.75	0.11	0.01	0.05	0.00	0.00	<3m	<3m	N/A
92	12/28/25 10:15	42.25	0.83	0.02	0.21	0.03	0.02	<3m	<3m	3m

Notes:

(1) Recurrence intervals given in ranges of less than 3 months (<3m), 3-months, (3m), 3-6 months (3-6m), 6 months (6m), 6 months - 1 year (6m-1y), 1 year (1y), 1 to 2 year (1y-2y) or the nearest 6-month interval for recurrence intervals >2 year, based on Atlas 14.

The total rainfall and number of storms at each rain gauge were identified for the period from January 1, 2025 to December 31, 2025, and the number of storms were categorized by depth. Table A-5 presents this comparison. As indicated in Table A-5, during 2025 the rain gauges measured an average total rainfall volume of 40.08 inches.

Table A-5. Frequency of Events within Selected Ranges of Total Rainfall for January 1, 2025 to December 31, 2025

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
January - December 2025							
Average of Rain Gauges							
Average	40.08	88	46	13	18	9	2
MWRA Rain Gauges							
Ward Street	42.39	92	50	13	17	10	2
Columbus Park	41.35	84	45	14	15	8	2
Chelsea Creek	38.18	91	52	13	15	9	2
Hanscom AFB	35.91	90	49	12	20	8	1
Somerville Remote	37.69	85	43	16	16	9	1
Hayes PS	34.90	89	51	13	15	9	1
BWSC Rain Gauges							
Allston	39.64	85	43	10	21	9	2
Charlestown	38.00	83	41	15	16	9	2
Dorch-Adams	43.18	88	45	16	17	6	4
Dorch-Talbot	46.13	95	50	16	18	7	4
Hyde Park	46.10	87	44	11	20	8	4
East Boston	39.94	83	43	14	16	8	2
Longwood	41.20	81	39	11	17	12	2
Roslindale	48.24	90	43	15	19	10	3
Roxbury	43.99	86	46	10	19	8	3
Union Park	42.04	85	42	17	15	9	2
USGS Rain Gauge							
Fresh Pond	35.91	90	49	12	20	8	1
MWRA Project Gauges (Removed)[1]							
Lexington Farm	35.91	90	49	12	20	8	1
Spot Pond	34.90	89	51	13	15	9	1
Waltham Farm	35.91	90	49	12	20	8	1

Notes:

(1) Project gauges were removed as of July 1, 2020. Project gauge data has been replaced with the nearest rain gauge, following the QA/QC procedures and closest rain gauges substitution table.

Historical data shows that storms with depths greater than 2 inches are of importance because higher depth storms are more likely to cause CSO activations and larger volumes compared to lower depth storms. Storms with greater than 2 inches of total rainfall at the Ward Street, Columbus Park, Chelsea Creek Headworks, and USGS Fresh Pond rain gauges were identified in Table A-6 for the 2025 time period.

Table A-6. Storms Between January 1, 2025 to December 31, 2025, with Greater Than 2 Inches of Total Rainfall

Rain gauge	Date	Duration (hr)	Total Rainfall (inches)	Average Intensity (in/hr)	Peak Intensity (in/hr)	Storm Recurrence Interval (24-hr)(1)
January - December 2025 Rain Gauge Data						
Ward Street Headworks (BO-DI-1)	5/22/2025	21.75	3.61	0.17	0.47	3y
	10/12/2025	57.00	3.22	0.06	0.23	1y
Columbus Park Headworks (BO-DI-2)	5/22/2025	21.50	4.36	0.20	0.58	5y
	10/12/2025	62.00	4.29	0.07	0.31	2y
Chelsea Creek Headworks (CH-BO-1)	5/22/2025	21.75	3.31	0.15	0.40	2y
	10/12/2025	56.25	2.03	0.04	0.16	6m
Fresh Pond (USGS)	5/22/2025	18.25	2.44	0.13	0.40	6m-1y

Notes:

(1) Recurrence intervals given in ranges of less than 3 months (<3m), 3-months, (3m), 3-6 months (3-6m), 6 months (6m), 6 months - 1 year (6m-1y), 1 year (1y), 1 to 2 year (1y-2y) or the nearest 6-month interval for recurrence intervals >2 year, based on Atlas 14.

The storm with the largest depth over the 2025 period was recorded at Columbus Park Headworks (BO-DI-2) on May 22nd, 2025, with 4.36 inches of rainfall over 21.50 hours, which equates to a 5-year 24-hour duration recurrence interval.

Storms with intensities greater than 0.40 in/hr are of importance because higher intensity storms are more likely to cause CSO activations and volumes compared to lower intensity storms. For the four gauges shown in Table A-7, the number of storms with peak intensities greater than 0.40 in/hr ranged from six to ten. The maximum return interval was recorded at the Fresh Pond gauge which recorded a 1-year return interval for the 1-hour duration on October 8th, 2025. The number of storms with peak intensities greater than 0.75 in/hr ranged from 0 to 2 storms across the four gages in Table A-7.

For storms with peak rainfall intensities greater than 0.4 in/hr at Ward Street Headworks, Columbus Park Headworks, and Chelsea Creek Headworks rain gauges, hyetographs were developed. These hyetographs show the 15-minute rainfall intensities and the distribution of rainfall during the storm. Rainfall distribution during a storm can impact the behavior of system hydraulics due to soil saturation. For example, a storm where the peak rainfall occurs towards the end of the event will generally create more CSO than a storm with similar total rainfall and peak intensity, where the peak occurs at the beginning of the storm. An example hyetograph for the May 22nd, 2025, storm at the Ward Street gauge is shown in Figure A-2. This hyetograph is an example of a large storm event in which the beginning of the storm resulted in saturated soil conditions. This could result in inflow sources that are not present in smaller storms, contributing runoff to the combined sewer collection system which could compound the impact of this event (3.61 inches total of rainfall at the Ward Street gauge) on CSO volumes.

Table A-7. Storms Between January 1, 2025 to December 31, 2025, with Peak Intensities Greater than 0.40 inches/hour

Rain gauge	Date	Duration (hr)	Total Rainfall (inches)	Average Intensity (in/hr)	Peak Intensity (in/hr)	Storm Recurrence Interval (1-hr)(1)
January - December 2025 Rain Gauge Data						
Ward Street Headworks (BO-DI-1)	3/16/2025	17.50	1.65	0.09	0.56	6m
	5/22/2025	21.75	3.61	0.17	0.47	3m-6m
	6/7/2025	5.50	1.47	0.27	0.69	6m-1y
	7/20/2025	0.75	0.53	0.71	0.53	3m-6m
	8/14/2025	1.00	0.71	0.71	0.71	6m-1y
	9/6/2025	23.25	1.45	0.06	0.45	3m-6m
	9/24/2025	38.75	1.76	0.05	0.65	6m
	10/8/2025	4.75	1.03	0.22	0.66	6m
Columbus Park Headworks (BO-DI-2)	3/16/2025	17.75	1.70	0.10	0.48	3m-6m
	5/2/2025	1.75	0.50	0.29	0.46	3m-6m
	5/22/2025	21.50	4.36	0.20	0.58	6m
	6/7/2025	4.25	1.05	0.25	0.44	3m-6m
	7/9/2025	22.75	1.82	0.08	0.54	6m
	7/20/2025	0.75	0.45	0.60	0.45	3m-6m
	8/14/2025	0.75	0.72	0.96	0.72	6m-1y
	9/6/2025	23.25	1.56	0.07	0.60	6m
	9/24/2025	39.25	1.62	0.04	0.50	3m-6m
	10/8/2025	4.50	0.81	0.18	0.55	6m
Chelsea Creek Headworks (CH-BO-1)	3/17/2025	16.50	1.47	0.09	0.51	3m-6m
	7/20/2025	0.75	0.45	0.60	0.45	3m-6m
	7/25/2025	0.50	0.41	0.82	0.41	3m
	9/6/2025	22.25	1.51	0.07	0.54	6m
	9/24/2025	38.75	1.69	0.04	0.59	6m
	10/8/2025	4.50	1.13	0.25	0.70	6m-1y
Fresh Pond (USGS)	3/17/2025	15.25	1.28	0.08	0.55	6m
	5/22/2025	18.25	2.44	0.13	0.40	3m
	7/20/2025	0.50	0.42	0.84	0.42	3m
	7/31/2025	21.25	1.65	0.08	0.43	3m
	8/14/2025	0.75	0.63	0.84	0.63	6m
	8/29/2025	10.00	0.53	0.05	0.40	3m
	9/6/2025	20.00	1.79	0.09	0.85	1y
	10/8/2025	4.50	1.12	0.25	0.89	1y
	10/20/2025	4.00	0.75	0.19	0.45	3m-6m

Notes:

(1) Recurrence intervals given in ranges of less than 3 months (<3m), 3-months, (3m), 3-6 months (3-6m), 6 months (6m), 6 months-1 year (6m-1y), 1 year (1y), 1 to 2 year (1y-2y) or the nearest 6-month interval for recurrence intervals >2 year, based on Atlas 14.

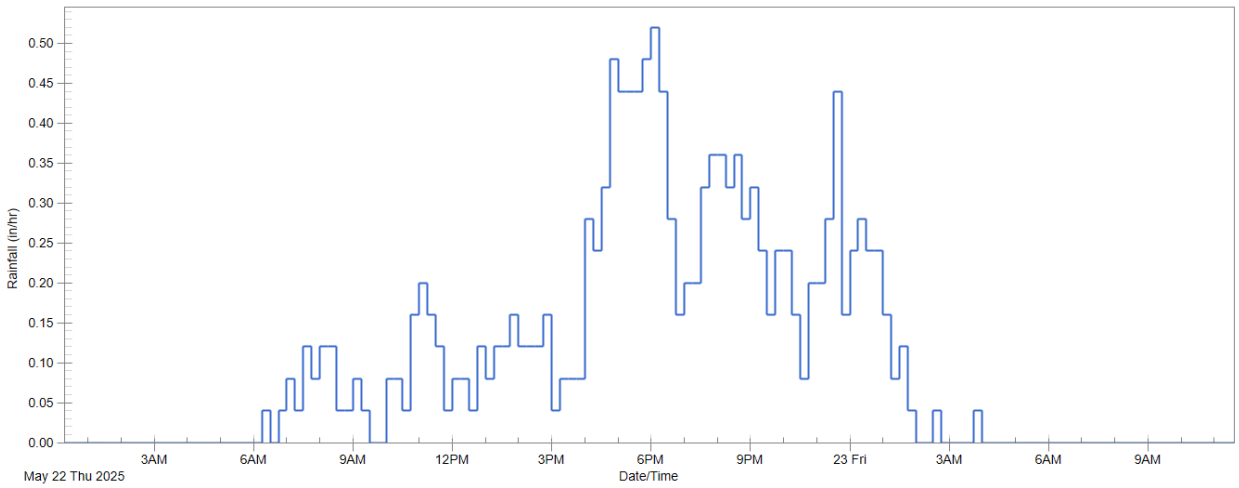

Figure A-2. Hyetograph from the BO-DI-1 Gauge for May 22-23, 2025

The following is a summary of the rainfall from January 1, 2025 to December 31, 2025:

- 2025 averaged 88 storm events across the rain gauges assessed, with an average annual rainfall depth of 40.08 inches (Table A-5);
- The distribution of storms by rainfall depth categories for 2025 was as follows:
  - 46 storms with total depths less than 0.25 inches;
  - 13 storms with total depths between 0.25 and 0.5 inches;
  - 18 storms with total depths between 0.5 and 1.0 inches;
  - 9 storms with total depths between 1.0 and 2.0 inches; and
  - 2 storms with total depths greater than 2.0 inches (Table A-5).
- In terms of larger storms, for the four gauges shown in Table A-6, the number of storms with greater than 2 inches of total rainfall in 2025 ranged from one to two, for an average of 1.75 storms. Two storm events were recorded to have a depth greater than 2 inches at Ward St (BO-DI-1), Columbus Park (BO-DI-2), and Chelsea Creek (CH-BO-1), and one storm recorded a depth greater than 2 inches at USGS Fresh Pond. For the four gauges shown in Table A-6, the largest storm in 2025 with respect to total depth was measured by the Columbus Park (BO-DI-2) gauge on May 22, 2025 with a total depth of 4.36 inches. (Table A-6).
- For the four gauges shown in Table A-7, the number of storms with peak intensities greater than 0.40 inches per hour ranged from six to ten. On October 8, 2025, the USGS Fresh Pond gauge measured a storm with a peak intensity of 0.89 inches per hour which is equivalent to a 1-year, 1-hour event. The other three gauges presented in Table A-7 had individual storms with maximum peak intensities between 0.70 and 0.72 inches per hour.