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NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
COMBINED SEWER OVERFLOW PERMIT NO. MA0101982

2017 ANNUAL REPORT

This report has been prepared in accordance with Part I, Section D of the above referenced permit issued to the City of Somerville Department of Public Works on 11 June 2012. The permit authorizes the City of Somerville to discharge flows from two Combined Sewer Overflows (CSO), one on the Alewife Brook designated as SOM-001A, and one on the Mystic River designated as SOM-007A.

Activation Frequency and Discharge Volumes

In accordance with Part I, Section C, Paragraph 4, the City of Somerville maintains a meter at SOM-001A to supply direct measurement of discharges from SOM-001A, and utilizes estimates provided by the Massachusetts Water Resources Authority (MWRA) to determine discharges from SOM-007A.

SOM-001A

SOM-001A is located on the Alewife Brook at a location within the City of Cambridge where flow from the western and central portions of Somerville discharges to the MWRA's Alewife Brook Conduit via Somerville's Tannery Brook Conduit. In calendar year 2017, the CSO at this location activated a total of fifteen (15) times, in comparison to the six (6) activations recorded in calendar year 2016. The table below summarizes the duration and volume of each discharge as measured by the meter, and the cumulative precipitation depth, according to recordings at the USGS precipitation gauge at Fresh Pond in Cambridge.

Activation Dates	Duration (hours)	Volume (gal)	Cumulative Precip. (in)
6-Apr-2017	0.33	59,308	1.09
25-Apr-2017	0.33	51,269	0.79
5-May-2017	0.50	299,068	0.84
26-May-2017	0.83	889,397	1.32
13-Jun-2017	0.50	559,377	0.17
16-Jun-2017	0.75	365,293	1.43
27-Jun-2017	0.33	48,001	0.50
12-Jul-2017	1.50	3,078,928	1.42
18-Jul-2017	0.58	969,702	0.51
24-Jul-2017	0.42	58,031	1.09
23-Aug-2017	0.08	251	0.31
14-Sep-2017	0.58	770,750	0.40
15-Sep-2017	0.50	498,239	0.60
30-Sep-2017	0.33	118,678	0.29
30-Oct-2017	4.67	4,298,205	3.22

SOM-007A

SOM-007A, along with MWR-205A, discharge treated effluent from the MWRA Somerville Marginal CSO screening and disinfection facility to a location upstream of the Amelia Earhart Dam on the Mystic River during mid- to high-tide conditions. Under low tide conditions, discharge from the facility is through MWR-205. While SOM-007A is permitted to Somerville under the above referenced permit, MWR-205 and MWR-205A are permitted to MWRA under Permit No. MA0103284. MWRA provides data for the Somerville Marginal Facility. That data indicates a total of twenty two (22) activations in calendar 2017. Please note the data provide total facility activation volumes and does not provide individual volumes at each of the three outfall locations.

Activation Dates	Duration (hours)	Volume (Mgal)	Cumulative Precip. (in)
3-Jan-2017	1.58	1.43	0.17
24-Jan-2017	6.20	3.32	1.14
1-Apr-2017	14.08	8.83	2.17
6-Apr-2017	7.03	3.15	1.09
25-Apr-2017	2.40	1.63	0.79
5-May-2017	2.93	1.42	0.84
14-May-2017	1.53	1.17	0.92
26-May-2017	3.58	2.15	1.32
6-Jun-2017	2.82	0.73	1.34
13-Jun-2017	1.57	2.95	0.17
16-Jun-2017	5.67	7.75	1.43
27-Jun-2017	1.12	0.55	0.50
12-Jul-2017	2.63	5.47	1.42
18-Jul-2017	1.83	1.79	0.51
24-Jul-2017	4.03	4.05	1.09
23-Aug-2017	1.02	0.51	0.31
7-Sep-2017	2.88	1.94	0.91
14-Sep-2017	1.08	0.20	0.40
30-Sep-2017	3.52	1.32	0.29
25-Oct-2017	3.27	1.12	1.07
29-Oct-2017	10.45	17.19	0.82
6-Dec-2017	2.42	0.37	0.55

Additional information regarding operation of SOM-007A/MWR-205A/MWR-205 can be found in the MWRA's annual CSO discharge report.

MWRA Model Comparison

2017 Precipitation Evaluation

The MWRA provided an analysis of events that resulted in activations. According to data collected at the Cambridge Fresh Pond rain gauge, only the 29 October 2017 storm matches the profile of a 24-hour design storm that would trigger an overflow, and 7 events had peak 1-hour intensities that correspond to design storms. Generally, the overall volume and distribution of storms in 2017 was similar to an average year.

Event	24-hour Storm Recurrence Interval	1-hour Peak Intensity Recurrence Interval
3-Jan-2017		
24-Jan-2017		
1-Apr-2017		
6-Apr-2017		
25-Apr-2017		
5-May-2017		
14-May-2017		
26-May-2017		< 3-month
6-Jun-2017		
13-Jun-2017		
16-Jun-2017		< 3-month
27-Jun-2017		
12-Jul-2017		6-month
18-Jul-2017		< 3-month
24-Jul-2017		
23-Aug-2017		
7-Sep-2017		
14-Sep-2017		< 3-month
15-Sep-2017		3-month
30-Sep-2017		
25-Oct-2017		
29-Oct-2017	2-year	2-year
30-Oct-2017		
6-Dec-2017		

CSO Volume & Frequency for Typical Year Precipitation

MWRA modeled the 2017 system conditions for both the 2017 rainfall and the typical year precipitation as summarized in the table below:

	2017 RAINFALL UNDER 2016 SYSTEM CONDITIONS			TYPICAL-YEAR RAINFALL UNDER 2017 SYSTEM CONDITIONS		TYPICAL-YEAR RAINFALL W/ LONG TERM CSO CONTROL PLAN	
Outfall	**Activation Frequency**	**Duration (hrs)**	**Volume (MG)**	**Activation Frequency**	**Volume (MG)**	**Activation Frequency**	**Volume (MG)**
ALEWIFE BROOK							
SOM001A	2	2.98	3.02	5	3.90	3	1.67
UPPER MYSTIC RIVER							
SOM007A/MWR205A	12	13.35	2.20	2	1.82	3	3.48

Evaluation

Both SOM-001A and the Somerville Marginal CSO Facility outfalls experienced more frequent and higher volume activations than the model predicted. Preliminary analyses by both the City of Somerville and MWRA provisionally conclude that the activations coincide with short-duration, high-intensity cloudburst precipitation. For SOM-001A in particular, it appears that the 24-inch orifice plate installed in 2013 by the MWRA at the connection of the City's Tannery Brook conduit to the MWRA's Alewife Brook Conduit, which was intended to improve system performance prior to the sewer separation in Cambridge and the closure of CAM-004, may now be causing a hydraulic restriction that increases discharges under such cloudburst conditions. Of the 15 activations at SOM-001A, only 2 had a duration of over an hour, and a half of the activations were 30 minutes or less. During those times, the Alewife Brook Conduit had capacity to accept flows, but the instantaneous rainfall created peak flows in the Tannery Brook Conduit that exceeded the hydraulic capacity of the orifice plate.

CSO Abatement Work Report

In 2013, the MWRA completed an upgrade to the size of the local sewer connection between Somerville's Tannery Brook Conduit and MWRA's interceptor system, and installed an underflow baffle to control the discharge of floatable materials. Additional modifications have been contemplated to follow the CAM-004 separation in Cambridge, which was completed last year; however, those modifications have not taken place.

In 2013, the City of Somerville completed an investigation of the regulator manholes that divert high level flows from the city's connection to the MWRA Cambridge Branch interceptor to the Alewife Brook Conduit. The resulting report was submitted for review in 2014; however, no additional actions have been required.

No modifications to the city's system that connects to the Alewife Brook or the Mystic River CSO discharges have taken place in 2017. Annual reports submitted by the City of Cambridge under Permit No. 0101974 and by the MWRA under Permit No. 0103284 can provide information on modifications to the shared systems that might influence discharges from the CSOs permitted to the City of Somerville.

The City of Somerville is currently in the second year of a multiyear program to conduct a Sewer System Evaluation Study. Last year, the City conducted inspection of every manhole in the system for a total of over 4,448 inspections. Based on those inspections, the City is currently developing designs to rehabilitate identified manhole defects to eliminate Infiltration. In 2018, the City is launching the first of a multiple-year program to conduct pipeline inspections, including cleaning, CCTV and flow isolation. These subsequent activities are anticipated to yield further pipe rehabilitation efforts to further reduce Infiltration and Inflow (I/I) as the program continues.

Conclusion

The City of Somerville is currently working with the MWRA and the City of Cambridge to evaluate the capacity of the Alewife Brook Conduit and to design alterations to the connection of the Tannery Brook Conduit to reduce the frequency of SOM-001A activations whilst not adversely impacting other CSO locations.