

**2019 Annual Report
National Pollutant Discharge Elimination System**

For The
City of Cambridge, Massachusetts
Combined Sewer Overflow Permit
#MA0101974

Submitted to
U.S. Environmental Protection Agency
Water Technical Unit

MA Department of Environmental Protection
Bureau of Resource Protection

Submitted by

City of Cambridge
Department of Public Works



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Signature of Authorized Official: Louis A. DePasquale
City Manager, City of Cambridge



Date

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1. Purpose of Report

This report has been prepared in accordance with Part I, Section D of Permit No. MA0101974, issued to the City of Cambridge Department of Public Works on September 30, 2009. The permit authorizes the City of Cambridge to discharge flow from twelve (12) Combined Sewer Overflows (CSO) located in eleven (11) regulator structures to the receiving water bodies named in the permit. Since the permit was issued, three (3) of the CSOs have been permanently closed and two (2) more are temporarily closed pending hydraulic evaluations, therefore this report presents the results at the seven (7) active CSOs in the City of Cambridge.

The City of Cambridge is additionally required to provide a comparison between the precipitation for the year and the precipitation of the typical year under future planned conditions in the MWRA Final CSO Facilities Plan or “Notice of Project Change for the Long Term CSO Control Plan for Alewife Brook” document. Also, required for each CSO is a comparison between the activation volume and frequency for the year and the volume and frequency during a typical year under future planned conditions.

Finally, an evaluation was performed of whether the CSO activation volumes and frequencies for 2019 are in accordance with the estimate in the MWRA Final CSO Facilities Plan or the report entitled “Notice of Project Change for the Long Term CSO Control Plan for Alewife Brook”, given the precipitation which occurred during the year, and the CSO abatement activities which have been implemented. Where CSO discharges are determined to be greater than the activation frequency or volume in either document, an assessment of the results was completed and documented. A discussion of remaining CSO abatement activities and an assessment of the impact of those projects on attaining the level of CSO control identified in the relevant document or any amendments is provided in this document.

The 2019 results indicated improved correlation between the meter data from the City’s meters, as well as the temporary MWRA meters and the CSO spill activations simulated by the City’s network model. In addition, the CSO results being simulated for the typical year with the 2019 system conditions are showing spill activations and volumes that are very close to the agreed upon LTCP values and in several cases, the CSO locations are performing better than the LTCP requirements, as outlined in Table 1.1.

Overall, on the Alewife Brook system the total CSO volume during the typical year is 4.68 MG, only 1% higher than the LTCP total of 4.63 MG from the four active CSOs (CAM001, CAM002, 40A and CAM401B). The system is very close to meeting the LTCP requirements. It should be noted here that the SOM01A underflow increase, completed on March 27, 2019 was increased from the size originally conceived in the LTCP. The increase of the SOM01A underflow, while it improved the performance of SOM01A, negatively impacted the typical year spill volume from the Cambridge Alewife Brook CSOs overall. Had the SOM01A underflow change not been increased in size, the total Alewife Brook CSO volume during the typical year would be approximately 4.04 MG and would, therefore be meeting the LTCP total of 4.63MG.

On the Charles River system the total CSO volume during the typical year is 1.10 MG, 17% lower than the LTCP total of 1.33 MG from the three active CSOs.

Table 1.1 Comparison of 2019 and Typical Year CSO Results

	2019 RAINFALL UNDER 2019 SYSTEM CONDITIONS*		TYPICAL YEAR RAINFALL UNDER 2019 SYSTEM CONDITIONS*		TYPICAL YEAR RAINFALL WITH LONG TERM CONTROL PLAN**	
OUTFALL	ACTIVATION FREQUENCY	VOLUME (MG)	ACTIVATION FREQUENCY	VOLUME (MG)	ACTIVATION FREQUENCY	VOLUME (MG)
ALEWIFE BROOK						
CAM 001	3 ⁴	0.38	1	0.06	5	0.19
CAM 002	2	0.16	0	0	4	0.69
CAM 004 ¹	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	N/A
CAM 400 ²	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	N/A
CAM 401A	14	7.74	9	3.73	5	1.61
CAM 401B	7	2.26	4	0.89	7	2.15
TOTAL	26	10.54	14	4.68⁵	21	4.63⁵
CHARLES RIVER						
CAM 005	7	3.42	6	0.95	3	0.84
CAM 007	2	2.87	1	0.01	1	0.03
CAM 009 ³	0	0	0	0	2	0.01
CAM 011 ³	0	0	0	0	0	0
CAM 017	3	4.90	1	0.14	1	0.45
TOTAL	12	11.19	8	1.10	7	1.33

* ICM SIMULATION CONDITION WITH 15MIN TIMESTEP (60s) WITH 15 RESULTS MULTIPLIERS.

**VALUES REFLECT TARGET CSO VOLUMES AT LTCP COMPLETION AS PER CSO PERMIT. THESE ARE NOT MODEL RESULTS.

1. CAM 004 CLOSED ON DECEMBER 27, 2015

2. CAM 400 CLOSED ON MARCH 31, 2011

3. TEMPORARILY PLUGGED

4. A SPILL WAS ADDED TO THE MODEL-SIMULATED EVENTS ON 10/17/19. MODELED DEPTH WAS JUST BELOW THE WEIR CREST WHEN THE METER DATA SIMULTANEOUSLY SHOWED A SPILL.

5. THIS TOTAL DOES NOT INCLUDED MWRA 003 AND SOM01A, THE TOTL LTCP VOLUME OF CSO IS 7.29 MG PER YEAR IF THESE ARE INCLUDED

2. Hydraulic Model Updates

During this calendar year 2019 analysis, the existing hydraulic model was updated with several system updates scheduled as part of the LTCP (see Section 3.4). No model calibration was performed during the 2019 reporting period. As in previous annual reports, the hydraulic model includes the MWRA network which incorporates the operational parameters at MWRA facilities.

3. Combined Sewer Overflow Monitoring Plan

As part of the 2019 Annual CSO reporting process, a review of the available meter data for 2019 was performed. This data review identified periods with good quality meter data that could be used to cross-check against model results. Potential meter malfunctions and data discontinuities were also identified and documented. CSO activations and volumes presented in this report are based on model-simulated data, however the model simulations have been cross-checked against MWRA or City of Cambridge (The City) meter data, when available. Where flow meter data was available, the modeled and metered CSO activations were well correlated during the 2019 CSO events. Section 3 provides an overview of the City's CSO monitoring program, the modelled CSO simulations, as well as correlation between the two at each CSO regulator.

3.1 Existing CSO monitoring methodology

3.1.1 Existing CSO Structures

In accordance with the City's current CSO permit, the city has a total of twelve CSOs located in 11 regulator structures (listed in Table 3.1), five regulator structures are located on the Charles River and six regulator structures are located on Alewife Brook.

Seven of the twelve existing CSOs are currently open, four located on the Alewife Brook and three on the Charles River. On the Alewife Brook, the CAM004 and CAM400 regulators were permanently closed and CAM002B is temporarily closed. On the Charles River, both CAM009 and CAM011 have been temporarily closed. Figure 3.1 presents the locations of the seven active CSOs throughout the City.

Table 3.1 Summary of Combined Sewer Regulator Structures

Regulator Structure	Location	Status	Waterbody
CAM 001	Alewife Brook Parkway @ Foch St.	Open	Alewife Brook
CAM 002	2A-Massachusetts Ave. at Alewife Brook Parkway	Open	Alewife Brook
	2B-Massachusetts Ave. at Alewife Brook Parkway	Closed ¹	Alewife Brook
CAM 004	Fresh Pond Rotary	Closed ²	Alewife Brook
CAM 400	Alewife Brook Parkway and Harrison Avenue	Closed ³	Alewife Brook
CAM 401A	Sherman Street at railroad crossing	Open	Alewife Brook
CAM 401B	Massachusetts Ave. at Alewife Brook Parkway	Open	Alewife Brook
CAM 005	Mount Auburn Street @ Lowell Street	Open	Charles River
CAM 007	Memorial Drive at Hawthorne Street	Open	Charles River
CAM 009	Memorial Dr. at Old Murray Rd.	Closed ⁴	Charles River
CAM 011	Plympton St. @Memorial Dr.	Closed ⁴	Charles River
CAM 017	Binney Street at Land Blvd.	Open	Charles River

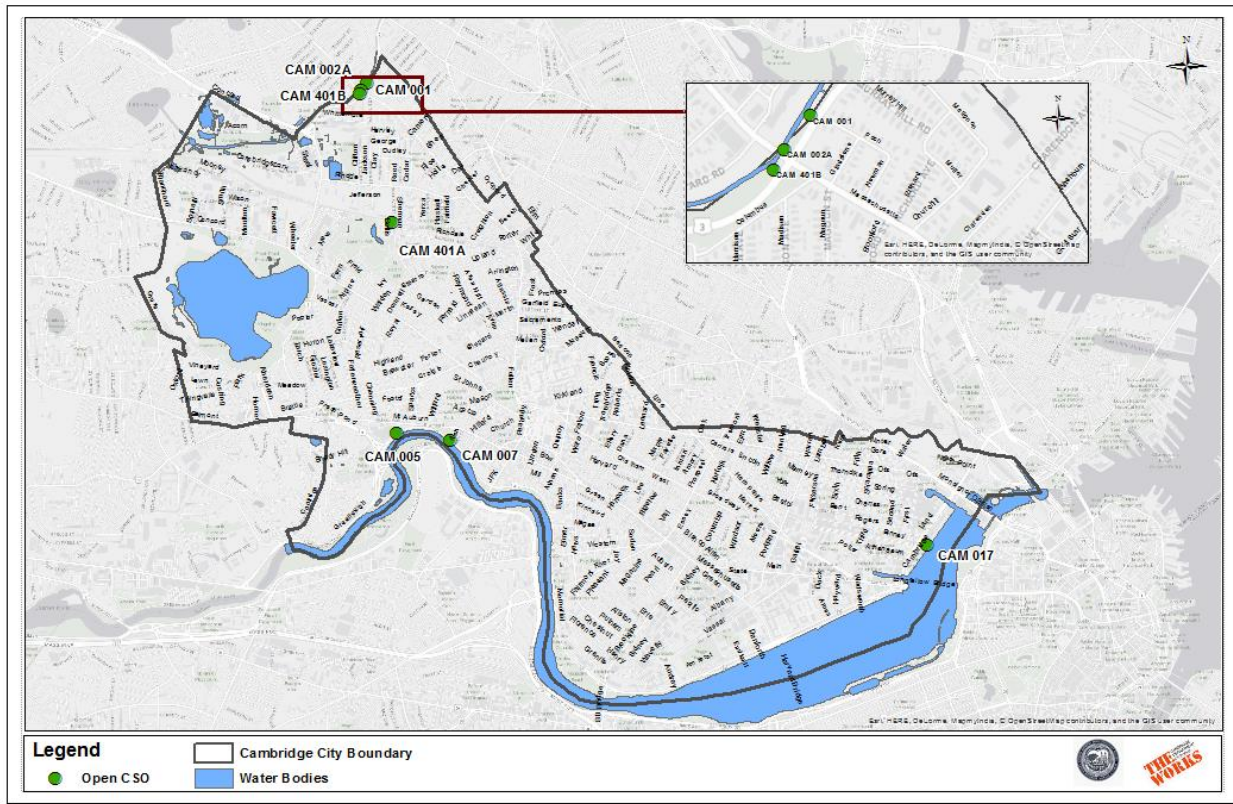
¹ Temporarily Closed

² Permanently closed on December 27, 2015

³ Permanently closed on March 31, 2011

⁴ City retains the right to re-open once a hydraulic study is completed

Figure 3.1 Active CSO Regulator Locations



3.1.2 CSO Monitoring

The following section outlines the 2019 network model simulation results for CSO spills and volumes, along with the methodology for CSO monitoring at each regulator location. Where relevant, City model and meter data have also been compared to temporary meters installed by the MWRA as part of its LTCP monitoring program. The results for the Alewife Brook and Charles River CSOs are located in Tables 3.2 and 3.3, respectively. The regulator configurations are outlined in the CSO plans and profiles included in Appendix IV attached.

The City of Cambridge has been closely coordinating with the MWRA on CSO monitoring and reporting by sharing CSO metering data, comparing model simulations and coordinating field investigations. Where relevant, references to the MWRA temporary meter data is provided in the following analyses.

CAM 001 Monitoring

The modelled data predicted 2 spills on August 7 and September 2, 2019 with a total volume of approximately 0.38 MG. The CAM001 regulator is monitored by an outfall pipe flow meter, as well as a smart cover level sensor in the regulator manhole.

The meter located on the outfall pipe recorded these two modelled spills (during which the depth and velocity in the meter were both above zero), as well as a third spill on October 17, 2019. On October 17, model depth reached 15.21 ft CCB in the regulator, which was considered a CSO spill given the depth proximity to the weir crest of 15.22 ft CCB. The CAM 001 smart cover indicated these dates as high-water alarm (depth > 55 inches). The data from the smart cover was observed to peak and not exceed 55 inches on multiple occasions, including on the three activation dates discussed above (8/7, 9/2 and 10/17). There was appreciable variability in the base flow observed, which may be attributed to the level sensor shifting in the regulator structure.

CAM 002A Monitoring

At the CAM002 regulator, two spills were simulated in the network model during 2019 on August 8th and September 2nd with a total of 0.16 MG. The City has a depth sensor located in the regulator as well as a flow meter located on the CAM002A outfall pipe. The City CAM002A outfall pipe flow meter data indicated 0 spills during the 2019 period of record, on the same two dates the CAM002 regulator level reached the highest recorded depths, however the recorded depths were not over the weir, confirming that no spill events were observed.

CAM 004 Monitoring

The CAM 004 CSO regulator was located within the Drain Vault 5 structure in the Alewife Brook Rotary at the junction of Concord Avenue and The Alewife Brook Parkway. The CAM004 outfall was permanently closed on December 27, 2015, as part of a multiyear construction project in accordance with the MWRA's LTCP for the Alewife Brook.

CAM 400 Monitoring

Sewer separation work in this area was completed in March 2011 and the CAM 400 CSO regulator was permanently closed in accordance with the MWRA's LTCP for the Alewife Brook.

CAM 401A Monitoring

The CAM 401A regulator structure includes floatables control brush screens mounted on a static weir structure, as well as flap gates located just downstream of the weir. The flap gates prevent backflow from the City's storm drain into the combined sewer on Sherman Avenue. Due to the complicated nature of the structure and the difficulty identifying spill activations and calculating spill volume, the City's model was used to determine the activation volume at the CAM 401A regulator. The model simulated 14 spill events in 2019.

The City also maintains a level sensor in the 401A regulator structure. The City's level sensor recorded appreciable variability in baseflow levels throughout 2019. Review of the data indicated that with a threshold of -10" level reading used to assume a spill activation, 10 out of the 14 modelled spill events are observed in the City's metered data.

The temporary MWRA meter located at the incoming combined sewer upstream (south) of the CAM 401A regulator in Sherman Avenue indicated spill events during each of the 14 modelled spills at CAM401A. In addition, the baseflow being simulated in the model was observed to be correlated

with the baseflow being recorded at the temporary MWRA meter. The modelled spill activations (14 spills) and volume (7.74 MG) at 401A are being reported in this 2019 report.

CAM 401B Monitoring

At the CAM 401B regulator, depth and flow is recorded inside the regulator structure and a flow meter is also installed on the 401B CSO outfall pipe. Three CSO activations (August 29th, September 2nd, October 17th) were reported at the CAM401B regulator during 2019 from the SCADA data output, all of which were public CSO notification dates (see Appendix III). The model simulated 7 spills during 2019 with a total volume of 2.26 MG.

Three out of the four additional spills reported in the model (compared to the meter) account for only 6% of the total spill volume. Review of the meter data indicated a lower average baseflow during this summer time period of approximately 6 inches lower on dates preceding August 8. The higher modelled activations may be attributed to the observed/metered baseflow during this time period being lower than the average baseflow assumed in the model. For instance, the level observed in the meter data on July 6th and August 8th, 2019 is around 4 inches less than the activation threshold of 5.47 ft thus not triggering a spill. The model however, with a uniform baseflow (which is 6 inches higher than the meter data) indicates a spill on these dates.

CAM 005 Monitoring

The network model simulated seven CSO activations at CAM005 in 2019 (April 15th, July 6th, July 17th, July 31st, August 7th, September 2nd, and October 17th) with a total volume of approximately 3.42 MG, as shown in Table 3.3. The CAM 005 outfall is monitored with a depth/velocity sensor mounted on the upstream side of the outfall weir. The City level data indicated 4 spill events. The spills reported by both the City meter and the model simulation results (August 8, August 29, September 2, October 17, 2019) account for 85% of the total spill volume. During the April 15 and July 29, 2019 storm events, the DPW meter indicated level to be just a few inches lower than the activation threshold for the spill. The model-simulated spills on July 6 and July 17, 2019 were corroborated by the MWRA flow meters, however the DPW meter shows no correlation in level on these dates and was hence suspected to have malfunctioned during that time period.

The MWRA's M1MP1 meter is located on the 54-inch incoming sewer to the CAM005 regulator. The MWRA flow depth data was reviewed for correlation with the rainfall data, as well as correlation with the city's model simulation at the CAM005. The MWRA temporary meter reported 7 spills which correspond to each of the model simulated spills on those same dates.

CAM 007 Monitoring

The model simulated 2 spills at the CAM007 regulator on August 8th 2019 and September 2nd with a total of 2.87 MG. The CAM007 structure is monitored using a DPW depth sensor in the regulator and positive depth meter readings indicate a CSO spill, which occurred three times during 2019 (August 8th, September 2nd, and October 17th) two of which were on those dates simulated by the model. The model simulated baseflow appeared to be lower than the metered baseflow during the spill event metered on October 17th, whereas during the two previous events on August 7th and September 2nd, where the model did match the metered data, the baseflow represented in the model

was closer to the baseflow observed in the data. The model does not vary baseflow by season and this is most likely the reason that the model did not simulate the spill on October 17th.

Level data from MWRA meters M1MP2 and M2MP1 located at the 42-inch and 36-inch inlets, respectively was reviewed. All the meters were found to indicate the same three spill events as the DPW depth sensor data.

CAM017 Monitoring

The network model simulated three spills at CAM017 on August 8th, September 2nd, and October 17th, 2019 and a total of 4.90 MG. At the CAM017 regulator, meters are located on the incoming 72" combined sewer on Binney Street, as well as on one of the static weir crests. Meter data for 2019 indicated 4 spill events on July 6th, August 8th, September 2nd and October 17th. The August 8th and September 2nd events showed inclinometer meter movement, whereas the July 6th and October 17th events had depths that exceeded the bending weir with corresponding velocity, however the inclinometer did not register movement.

It should be noted that the calculation of CSO volume at this location is dependent upon the modelled CAM 017 bending weir operation parameters, as well as the operation of the Prison Point wet weather facility gates.

3.2 Summary of 2019 Model Versus Meter CSO Activations

In 2019 there were a total of twenty-six modelled activations at the four active Alewife Brook CSO regulators and twelve modelled activations occurred at the three Charles River CSO regulators. This report includes an analysis of the modelled CSO events as compared to the metered CSO events and presents both sets of data. A summary of 2019 modelled and metered activations for the Alewife Brook and Charles River outfalls is provided below and in Table 3.2 and 3.3, respectively.

3.2.1 Alewife Brook CSO Results

At the four active CSO outfalls along Alewife Brook the model predicted a total of twenty-six spills in 2019 resulting in approximately 10.54 MG of CSO volume. The Alewife Brook CSO spills occurred on fourteen days in 2019; 15th, April 22nd, June 20th, June 21st, June 25th, July 6th, July 12th, July 17th, July 31st, August 8th, August 28th, September 2nd, October 17th, and October 27th. The following is an overview of each of the Alewife Brook CSO results;

- CAM001: The model simulated a total of two spills at CAM001 during 2019 with a total volume of 0.38 MG (August 7th and September 2nd). The outfall meter data indicated four spills, two of which matched the model-simulated dates and during the third metered event (October 17th) the model depth came within 1-2 inches of breaching the weir. This date is therefore being considered a 2019 spill event, given its correlation to the metered data. During the fourth metered event (August 28th), the modelled simulated depth was within 1 ft of the weir crest elevation and the metered spill recorded on that date was the smallest observed;

- CAM002A: The model simulated a total of two spills at CAM002A during 2019 with a total volume of 0.16 MG (August 7th and September 2nd). The metered data indicated no spills during 2019, however the depth recorded in the CAM002 regulator was at the highest level on August 7th and subsequently 6” below that level on September 2nd. During 2019, the temporary plate that previously blocked the CAM002A outfall pipe was removed on May 16, 2019 and the connection to the Alewife Brook Conduit was reinstated as part of the LTCP work;
- CAM 401A: The model simulated a total of fourteen spills at CAM401A during 2019 with a total volume of 7.74MG (April 15th, April 22nd, June 20th, June 21st, June 25th, July 6th, July 12th, July 17th, July 31st, August 7th, August 28th, September 2nd, October 17th, and October 27th). The City’s network model was used to determine spill activations and spill volumes in the 401A regulator and the results were compared to the available depth data in the adjacent combined sewer pipe. The City’s depth data was not available for the entire year, however when reviewed against the MWRA temporary meter data in the adjacent combined sewer pipe, all 14 spills were also observed on the same model-simulated spill dates;
- CAM 401B: The model simulated a total of seven spills at CAM 401B during 2019 with a total volume of 2.26 MG (April 15th, July 6th, July 17th, August 7th, August 29th, and October 17th). The volume of the largest spill was 1.53 MG and occurred on August 7th. The City’s level data in the 401B structure indicate three spills which matched three of the modelled spill dates, assuming a threshold of 5.47 ft to the outfall pipe invert. The MWRA temporary metered data matched 4 of the 7 modelled spill events.

Table 3.2 Summary of 2019 Activations at Alewife Brook CSOs

Receiving Water	Outfall No.	Metered Results			Modelled Results		
		2019 CSO Spills	Meter Type (Threshold)	Spill Dates	2019 CSO Spills	2019 CSO Volume (MG)	Spill Dates
Alewife Brook	CAM001	4	Outfall Meter (Depth, Vel>0)	8/8/19 8/28/19 9/2/19 10/17/19	3 ⁴	0.38	8/8/19 9/2/19 10/17/19
	CAM002A	0	Level sensor (Depth> 9.78 feet after 5/16, >10.78 feet before 5/16)	-	2	0.16	8/8/19 9/2/19
	CAM002B ¹	-	-	-	-	-	-
	CAM004 ²	-	-	-	-	-	-
	CAM400 ³	-	-	-	-	-	-
	CAM401A	14	CDPW Level Sensor (Depth >- 10")	4/22/19, 4/27/19, 5/30/19, 6/29/19, 7/6/19, 7/12/19, 7/17/19, 7/31/19, 8/8/19, 8/29/19, 9/2/19, 10/17/19, 10/27/19, & 11/24/19	14	7.74	4/15/19, 4/22/19, 6/20/19, 6/21/19, 6/25/19, 7/6/19, 7/12/19, 7/17/19, 7/31/19, 8/8/19, 8/28/19, 9/2/19, 10/17/19, & 10/27/19
	CAM401B	3	CDPW Level Sensor (Depth >5.47 ft)		7 ⁵	2.26	4/15/19, 7/6/19, 7/17/19, 8/8/19, 8/29/19, 9/2/19, & 10/17/19
	TOTAL	21⁶	-		26	10.54	

1 CAM 002B is temporarily closed
 2 Permanently closed December 27, 2015
 3 Permanently closed on March 31, 2011
 4 A spill was added to the model-simulated events on 10/17/19. Modeled depth was just below the weir crest when the meter data simultaneously showed a spill.
 5 Three of these spills occurred during periods when baseflow was lower than average and account for only 6% of the volume
 6 Metered spill total calculated using highest observed spill count

3.2.2 Charles River CSO Results

The three active CSO outfalls on the Charles River spilled a total of twelve times in 2019 resulting in approximately 11.19 MG of CSO volume. The Charles River CSO spills occurred on seven days in 2019; April 15th, July 6th, July 17th, July 31st, August 8th, September 2nd and October 17th. All three Charles River CSOs spilled during the August 7th storm event. In addition, CAM005 and CAM017 both spilled on the October 17th storm event. The following is an overview of each of the Charles River CSO results;

- CAM005: The model simulated a total of seven spills at CAM005 during 2019 with a total volume of 3.42 MG (April 15th, July 6th, July 17th, July 31st, August 7th, September 2nd and October 17th). The metered depth indicated four spills, three of which matched the modeled results (August 8th, September 2nd and October 17th). The fourth metered event, the August 29th storm event, was only 0.008” over the weir, which is a negligible depth over the weir. The spills on August 8th, September 2nd and October 17th, which matched the metered spill events, accounted for 93% of the total spill volume at this location, whereas the four spills that were simulated in the model and not metered accounted for only 7% of the spill volume in 2019;
- CAM007: The model simulated a total of two spills at CAM007 during 2019 with a total of 2.87 MG (August 7th and September 2nd). Metered depth data from the City’s meter indicated three spills on the two model-simulated dates, as well as one additional metered spill on October 17th. The model simulated baseflow appeared to be lower than the metered baseflow during the spill event metered on October 17th, whereas during the two previous events on August 7th and September 2nd, where the model did match the metered data, the baseflow represented in the model was closer to the baseflow observed in the data. The model does not vary baseflow by season and this is most likely the reason that the model did not simulate the spill on October 17th;
- CAM017: At CAM017, the model simulated three spill events on August 8th, September 2nd, and October 17th, all of which were correlated to the metered spill events, with only one event on July 6th that was metered and not replicated in the model. It should be noted that on the July 6th event, the inclinometer meter did not activate and is therefore not being considered a spill event.

Table 3.3 Summary of 2019 Activations at Charles River CSOs

Receiving Water	Outfall No.	Metered Results			Modelled Results		Spill Dates
		2019 CSO Spills	Meter Type (Threshold)	Spill Dates	2019 CSO Spills	2019 CSO Volume (MG)	
Charles River	CAM005	4	Level Sensor (Depth >0)	8/8/19, 8/29/19, 9/2/19 & 10/17/19	7	3.42	4/15/19, 7/6/19, 7/17/19, 7/31/19, 8/8/19, 9/2/19, & 10/17/19
	CAM007	3	Level Sensor (Depth >0)	8/8/19, 9/2/19, & 10/17/19	2	2.87	8/8//19 & 9/2/19
	CAM009 ¹	-	-	-	-	-	-
	CAM011 ¹	-	-	-	-	-	-
	CAM 017	4	Inclinometer triggered or depth and velocity across bending weir>0	7/6/19, 8/8/19, 9/2/19, & 10/17/19	3	4.90	8/8/19, 9/2/19, & 10/17/19
	TOTAL	11	-	-	12	11.19	-

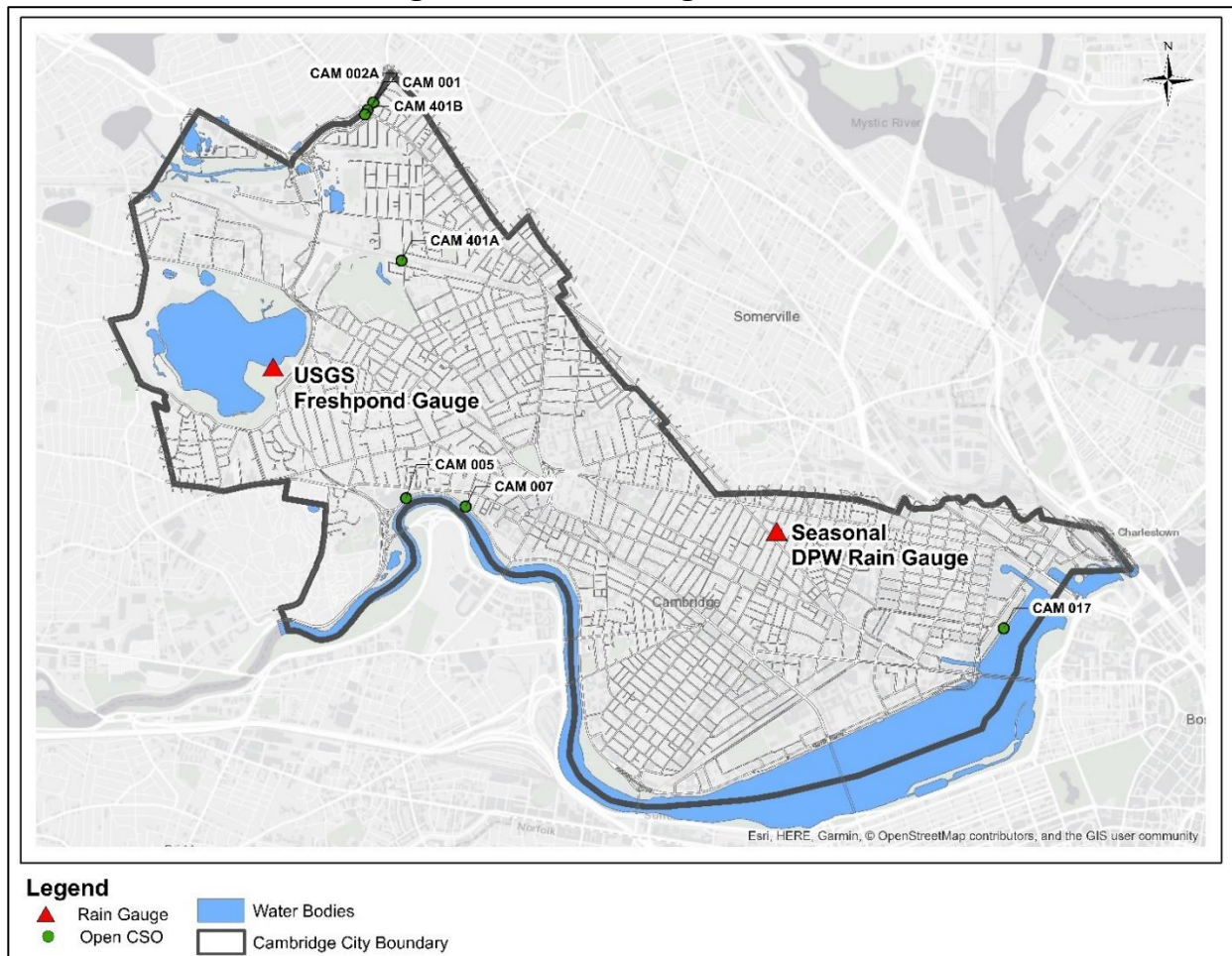
¹ CAM 009 and CAM 011 are temporarily closed

3.3 Rainfall Characteristics

Under the City of Cambridge Combined Sewer Overflow Permit MA0101974, as part of the CSO NPDES Annual Report, precipitation data from the previous calendar year (2019) must be analyzed against the typical year (1992) rainfall record.

The City of Cambridge currently operates one seasonal rain gauge on the roof of the Cambridge DPW that in 2019 was operational from March 23, 2019 through December 18, 2019. The Cambridge DPW gauge data is presented in Appendix I. In addition to the seasonal DPW rainfall gauge, a second rain gauge operated by the USGS is in Fresh Pond. Figure 3.2 shows the location of the two rainfall gauges used to obtain 2019 rainfall data.

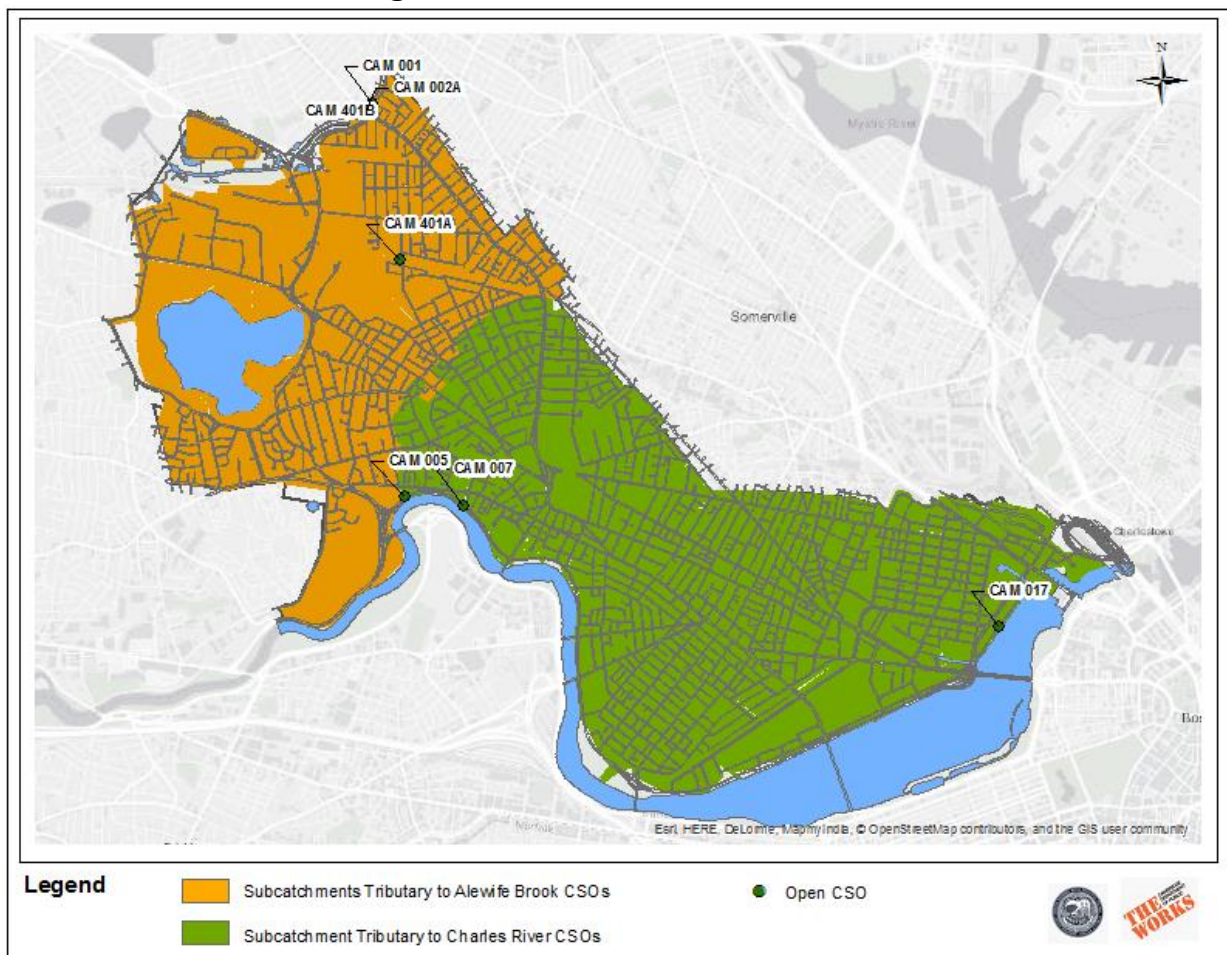
Figure 3.2 Rain Gauge Locations



Given the geographic location of the two rain gauges in the two different watersheds in the City (Alewife Brook and Charles River), it was determined that the USGS Fresh Pond gauge would be most spatially representative of the Alewife Brook subcatchments and CSOs, as well as Charles River areas in close proximity to the west of the City, whereas the DPW seasonal gauge provides a more spatially representative rainfall data for most of the Charles River subcatchments and CSOs. Figure 3.3 presents the model subcatchments tributary to the Alewife Brook CSOs and those tributary to the Charles River CSOs.

The Cambridge DPW gauge is removed over the winter months, therefore, to create a year-long rainfall series for the Charles River catchments, missing rainfall data was filled in with rainfall data from the USGS gage from January 1st through March 22nd. In addition, the Freshpond rainfall gauge was not operational from December 18th through December 31st, 2019, therefore rainfall data from Boston Water and Sewer Allston rain gauge was used to fill in this missing data. The two 2019 annual rainfall series (the USGS Fresh Pond Gauge data for the Alewife Brook and the hybrid rainfall series data for the Charles River catchments) were compared to the typical year rainfall to assess any similarities and differences in the rainfall distribution and patterns.

Figure 3.3 Model Subcatchments



As shown in Graph 3.1, the accumulated 2019 USGS Fresh Pond and CDPW rainfall data are both less than the typical year (1992) rainfall. In addition, Figure 3.4 presents a map of the twenty-year average precipitation in the Northeast United States, indicating that the average total precipitation from 1981 to 2010 is between 45 and 50 inches, which is greater than the observed 2019 total rainfall (40.66 inches in the hybrid rainfall series and 35.72 inches in the USGS rainfall series at Fresh Pond). MWRA model simulations and CSO analyses employ the USGS Fresh Pond rainfall series alone, which may result in differences in CSO reporting for the Charles River CSOs.

A review of the distribution of storms in 2019 by total rainfall was performed. Tables 3.4 and 3.5 present a comparison of storm frequency and volumes within various ranges of total precipitation for the two 2019 series and for the typical year. The USGS rain gauge recorded two storms more than the typical year (120 versus 118). On the other hand, the 2019 USGS/DPW series had a larger number of storms totaling 123 for the year. The number of storms were counted assuming an inter-event time equal to six hours. Both 2019 rainfall series had a lower total rainfall than the typical year (22.72% less for the USGS Fresh Pond series). The Fresh Pond gage had 81 storms in the <0.25inch

range, with a total volume of 6.97in and the hybrid rainfall series recorded more storms in this lower range (83) with a greater total volume (7.73 inches).

Graph 3.1 Typical Year Rainfall versus 2019 Rainfall

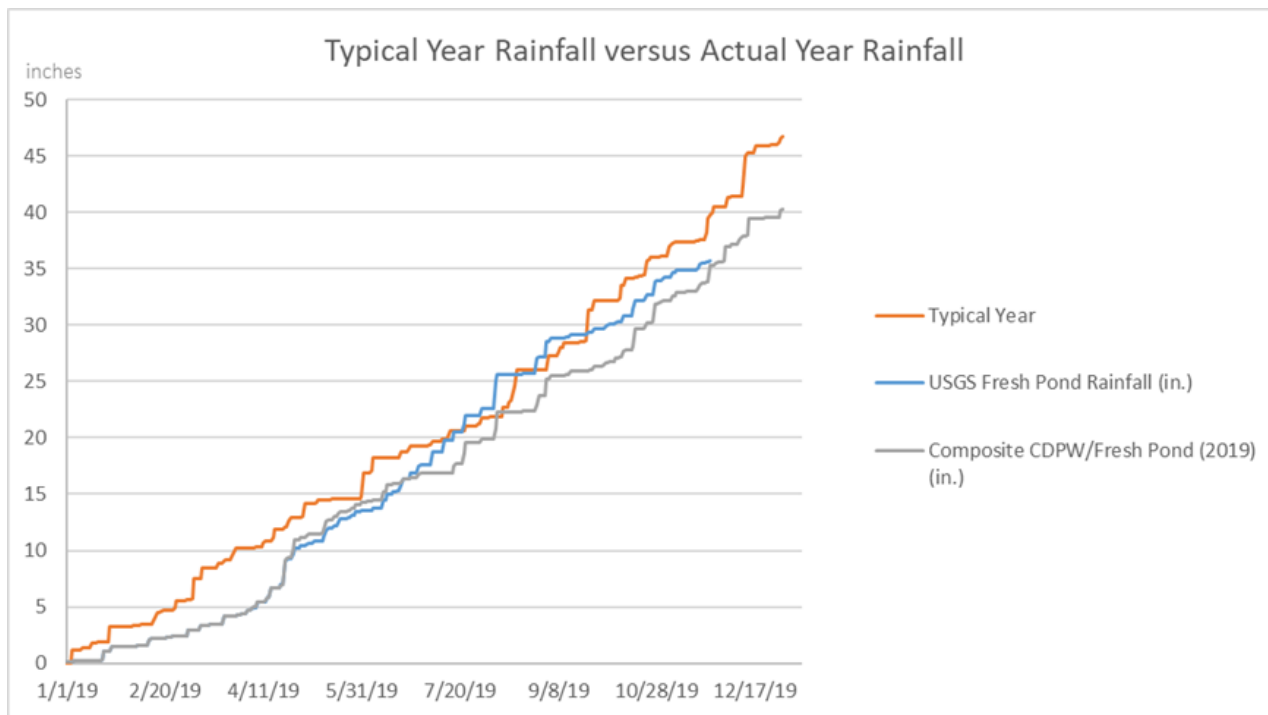
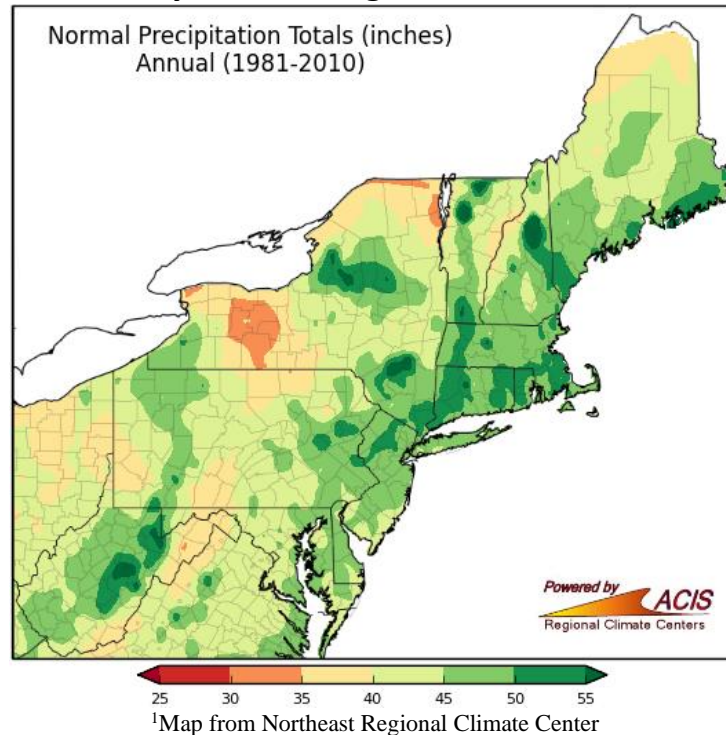


Figure 3.4 Twenty Year Average Rainfall in the Northeast US

The number of the typical year storms and volumes in the 0.25 to 0.50-inch range was slightly lower than those in 2019 USGS Fresh Pond but slightly higher than the USGS/DPW hybrid's number and volumes as shown in Tables 3.4 and 3.5. In the 0.50 to 1.0-inch volume range, the hybrid and Fresh Pond rainfall series had 4-5 less recorded storm events than in the typical year.

For storms with volumes greater than 1.0 inch and less than 2.0 inches, the hybrid and the Fresh Pond rainfall series had 6.77% and 47.1% less rainfall, respectively, than the typical year volume in the same range. The 2019 rainfall series had 2-5 less storm events in the 1.0 inch to 2.0 inch range than the typical year series. Both 2019 Fresh Pond and hybrid rainfall have 2 storms above 2.0 inches, while the typical year rainfall includes three storms of this magnitude.

Table 3.4 Frequency of Rainfall Events per Storm Depth Range

Rainfall Series	Total Rainfall (inches)	Total Number of Storms	Number of Storms by Depth				
			Depth <0.25 inches	Depth 0.25 to 0.50 inches	Depth 0.5 to 1.0 inches	Depth 1.0 to 2.0 inches	Depth >=2.0 inches
Typical Year	46.83	118	70	17	17	11	3
Fresh Pond/CDPW Composite	40.66	123	83	17	12	9	2
Fresh Pond (USGS)	35.72	120	81	18	13	6	2

Table 3.5. Annual Rainfall Depth Distribution per Storm Depth Range

Rainfall Series	Total Rainfall (inches)	Total Number of Storms	Total Rainfall Depth of Storms				
			Depth <0.25 inches	Depth 0.25 to 0.50 inches	Depth 0.5 to 1.0 inches	Depth 1.0 to 2.0 inches	Depth >=2.0 inches
Typical Year	46.83	118	4.52	6.33	12.01	15.06	8.91
Fresh Pond/CDPW Composite	40.66	123	7.73	6.06	8.20	14.04	4.64
Fresh Pond (USGS)	35.72	120	6.97	6.88	8.77	7.97	5.13

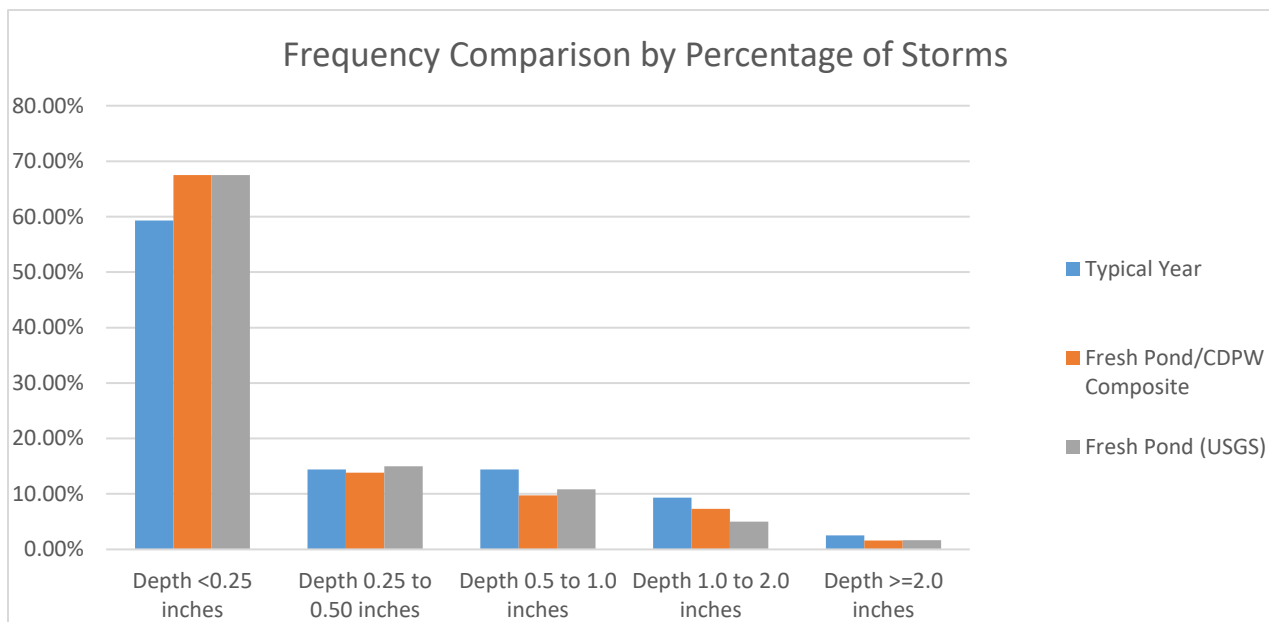
Table 3.6 and Graph 3.2 present the distribution of the total depth of storms by percentage. In 2019, the typical year series had rainfall mostly concentrated in the 0.5-1.0inch range and the 1.0-to-2.0 inch range, being the latter the most dominant in overall depth. On the other hand, the 2019 USGS series and the hybrid had most of the rainfall concentrated in the 0.50-to-1.0 inch and the 1.0-to-2.0 inch range with the latter being less dominant when compared to the typical year series. Moreover, the typical year had a larger amount of annual rainfall accumulated in events greater than 2 inches compared with the amount in 2019.

Table 3.6 Percent of Annual Rainfall Depth per Storm Depth Range

Rainfall Series	Total Rainfall (inches)	Total Number of Storms	Depth of Storms by Percentage				
			Depth <0.25 inches	Depth 0.25 to 0.50 inches	Depth 0.5 to 1.0 inches	Depth 1.0 to 2.0 inches	Depth >=2.0 inches
Typical Year	46.83	118	9.65%	13.52%	25.65%	32.16%	19.03%
CDPW/Fresh Pond Composite	40.66	123	19.00%	14.90%	20.16%	34.53%	11.41%
Fresh Pond (USGS)	35.72	120	19.51%	19.26%	24.55%	22.31%	14.36%

This variability amongst the 2019 series and the typical year indicates that significant deviations with regards to CSO performance are to be expected between CSOs in the Alewife Brook versus the Charles River basins. Overall performance measured against the typical year is a function not only of storm volumes but also of storm intensity, which is analyzed in this section.

Graph 3.2 Frequency Comparison of Total Rainfall Depth Distribution by Percentage



In addition to the analysis of storm events by total rainfall depth, the storm intensities of the 2019 and the typical year rainfall series were also compared. Table 3.7 presents the distribution of storms among of the rainfall series by 15-minute peak intensity. Table 3.8 presents the average and peak intensities for storms greater than 1 inch in depth and Table 3.9 presents the same metrics for storm events with a 15-minute peak intensity greater than 0.40in/hr.

Table 3.7 Number of Storm Events at Selected Ranges of 15-min Peak Intensity

Rainfall Series	No. of Storms	Total Rainfall	Number of Peak Intensity				
			0.01 to 0.10	0.10 to 0.25	0.25 to 0.50	0.50 to 1.0	> 1.0
		(inches)	(in/hr)	(in/hr)	(in/hr)	(in/hr)	(in/hr)
Typical Year	118	46.83	60	27	16	10	5
Fresh Pond/CDPW Composite	123	40.66	62	35	13	9	4
Fresh Pond (USGS)	120	35.72	57	30	16	8	9

As outlined in Table 3.8, the typical year includes fourteen storm events over one inch whereas both hybrid and the Fresh Pond gauge recorded eighteen and fifteen events greater than one inch in total rainfall, respectively. Storm events were counted assuming an inter-event time equal or greater than six hours (i.e. if no rain occurs between the end of one rainfall period and the beginning of the next then they are counted as two separate events). Recurrence intervals listed in Table 3.8 indicates that the typical year has two storms over one inch in rainfall (12/11/1992, 10/23/1992, and 9/22/1992) near or above the 1-year recurrence interval, whereas the 2019 data showed seven storm events with a recurrence interval greater than 1 year.

Table 3.8 Comparison of Storms Greater 1 Inch of Total Rainfall, Typical Year Versus 2019

Rainfall Series	No. of Storms	Date	Duration (hours)	Total Rainfall (in)	Average Int. (in/h)	15-min Peak Int (in/h)	Recurrence Interval
Typical year	14	12/11/1992	39.5	3.88	0.10	0.24	2Y~5Y
		9/22/1992	22.0	2.79	0.13	0.65	1Y~2Y
		5/31/1992	29.3	2.24	0.08	0.48	<1Y
		3/6/1992	34.0	1.89	0.06	0.22	<1Y
		11/21/1992	34.8	1.88	0.05	0.36	<1Y
		8/17/1992	25.5	1.81	0.07	0.80	<1Y
		1/23/1992	16.0	1.36	0.09	0.40	<1Y
		6/5/1992	17.3	1.34	0.08	1.00	<1Y
		9/3/1992	12.3	1.19	0.10	0.68	<1Y
		10/23/1992	3.0	1.18	0.39	1.08	<1Y
		1/4/1992	20.8	1.15	0.06	0.48	<1Y
		5/2/1992	5.5	1.14	0.21	1.32	<1Y
		8/15/1992	38.5	1.10	0.03	0.28	<1Y
		4/16/1992	30.0	1.02	0.03	0.28	<1Y

Rainfall Series	No. of Storms	Date	Duration (hours)	Total Rainfall (in)	Average Int. (in/h)	15-min Peak Int (in/h)	Recurrence Interval
Fresh Pond/CDPW Composite	10	4/22/2019	16.3	2.33	0.14	0.63	1Y
		8/7/2019	4.0	2.31			0.58
		7/22/2019	22.0	1.90	0.09	0.5	1Y
		10/16/2019	9.0	1.89	0.21	0.85	1Y
		10/27/2019	12.5	1.60	0.13	0.58	<1Y
		4/26/2019	21.8	1.55	0.07	0.62	<1Y
		12/13/2019	25.3	1.55	0.06	0.27	<1Y
		11/24/2019	18.0	1.46	0.08	0.9	<1Y
		9/2/2019	2.8	1.38	0.49	1.91	2Y
		8/28/2019	10.3	1.37	0.13	1.5	<1Y
		12/1/2019	19.3	1.35	0.07	0.18	<1Y
Fresh Pond (USGS)	8	8/7/2019	13.0	2.98	0.23	2.44	2Y
		4/22/2019	18.5	2.15	0.12	0.72	1Y
		7/22/2019	22.8	1.51	0.07	0.4	<1Y
		9/2/2019	5.5	1.41	0.26	1.96	<1Y
		10/16/2019	7.5	1.38	0.18	0.96	<1Y
		8/28/2019	10.3	1.37	0.13	1.2	<1Y
		10/27/2019	11.8	1.21	0.10	0.4	<1Y
		7/6/2019	3.8	1.09	0.29	1.12	<1Y

Table 3.9 lists storms with peak intensities greater than 0.40in/hr and their average intensities for all three-rainfall series.

Table 3.9 Comparison of Storms with 15-min Peak Intensities Greater than 0.40 Inches/hour, Typical Year Versus 2019

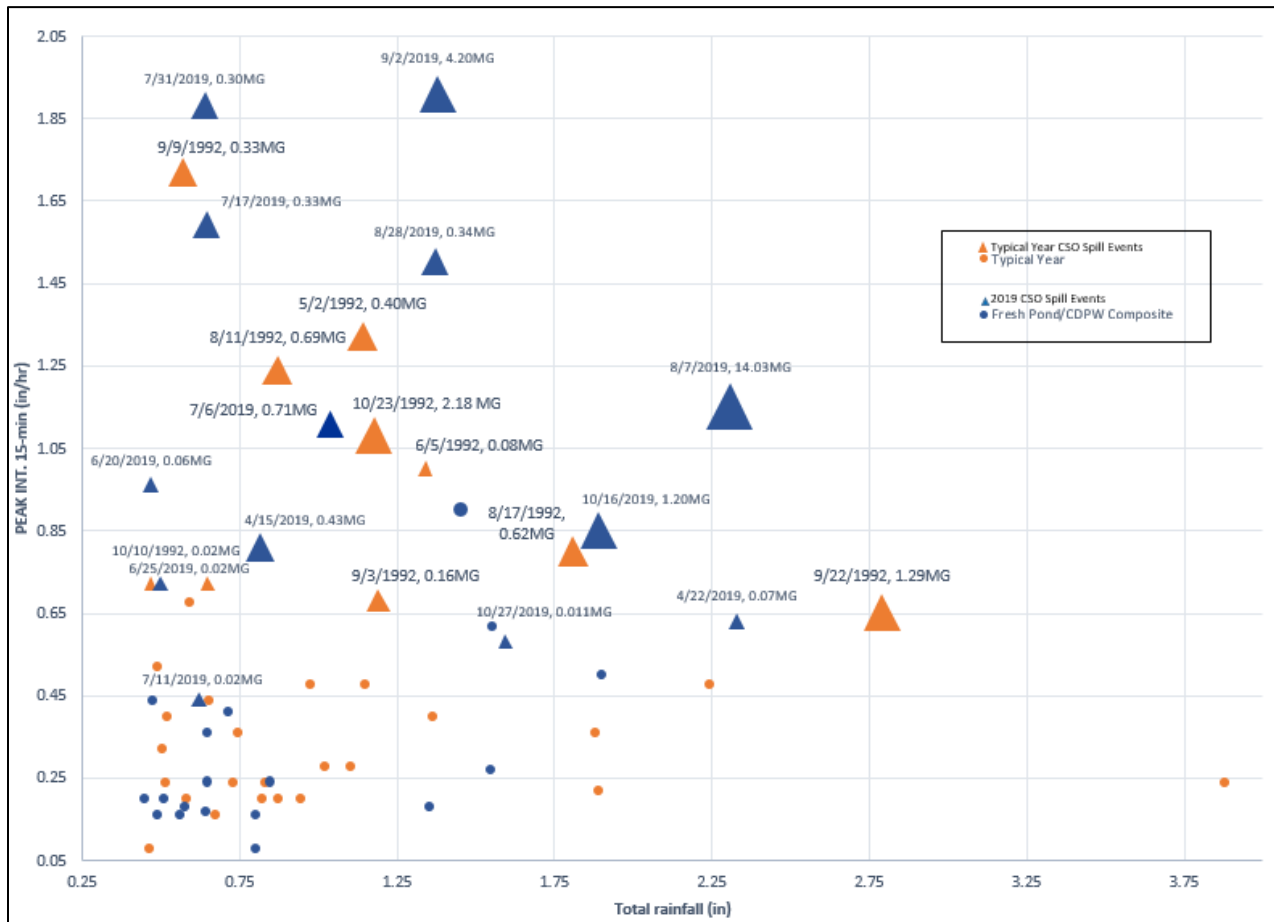
Rainfall Series	No. of Storms	Date	Duration (hours)	15-min Peak Intensity (in/h)	Average Intensity (in/h)	Recurrence Interval
Typical Year	20	9/9/1992	0.5	1.72	1.14	<1Y
		5/2/1992	5.5	1.32	0.21	<1Y
		8/11/1992	10.5	1.24	0.08	<1Y
		10/23/1992	3.0	1.08	0.39	~1Y
		6/5/1992	17.3	1.00	0.08	<1Y
		7/11/1992	0.5	0.84	0.44	<1Y
		8/17/1992	25.5	0.80	0.07	<1Y
		10/10/1992	5.3	0.72	0.09	<1Y
		10/10/1992	6.5	0.68	0.10	<1Y
		9/3/1992	12.3	0.68	0.10	<1Y
		7/31/1992	18.8	0.68	0.03	<1Y
		9/22/1992	22.0	0.65	0.13	<1Y
		7/29/1992	0.5	0.64	0.40	<1Y
Fresh Pond/CDPW Composite	15	9/2/2019	2.8	1.91	0.49	1Y~2Y
		7/17/2019	5.5	1.59	0.12	<1Y
		8/28/2019	10.3	1.50	0.13	<1Y
		8/7/2019	4.0	1.15	0.58	5Y
		11/24/2019	18.0	0.90	0.08	<1Y
		10/16/2019	9.0	0.85	0.21	<1Y
		4/15/2019	8.5	0.81	0.10	<1Y
		9/4/2019	0.8	0.75	0.43	<1Y
		4/22/2019	16.3	0.63	0.14	<1Y
		4/26/2019	21.8	0.62	0.07	<1Y
		10/27/2019	12.5	0.58	0.13	<1Y
		7/31/2019	1.8	0.53	0.17	<1Y
		7/22/2019	22.0	0.50	0.09	<1Y
		1/24/2019	6.3	0.44	0.07	<1Y
6/10/2019	11.5	0.41	0.06	<1Y		
Fresh Pond (USGS)	22	8/7/2019	13.0	2.44	0.23	2Y
		7/17/2019	9.0	2.40	0.08	<1Y
		9/2/2019	5.5	1.96	0.26	<1Y
		7/31/2019	1.5	1.88	0.43	<1Y
		4/15/2019	9.3	1.48	0.09	<1Y
		8/28/2019	10.3	1.20	0.13	<1Y
		6/29/2019	0.5	1.16	0.64	<1Y

Rainfall Series	No. of Storms	Date	Duration (hours)	15-min Peak Intensity (in/h)	Average Intensity (in/h)	Recurrence Interval
Fresh Pond (USGS)	22	7/6/2019	3.8	1.12	0.29	<1Y
		6/29/2019	2.3	1.00	0.14	<1Y
		10/16/2019	7.5	0.96	0.18	<1Y
		6/20/2019	10.0	0.96	0.05	<1Y
		9/4/2019	0.5	0.88	0.54	<1Y
		7/12/2019	6.0	0.84	0.07	<1Y
		6/25/2019	8.8	0.72	0.06	<1Y
		4/22/2019	18.5	0.72	0.12	1Y
		6/21/2019	2.5	0.68	0.21	<1Y
		6/11/2019	11.5	0.64	0.06	<1Y
		4/26/2019	12.8	0.48	0.07	<1Y
		10/22/2019	12.3	0.44	0.04	<1Y
		1/24/2019	6.3	0.44	0.07	<1Y
		5/20/2019	1.8	0.44	0.11	<1Y
		7/11/2019	9.0	0.44	0.07	<1Y

Comparison of peak intensity distributions of the 2019 rainfall series and the typical year shows that 2019 Fresh Pond rainfall data had 22 storms with a peak intensity higher than 0.40 in/hr. The typical year has a total of five storms with an average intensity greater than 0.30in/h. Four out of these five have a duration of 30 minutes or less and only the 10/23/1992 is more significant in terms of duration (3 hours) and rainfall accumulation (1.18 inches). On the other hand, the 2019 hybrid series had three events with an average rainfall intensity greater than 0.30in/h and 2019 Fresh Pond rainfall series has three storms (7/31/2019, 6/29/2019, 9/4/2019) with average intensity greater than 0.30 inch/hour, and all of them have a duration of more than 30 minutes and a rainfall accumulation of 0.64 inches, 0.32inches and 0.27inches, respectively.

The typical year and 2019 storm events (for both the hybrid and Fresh Pond time series) are presented in Graph 3.3. This figure includes all storms over 0.45” of total rainfall and clearly indicates several 2019 storm events that were outliers with respect to their 15-minute peak intensity and total volume ratios (shown with a blue fill) while the typical year were marked in orange. All storms that caused a CSO spills during both storms were indicated as a triangle. The storms that were causing a spill in the typical year are within the similar rainfall characteristic as those during 2019 storms. For 2019 rainfall, the CSO spill events include July 17th, July 31st, August 7th, September 2nd and October 17th, 2019. These storm events with high peak intensity and total volume, as would be expected, were responsible for a majority of the CSO spills recorded in 2019, as previously outlined in this report.

Graph 3.3 Typical Year and 2019 Rainfall Events, Peak 15-Minute Intensity for Storms Greater than 0.45” Total Rainfall



3.4 Combined Sewer Overflow Comparison

With the analysis of the 2019 rainfall complete and the CSO spill count and activations for 2019 calculated, the 2019 CSO results were then compared to those anticipated during the typical rainfall year. Table 3.10 presents the 2019 and typical year model simulation results for the existing conditions (2019) Cambridge network model, as well as the target CSO volumes at LTCO completion, per the CSO permit. The existing conditions (2019) model was adjusted with changes at the CAM002 and SOM001 regulators with the outstanding LTCP work including the following changes:

1. CAM002
 - Remove temporary plate partially blocking the CAM002A outfall pipe
 - Remove bulkhead to connect CAM002 regulator to the Alewife Brook Conduit

This work was completed by the City on May 16, 2019.

2. SOM01A (note that SOM01A is not owned by Cambridge, but its modification affected the performance of Cambridge's CSOs):
 - Expand the underflow pipe equivalent diameter from 2 to 3 feet

This work was completed by the MWRA on March 27, 2019.

As noted previously, there are a number of inactive CSOs on both the Alewife Brook and the Charles River systems that are included in the table for consistency.

Table 3.10 Comparison of 2019 and Typical Year CSO Results

	2019 RAINFALL UNDER 2019 SYSTEM CONDITIONS*		TYPICAL YEAR RAINFALL UNDER 2019 SYSTEM CONDITIONS*		TYPICAL YEAR RAINFALL WITH LONG TERM CONTROL PLAN**	
OUTFALL	ACTIVATION FREQUENCY	VOLUME (MG)	ACTIVATION FREQUENCY	VOLUME (MG)	ACTIVATION FREQUENCY	VOLUME (MG)
ALEWIFE BROOK						
CAM 001	3 ⁴	0.38	1	0.06	5	0.19
CAM 002	2	0.16	0	0	4	0.69
CAM 004 ¹	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	N/A
CAM 400 ²	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	N/A
CAM 401A	14	7.74	9	3.73	5	1.61
CAM 401B	7	2.26	4	0.89	7	2.15
TOTAL	26	10.54	14	4.68⁵	21	4.63⁵
CHARLES RIVER						
CAM 005	7	3.42	6	0.95	3	0.84
CAM 007	2	2.87	1	0.01	1	0.03
CAM 009 ³	0	0	0	0	2	0.01
CAM 011 ³	0	0	0	0	0	0
CAM 017	3	4.90	1	0.14	1	0.45
TOTAL	12	11.19	8	1.10	7	1.33

* ICM SIMULATION CONDITION WITH 15MIN TIMESTEP (60s) WITH 15 RESULTS MULTIPLIERS.

**VALUES REFLECT TARGET CSO VOLUMES AT LTCP COMPLETION AS PER CSO PERMIT.

1. CAM 004 CLOSED ON DECEMBER 27, 2015

2. CAM 400 CLOSED ON MARCH 31, 2011

3. TEMPORARILY PLUGGED

4. A SPILL WAS ADDED TO THE MODEL-SIMULATED EVENTS ON 10/17/19. MODELED DEPTH WAS JUST BELOW THE WEIR CREST WHEN THE METER DATA SIMULTANEOUSLY SHOWED A SPILL.

5. THIS TOTAL DOES NOT INCLUDED MWRA 003 AND SOM01A, THE TOTL LTCP VOLUME OF CSO IS 7.29 MG PER YEAR IF THESE ARE INCLUDED

Alewife Brook Comparisons

The Alewife Brook in existing conditions showed a total of twenty-six activations with 10.54 MG volume under the 2019 rainfall series while in a typical year it resulted in a total of fourteen spills and 4.68 MG in total. The fourteen spills are lower than the twenty-one target spills in the LTCP model. The total volume of 4.68 MG is 0.05 MG (1%) higher than the targeted 4.63 MG in a typical year in LTCP conditions. A summary of the CSO activations under different rainfall and system conditions is provided below.

CAM 001

The 2019 rainfall under the existing conditions resulted in three activations with an overflow volume of 0.38 MG, while the typical year rainfall in the existing conditions model generates one spill with a volume of 0.06 MG. CAM 001, therefore, meets the targeted 5 spills and total volume of 0.19 MG during the typical year in LTCP conditions.

CAM 002

The 2019 rainfall under existing conditions resulted in 2 activations. The typical year under 2019 system conditions generated no activations, which is less than the targeted 0.69MG under LTCP conditions during a typical rainfall year in LTCP conditions.

CAM 004

This structure was closed as of December 27, 2015 and the LTCP has CAM 004 closed since that date.

CAM 400

This structure was closed as of March 31, 2011 and the LTCP has CAM 400 closed since that date.

CAM 401A

The 2019 rainfall under existing conditions resulted in fourteen overflows with 7.74 MG of volume in current model conditions. In a typical year rainfall under current system conditions, there were nine activations and a total of 3.73 MG of CSO volume at CAM 401A. This is more than the targeted 1.61MG in LTCP conditions in a typical year, however the CAM401A system interacts with the CAM401B system thus frequency and volume of activations should be considered together.

CAM 401B

The 2019 rainfall under existing conditions resulted in seven spills and a total volume of 2.26 MG, while during the typical year rainfall under current conditions four spills are activated with a total of 0.89 MG. The typical year rainfall under LTCP targets 7 spill events and a total of 2.15 MG therefore the existing conditions model meets this target. A review of the 401A and 401B results together indicates that the combined, targeted LTCP volume in a typical year 3.76 MG (in 12 spills)

is close to being achieved with the total volume of 4.62 MG (in 13 spills) in the existing conditions model under the typical year rainfall.

Alewife CSOs Under the LTCP

It should be noted that adjustment of the SOM01A underflow, completed on March 27, 2019 as previously stated, was not a part of the original LTCP as initially conceived. The increase of the SOM01A underflow from 2ft to 3-ft diameter results in improved performance at SOM01A and MWRA003. Over the typical year simulation, the combined spill count from SOM01A and MWRA003 decrease by 4 spills and approximately 50% in spill volume, thereby reducing the total Alewife spill count and volume, as outlined in Table 3.11. This SOM01A underflow adjustment, however, comes at a cost of increases in spill volumes at CAM001, CAM401 and 401B, as well as increased spill count at 401B. Without the SOM01A underflow change, the total CSO volume from the Cambridge Alewife Brook CSOs would be 4.04 MG, which would meet the 4.63

Table 3.11 Effects of SOM01A Changes on Typical Year Alewife Brook CSO Results

CSO	TYPICAL YEAR RAINFALL UNDER 2019 SYSTEM CONDITIONS		TYPICAL YEAR RAINFALL UNDER 2019 SYSTEM CONDITIONS (NO SOM01A UNDERFLOW INCREASE)	
	Spills	Volume (MG)	Spills	Volume (MG)
CAM001	1	0.06	1	0.02
CAM002	0	0	0	0
CAM401A	9	3.73	9	3.68
CAM401B	4	0.89	3	0.34
SOM001	4	1.29	6	3.33
MWRA003	1	1.94	3	3.25
TOTAL CAMBRIDGE	14	4.68	13	4.04
TOTAL ALEWIFE	19	7.82	22	10.62

Charles River Comparisons

The Charles River system in existing conditions showed a total of twelve activations with 11.19 MG volume under the 2019 rainfall series, while the typical year rainfall resulted in a total of eight spills and 1.10 MG in total. The Cambridge CSO 2019 typical year results are one spill event higher than the targeted seven spills and 0.23 MG lower than the 1.33 MG spill volume in a typical year in LTCP conditions. The overall spill volume of 1.10 MG is 0.23 MG (approximately 17%) lower than the targeted 1.33 MG meeting the targeted LTCP volume in the Charles River system. A summary of the CSO activations under different rainfall and system conditions is provided below.

CAM 005

The 2019 rainfall under the existing conditions resulted in seven activations with an overflow volume of 3.42 MG, while the typical year rainfall in the existing conditions model generates six spills and a total of 0.95 MG. The typical year rainfall under LTCP conditions target is three spills and a total volume of 0.84MG in a year.

A review of the typical year spills under existing conditions indicates that the three smallest spills amount for only 17% of the volume. If these three small spills (between 23,000 and 83,000 gallons) were controlled at CAM005, the LTCP would be met at this regulator.

CAM 007

The 2019 rainfall under the existing conditions resulted in two spills with a volume of 2.87 MG, while the typical year rainfall under existing conditions generates one spill with a total volume of 0.01 MG. The typical year rainfall under LTCP conditions targets one spill with a total volume of 0.03 MG at CAM007 therefore the existing conditions model under typical year rainfall meets the LTCP target.

CAM 009 and CAM 011

CAM 009 and CAM 011 are temporarily plugged. The LTCP has both outfalls open. The City of Cambridge plans to keep these outfalls closed until a more comprehensive study can be completed in this area on the effects of climate change and upstream conditions.

CAM 017

The 2019 rainfall under existing conditions resulted in three spills and a total volume of 4.90 MG at CAM017, while the typical year rainfall under 2019 system conditions would generate one spill with a total volume of 0.14 MG. This one spill meets the targeted spill count and its volume is 0.31 MG (68%) lower than the targeted 0.45MG in a typical year under LTCP conditions.

3.5 Monitoring Recommendations

The 2019 CSO data analysis carried out on both the metered CSO data and the modeled CSO simulations identified a number of recommendations for the CSO monitoring and analysis moving into 2020, as outlined below.

CAM001

In analysis of the CAM001 smart cover data, appreciable variability in baseflow was observed. This sensor will be reviewed to ensure that any migration of the sensor is minimized. The data was valuable in that it showed the depth reaching the high-water level during the spills recorded in the outfall meter, indicating good correlation during wet weather events. The DPW CAM001 outfall meter data appeared to be showing good correlation with the 2019 model simulations.

CAM002

The CAM002 model results which simulated two spills were higher than the metered data that indicated no spills in 2019. A review of the CAM002 depths will be carried out during 2020 in order to review any changes to regulator flow balance resulting from the 2019 LTCP changes to the CAM002 regulator and changes at the SOM01A regulator. The existing SCADA monitoring will be maintained as it is providing sufficient understanding of flow through this regulator.

CAM401A

At CAM401A, the modelled spill events are well correlated with the depth data available from both the City meter and the MWRA meter. Installation of a secondary form of monitoring at the CAM 401A regulator is recommended. In particular, the City will attempt to monitor whether the scrub brush set up is turning in conjunction with the depth threshold being reached. This will serve to confirm the validity of the depth threshold being used for spill activations and volumes, as measured by the City's level sensor. A review of maintenance options for reducing backwater in the Sherman Avenue combined sewer will also be carried out.

CAM 401B

At CAM401B, the modelled CSO results match the DPW flow meter data for the larger storm event. The level data at 401B did not indicate spills during two of the three storm events simulated in the model. An analysis of the observed antecedent conditions before each of the spill events indicated that the baseflow at this location is highly variable and may be having an effect on the meter-to-model correlation. A thorough review of seasonal baseflow variability will be carried out at this location.

CAM005

A smart cover level sensor was installed just downstream (north) of the CAM005 regulator on the 30"/42" MWRA North Charles Relief Sewer. This additional level sensor data will be used to analyze the head losses associated with the complicated regulator structure at CAM005. There is an existing pipe presumed to be blocking some flow in this vicinity, along with a two 90° bends and the confluence of a large local combined sewer with the MWRA interceptor. Given these complicating factors, the smart cover data will be used to better understand the variability in depth between the conveyance system and the CAM005 overflow weir. In addition, the City has also planned an investigation of the presumed pipe blocking flow.

CAM007

During the next calendar year, the CAM007 regulator will be further calibrated with the temporary flow metering data from the incoming pipes. In particular, the baseflow in the regulator structure will be reviewed in order to improve representation of standing water in the regulator during dry weather, which appears to vary seasonally and may be effecting the model's representation of spills at this location.

CAM017

The flow meters and inclinometers located at CAM017 showed good correlation with the modelled simulation at this location. This data will continue to be relied upon for monitoring CSO

performance at this regulator. Future flow metering will be considered in the Binney Street combined sewer further up-stream of the CAM017 regulator. Periodic review of the operation of the Prison Point wet weather sluice gates will continue to be carried out to provide a sense of the effects of gate operation on depths in the CAM017 regulator.

3.6 Coordination with MWRA

System-wide, The City has been regularly coordinating with the MWRA due to recent changes in the CSO variances for the Alewife Brook and Charles River. During the 2019 calendar year, the City met regularly with the MWRA, and continues to do so, to review their respective CSO metering and modeling efforts. MWRA depth data has been used to cross check with the City meter depth. Pump operations and system optimization at different key MWRA facilities vary in response to forecasts of extreme rainfall or quickly rising levels in the system. The City's model is limited to representing the facilities in a binary fashion, therefore continued coordination between the City and the MWRA regarding how these facilities are being operated during large rainfall events will be required to continuously validate the model results.

4. Status of CSO Abatement Projects

4.1 Project Updates

The City of Cambridge continues to implement abatement projects to remove stormwater from its combined sewer system, however continued sewer separation is dependent upon cost effective strategies to manage water quality from stormwater discharges, in particular from Phosphorous. This may include designing systems in which some portion of the stormwater continues to discharge to the sewer system, when there would be no increase to CSO activations and volumes. These non-LTCP abatement projects are aimed at improving level of service and hence reducing activations and volume of CSO discharges. Such abatement projects include:

- Cardinal Medeiros and Binney St sewer separation
- Cottage Lopez drainage improvements
- Willard St Outfall
- Talbot Street Outfall
- Monsignor O'Brien Highway sewer separation and new Lechmere Canal outfall
- The Port I/I removal and flood alleviation project

The information provided in this Annual Report conforms to information and data submitted to the MWRA for inclusion in their court-ordered annual report on CSO abatement project progress.

As described in more detail in the MWRA 2015 CSO Annual Progress Reports (available at <http://www.mwra.com/cso/csoannualreports.htm>), the CSO Control Plan for Alewife Brook includes four (4) project components for which the City of Cambridge is responsible, including:

- CAM004 Stormwater Outfall and Wetland Basin (Contract 12)
- CAM004 Sewer Separation (Contracts 8A, 8B, and 9)
- CAM400 Common Manhole Separation (Contract 13)
- Interceptor Connection Relief and Floatables Control (Contract 4)

All of these projects have been completed.

4.2 Project Schedule

Design and construction milestones for the Alewife Brook projects were added to Schedule Seven (7) in 2006 when EPA and DEP approved the regional long-term CSO control plan. Dates of completion are listed below.

Project	Benefit	Implementation Status
Contract 4: Interceptor Connection Relief and Floatables Control	Upgrades connections between Cambridge and MWRA systems to provide greater capacity; provides floatables control.	Project completed in October 2010.
Contract 13: CAM400 Manhole Separation	Removes stormwater from the sewer system; eliminate CSO at Outfall CAM400.	Project completed in March 2012.
Contract 12: CAM004 Stormwater Outfall and Wetland Basin	Conveys separated stormwater flows to wetland system for treatment and flow attenuation.	Project completed in 2014.
Contracts 8A, 8B and 9: CAM004 Sewer Separation	Removes stormwater from the sewer system; eliminate CSO at Outfall CAM004.	CAM004 CSO closed in 2015

Table 4.1 – City of Cambridge CSO Abatement Projects and Status

CSO Outfall	Required Project Type Under 2 nd Stipulation	Receiving Water	Contract / Project Name	Completion Date or Proposed Completion Date	Notes
CAM001	Floatables Control	Alewife	Contract 4 - Floatables	October 2010	Baffles installed.
CAM002	Floatables control; interceptor relief	Alewife	Contract 4 - Floatables	October 2010	Baffles installed 2010 and blocked underflow 2019 update: underflow no longer blocked and 002A baffle has been removed-2019
CAM004	Sewer Separation	Alewife	2A/2B Fresh Pond Parkway	2001	Outfall CAM004 was permanently closed.
CAM004	Sewer Separation	Alewife	Contract 8A/8B/9	December 27 th 2015	Separated storm water drains to treatment wetland.
CAM004	Sewer Separation	Alewife	Contract 12-Stormwater Outfall	April 2013	Stormwater outfall and treatment wetland
CAM400	Sewer Separation / common manholes	Alewife	Contract 13	March 2011	CSO regulator eliminated; converted to stormwater outfall.
CAM401A	Floatables Control	Alewife	Bellis Circle	2005	Installed brush screen
CAM401B	Floatables control; interceptor relief	Alewife	Contract 4-Floatables	October 2010	Baffles installed in 2010 and underflow throttled. CAM401B underflow throttle removed.
CAM005	Hydraulic Relief	Charles	MWRA CAM005 Hydraulic Relief	2000	For full project description see: http://www.mwra.com/annual/csuar/2009/csuar2009.pdf
CAM007	Floatables Control	Charles	Contract 5	2009	Baffle installed
CAM009	Floatables Control	Charles	Contract 5	2009	Outfall temporarily plugged
CAM011	Floatables Control	Charles	Contract 5	2009	Outfall temporarily plugged
CAM017	Floatables Control	Charles	Contract 5	2009	Baffles were installed in 2009.
CAM017	Hydraulic Relief	Charles	CAM 017 Hydraulic Relief	2013	Bending weirs and baffles installed in 2014

5. Modifications to Nine Minimum Controls Plan

The Nine Minimum Controls Plan (NMCP) was substantially updated in its entirety and submitted together with the first annual report (April 2009). The plan provides a summary of the evaluations undertaken to address each control measure since the original plan was developed in 1997.

Enhancements were made to the NMCP to meet the minimum implementation levels stipulated in the permit. These Public Notification requirements will be further updated to reflect changes in current permit requirements and as included in the Variance for CSO Discharges to both the Alewife brook/Upper Mystic River basin and the Charles River Basin effective September 1, 2019. These enhancements were summarized in Table 5.1.

Table 5.1 –Enhancements to the Nine Minimum Controls Plan

Control Measure	Proposed Enhancement
1. Proper Operation and Regular Maintenance Programs	<ul style="list-style-type: none"> • Adherence to detailed “Good Housekeeping Manual” to provide specific guidance and protocols for major DPW tasks • Development and utilization of routine inspection forms and work order system • Update of infrastructure assets and nomenclature • Update of DPW organizational structure and budget figures
2. Maximization of Storage in the Collection System	<ul style="list-style-type: none"> • Update database of existing key regulator components • Establish procedure for documentation of purpose and benefits to any future modifications to existing structures
3. Review and Modification of Pretreatment Requirements	<ul style="list-style-type: none"> • Adherence to recently developed Wastewater and Stormwater Use Regulations, inspection frequencies and enforcement activities
4. Maximization of Flow to POTW	<ul style="list-style-type: none"> • Maintain updated inventory of CSO capital projects; • Continue funding for annual cleaning and remedial repair and reconstruction contracts
5. Prohibition/Elimination of Dry Weather Discharges	<ul style="list-style-type: none"> • The City is unaware of any dry weather discharges from CSO outfalls
6. Control of Solid and Floatable Materials in CSOs	<ul style="list-style-type: none"> • Continue to implement floatable controls projects in conformance with revised Schedule Seven milestone deadlines. • Continue to require compliance with new City Wastewater and Stormwater Use Regulations
7. Pollution Prevention Programs to Reduce Contaminants in CSOs	<ul style="list-style-type: none"> • Adherence to “Good Housekeeping Manual” guidance and protocols to reduce the City’s contribution of contaminants to stormwater; • Adherence to City of Cambridge Integrated Pest Management plan to reduce contributions of pesticides, fungicides, herbicides and fertilizer to run-off; • Continue aggressive recycling, street sweeping and household hazardous waste collections and management • Continue with public education and outreach activities • Continue to require compliance with new City Wastewater and Stormwater Use Regulations

Control Measure	Proposed Enhancement
<p>8. Public Notification</p>	<ul style="list-style-type: none"> • Beginning on or before December 31, 2020 develop and implement a subscriber based notification system to provide CSO alert notifications to any interested party no later than 4 hours after becoming aware of a CSO event. • Current public notification is based on real time monitoring at CAM002 and CAM401B. The City is in the process of installing real-time monitoring systems on all remaining active CSOs.
<p>9. Monitoring to Characterize CSO Impacts and Efficacy of CSO Controls</p>	<ul style="list-style-type: none"> • On a regulator site-specific basis, use revised weir equations and parameters and/or hydraulic models and analysis to estimate effluent volumes released during CSO events

APPENDIX I

2019 DAILY RAINFALL DATA

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS
 2019 DAILY RAINFALL DATA
 USGS METER AT FRESHPOND, CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
1/1/19	0.11	0.00	0.08
1/2/19	0.00	0.00	0.00
1/3/19	0.00	0.00	0.00
1/4/19	0.00	0.00	0.00
1/5/19	0.10	0.00	0.08
1/6/19	0.00	0.00	0.00
1/7/19	0.00	0.00	0.00
1/8/19	0.00	0.00	0.00
1/9/19	0.02	0.00	0.04
1/10/19	0.00	0.00	0.00
1/11/19	0.00	0.00	0.00
1/12/19	0.00	0.00	0.00
1/13/19	0.00	0.00	0.00
1/14/19	0.00	0.00	0.00
1/15/19	0.00	0.00	0.00
1/16/19	0.00	0.00	0.00
1/17/19	0.00	0.00	0.00
1/18/19	0.00	0.00	0.00
1/19/19	0.04	0.00	0.04
1/20/19	0.76	0.03	0.16
1/21/19	0.00	0.00	0.00
1/22/19	0.00	0.00	0.00
1/23/19	0.00	0.00	0.00
1/24/19	0.47	0.02	0.44
1/25/19	0.00	0.00	0.00
1/26/19	0.00	0.00	0.00
1/27/19	0.00	0.00	0.00
1/28/19	0.00	0.00	0.00
1/29/19	0.00	0.00	0.00
1/30/19	0.00	0.00	0.00
1/31/19	0.00	0.00	0.00
Total	1.5		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS
 2019 DAILY RAINFALL DATA
 USGS METER AT FRESHPOND, CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
2/1/19	0.00	0.00	0.00
2/2/19	0.00	0.00	0.00
2/3/19	0.00	0.00	0.00
2/4/19	0.00	0.00	0.00
2/5/19	0.00	0.00	0.00
2/6/19	0.09	0.00	0.08
2/7/19	0.00	0.00	0.00
2/8/19	0.00	0.00	0.00
2/9/19	0.00	0.00	0.00
2/10/19	0.00	0.00	0.00
2/11/19	0.00	0.00	0.00
2/12/19	0.47	0.02	0.16
2/13/19	0.09	0.00	0.08
2/14/19	0.00	0.00	0.00
2/15/19	0.00	0.00	0.00
2/16/19	0.00	0.00	0.00
2/17/19	0.00	0.00	0.00
2/18/19	0.05	0.00	0.08
2/19/19	0.00	0.00	0.00
2/20/19	0.00	0.00	0.00
2/21/19	0.14	0.01	0.12
2/22/19	0.00	0.00	0.00
2/23/19	0.00	0.00	0.00
2/24/19	0.04	0.00	0.04
2/25/19	0.00	0.00	0.00
2/26/19	0.00	0.00	0.00
2/27/19	0.00	0.00	0.00
2/28/19	0.02	0.00	0.04
Total	0.90		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS

2019 DAILY RAINFALL DATA

USGS METER AT FRESHPOND, CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
3/1/19	0.00	0.00	0.00
3/2/19	0.02	0.00	0.04
3/3/19	0.00	0.00	0.00
3/4/19	0.45	0.02	0.20
3/5/19	0.00	0.00	0.00
3/6/19	0.00	0.00	0.00
3/7/19	0.00	0.00	0.00
3/8/19	0.00	0.00	0.00
3/9/19	0.00	0.00	0.00
3/10/19	0.49	0.02	0.16
3/11/19	0.00	0.00	0.00
3/12/19	0.00	0.00	0.00
3/13/19	0.00	0.00	0.00
3/14/19	0.00	0.00	0.00
3/15/19	0.12	0.01	0.36
3/16/19	0.01	0.00	0.04
3/17/19	0.00	0.00	0.00
3/18/19	0.00	0.00	0.00
3/19/19	0.00	0.00	0.00
3/20/19	0.00	0.00	0.00
3/21/19	0.00	0.00	0.00
3/22/19	0.65	0.03	0.36
3/23/19	0.06	0.00	0.05
3/24/19	0.00	0.00	0.00
3/25/19	0.00	0.00	0.00
3/26/19	0.00	0.00	0.00
3/27/19	0.00	0.00	0.00
3/28/19	0.00	0.00	0.00
3/29/19	0.03	0.00	0.03
3/30/19	0.00	0.00	0.00
3/31/19	0.13	0.01	0.08
Total	1.96		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS
 2019 DAILY RAINFALL DATA
 USGS METER AT FRESHPOND, CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
4/1/19	0.00	0.00	0.00
4/2/19	0.00	0.00	0.00
4/3/19	0.37	0.02	0.09
4/4/19	0.00	0.00	0.00
4/5/19	0.07	0.00	0.04
4/6/19	0.16	0.01	0.10
4/7/19	0.00	0.00	0.00
4/8/19	0.41	0.02	0.17
4/9/19	0.08	0.00	0.10
4/10/19	0.00	0.00	0.00
4/11/19	0.00	0.00	0.00
4/12/19	0.05	0.00	0.06
4/13/19	0.37	0.02	0.13
4/14/19	0.00	0.00	0.00
4/15/19	0.82	0.03	0.81
4/16/19	0.00	0.00	0.00
4/17/19	0.00	0.00	0.00
4/18/19	0.00	0.00	0.00
4/19/19	0.00	0.00	0.00
4/20/19	0.23	0.01	0.25
4/21/19	0.04	0.00	0.04
4/22/19	2.13	0.09	0.63
4/23/19	0.21	0.01	0.27
4/24/19	0.12	0.01	0.15
4/25/19	0.00	0.00	0.00
4/26/19	0.68	0.03	0.62
4/27/19	0.87	0.04	0.59
4/28/19	0.00	0.00	0.00
4/29/19	0.00	0.00	0.00
4/30/19	0.15	0.01	0.06
Total	6.76		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS
 2019 DAILY RAINFALL DATA
 USGS METER AT FRESHPOND, CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
5/1/19	0.00	0.00	0.00
5/2/19	0.05	0.00	0.06
5/3/19	0.10	0.00	0.12
5/4/19	0.14	0.01	0.11
5/5/19	0.01	0.00	0.03
5/6/19	0.00	0.00	0.00
5/7/19	0.09	0.00	0.09
5/8/19	0.00	0.00	0.00
5/9/19	0.00	0.00	0.00
5/10/19	0.00	0.00	0.00
5/11/19	0.02	0.00	0.03
5/12/19	0.37	0.02	0.06
5/13/19	0.67	0.03	0.24
5/14/19	0.18	0.01	0.06
5/15/19	0.01	0.00	0.02
5/16/19	0.00	0.00	0.02
5/17/19	0.26	0.01	0.09
5/18/19	0.00	0.00	0.00
5/19/19	0.19	0.01	0.18
5/20/19	0.18	0.01	0.21
5/21/19	0.00	0.00	0.00
5/22/19	0.00	0.00	0.00
5/23/19	0.04	0.00	0.18
5/24/19	0.09	0.00	0.19
5/25/19	0.00	0.00	0.00
5/26/19	0.22	0.01	0.33
5/27/19	0.00	0.00	0.00
5/28/19	0.31	0.01	0.15
5/29/19	0.00	0.00	0.00
5/30/19	0.06	0.00	0.09
5/31/19	0.16	0.01	0.21
Total	3.15		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS
 2019 DAILY RAINFALL DATA
 USGS METER AT FRESHPOND, CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
6/1/19	0.00	0.00	0.00
6/2/19	0.02	0.00	0.06
6/3/19	0.06	0.00	0.06
6/4/19	0.00	0.00	0.00
6/5/19	0.01	0.00	0.02
6/6/19	0.12	0.01	0.12
6/7/19	0.00	0.00	0.00
6/8/19	0.00	0.00	0.00
6/9/19	0.00	0.00	0.00
6/10/19	0.02	0.00	0.07
6/11/19	0.69	0.03	0.41
6/12/19	0.00	0.00	0.00
6/13/19	0.65	0.03	0.24
6/14/19	0.00	0.00	0.00
6/15/19	0.00	0.00	0.00
6/16/19	0.05	0.00	0.03
6/17/19	0.00	0.00	0.01
6/18/19	0.03	0.00	0.03
6/19/19	0.00	0.00	0.00
6/20/19	0.16	0.01	0.21
6/21/19	0.30	0.01	0.30
6/22/19	0.01	0.00	0.02
6/23/19	0.00	0.00	0.00
6/24/19	0.00	0.00	0.00
6/25/19	0.04	0.00	0.03
6/26/19	0.00	0.00	0.00
6/27/19	0.00	0.00	0.00
6/28/19	0.00	0.00	0.00
6/29/19	0.31	0.01	0.35
6/30/19	0.15	0.01	0.27
Total	2.62		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS
 2019 DAILY RAINFALL DATA
 USGS METER AT FRESHPOND, CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
7/1/19	0.00	0.00	0.00
7/2/19	0.00	0.00	0.00
7/3/19	0.00	0.00	0.00
7/4/19	0.00	0.00	0.00
7/5/19	0.00	0.00	0.00
7/6/19	1.09	0.05	1.12
7/7/19	0.00	0.00	0.00
7/8/19	0.00	0.00	0.00
7/9/19	0.00	0.00	0.00
7/10/19	0.00	0.00	0.00
7/11/19	0.01	0.00	0.04
7/12/19	1.04	0.04	0.84
7/13/19	0.00	0.00	0.00
7/14/19	0.00	0.00	0.00
7/15/19	0.00	0.00	0.00
7/16/19	0.00	0.00	0.00
7/17/19	0.75	0.03	2.40
7/18/19	0.00	0.00	0.00
7/19/19	0.00	0.00	0.00
7/20/19	0.00	0.00	0.00
7/21/19	0.00	0.00	0.00
7/22/19	0.75	0.03	0.24
7/23/19	0.76	0.03	0.40
7/24/19	0.00	0.00	0.00
7/25/19	0.00	0.00	0.00
7/26/19	0.00	0.00	0.00
7/27/19	0.00	0.00	0.00
7/28/19	0.00	0.00	0.00
7/29/19	0.00	0.00	0.00
7/30/19	0.00	0.00	0.00
7/31/19	0.64	0.03	1.88
Total	5.04		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS
 2019 DAILY RAINFALL DATA
 USGS METER AT FRESHPOND, CAMBRIDGE, MA

8/1/19	0.00	0.00	0.00
8/2/19	0.00	0.00	0.00
8/3/19	0.00	0.00	0.00
8/4/19	0.00	0.00	0.00
8/5/19	0.00	0.00	0.00
8/6/19	0.00	0.00	0.00
8/7/19	2.44	0.10	2.44
8/8/19	0.55	0.02	1.56
8/9/19	0.00	0.00	0.00
8/10/19	0.00	0.00	0.00
8/11/19	0.00	0.00	0.00
8/12/19	0.00	0.00	0.00
8/13/19	0.00	0.00	0.00
8/14/19	0.00	0.00	0.00
8/15/19	0.00	0.00	0.00
8/16/19	0.00	0.00	0.00
8/17/19	0.00	0.00	0.00
8/18/19	0.01	0.00	0.04
8/19/19	0.00	0.00	0.00
8/20/19	0.00	0.00	0.00
8/21/19	0.10	0.00	0.16
8/22/19	0.00	0.00	0.00
8/23/19	0.02	0.00	0.04
8/24/19	0.00	0.00	0.00
8/25/19	0.00	0.00	0.00
8/26/19	0.00	0.00	0.00
8/27/19	0.00	0.00	0.00
8/28/19	1.35	0.06	1.20
8/29/19	0.02	0.00	0.04
8/30/19	0.00	0.00	0.00
8/31/19	0.00	0.00	0.00
Total	4.49		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS
 2019 DAILY RAINFALL DATA
 USGS METER AT FRESHPOND, CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
9/1/19	0.00	0.00	0.00
9/2/19	1.41	0.06	1.96
9/3/19	0.00	0.00	0.00
9/4/19	0.27	0.01	0.88
9/5/19	0.00	0.00	0.00
9/6/19	0.00	0.00	0.00
9/7/19	0.04	0.00	0.04
9/8/19	0.00	0.00	0.00
9/9/19	0.00	0.00	0.00
9/10/19	0.00	0.00	0.00
9/11/19	0.00	0.00	0.00
9/12/19	0.07	0.00	0.12
9/13/19	0.00	0.00	0.00
9/14/19	0.26	0.01	0.32
9/15/19	0.01	0.00	0.04
9/16/19	0.00	0.00	0.00
9/17/19	0.00	0.00	0.00
9/18/19	0.00	0.00	0.00
9/19/19	0.00	0.00	0.00
9/20/19	0.00	0.00	0.00
9/21/19	0.00	0.00	0.00
9/22/19	0.00	0.00	0.00
9/23/19	0.14	0.01	0.24
9/24/19	0.03	0.00	0.04
9/25/19	0.00	0.00	0.00
9/26/19	0.32	0.01	0.24
9/27/19	0.00	0.00	0.00
9/28/19	0.00	0.00	0.00
9/29/19	0.00	0.00	0.00
9/30/19	0.00	0.00	0.00
Total	2.55		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS
 2019 DAILY RAINFALL DATA
 USGS METER AT FRESHPOND, CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
10/1/19	0.03	0.00	0.08
10/2/19	0.22	0.01	0.16
10/3/19	0.04	0.00	0.04
10/4/19	0.07	0.00	0.08
10/5/19	0.00	0.00	0.00
10/6/19	0.00	0.00	0.00
10/7/19	0.19	0.01	0.16
10/8/19	0.02	0.00	0.04
10/9/19	0.04	0.00	0.04
10/10/19	0.04	0.00	0.04
10/11/19	0.44	0.02	0.16
10/12/19	0.04	0.00	0.04
10/13/19	0.00	0.00	0.00
10/14/19	0.00	0.00	0.00
10/15/19	0.00	0.00	0.00
10/16/19	0.68	0.03	0.32
10/17/19	0.71	0.03	0.96
10/18/19	0.00	0.00	0.00
10/19/19	0.00	0.00	0.00
10/20/19	0.00	0.00	0.00
10/21/19	0.00	0.00	0.00
10/22/19	0.09	0.00	0.08
10/23/19	0.37	0.02	0.44
10/24/19	0.00	0.00	0.00
10/25/19	0.00	0.00	0.00
10/26/19	0.00	0.00	0.00
10/27/19	1.21	0.05	0.40
10/28/19	0.05	0.00	0.04
10/29/19	0.03	0.00	0.04
10/30/19	0.04	0.00	0.04
10/31/19	0.17	0.01	0.12
Total	4.48		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS
 2019 DAILY RAINFALL DATA
 USGS METER AT FRESHPOND, CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
11/1/19	0.09	0.00	0.12
11/2/19	0.00	0.00	0.00
11/3/19	0.00	0.00	0.00
11/4/19	0.00	0.00	0.00
11/5/19	0.41	0.02	0.36
11/6/19	0.00	0.00	0.00
11/7/19	0.17	0.01	0.08
11/8/19	0.00	0.00	0.00
11/9/19	0.00	0.00	0.00
11/10/19	0.00	0.00	0.00
11/11/19	0.00	0.00	0.00
11/12/19	0.07	0.00	0.04
11/13/19	0.00	0.00	0.00
11/14/19	0.00	0.00	0.00
11/15/19	0.00	0.00	0.00
11/16/19	0.00	0.00	0.00
11/17/19	0.00	0.00	0.00
11/18/19	0.23	0.01	0.08
11/19/19	0.23	0.01	0.16
11/20/19	0.15	0.01	0.08
11/21/19	0.00	0.00	0.00
11/22/19	0.09	0.00	0.08
11/23/19	0.00	0.00	0.00
11/24/19	0.11	0.00	0.04
11/25/19	NA	NA	NA
11/26/19	NA	NA	NA
11/27/19	NA	NA	NA
11/28/19	NA	NA	NA
11/29/19	NA	NA	NA
11/30/19	NA	NA	NA
Total	1.55		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS

2019 DAILY RAINFALL DATA

DPW RAINFALL GAUGE (3.23.2019 – 12.18.2019), CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
3/1/19	NA	NA	NA
3/2/19	NA	NA	NA
3/3/19	NA	NA	NA
3/4/19	NA	NA	NA
3/5/19	NA	NA	NA
3/6/19	NA	NA	NA
3/7/19	NA	NA	NA
3/8/19	NA	NA	NA
3/9/19	NA	NA	NA
3/10/19	NA	NA	NA
3/11/19	NA	NA	NA
3/12/19	NA	NA	NA
3/13/19	NA	NA	NA
3/14/19	NA	NA	NA
3/15/19	NA	NA	NA
3/16/19	NA	NA	NA
3/17/19	NA	NA	NA
3/18/19	NA	NA	NA
3/19/19	NA	NA	NA
3/20/19	NA	NA	NA
3/21/19	NA	NA	NA
3/22/19	NA	NA	NA
3/23/19	0.06	0.00	0.05
3/24/19	0.00	0.00	0.00
3/25/19	0.00	0.00	0.00
3/26/19	0.00	0.00	0.00
3/27/19	0.00	0.00	0.00
3/28/19	0.00	0.00	0.00
3/29/19	0.03	0.00	0.03
3/30/19	0.00	0.00	0.00
3/31/19	0.13	0.01	0.08
Total	0.22		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS

2019 DAILY RAINFALL DATA

DPW RAINFALL GAUGE (3.23.2019 – 12.18.2019), CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
4/1/19	0.00	0.00	0.00
4/2/19	0.00	0.00	0.00
4/3/19	0.37	0.02	0.09
4/4/19	0.00	0.00	0.00
4/5/19	0.07	0.00	0.04
4/6/19	0.16	0.01	0.10
4/7/19	0.00	0.00	0.00
4/8/19	0.41	0.02	0.17
4/9/19	0.08	0.00	0.10
4/10/19	0.00	0.00	0.00
4/11/19	0.00	0.00	0.00
4/12/19	0.05	0.00	0.06
4/13/19	0.37	0.02	0.13
4/14/19	0.00	0.00	0.00
4/15/19	0.82	0.03	0.81
4/16/19	0.00	0.00	0.00
4/17/19	0.00	0.00	0.00
4/18/19	0.00	0.00	0.00
4/19/19	0.00	0.00	0.00
4/20/19	0.23	0.01	0.25
4/21/19	0.04	0.00	0.04
4/22/19	2.13	0.09	0.63
4/23/19	0.21	0.01	0.27
4/24/19	0.12	0.01	0.15
4/25/19	0.00	0.00	0.00
4/26/19	0.68	0.03	0.62
4/27/19	0.87	0.04	0.59
4/28/19	0.00	0.00	0.00
4/29/19	0.00	0.00	0.00
4/30/19	0.15	0.01	0.06
Total	6.76		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS

2019 DAILY RAINFALL DATA

DPW RAINFALL GAUGE (3.23.2019 – 12.18.2019), CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
5/1/19	0.00	0.00	0.00
5/2/19	0.05	0.00	0.06
5/3/19	0.10	0.00	0.12
5/4/19	0.14	0.01	0.11
5/5/19	0.01	0.00	0.03
5/6/19	0.00	0.00	0.00
5/7/19	0.09	0.00	0.09
5/8/19	0.00	0.00	0.00
5/9/19	0.00	0.00	0.00
5/10/19	0.00	0.00	0.00
5/11/19	0.02	0.00	0.03
5/12/19	0.37	0.02	0.06
5/13/19	0.67	0.03	0.24
5/14/19	0.18	0.01	0.06
5/15/19	0.01	0.00	0.02
5/16/19	0.00	0.00	0.02
5/17/19	0.26	0.01	0.09
5/18/19	0.00	0.00	0.00
5/19/19	0.19	0.01	0.18
5/20/19	0.18	0.01	0.21
5/21/19	0.00	0.00	0.00
5/22/19	0.00	0.00	0.00
5/23/19	0.04	0.00	0.18
5/24/19	0.09	0.00	0.19
5/25/19	0.00	0.00	0.00
5/26/19	0.22	0.01	0.33
5/27/19	0.00	0.00	0.00
5/28/19	0.31	0.01	0.15
5/29/19	0.00	0.00	0.00
5/30/19	0.06	0.00	0.09
5/31/19	0.16	0.01	0.21
Total	3.15		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS

2019 DAILY RAINFALL DATA

DPW RAINFALL GAUGE (3.23.2019 – 12.18.2019), CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
6/1/19	0.00	0.00	0.00
6/2/19	0.02	0.00	0.06
6/3/19	0.06	0.00	0.06
6/4/19	0.00	0.00	0.00
6/5/19	0.01	0.00	0.02
6/6/19	0.12	0.01	0.12
6/7/19	0.00	0.00	0.00
6/8/19	0.00	0.00	0.00
6/9/19	0.00	0.00	0.00
6/10/19	0.02	0.00	0.07
6/11/19	0.69	0.03	0.41
6/12/19	0.00	0.00	0.00
6/13/19	0.65	0.03	0.24
6/14/19	0.00	0.00	0.00
6/15/19	0.00	0.00	0.00
6/16/19	0.05	0.00	0.03
6/17/19	0.00	0.00	0.01
6/18/19	0.03	0.00	0.03
6/19/19	0.00	0.00	0.00
6/20/19	0.16	0.01	0.21
6/21/19	0.30	0.01	0.30
6/22/19	0.01	0.00	0.02
6/23/19	0.00	0.00	0.00
6/24/19	0.00	0.00	0.00
6/25/19	0.04	0.00	0.03
6/26/19	0.00	0.00	0.00
6/27/19	0.00	0.00	0.00
6/28/19	0.00	0.00	0.00
6/29/19	0.31	0.01	0.35
6/30/19	0.15	0.01	0.27
Total	2.62		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS

2019 DAILY RAINFALL DATA

DPW RAINFALL GAUGE (3.23.2019 – 12.18.2019), CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
7/1/19	0.01	0.00	0.02
7/2/19	0.00	0.00	0.00
7/3/19	0.00	0.00	0.00
7/4/19	0.00	0.00	0.00
7/5/19	0.00	0.00	0.00
7/6/19	0.00	0.00	0.00
7/7/19	0.00	0.00	0.00
7/8/19	0.00	0.00	0.00
7/9/19	0.00	0.00	0.00
7/10/19	0.00	0.00	0.00
7/11/19	0.00	0.00	0.00
7/12/19	0.00	0.00	0.00
7/13/19	0.00	0.00	0.00
7/14/19	0.00	0.00	0.00
7/15/19	0.00	0.00	0.00
7/16/19	0.00	0.00	0.00
7/17/19	0.64	0.03	1.59
7/18/19	0.15	0.01	0.25
7/19/19	0.00	0.00	0.00
7/20/19	0.00	0.00	0.00
7/21/19	0.00	0.00	0.00
7/22/19	0.93	0.04	0.40
7/23/19	0.96	0.04	0.50
7/24/19	0.00	0.00	0.00
7/25/19	0.00	0.00	0.00
7/26/19	0.00	0.00	0.00
7/27/19	0.00	0.00	0.00
7/28/19	0.00	0.00	0.00
7/29/19	0.00	0.00	0.00
7/30/19	0.00	0.00	0.00
7/31/19	0.31	0.01	0.53
Total	3.00		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS

2019 DAILY RAINFALL DATA

DPW RAINFALL GAUGE (3.23.2019 – 12.18.2019), CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
8/1/19	0.00	0.00	0.00
8/2/19	0.00	0.00	0.00
8/3/19	0.00	0.00	0.00
8/4/19	0.00	0.00	0.00
8/5/19	0.00	0.00	0.00
8/6/19	0.00	0.00	0.00
8/7/19	0.94	0.04	0.81
8/8/19	1.51	0.06	1.15
8/9/19	0.00	0.00	0.00
8/10/19	0.00	0.00	0.00
8/11/19	0.00	0.00	0.00
8/12/19	0.00	0.00	0.00
8/13/19	0.00	0.00	0.00
8/14/19	0.00	0.00	0.00
8/15/19	0.00	0.00	0.00
8/16/19	0.00	0.00	0.00
8/17/19	0.00	0.00	0.00
8/18/19	0.00	0.00	0.00
8/19/19	0.00	0.00	0.00
8/20/19	0.00	0.00	0.00
8/21/19	0.07	0.00	0.12
8/22/19	0.00	0.00	0.00
8/23/19	0.01	0.00	0.03
8/24/19	0.00	0.00	0.00
8/25/19	0.00	0.00	0.00
8/26/19	0.00	0.00	0.00
8/27/19	0.00	0.00	0.00
8/28/19	0.54	0.02	0.21
8/29/19	0.83	0.03	1.50
8/30/19	0.00	0.00	0.00
8/31/19	0.00	0.00	0.00
Total	3.90		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS
 2019 DAILY RAINFALL DATA
 DPW RAINFALL GAUGE (3.23.2019 – 12.18.2019), CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
9/1/19	0.00	0.00	0.00
9/2/19	1.38	0.06	1.91
9/3/19	0.01	0.00	0.03
9/4/19	0.35	0.01	0.75
9/5/19	0.00	0.00	0.00
9/6/19	0.00	0.00	0.00
9/7/19	0.04	0.00	0.03
9/8/19	0.00	0.00	0.00
9/9/19	0.00	0.00	0.00
9/10/19	0.00	0.00	0.00
9/11/19	0.00	0.00	0.00
9/12/19	0.05	0.00	0.06
9/13/19	0.00	0.00	0.00
9/14/19	0.28	0.01	0.23
9/15/19	0.02	0.00	0.02
9/16/19	0.00	0.00	0.00
9/17/19	0.00	0.00	0.00
9/18/19	0.00	0.00	0.00
9/19/19	0.00	0.00	0.00
9/20/19	0.00	0.00	0.00
9/21/19	0.00	0.00	0.00
9/22/19	0.00	0.00	0.00
9/23/19	0.04	0.00	0.15
9/24/19	0.12	0.01	0.17
9/25/19	0.00	0.00	0.00
9/26/19	0.31	0.01	0.21
9/27/19	0.00	0.00	0.00
9/28/19	0.00	0.00	0.00
9/29/19	0.00	0.00	0.00
9/30/19	0.00	0.00	0.00
Total	2.60		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS

2019 DAILY RAINFALL DATA

DPW RAINFALL GAUGE (3.23.2019 – 12.18.2019), CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
10/1/19	0.02	0.00	0.03
10/2/19	0.24	0.01	0.16
10/3/19	0.01	0.00	0.03
10/4/19	0.11	0.00	0.06
10/5/19	0.00	0.00	0.00
10/6/19	0.00	0.00	0.00
10/7/19	0.28	0.01	0.26
10/8/19	0.02	0.00	0.03
10/9/19	0.07	0.00	0.06
10/10/19	0.01	0.00	0.03
10/11/19	0.60	0.02	0.17
10/12/19	0.04	0.00	0.03
10/13/19	0.00	0.00	0.00
10/14/19	0.00	0.00	0.00
10/15/19	0.00	0.00	0.00
10/16/19	0.32	0.01	0.46
10/17/19	1.57	0.07	0.85
10/18/19	0.00	0.00	0.00
10/19/19	0.00	0.00	0.00
10/20/19	0.00	0.00	0.00
10/21/19	0.00	0.00	0.00
10/22/19	0.12	0.00	0.03
10/23/19	0.45	0.02	0.18
10/24/19	0.00	0.00	0.00
10/25/19	0.00	0.00	0.00
10/26/19	0.01	0.00	0.02
10/27/19	1.59	0.07	0.58
10/28/19	0.06	0.00	0.04
10/29/19	0.08	0.00	0.06
10/30/19	0.07	0.00	0.06
10/31/19	0.09	0.00	0.06
Total	5.76		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS

2019 DAILY RAINFALL DATA

DPW RAINFALL GAUGE (3.23.2019 – 12.18.2019), CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
11/1/19	0.08	0.00	0.06
11/2/19	0.00	0.00	0.00
11/3/19	0.00	0.00	0.00
11/4/19	0.00	0.00	0.00
11/5/19	0.42	0.02	0.30
11/6/19	0.00	0.00	0.00
11/7/19	0.30	0.01	0.12
11/8/19	0.00	0.00	0.02
11/9/19	0.00	0.00	0.00
11/10/19	0.00	0.00	0.00
11/11/19	0.00	0.00	0.00
11/12/19	0.09	0.00	0.05
11/13/19	0.00	0.00	0.00
11/14/19	0.00	0.00	0.00
11/15/19	0.00	0.00	0.00
11/16/19	0.00	0.00	0.00
11/17/19	0.00	0.00	0.00
11/18/19	0.27	0.01	0.09
11/19/19	0.25	0.01	0.14
11/20/19	0.21	0.01	0.06
11/21/19	0.00	0.00	0.00
11/22/19	0.08	0.00	0.06
11/23/19	0.00	0.00	0.00
11/24/19	1.46	0.06	0.90
11/25/19	0.00	0.00	0.00
11/26/19	0.00	0.00	0.00
11/27/19	0.17	0.01	0.15
11/28/19	0.10	0.00	0.06
11/29/19	0.00	0.00	0.00
11/30/19	0.00	0.00	0.00
Total	3.43		

CITY OF CAMBRIDGE DEPARTMENT OF PUBLIC WORKS

2019 DAILY RAINFALL DATA

DPW RAINFALL GAUGE (3.23.2019 – 12.18.2019), CAMBRIDGE, MA

Date	Daily Rainfall (in.)	Average Intensity (in/hr)	Maximum Intensity (in/hr)
12/1/19	0.13	0.01	0.11
12/2/19	1.22	0.05	0.18
12/3/19	0.00	0.00	0.00
12/4/19	0.09	0.00	0.03
12/5/19	0.12	0.00	0.06
12/6/19	0.00	0.00	0.00
12/7/19	0.00	0.00	0.00
12/8/19	0.00	0.00	0.00
12/9/19	0.48	0.02	0.20
12/10/19	0.18	0.01	0.06
12/11/19	0.08	0.00	0.05
12/12/19	0.00	0.00	0.00
12/13/19	0.16	0.01	0.06
12/14/19	1.39	0.06	0.27
12/15/19	0.00	0.00	0.00
12/16/19	0.00	0.00	0.00
12/17/19	0.02	0.00	0.03
12/18/19	0.01	0.00	0.02
12/19/19	NA	NA	NA
12/20/19	NA	NA	NA
12/21/19	NA	NA	NA
12/22/19	NA	NA	NA
12/23/19	NA	NA	NA
12/24/19	NA	NA	NA
12/25/19	NA	NA	NA
12/26/19	NA	NA	NA
12/27/19	NA	NA	NA
12/28/19	NA	NA	NA
12/29/19	NA	NA	NA
12/30/19	NA	NA	NA
31-Dec-19	NA	NA	NA
Total	4.75		

APPENDIX II

MONTHLY CSO VOLUMES

April 2019 Daily Rainfall and Combined Sewer Overflows

			Alewife Brook				Charles River		
April	Rain Gauges		CAM001	CAM002	CAM401A	CAM401B	CAM005	CAM007	CAM017
	Cambridge DPW	USGS Fresh Pond	Foch St. @Alewife Brook Pkwy.	Mass Ave. @ Alewife Brook Pkwy	Sherman St. @ B&M Railroad	Mass Ave./Columbus Ave. @ Alewife Brook Pkwy	Lowell St. @ Mt. Auburn St.	Memorial Dr. @ Hawthorne St.	Edwin Land Blvd. @ Binney St.
	(in)	(in)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)
4/1	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/2	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/3	0.37	0.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/4	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/5	0.07	0.07	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/6	0.16	0.15	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/7	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/8	0.41	0.41	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/9	0.08	0.07	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/10	0.00	0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/11	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/12	0.05	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/13	0.37	0.39	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/14	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/15	0.82	0.86	0.000	0.000	0.316	0.038	0.080	0.000	0.000
4/16	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/17	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/18	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/19	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/20	0.23	0.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/21	0.04	0.04	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/22	2.13	1.97	0.000	0.000	0.073	0.000	0.000	0.000	0.000
4/23	0.21	0.21	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/24	0.12	0.09	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/25	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/26	0.68	0.47	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/27	0.87	0.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/28	0.00	0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/29	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4/30	0.15	0.12	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	6.76	5.97	0.000	0.000	0.389	0.038	0.080	0.000	0.000

June 2019 Daily Rainfall and Combined Sewer Overflows

			Alewife Brook				Charles River		
June	Rain Gauges		CAM001	CAM002	CAM401A	CAM401B	CAM005	CAM007	CAM017
	Cambridge DPW	USGS Fresh Pond	Foch St. @Alewife Brook Pkwy.	Mass Ave. @ Alewife Brook Pkwy	Sherman St. @ B&M Railroad	Mass Ave./Columbus Ave. @ Alewife Brook Pkwy	Lowell St. @ Mt. Auburn St.	Memorial Dr. @ Hawthorne St.	Edwin Land Blvd. @ Binney St.
	(in)	(in)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)
6/1	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/2	0.02	0.04	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/3	0.06	0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/4	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/5	0.01	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/6	0.12	0.17	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/7	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/8	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/9	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/10	0.02	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/11	0.69	0.73	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/12	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/13	0.65	0.51	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/14	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/15	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/16	0.05	0.21	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/17	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/18	0.03	0.12	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/19	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/20	0.16	0.47	0.000	0.000	0.025	0.000	0.000	0.000	0.000
6/21	0.30	0.55	0.000	0.000	0.033	0.000	0.000	0.000	0.000
6/22	0.01	0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/23	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/24	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/25	0.04	0.50	0.000	0.000	0.022	0.000	0.000	0.000	0.000
6/26	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/27	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/28	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/29	0.31	0.62	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6/30	0.15	0.14	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	2.62	4.08	0.000	0.000	0.080	0.000	0.000	0.000	0.000

July 2019 Daily Rainfall and Combined Sewer Overflows

			Alewife Brook				Charles River		
July	Rain Gauges		CAM001	CAM002	CAM401A	CAM401B	CAM005	CAM007	CAM017
	Cambridge DPW	USGS Fresh Pond	Foch St. @Alewife Brook Pkwy.	Mass Ave. @ Alewife Brook Pkwy	Sherman St. @ B&M Railroad	Mass Ave./Columbus Ave. @ Alewife Brook Pkwy	Lowell St. @ Mt. Auburn St.	Memorial Dr. @ Hawthorne St.	Edwin Land Blvd. @ Binney St.
	(in)	(in)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)
7/1	0.01	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/2	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/3	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/4	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/5	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/6	0.00	1.09	0.000	0.000	0.516	0.106	0.084	0.000	0.000
7/7	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/8	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/9	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/10	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/11	0.00	0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/12	0.00	1.04	0.000	0.000	0.021	0.000	0.000	0.000	0.000
7/13	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/14	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/15	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/16	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/17	0.64	0.75	0.000	0.000	0.309	0.013	0.008	0.000	0.000
7/18	0.15	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/19	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/21	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/22	0.93	0.75	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/23	0.96	0.76	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/24	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/25	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/26	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/27	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/28	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/29	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/30	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7/31	0.31	0.64	0.000	0.000	0.238	0.000	0.063	0.000	0.000
Total	3.00	5.04	0.000	0.000	1.084	0.119	0.155	0.000	0.000

August 2019 Daily Rainfall and Combined Sewer Overflows

			Alewife Brook				Charles River		
August	Rain Gauges		CAM001	CAM002	CAM401A	CAM401B	CAM005	CAM007	CAM017
	Cambridge DPW	USGS Fresh Pond	Foch St. @Alewife Brook Pkwy.	Mass Ave. @ Alewife Brook Pkwy	Sherman St. @ B&M Railroad	Mass Ave./Columbus Ave. @ Alewife Brook Pkwy	Lowell St. @ Mt. Auburn St.	Memorial Dr. @ Hawthorne St.	Edwin Land Blvd. @ Binney St.
	(in)	(in)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)
8/1	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/2	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/3	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/4	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/5	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/6	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/7	0.94	2.44	0.295	0.000	3.699	1.525	2.394	2.779	0.000
8/8	1.51	0.55	0.000	0.126	0.000	0.000	0.000	0.000	3.213
8/9	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/10	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/11	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/12	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/13	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/14	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/15	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/16	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/17	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/18	0.00	0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/19	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/21	0.07	0.10	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/22	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/23	0.01	0.02	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/24	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/25	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/26	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/27	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/28	0.54	1.35	0.000	0.000	0.337	0.000	0.000	0.000	0.000
8/29	0.83	0.02	0.000	0.000	0.000	0.004	0.017	0.000	0.000
8/30	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8/31	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	3.90	4.49	0.295	0.126	4.036	1.529	2.394	2.779	3.213

September 2019 Daily Rainfall and Combined Sewer Overflows

		Alewife Brook					Charles River		
September	Rain Gauges		CAM001	CAM002	CAM401A	CAM401B	CAM005	CAM007	CAM017
	Cambridge DPW	USGS Fresh Pond	Foch St. @Alewife Brook Pkwy.	Mass Ave. @ Alewife Brook Pkwy	Sherman St. @ B&M Railroad	Mass Ave./Columbus Ave. @ Alewife Brook Pkwy	Lowell St. @ Mt. Auburn St.	Memorial Dr. @ Hawthorne St.	Edwin Land Blvd. @ Binney St.
	(in)	(in)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)
9/1	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/2	1.38	1.41	0.087	0.029	1.620	0.483	0.740	0.087	1.145
9/3	0.01	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/4	0.35	0.27	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/5	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/6	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/7	0.04	0.04	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/8	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/9	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/10	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/11	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/12	0.05	0.07	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/13	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/14	0.28	0.26	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/15	0.02	0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/16	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/17	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/18	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/19	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/21	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/22	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/23	0.04	0.14	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/24	0.12	0.03	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/25	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/26	0.31	0.32	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/27	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/28	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/29	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9/30	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	2.60	2.55	0.087	0.029	1.620	0.483	0.740	0.087	1.145

October 2019 Daily Rainfall and Combined Sewer Overflows

			Alewife Brook				Charles River		
October	Rain Gauges		CAM001	CAM002	CAM401A	CAM401B	CAM005	CAM007	CAM017
	Cambridge DPW	USGS Fresh Pond	Foch St. @Alewife Brook Pkwy.	Mass Ave. @ Alewife Brook Pkwy	Sherman St. @ B&M Railroad	Mass Ave./Columbus Ave. @ Alewife Brook Pkwy	Lowell St. @ Mt. Auburn St.	Memorial Dr. @ Hawthorne St.	Edwin Land Blvd. @ Binney St.
	(in)	(in)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)
10/1	0.02	0.03	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/2	0.24	0.22	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/3	0.01	0.04	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/4	0.11	0.07	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/5	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/6	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/7	0.28	0.19	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/8	0.02	0.02	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/9	0.07	0.04	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/10	0.01	0.04	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/11	0.60	0.44	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/12	0.04	0.04	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/13	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/14	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/15	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/16	0.32	0.68	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/17	1.57	0.71	0.000	0.000	0.524	0.092	0.047	0.000	0.540
10/18	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/19	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/21	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/22	0.12	0.09	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/23	0.45	0.37	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/24	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/25	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/26	0.01	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/27	1.59	1.21	0.000	0.000	0.011	0.000	0.000	0.000	0.000
10/28	0.06	0.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/29	0.08	0.03	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/30	0.07	0.04	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10/31	0.09	0.17	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	5.76	4.48	0.000	0.000	0.535	0.092	0.047	0.000	0.540

APPENDIX III
CSO NOTIFICATIONS



Notice Alert: CSO Activation in Alewife Brook

TO: Patrick Herron, Executive Director, Mystic River Watershed Association
Sam Lipson, Director, Environmental Health Unit, Cambridge Dept. of Public Health
Christine Connolly Bongiorno, Director, Arlington Department of Public Health
Angela Braun, Director, Belmont Department of Public Health
Kevin Brander, Department of Environmental Protection
Todd Borci, United States Environmental Protection Agency
William Walsh-Rogalski, United States Environmental Protection Agency

FROM: James Wilcox, Cambridge DPW

CC: City of Somerville - Richard Willette, DPW Director of Operations; Vithal Deshpande, Env. Coord.

Friends of Alewife Reservation – Ellen Mass
MWRA – Ria Convery, David Parker, David Wu, Nicole Johnson, Wenley Jiang, Wendy Leo, Maret
Smolow, Nadine Smoske, Mark Sullivan
Representative Denise Provost
Mystic River Watershed Association – Beth MacBlane, Kim Provo
Town of Arlington – Michael Rademacher, DPW Director
Town of Belmont – Glenn Clancy, Director Department of Community Development
City of Cambridge Department of Public Works – Owen O’Riordan, Kathy Watkins, James Wilcox,
Catherine Daly Woodbury, Jeya Niranjana, Brian McLane, Rebecca Fuentes, Kate Riley, Wendy Robinson, Dan Riviello, Mike Abcunas, Catherine Mitrano

RE: **Notice Alert: CSO Activation in Alewife Brook**

DATE: August 29, 2019

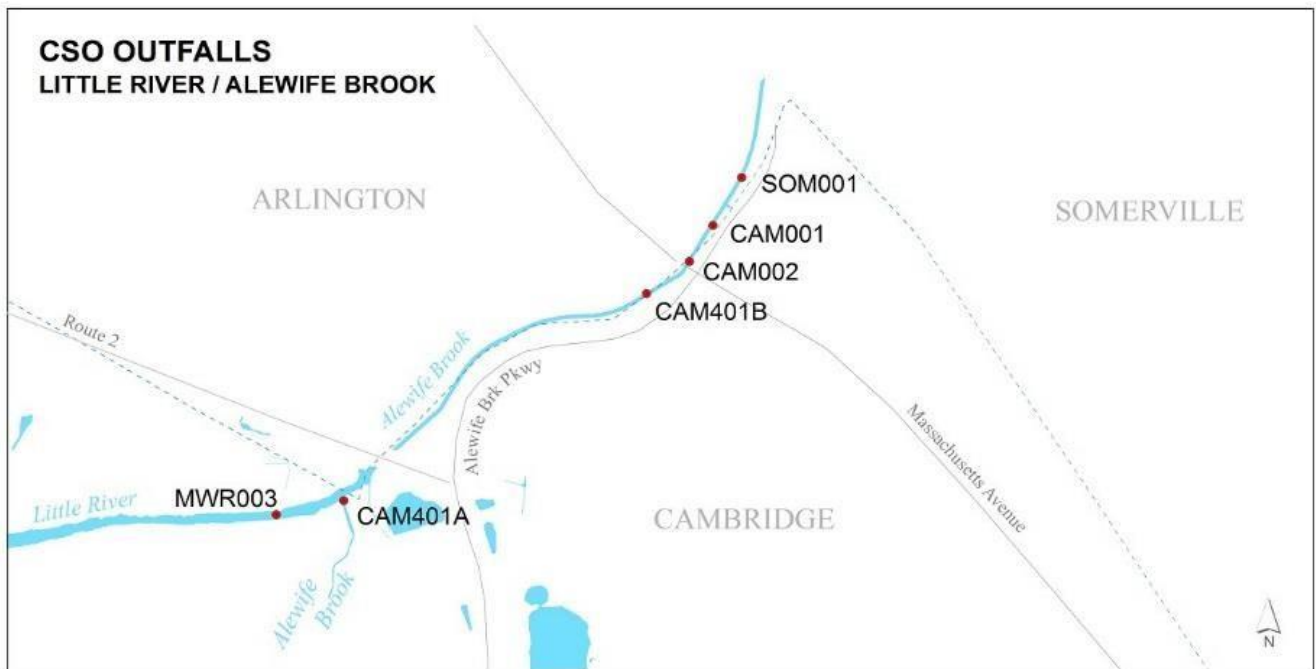
In accordance with the conditions of the Department of Environmental Protection's (DEP) Alewife Brook/Upper Mystic River Variance we are hereby notifying you that a Combined Sewer Overflow (CSO) occurred at CAM401B on August 29, 2019 and discharged into the Alewife Brook. The Variance approved workplan requires the Cambridge Department of Public Works (DPW) to notify local health agents, DEP, EPA and MRWA within 24 hours of when a CSO event occurs. This notification does not reflect the absence of any activation at other sites. Rather, the notice is intended to be confirmation to users of the resource that untreated sewage discharges to the Brook/River have occurred.

The water quality in Alewife Brook is often impaired due to bacterial and other pollutants from a number of sources, including stormwater runoff, CSOs and cross connections between sanitary sewers and stormwater drains. Water quality in the brook during both wet and dry weather generally fails to meet state bacteria standards for fishing and swimming. Contaminant sources originate in the watershed communities of Belmont, Arlington, Cambridge and Somerville, all of which are undertaking programs to identify and control the sources of pollution to the brook.

Portions of Cambridge and Somerville are served by combined stormwater and sanitary sewer systems, common in older cities. There are six CSO outfalls on Alewife Brook (see the attached map for locations) which discharge untreated CSO (a mixture of wastewater and stormwater) during moderate and heavy

rainfall to relieve the system and prevent sewer backups into homes, businesses, and streets. In addition, bordering communities also have separate drainage pipes that collect stormwater runoff and carry it to the brook. Discharges from CSOs and from separate stormwater pipes include bacteria and other pathogens, oxygen-demanding pollutants, solids and other contaminants. Public health officials recommend avoiding contact with the brook during and for 48 hours following rain storms, as there may be increased health risks during these periods. Contact with floodwaters should also be avoided as they may contain similar contaminants and pose associated health risks. Clean up information following a flood is available on the MA Department of Environmental Protection web site at: <http://www.mass.gov/dep/floodcleanup.htm> For real-time water data at Fresh Pond Reservoir, you can view the United States Geological Survey National Water System website at: <http://waterdata.usgs.gov/ma/nwis> Please contact Catherine Daly Woodbury at 617-349-4818 or James Wilcox at 617-349-6426 if you have any questions.

CSO Outfalls along the Little River/Alewife Brook





Notice Alert: CSO Activation in Alewife Brook

**TO: Patrick Herron, Executive Director, Mystic River Watershed Association
Sam Lipson, Director, Environmental Health Unit, Cambridge Dept. of Public Health
Christine Connolly Bongiorno, Director, Arlington Department of Public Health
Angela Braun, Director, Belmont Department of Public Health
Kevin Brander, Department of Environmental Protection
Todd Borci, United States Environmental Protection Agency
William Walsh-Rogalski, United States Environmental Protection Agency**

FROM: James Wilcox, Cambridge DPW

CC: City of Somerville - Richard Willette, DPW Director of Operations; Vithal Deshpande, Env. Coord.

**Friends of Alewife Reservation – Ellen Mass
MWRA – Ria Convery, David Parker, David Wu, Nicole Johnson, Wenley Jiang, Wendy Leo, Maret
Smolow, Nadine Smoske, Mark Sullivan
Representative Denise Provost
Mystic River Watershed Association – Beth MacBlane, Kim Provo
Town of Arlington – Michael Rademacher, DPW Director
Town of Belmont – Glenn Clancy, Director Department of Community Development
City of Cambridge Department of Public Works – Owen O’Riordan, Kathy Watkins, James Wilcox,
Catherine Daly Woodbury, Jeya Niranjana, Brian McLane, Rebecca Fuentes, Kate Riley, Wendy Robinson, Dan Riviello, Mike Abcunas, Catherine Mitrano**

RE: Notice Alert: CSO Activation in Alewife Brook

DATE: September 2, 2019

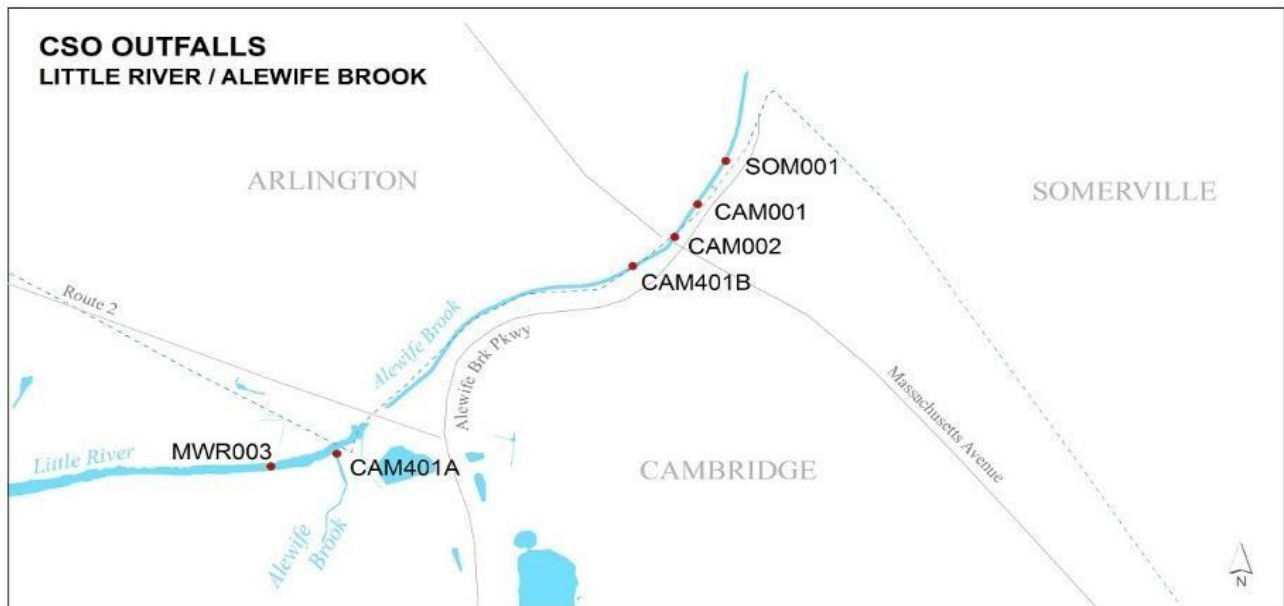
In accordance with the conditions of the Department of Environmental Protection's (DEP) Alewife Brook/Upper Mystic River Variance we are hereby notifying you that a Combined Sewer Overflow (CSO) occurred at CAM401B on September 2, 2019 and discharged into the Alewife Brook. The Variance approved workplan requires the Cambridge Department of Public Works (DPW) to notify local health agents, DEP, EPA and MRWA within 24 hours of when a CSO event occurs. This notification does not reflect the absence of any activation at other sites. Rather, the notice is intended to be confirmation to users of the resource that untreated sewage discharges to the Brook/River have occurred.

The water quality in Alewife Brook is often impaired due to bacterial and other pollutants from a number of sources, including stormwater runoff, CSOs and cross connections between sanitary sewers and stormwater drains. Water quality in the brook during both wet and dry weather generally fails to meet state bacteria standards for fishing and swimming. Contaminant sources originate in the watershed communities of Belmont, Arlington, Cambridge and Somerville, all of which are undertaking programs to identify and control the sources of pollution to the brook.

Portions of Cambridge and Somerville are served by combined stormwater and sanitary sewer systems, common in older cities. There are six CSO outfalls on Alewife Brook (see the attached map for locations) which discharge untreated CSO (a mixture of wastewater and stormwater) during moderate and heavy

rainfall to relieve the system and prevent sewer backups into homes, businesses, and streets. In addition, bordering communities also have separate drainage pipes that collect stormwater runoff and carry it to the brook. Discharges from CSOs and from separate stormwater pipes include bacteria and other pathogens, oxygen-demanding pollutants, solids and other contaminants. Public health officials recommend avoiding contact with the brook during and for 48 hours following rain storms, as there may be increased health risks during these periods. Contact with floodwaters should also be avoided as they may contain similar contaminants and pose associated health risks. Clean up information following a flood is available on the MA Department of Environmental Protection web site at: <http://www.mass.gov/dep/floodcleanup.htm> For real-time water data at Fresh Pond Reservoir, you can view the United States Geological Survey National Water System website at: <http://waterdata.usgs.gov/ma/nwis> Please contact Catherine Daly Woodbury at 617-349-4818 or James Wilcox at 617-349-6426 if you have any questions.

CSO Outfalls along the Little River/Alewife Brook





Notice Alert: CSO Activation in Alewife Brook

DATE: October 17, 2019

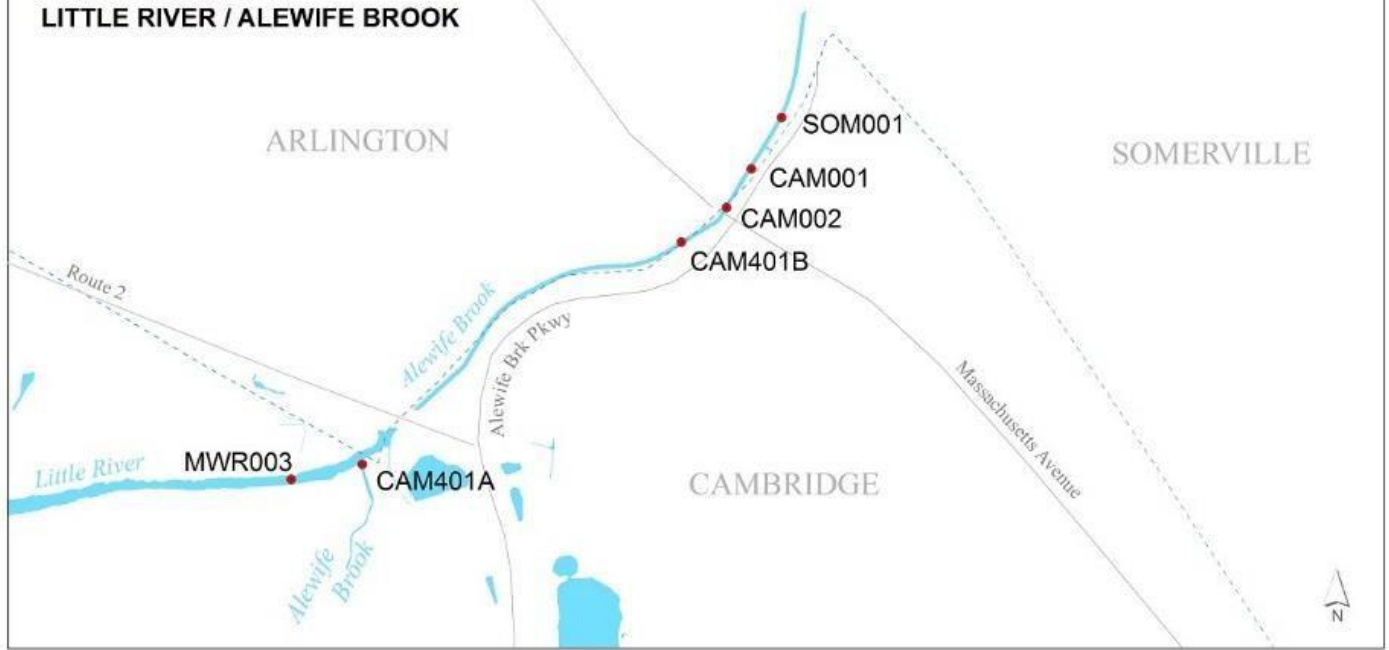
In accordance with the conditions of the Department of Environmental Protection's (DEP) Alewife Brook/Upper Mystic River Variance we are hereby notifying you that a Combined Sewer Overflow (CSO) occurred at **CAM401B** on **October 17, 2019** and discharged into the Alewife Brook. The Variance approved workplan requires the Cambridge Department of Public Works (DPW) to notify local health agents, DEP, EPA and MRWA within 24 hours of when a CSO event occurs. This notification does not reflect the absence of any activation at other sites. Rather, the notice is intended to be confirmation to users of the resource that untreated sewage discharges to the Brook/River have occurred.

The water quality in Alewife Brook is often impaired due to bacterial and other pollutants from a number of sources, including stormwater runoff, CSOs and cross connections between sanitary sewers and stormwater drains. Water quality in the brook during both wet and dry weather generally fails to meet state bacteria standards for fishing and swimming. Contaminant sources originate in the watershed communities of Belmont, Arlington, Cambridge and Somerville, all of which are undertaking programs to identify and control the sources of pollution to the brook.

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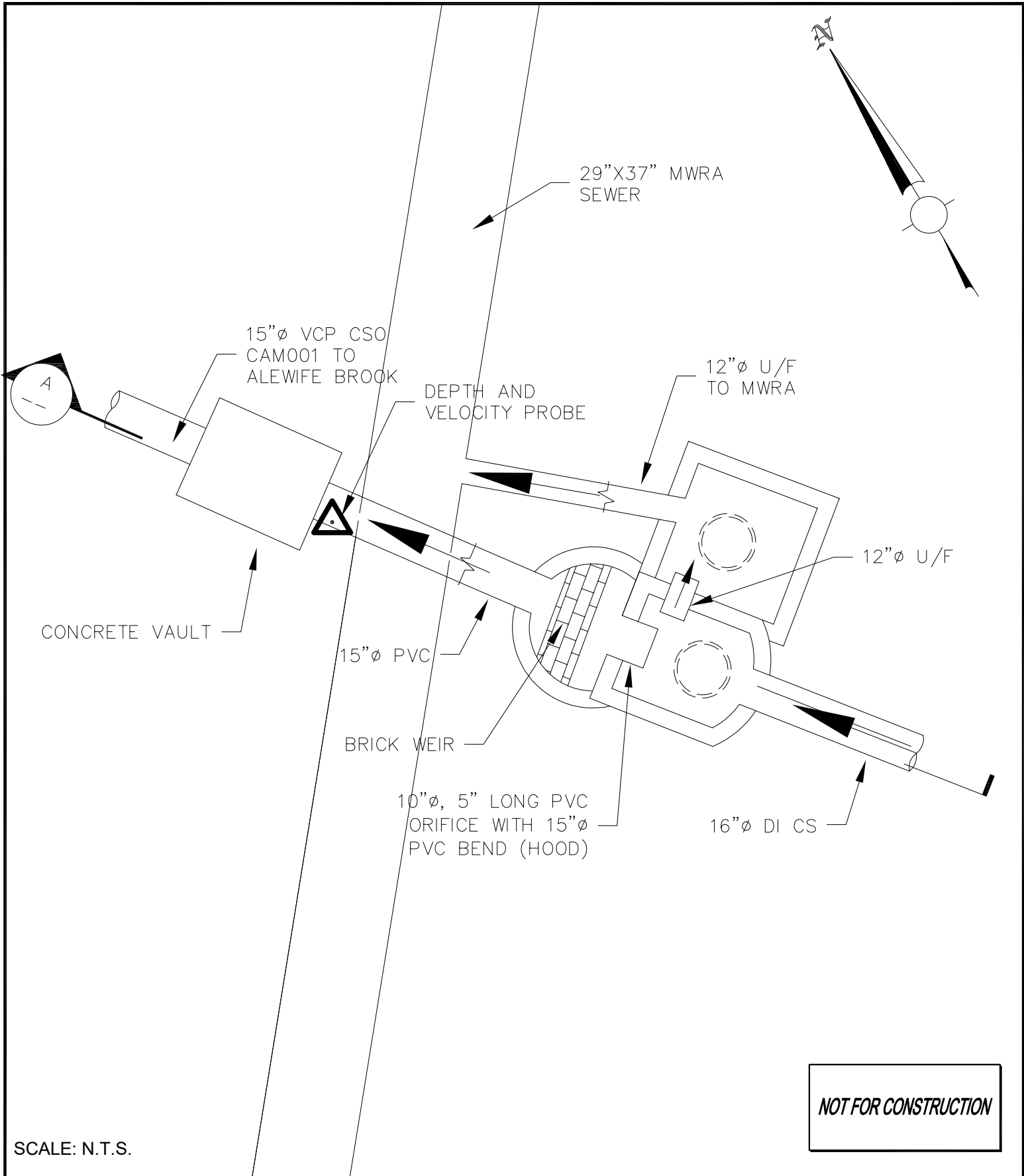
CSO Outfalls along the Little River/Alewife Brook

CSO OUTFALLS
LITTLE RIVER / ALEWIFE BROOK



APPENDIX IV

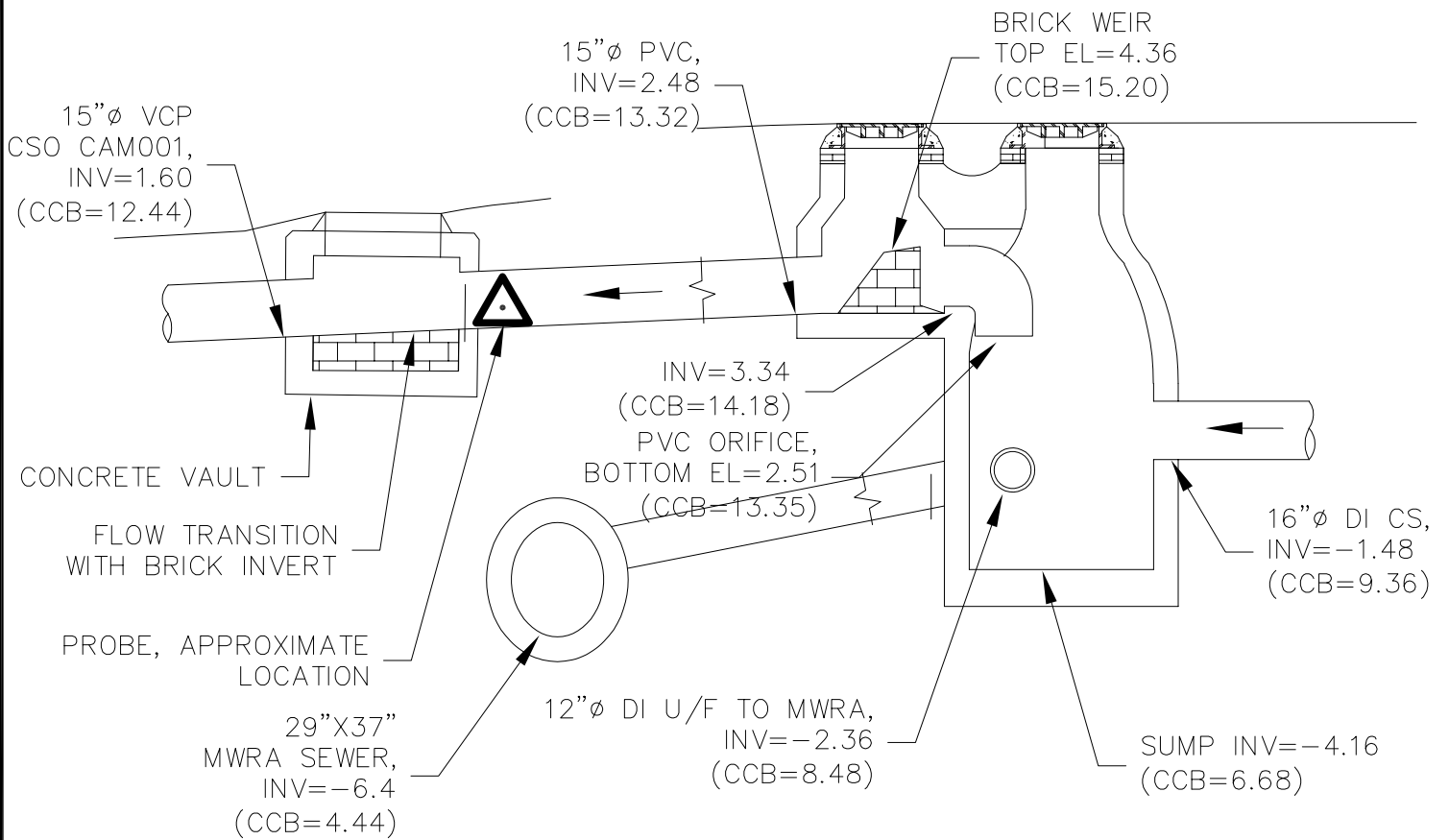
CSO Regulator Structure Profiles



SCALE: N.T.S.

NOT FOR CONSTRUCTION

**CSO REGULATOR STRUCTURE
CAM001 PLAN**



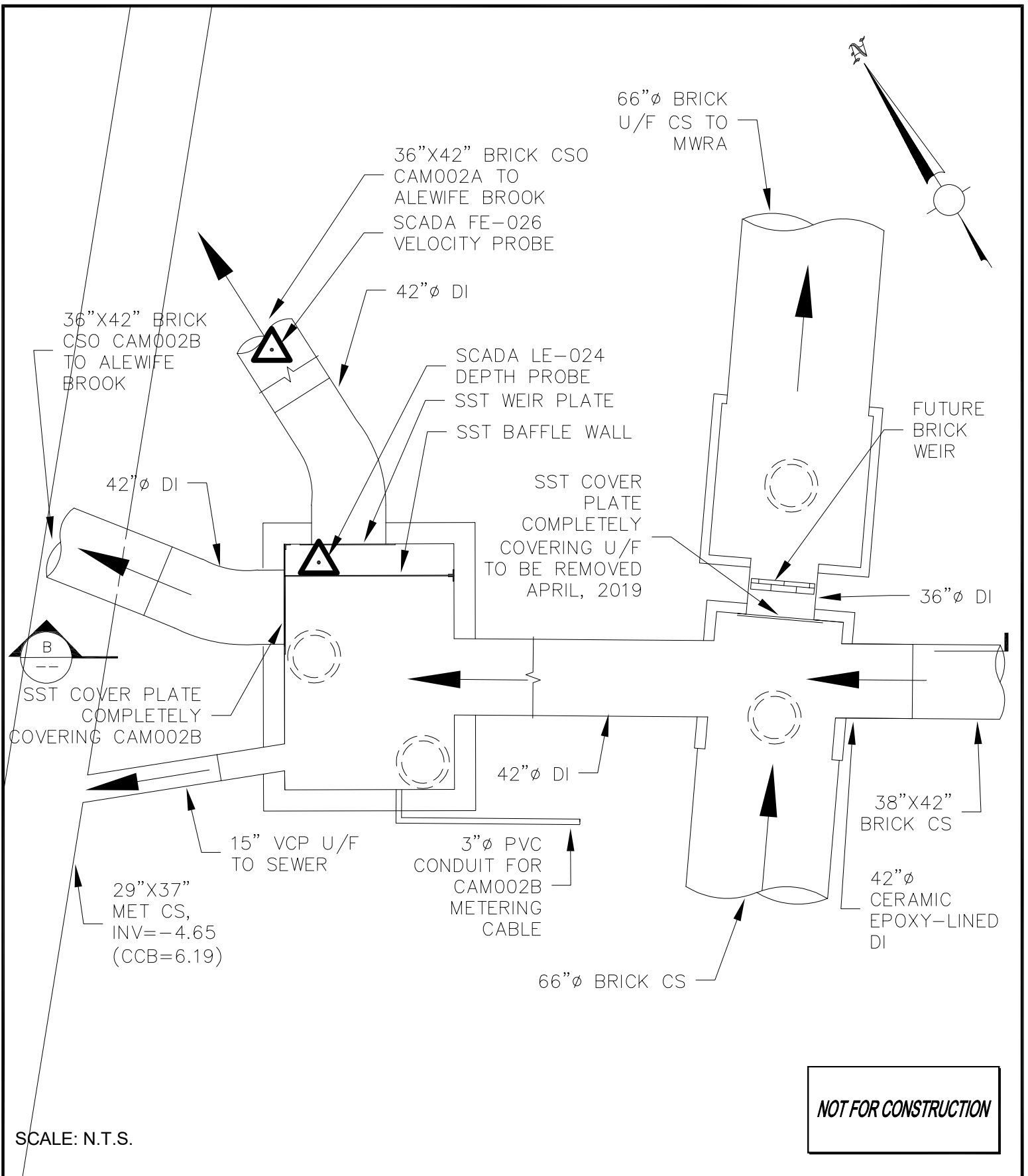
SECTION



NOT FOR CONSTRUCTION

SCALE: N.T.S.

CSO REGULATOR STRUCTURE CAM001 PROFILE



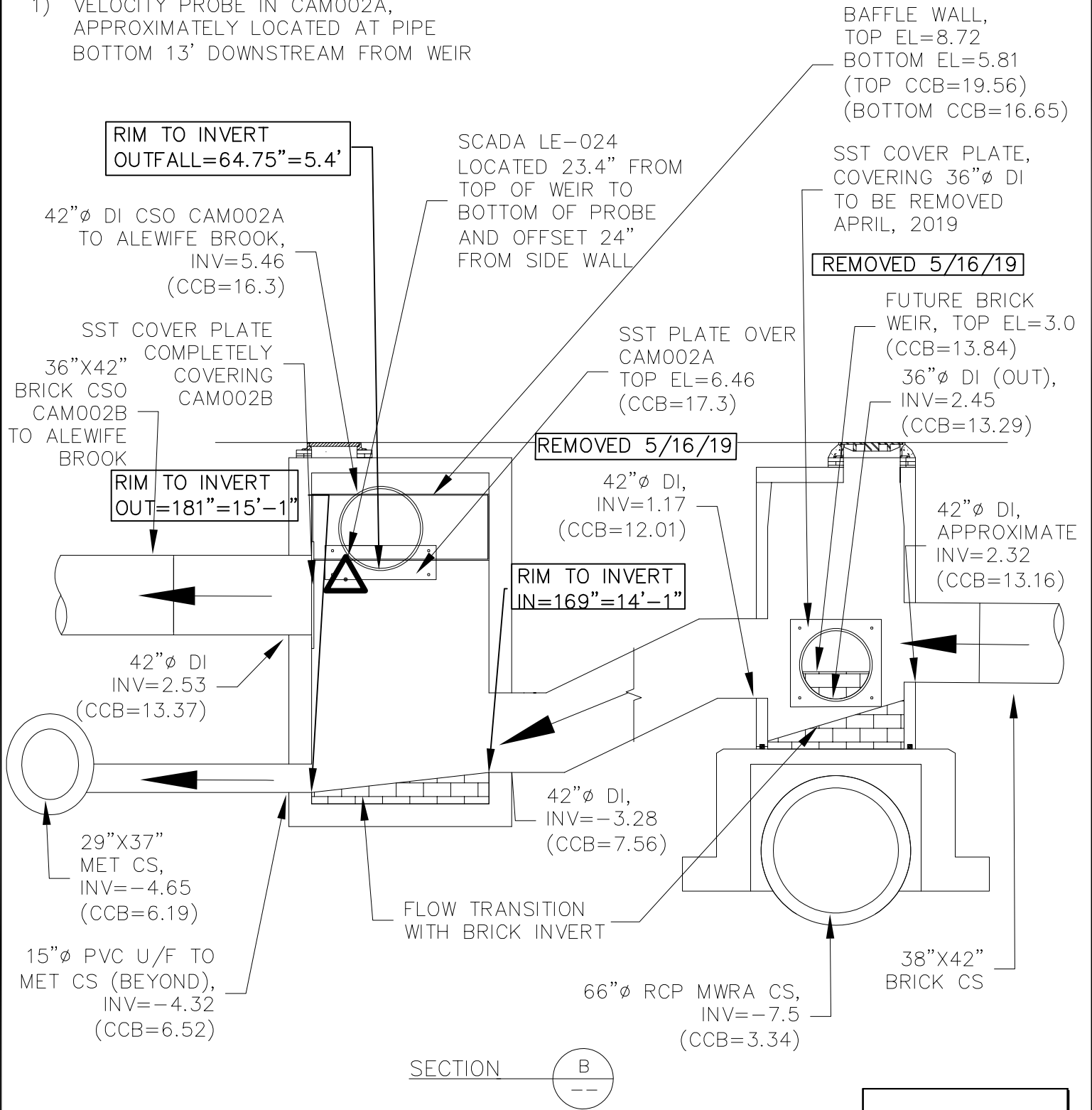
SCALE: N.T.S.

NOT FOR CONSTRUCTION

CSO REGULATOR STRUCTURE CAM002 PLAN

NOTES:

- 1) VELOCITY PROBE IN CAM002A, APPROXIMATELY LOCATED AT PIPE BOTTOM 13' DOWNSTREAM FROM WEIR

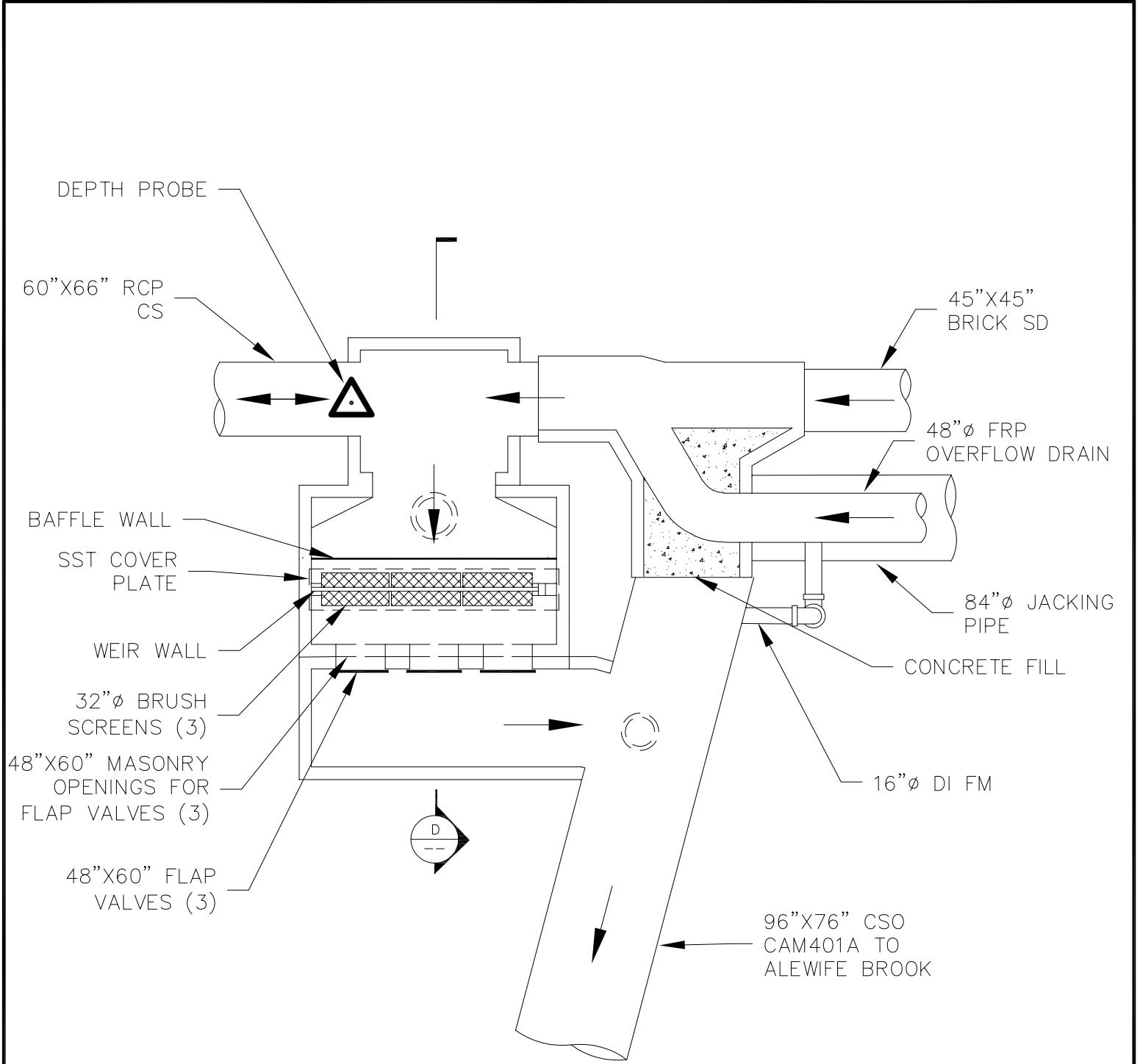


NOT FOR CONSTRUCTION

SCALE: N.T.S.



**CSO REGULATOR STRUCTURE
CAM002 PROFILE**



DEPTH PROBE

60"X66" RCP
CS

45"X45"
BRICK SD

48"Ø FRP
OVERFLOW DRAIN

BAFFLE WALL

SST COVER
PLATE

84"Ø JACKING
PIPE

WEIR WALL

CONCRETE FILL

32"Ø BRUSH
SCREENS (3)

48"X60" MASONRY
OPENINGS FOR
FLAP VALVES (3)

16"Ø DI FM

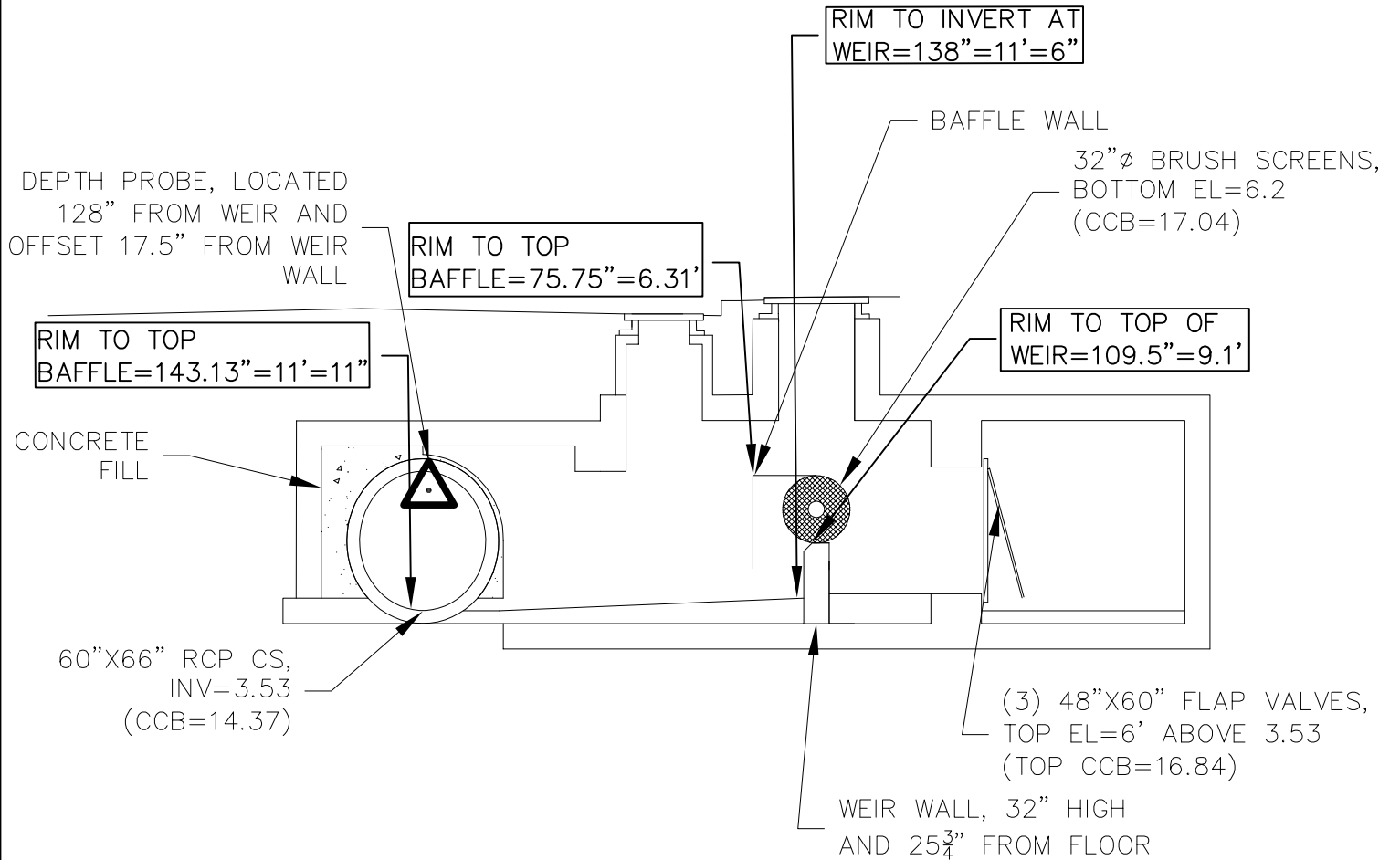
48"X60" FLAP
VALVES (3)

96"X76" CSO
CAM401A TO
ALEWIFE BROOK

NOT FOR CONSTRUCTION

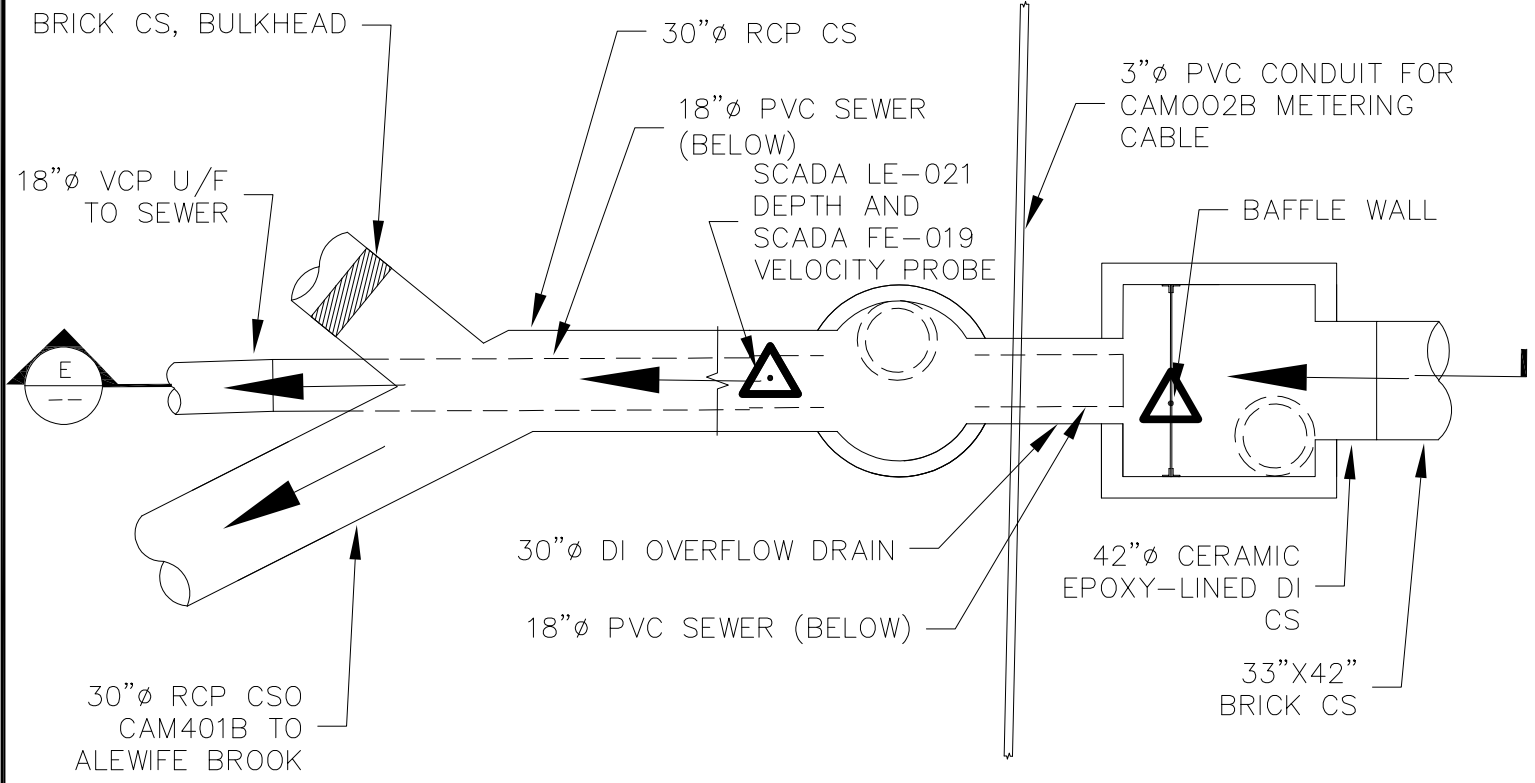
SCALE: N.T.S.

**CSO REGULATOR STRUCTURE
CAM0401A PLAN**



NOT FOR CONSTRUCTION

**CSO REGULATOR STRUCTURE
CAM401A PROFILE**



BRICK CS, BULKHEAD

18" VCP U/F TO SEWER

30" RCP CS

18" PVC SEWER (BELOW)

SCADA LE-021 DEPTH AND SCADA FE-019 VELOCITY PROBE

3" PVC CONDUIT FOR CAM002B METERING CABLE

BAFFLE WALL

30" DI OVERFLOW DRAIN

18" PVC SEWER (BELOW)

42" CERAMIC EPOXY-LINED DI CS

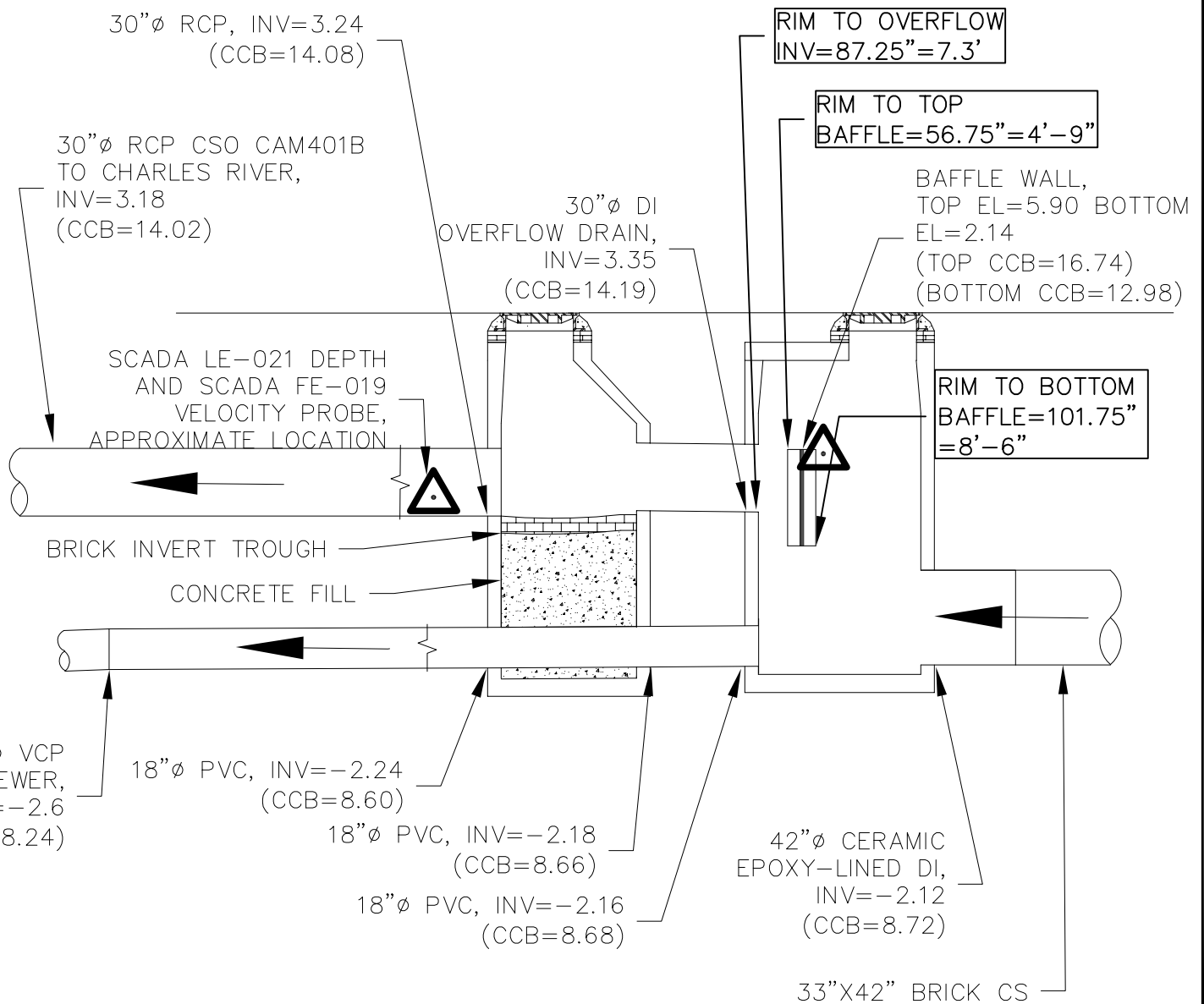
33"X42" BRICK CS

30" RCP CSO CAM401B TO ALEWIFE BROOK

SCALE: N.T.S.

NOT FOR CONSTRUCTION

CSO REGULATOR STRUCTURE CAM401B PLAN

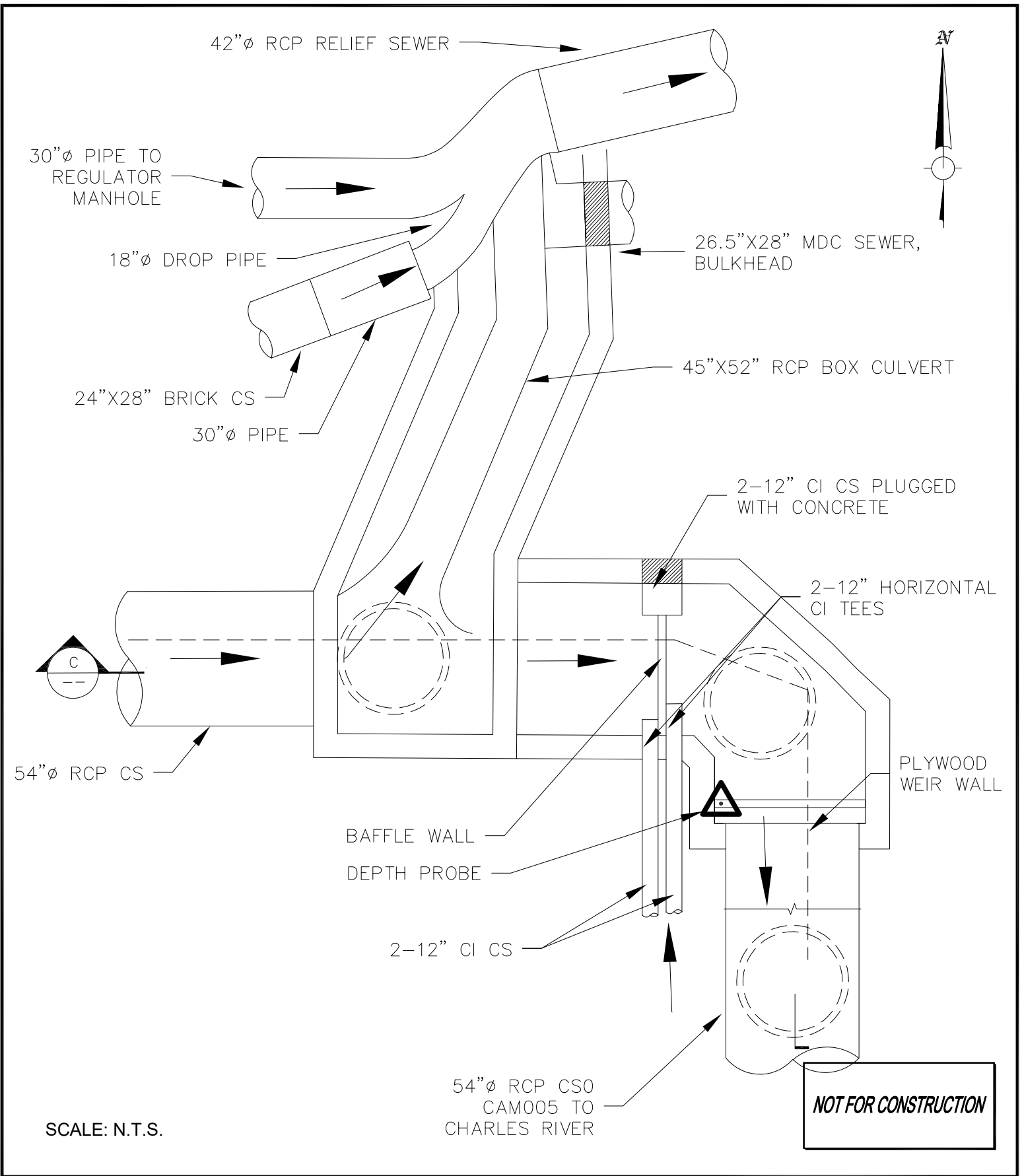


SECTION 

NOT FOR CONSTRUCTION

SCALE: N.T.S.

**CSO REGULATOR STRUCTURE
CAM401B PROFILE**



CSO REGULATOR STRUCTURE CAM005 PLAN

MH"A"RIM EL=
122.67" (MDC)

RIM TO WEIR TOP
MH"A"=171.25"=14.27'

RIM TO INVERT
MH"H'=211.75"=17'-8"

BAFFLE WALL,
BOTTOM EL=13.22
(CCB=24.06)

PLYWOOD WEIR WALL,
TOP EL=14.82*
BOTTOM EL=10.94*
(TOP CCB=25.66)
(BOTTOM CCB=21.78)

DEPTH PROBE,
LOCATED ON
WEIR WALL,
23.2" BELOW
TOP OF WEIR
WALL AND 5"
FROM WALL OF
CAM005

52"X45"RCP
BOX CULVERT

54"Ø RCP CS,
INV=10.94*
(CCB= 21.78)

54"Ø RCP CS,
INV=10.94*
(CCB=21.78)

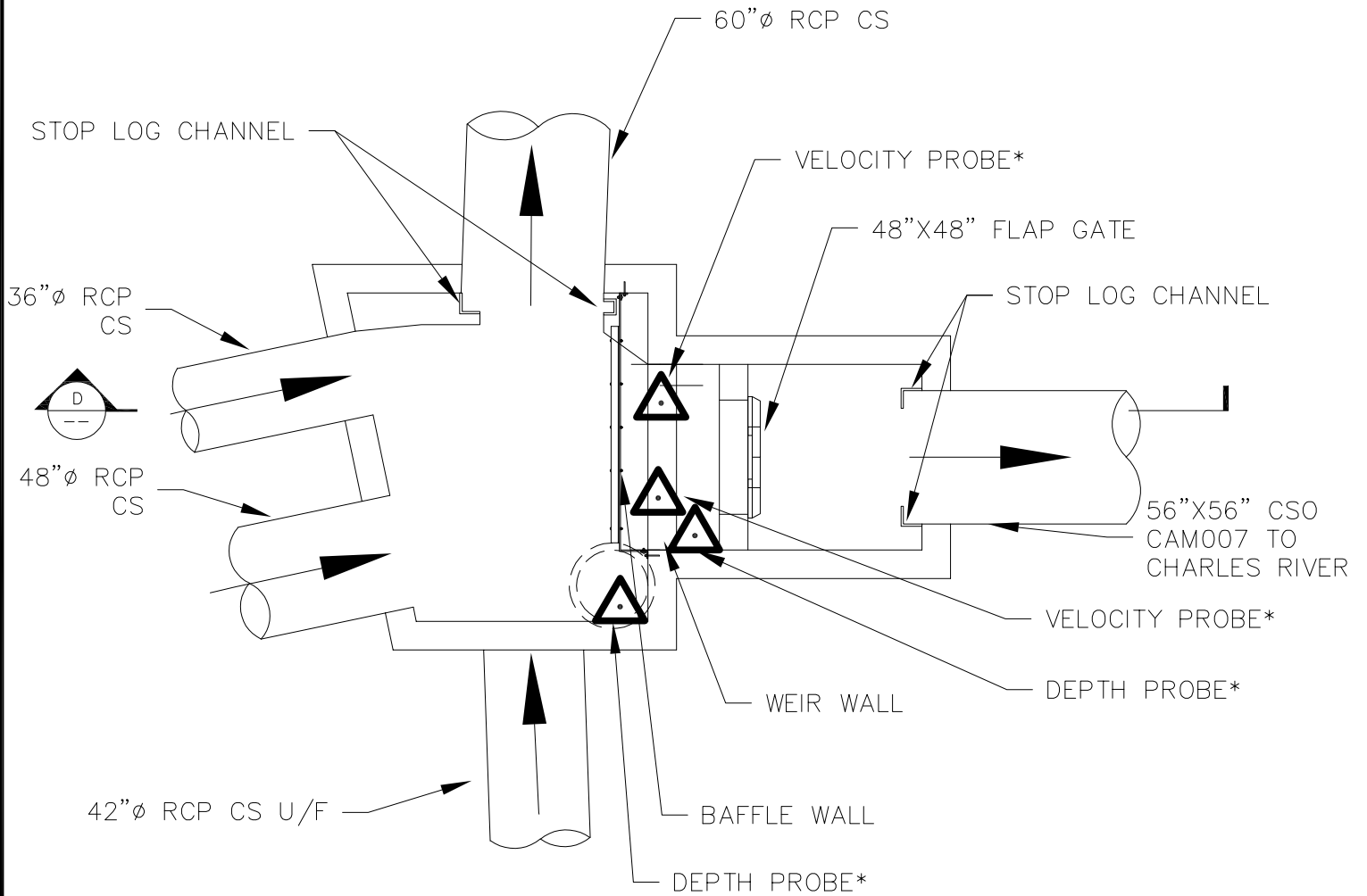
SECTION



NOT FOR CONSTRUCTION

SCALE: N.T.S.

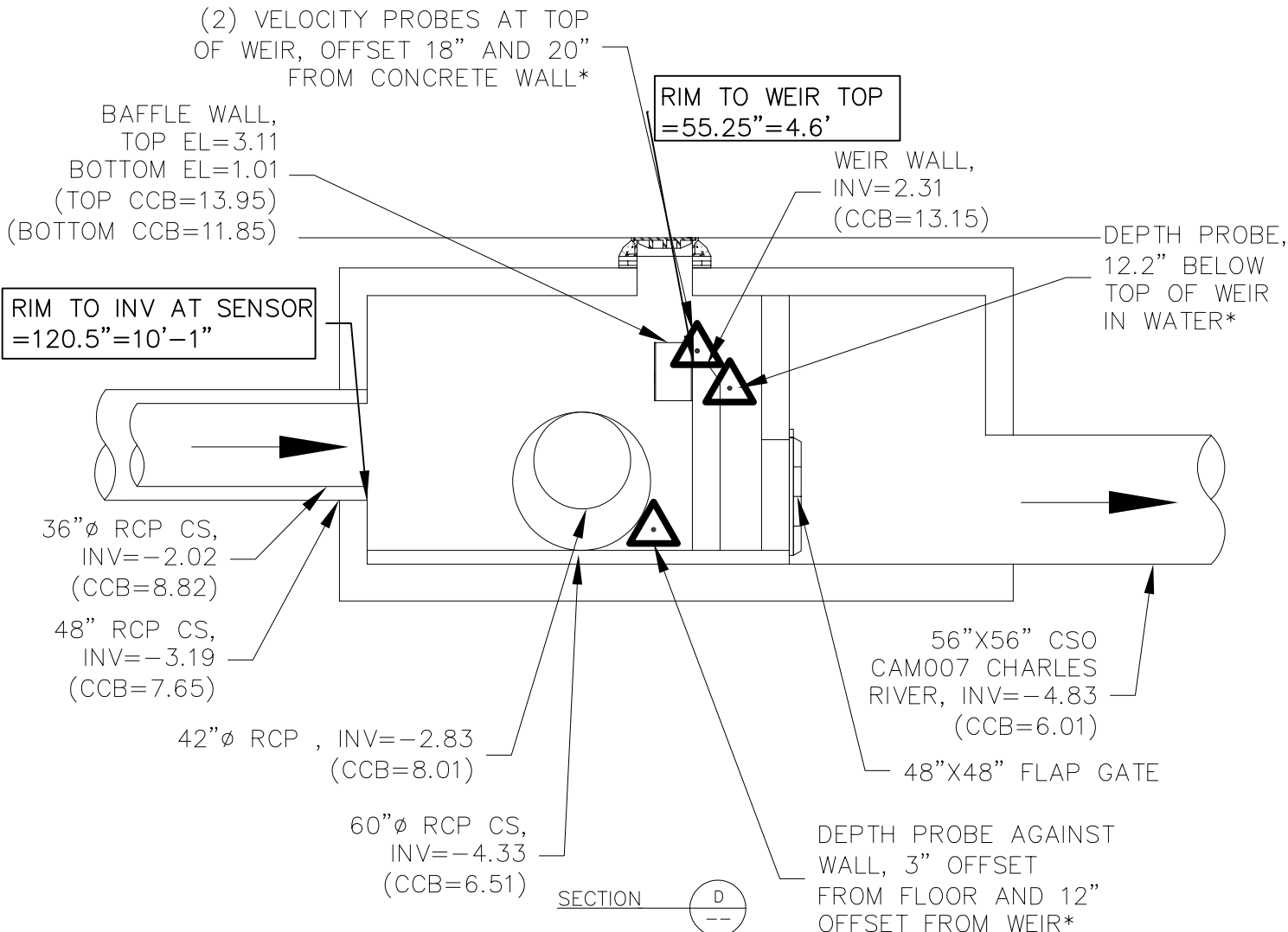
CSO REGULATOR STRUCTURE CAM005 PROFILE



NOT FOR CONSTRUCTION

SCALE: N.T.S.

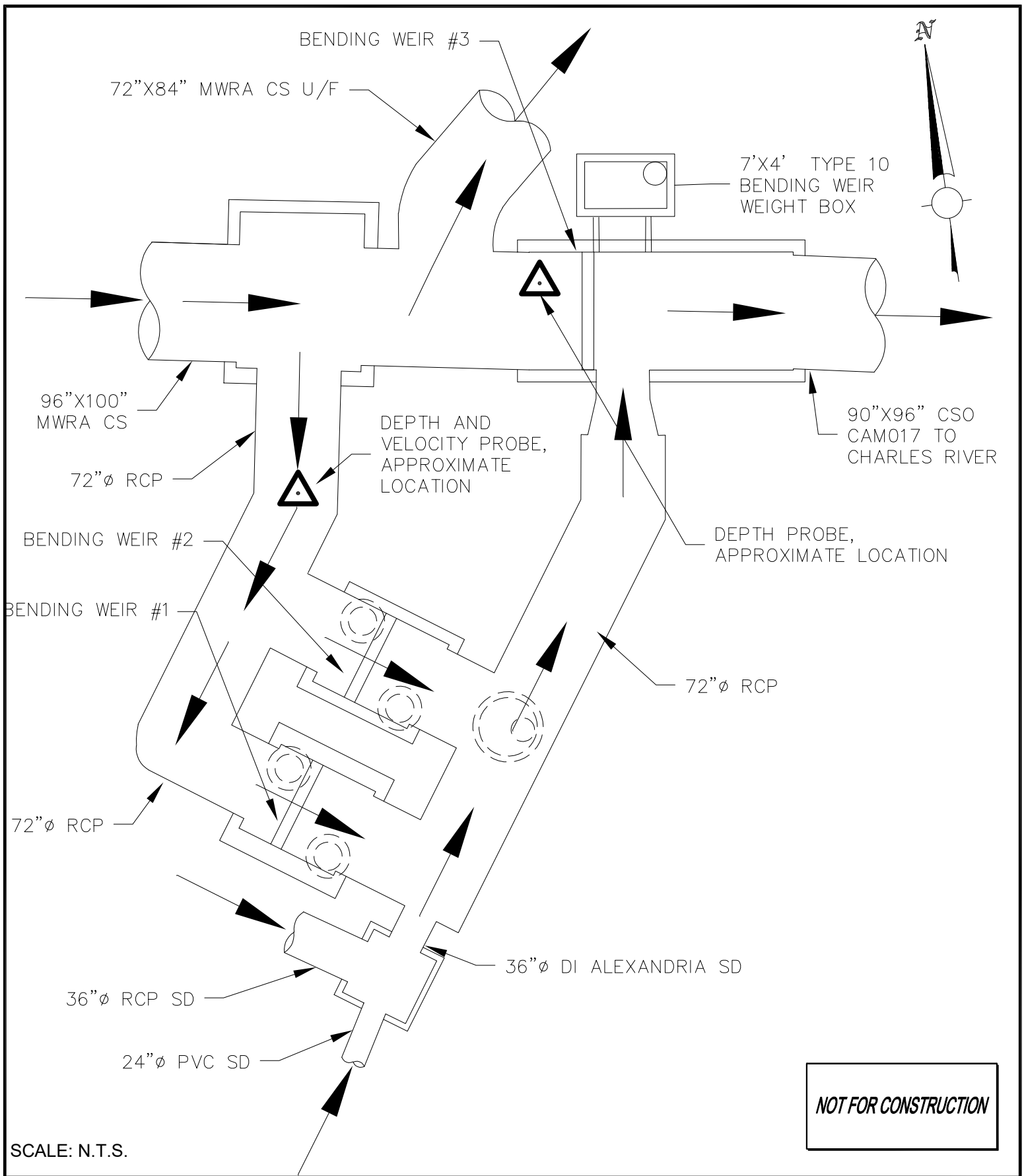
CSO REGULATOR STRUCTURE CAM007 PLAN



NOT FOR CONSTRUCTION

SCALE: N.T.S.

**CSO REGULATOR STRUCTURE
CAM007 PROFILE**



SCALE: N.T.S.

NOT FOR CONSTRUCTION

**CSO REGULATOR STRUCTURE
CAM017 PLAN**