AECOM

Evaluation of Floatables Control Systems for MWRA CSO Outfalls Along the Charles River, Upper Mystic River, and Alewife Brook

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1. Introduction

Exhibit A Item 3 in both the *2024 Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin* (Alewife Variance) and the *2024 Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Lower Charles River/Charles Basin* (Charles River Variance) requires MWRA to "complete an evaluation of floatables control for each of MWRA's outfalls that discharges to Alewife Brook, Upper Mystic River, or Lower Charles River/Charles River Basin and submit a written report to MassDEP. The evaluation shall assess the effectiveness of the current controls and identify recommendations for improvements. MWRA shall implement the recommendations identified by the evaluation."[1]

This report presents the findings of the floatables control feasibility study conducted by MWRA in accordance with the Variance requirements, and is organized into the following chapters:

- Chapter 1: Introduction
- Chapter 2: Floatables Definition and Technologies for Control
- Chapter 3: Existing Floatables Control Systems at MWRA-owned Outfalls
- Chapter 4: Summary and Recommendations
- Chapter 5: References
- Appendix A: MWRA NPDES Monthly Inspection Log

2. Floatables Definition and Technologies for Control

"Floatables" refers to debris, trash, and other floating solid material that may be present in CSO discharges and can be one of the more visible pollutants impacting receiving waters. Floatables enter the sewer system when debris left along roads and paths are washed into storm drains during precipitation events, or when floatable items are flushed down toilets. They consist of natural and man-made items including leaves, plastic bottles, cigarette butts and food wrappers, and cover a range of shapes and sizes. However, this report focuses on floatables large enough to be visible to the human eye.

During dry-weather operation of combined sewer systems, floatables originating from street runoff or from sanitary sewage are conveyed to the wastewater treatment plant and filtered out with bar screens or similar technology during preliminary treatment. However, during wet weather, CSO events can allow floatable debris to enter nearby waterways.

While this report focusses on floatables generation at CSOs, CSOs are not the sole contributors of floatable material in waterways. Effective mitigation strategies should also account for other significant sources, including stormwater runoff from adjacent areas and littering.

The three main categories of floatables control systems include source controls, in-system controls and end-of-pipe controls. This section describes some of the more common technologies implemented for floatables control and their potential benefits and drawbacks.

2.1. Source Controls

Source controls are defined as measures that are taken to prevent trash and floatable materials from entering a combined sewer system. Proper disposal of man-made floatable materials like trash can prevent these items from entering the environment. This approach is beneficial by treating the accumulation of floatables at the source, reducing the necessity for in-system and end-of-pipe measures when effectively implemented.

[1] *2024 Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin*, and *2024 Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Lower Charles River/Charles Basin* Exhibit A, Item 3.

2.1.1 Catch Basin Modifications

Catch basins are a potential point for floatable materials to enter a combined sewer system if the materials are small enough to fall through the inlet grates. Certain catch basin design features can help prevent floatables from entering the combined sewer system and ultimately entering the waterway during a CSO discharge event.

Some common catch basin modifications include hoods (also called traps) that are placed over the catch basin outlet, submerged outlets that are connected to the sewer system via a riser, and trash buckets placed under the catch basin grate that are used to catch floatable materials but contain holes that allow water to pass through them. Figure 2-1 shows an example diagram of a catch basin fitted with a hood. Flow must pass under the hood to reach the outlet of the catch basin. At the end of a storm, as the water level in the catch basin drops below the elevation of the outlet, the floatable material is retained in the catch basin, to be removed as part of periodic catch basin cleaning operations. Figure 2-2 is an image of an actual catch basin hood, where several floatable materials can be seen inside after a maintenance check.

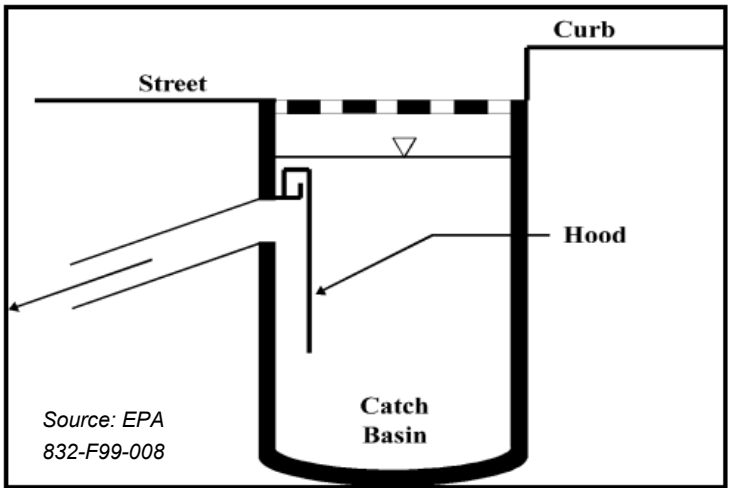

Figure 2-1 Diagram of Catch Basin with a Hood

Figure 2-2 Catch Basin Hood with Floatable Material

2.1.2 Street Sweeping

Street sweeping is a routine maintenance practice to sweep up and remove trash and debris that may accumulate on roadways and parking lots and that could enter a combined sewer system through catch basins. Vacuum sweeper vehicles are typically more effective than non-vacuum sweepers, as vacuum sweepers can be more effective at capturing both large debris and fine dust and sediment.

While street sweeping can be effective in removing materials that could potentially end up in a sewer system, it is typically considered a supplemental measure, implemented in conjunction with other floatable control measures to target the combined sewer water ways.

2.1.3 Public Education and Outreach

Education and outreach to the local community is an indirect but largely effective way to prevent floatable materials from entering a combined sewer system. Informing the public on how to properly dispose of trash and debris can help to prevent these materials from being dropped on the streets or dumped directly into sewer systems.

Some approaches to public education include informational signage, social media campaigns, and school outreach programs to teach students the importance of proper waste disposal.

2.2. In-System Controls

In-system controls cover a range of technologies implemented within a combined sewer system, typically at a CSO regulator, to capture floatables before they are discharged to the outfall.

2.2.1 Screens

Screens typically consist of sets of vertical and/or horizontal bars that trap solid materials larger than the opening space between the bars. The effectiveness of capturing floatable materials depends on the spacing between the bars. Bar spacings greater than about two inches are generally referred to as “trash racks”, intended to capture much larger materials. These trash racks are periodically cleaned manually using hand-held rakes and provide limited benefit in terms of capture of smaller floatable material. Figure 2-3 presents an example of a manually cleaned trash rack.

Figure 2-3 Manually cleaned Trash Rack in a Combined Sewer System

Bar screens with spacings closer than about two inches are typically provided with a mechanical cleaning/raking mechanism, to minimize the risk of the screens being blinded by materials and causing flow to backup upstream. The raking mechanisms for vertically oriented bar screens typically discharge the captured screenings to a container for off-site disposal. These mechanical screening operations require electrical power and typically an above-grade building to house the screenings disposal operation.

Horizontal bar screens are typically located along the top of a regulator weir and are oriented such that the screened material drops back into the combined sewer for conveyance to the wastewater treatment plant. This technology requires electrical power but avoids the need for above-ground facilities and off-site screenings disposal. Headloss through the screens and limitations due to the physical dimensions of existing regulators can create challenges to implement horizontal screens. Figure 2-4 presents an example of a mechanically cleaned horizontal bar screen.

Figure 2-4. Example of Mechanically cleaned Horizontal Bar Screen

2.2.2 Baffles

Baffles are vertically placed typically steel or fiberglass-reinforced plastic plates or concrete beams that are positioned in a CSO regulator such that flow has to pass under the baffle before discharging over the regulator weir. Similar to catch basin hoods, floatable material is retained behind the baffle while the CSO is discharging. After the rain event the baffle continues to retain the floatables while the water level in the regulator drops below the weir elevation. The captured floatables are then eventually discharged out the dry weather flow connection to the interceptor system for conveyance to the wastewater treatment plant. Figure 2-5 presents a schematic section view of an underflow baffle.

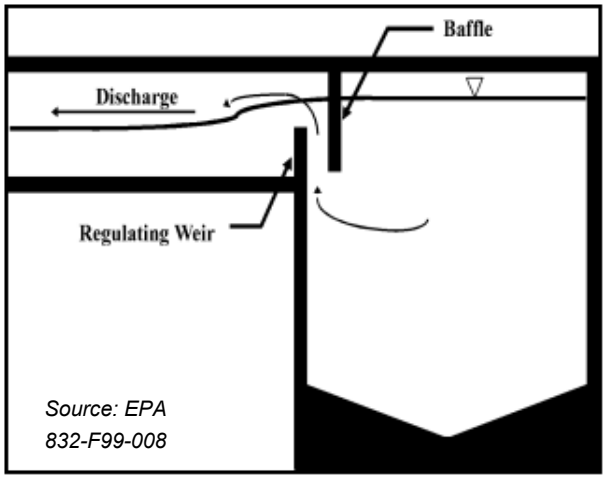

Figure 2-5 Diagram of an Underflow Baffle in a CSO Regulator

2.2.2 Hydrodynamic Separators

Hydrodynamic separators, or swirl and vortex units, use a cylindrical chamber to separate out trash and solids from incoming flows. The chamber causes flow to induce a circular pattern where the change in velocity causes solids to drop out of the flow and settle. This flow pattern, paired with screens and baffles over the upper outlet, serves the dual purpose of removing solids and capturing floatables and trash in the influent flow. Hydrodynamic separators would typically be located along the CSO outfall downstream of the regulator weir. Materials captured in the hydrodynamic separator would need to be removed following an activation event, typically using a vactor truck. Figure 2-6 presents an example of a hydrodynamic separator.

Source: Learn About Aquatic Trash | US EPA

Figure 2-6. Example of a Hydrodynamic Separator

2.3. End-of-Pipe Controls

End of pipe controls are floatables control measures that are located at the discharge point at the end of a CSO outfall pipe. The most common end-of-pipe controls include nets and containment booms.

2.3.1 Nets

End-of-pipe netting arrangements come in a variety of shapes, sizes and configurations. The nets are typically in some fashion fitted over the end of the outfall pipe, and capture materials larger than the net grid opening. Some netting installations sit in the receiving water, while others are attached directly to the end of the outfall pipe. In-line arrangements located along an outfall are also available. The nets typically need to be cleaned/replaced after each event, and some type of bypass or release mechanism is needed in case the nets fill and start to restrict flow in the outfall. The nets must also be checked for holes or other damage that could allow trash or floatables to pass through. Figure 2-7 presents an example of nets fitted directly onto the end of a CSO outfall.

Figure 2-7 End-of-Pipe Netting at an Outfall

2.3.2 Containment Booms

Containment booms are floating structures that create a continuous barrier across a water body and intercept floatables from the surface. Similar to netting, they are an end-of-pipe solution that can create a highly visible accumulation point of debris while preventing floatables from migrating further downstream in the receiving waters. Booms are typically anchored to structures installed on the shore and include curtains that extend below the surface of the water to act as a baffle across an open water body.

Trash that accumulates behind containment booms needs to be cleared on a regular basis, either manually or using a skimmer vessel that can retrieve debris from the water surface. Containment booms located within the receiving waters can be an impediment to recreation due to the physical barrier that they impose on the surface. Additionally, containment booms cannot be used during winter months in water bodies that regularly freeze as the boom needs to float on the water surface to be effective. Figure 2-8 presents an example of a containment boom.

Figure 2-8. Example of Containment Boom

3. Existing Floatables Control Measures at MWRA-owned Outfalls

MWRA and the Cities of Cambridge and Somerville are currently in the process of developing the Updated CSO Long-Term Control Plan (LTCP) to mitigate CSO discharges into the Charles River, Upper Mystic River, and Alewife Brook (the Variance waters). Of the remaining CSO outfalls to be addressed in the Updated LTCP that discharged into the Variance waters, eight are owned and operated by MWRA. Figure 3-1 provides a map of the MWRA-owned CSO outfalls.

The floatables control measures at each of the MWRA-owned outfalls to the Variance waters are summarized in Table 3-1 and described in more detail in the subsections below.

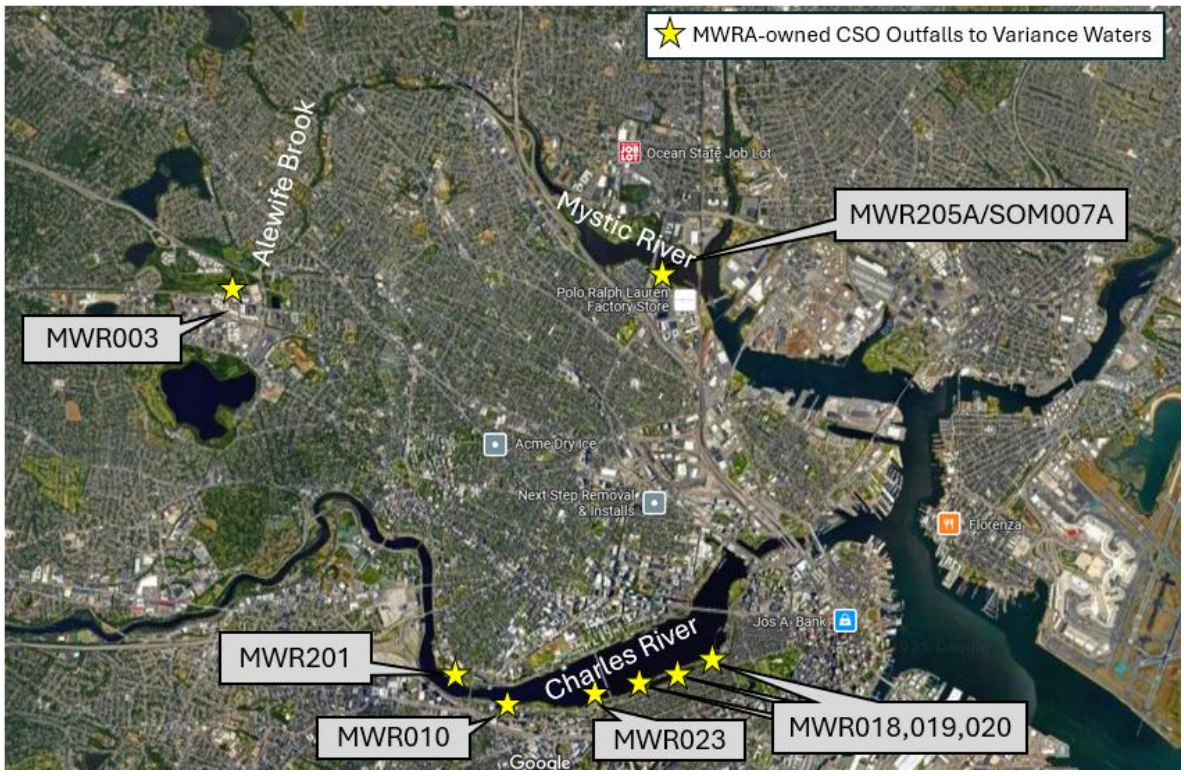

Figure 3-1 MWRA-Owned CSO Outfalls to Variance Waters

Table 3-1 Summary of Floatables Control Technologies on MWRA-owned CSO Facilities

Outfall	Receiving Water	Floatables Control Approach	Assessment of Effectiveness
MWR003	Alewife Brook	Underflow Baffle	No significant floatables have accumulated at this location based on monthly field inspections conducted by MWRA.
MWR205A/SOM007A (Somerville Marginal CSO Facility)	Mystic River	0.5-inch Spaced Mechanically cleaned Bar Screens	All CSO discharged at outfall MWR205A/SOM007A passes through the 0.5-inch bar screens prior to discharge. Separate storm drains connected to the outfall downstream of the bar screens could potentially contribute to discharge of floatables at this location.
MWR201 (Cottage Farm CSO Facility)	Charles River	3.5-inch and 0.5-inch Spaced Mechanically cleaned Bar Screens and effluent fine screens	All CSO discharged at outfall MWR201 passes through the 3.5-inch and 0.5-inch bar screens prior to discharge. Within the facility's detention basins, flow must also pass through hanging baffles as well as through fine screen prior to overtopping a final weir wall upstream of the outfall pipe.
MWR010	Charles River	No structural floatables control measures	MWR010 outfall is not predicted to activate in the 2050 Typical Year. Structural floatables control measures are not installed at this location. This outfall is subject to monthly field inspections. Source controls such as street sweeping and catch basin cleaning contribute to floatables control at this location.
MWR018, MWR019 and MWR020	Charles River	No structural floatables control measures	Structural floatables control measures are not installed at these locations. A maximum of four activations are predicted at these CSO outfalls in the 2050 Typical Year. These outfalls are subject to monthly field inspections. During these inspections, staff open the final controlling stoplog chamber prior to the CSO discharge and have not noticed the presence of any significant accumulation of floatables. Source controls such as street sweeping and catch basin cleaning contribute to floatables control at these locations.
MWR023	Charles River	No structural floatables control measures	Structural floatables control measures are not installed at the upstream regulators discharging to outfall MWR023. A maximum of six low volume activations are predicted at two CSO regulators tributary to MWR023 in the 2050 Typical Year. Source controls such as street sweeping and catch basin cleaning contribute to floatables control at this location.

3.1. Outfall MWR003

The regulator structure tributary to outfall MWR003 has an underflow baffle to minimize the release of floatables into the Alewife Brook. Figure 3-2 shows a section view through the regulator structure and identifies the location of the underflow baffle in red. Floatable materials retained behind the baffle during wet weather are conveyed through

MWRA's interceptor system for removal at downstream facilities. The MWR003 regulator structure is inspected monthly by MWRA to check for the accumulation of floatables, and no substantial quantities of floatables have been observed.

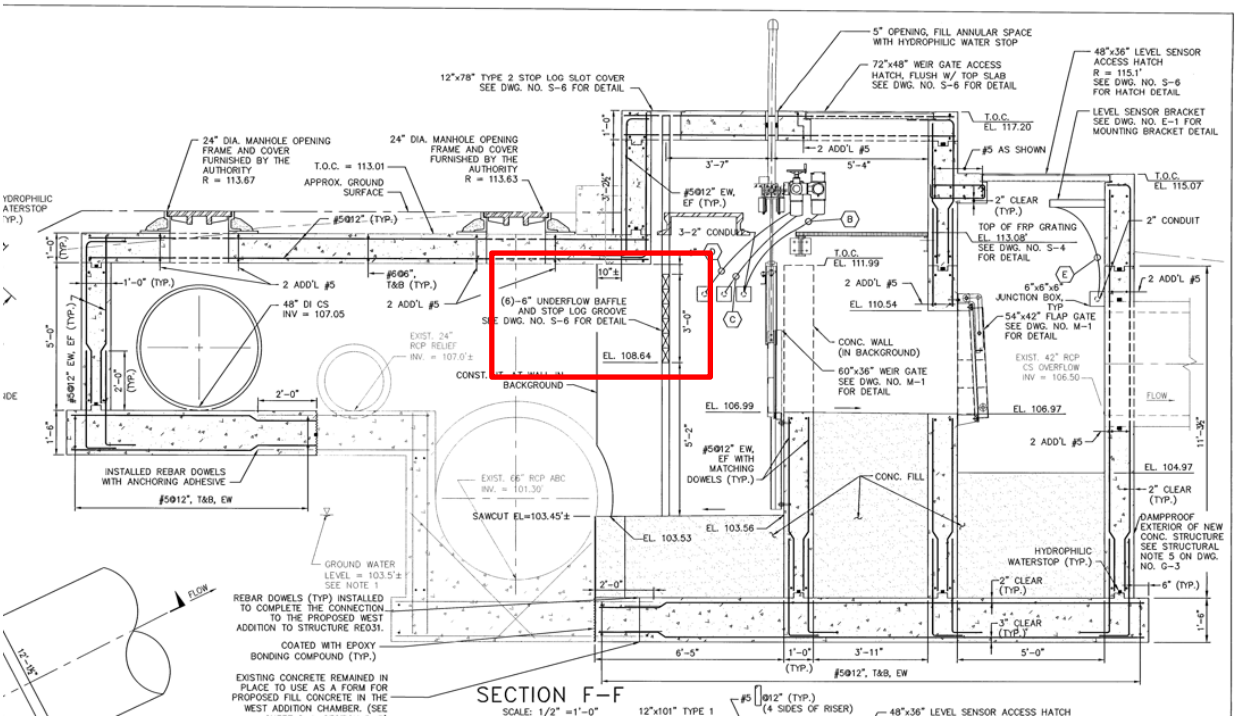

Figure 3-2 MWR003 Regulator Section Showing Underflow Baffle

3.2. Outfall MWR205A

The Somerville Marginal CSO Facility discharges MWR205/SOM007 to the saline portion of the Mystic River downstream of the Amelia Earhart Dam (a non-Variance water), and under certain tidal conditions will discharge at outfall MWR205A/SOM007A into the Upper Mystic River (a Variance water). The facility has 0.5-inch space mechanically cleaned bar screens to collect floatables as a CSO discharge occurs. The bar screens are operated based on the liquid level in the influent conduit. The bar screen cleaning system is activated when the facility influent gates are opened. The screenings collected are discharged to a traveling conveyor, also activated by the level sensor, which transports the solids to holding bins for disposal off site. Figure 3-3 presents a schematic of the Somerville Marginal CSO Facility. The bar screens in the figure are marked in red.

3.3. Outfall MWR201

The Cottage Farm CSO Treatment Facility discharges at outfall MWR201 on the Charles River. The facility has two sets of mechanically clean bar screens in series, with a set of coarse screens preceding a set of finer screens. The coarse bar screens have 3.5-inch-wide openings to catch large trash and floatables in the facility influent flow. The fine screens have 0.5-in-wide openings to catch smaller particles that could pass through the coarser screen. This dual screen system was implemented so that a finer screen would not be easily clogged by larger debris. The captured floatables are conveyed via a sluiceway back to the interceptor system. Figure 3-4 presents a schematic of the Cottage Farm CSO Facility. The bar screens in the figure are marked in red. In addition, screened flow is pumped to six detention tanks with total volume of 1.3 MG. Within the detention tanks, flow passes through a series of underflow baffles and then upwards through a fine mesh screen prior to overtopping a final weir wall, allowing treated CSO to enter the outfall pipe to the Charles River. The detention tanks further remove screenings as well as settleable materials including organics, which are flushed back to the MWRA's interceptor system through sluicing channels within the facility after the facility deactivates.

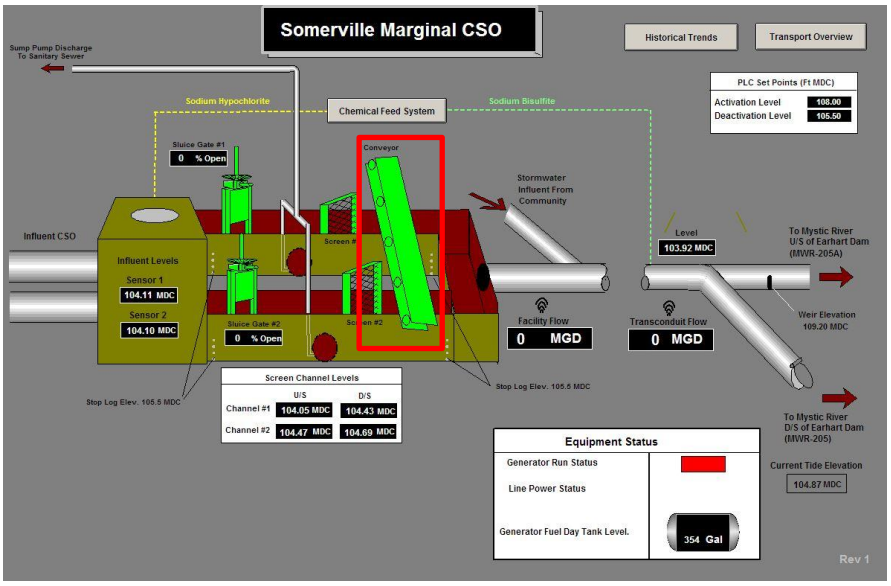

Figure 3-3 Somerville Marginal CSO Facility Schematic (MWR205A)

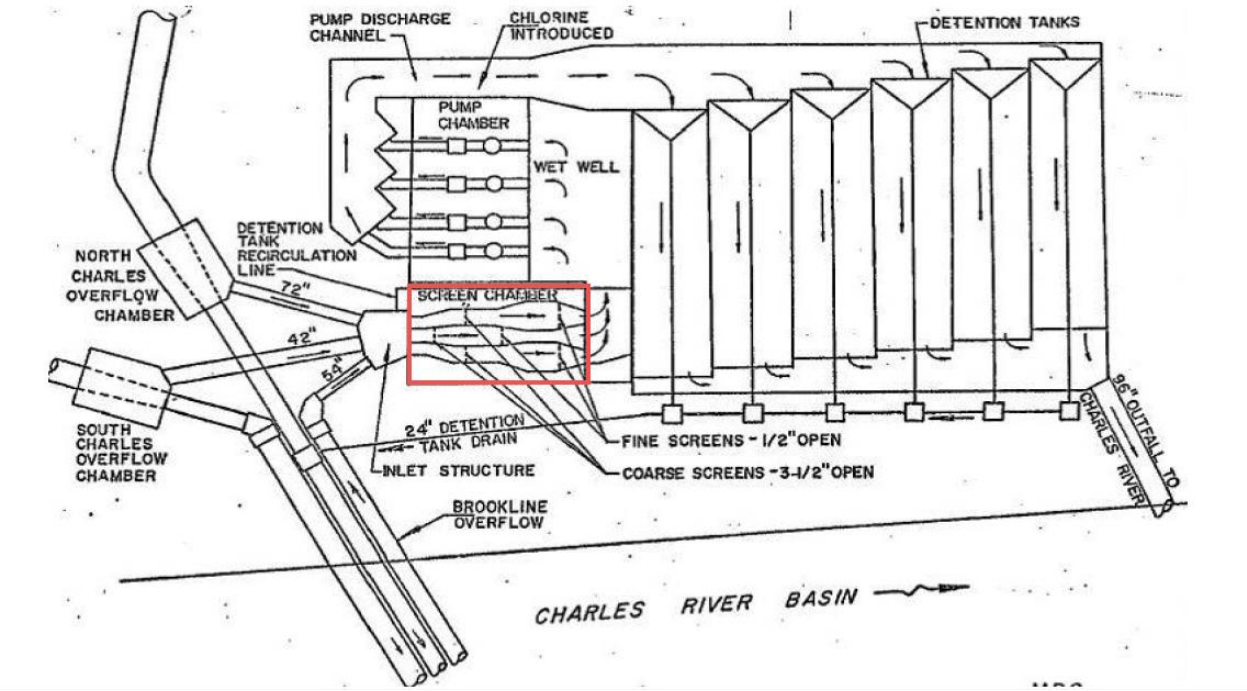

Figure 3-4 Cottage Farm CSO Facility Schematic

3.4. Outfall MWR010

CSO Outfall MWR010 is located on the Charles River. MWR010 outfall is not predicted to activate in the 2050 Typical Year. Structural floatables control measures are not installed at this location. Source controls such as street sweeping and catch basin cleaning contribute to floatables control at this location. MWRA staff performs monthly NPDES inspections at outfall MWR010.

3.4. Outfalls MWR018, MWR019, and MWR020

CSO Outfalls MWR018, MWR019, and MWR020 are located on the Charles River. These outfalls provide relief of the Boston Marginal Conduit, which receives flow from upstream combined areas. . Before discharging at these outfalls, flow must pass through large weir structures, then through a stop log structure with limited freeboard clearance, then through submerged outfalls discharging well beyond the shoreline. Under prior CSO Control efforts, structural floatables control measures were not provided for these outfalls due to the limited expected CSO activation frequency and volume.

MWRA staff performs monthly NPDES inspections of the controlling stoplog chambers within the outfall pipes leading to outfalls MWR018, MWR019, and MWR020. MWRA staff inspecting these chambers reported that they have not observed floatables of any significance within these chambers. A copy of the current monthly inspection log form is included in this report in Appendix A.

3.5. Outfall MWR023

CSO Outfall MWR023 is located on the Charles River. This outfall primarily conveys separate stormwater but can receive limited quantities of CSO from minimally active upstream regulators. Two upstream regulators are predicted to activate a maximum of 6 times in the projected 2050 TY with a predicted total volume of 0.13 MG. Under prior CSO Control efforts, the combined areas tributary to the remaining regulators were separated but the regulators remained open due to the remaining inflow. Structural floatables control measures were not provided for the upstream CSO regulators due to the limited expected CSO activation frequency and volume. MWRA staff performs monthly NPDES inspections at outfall MWR023

4. Summary and Recommendations

The majority of the CSO volume continuing to discharge from MWRA outfalls to the variance waters is discharged at two of MWRAs CSO treatment facilities (Cottage Farm CSO Facility (MWR201) and Somerville Marginal CSO Facility (MWR205A)). Floatables control is provided by 0.5-inch spaced mechanically cleaned bar screens. Additional floatable control measures in the form of a baffle and fine screens are provided at the Cottage Farm CSO Facility. Of the remaining locations, outfall MWR003 has an underflow baffle and the activation frequencies and volumes at the remaining outfalls are relatively low. Street sweeping and catch basin cleaning in the areas tributary to these outfalls provides a level of floatables control at these remaining outfalls. All of the MWRA CSO outfalls are inspected monthly as part of the NPDES permit requirements.

It is recommended that the existing control measures remain, and that MWRA continue with monthly NPDES field inspections.

5. References

Massachusetts Department of Environmental Protection. 2024. *Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin.* Retrieved May 23, 2025, from Mass.gov: https://www.mass.gov/doc/final-determination-to-adopt-a-water-quality-standards-variance-for-cso-overflow-discharges-alewife-brookupper-mystic/download

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United States Environmental Protection Agency Learn About Aquatic Trash | US EPA downloaded 9/26/25.

Appendix A: MWRA NPDES Monthly Inspection Log

MASSACHUSETTS WATER RESOURCES AUTHORITY
NPDES MONTHLY INSPECTIONS

Boston Marginal Conduit (BMC) **MWR 018** **MWR019** **MWR020**

CSO Oufall Number:	Location:			
Date/Time:	Weather:			
Condition	Good	Fair	Poor	Remedial Actions
Access Cover:				
Structure:				
Planking:				
Planking Bracket Hardware:				
Wedges:				
Planking Leaking:	Yes	No		
If Yes, Estimate Rate(gpm):				
WRA Sign Present:	Yes	No		
Maintenance				
Maintenance Required:	Yes	No		
Describe The Maintenance If Required:				
Reviewed By:				