SOMERVILLE COMBINED SEWER OVERFLOW (CSO) FLOATABLE CONTROL EVALUATION REPORT

SOMERVILLE, MA

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1 EXECUTIVE SUMMARY

In August 2024, the Massachusetts Department of Environmental Protection (MassDEP) issued the Final Determination to Adopt a Water Quality Standards Variance (Variance) for Combined Sewer Overflow (CSO) Discharges to Alewife Brook/Upper Mystic River Basin. This Variance was later approved by the United States Environmental Protection Agency (EPA). The Variance details regulatory requirements for municipalities discharging into the Alewife Brook and Upper Mystic River Basin. As part of the City of Somerville's (City) compliance with the Variance, the City completed a review of technologies available to control floatables in CSO discharges. This City manages one CSO outfall to the Alewife Brook (identified as SOM001A). The SOM001A outfall is located along the Alewife Brook Parkway near its intersection with Massachusetts Avenue in Cambridge, MA (as shown in **Figure 1** below).

Figure 1 - A View of SOM001A from the Alewife Brook Greenway *(Taken March 21, 2025)*

"Floatables" refers to debris, trash, and other floating solid material that may be present in CSO discharges and represent one of the most visible pollutants that can impact downstream receiving bodies of water. Methods for controlling floatables can include preventing floatables from entering the combined sewer system at the source, installing structural controls within the system or regulator itself to capture floatables, or installing technologies to capture floatables at the CSO outfall itself. The following memorandum discusses technologies that have precedent in floatables control and may be considered by the City of Somerville to bolster existing floatables controls in its combined sewer system. Floatables are not specific to combined sewer systems and also present a concern within stormwater systems as well. This report does not evaluate stormwater floatables control in detail.

The City is committed to mitigating floatables throughout the system, including at CSO regulators and outfalls. As such, the City has evaluated the following floatables control best management practices (BMPs) for CSOs in the following report: catch basin modifications, street sweeping, public education and outreach, baffles, screens, dynamic baffles, self-cleaning bar screens, hydrodynamic separators, netting, and containment booms. For each BMP, details describing cost, operation and maintenance requirements, and likely effectiveness were reviewed. Regulatory and permitting requirements were examined as part of this evaluation.

The effectiveness of existing floatable controls in the combined sewer system can most easily be assessed through visual observations of any floatable activity during a CSO event. A field investigation was performed at SOM001A. Additionally, insight into what impacts floatables control effectiveness is gained by reviewing the basis of design for existing floatables control and analyzing those controls using empirical equations. Due to the limited observation data during CSO events, this report is not able to render a complete assessment of the effectiveness of existing floatables control at SOM001A.

In conclusion, the most practical mitigation measures (in addition to what the City has already implemented) for enhancements to floatables control have been identified as a combination of the following:

1. Installation of a CB hood in one CB connected to the SOM001A structure. This will require coordination with the Department of Conservation and Recreation (DCR).
2. Continue with additional public education by installing placards adjacent to catch basins within the storm drainage areas tributary to Alewife Brook and publishing updates to Somerville’s stormwater website.
3. Install an internal camera within the SOM001A CSO regulator structure for up to two (2) months and in a position best suited to capture imagery of the CSO regulator’s performance during a wet weather event.

2 EVALUATION BACKGROUND

2.1 CSO VARIANCE

On August 30, 2024, MassDEP issued an updated Water Quality Standards Variance for CSO Discharges to the Alewife Brook/Upper Mystic River Basin to the City of Somerville. This Variance was later approved by the EPA (Massachusetts Department of Environmental Protection, 2024). The Variance requires the City to take steps to reduce CSO events and mitigate their impacts. MassDEP reached out to watershed advocacy groups for input on the Variance. The advocacy groups raised concerns about floatables associated with the CSO outfalls. As a result, the variance requires that the City complete an "evaluation of floatables control for each of the City of Somerville's outfalls that discharge to Alewife Brook or the Upper Mystic River. This City manages one CSO outfall to the Alewife Brook, SOM001A. The evaluation shall "assess the effectiveness of the current controls and identify recommendations for improvements." The variance also requires that the City implement the "recommendations for improvements."

2.2 PUBLIC INVOLVEMENT

Prior to issuing the Variance, MassDEP held a public comment period allowing for input on the Variance conditions. MassDEP received extensive feedback from watershed associations and members of the general public. Commenters expressed strong concern over the continued discharge of untreated sewage and the failure of existing floatables and odor controls, particularly at SOM001A. Members of Save the Alewife Brook, Green Cambridge, and the Arlington Select Board called for enforcement of existing requirements, installation of post-discharge containment measures (e.g., booms or netting), and periodic cleanup. They reported visible pollution in and along the banks of the Alewife Brook, including toilet paper and other sanitary waste. While comments reported floatables observed in the vicinity of the Alewife Brook, none reported witnessing floatables exiting the SOM001A structure.

Commenters informed MassDEP of their preference for floatables control measures. Save the Alewife Brook called for the implementation of green stormwater infrastructure, and local residents asked for increased public notification systems for sewage discharges and educational campaigns to reduce wet weather inflow. A record of public comments regarding the Variance can be found at the following link: Response to Variance Comments.

Since the publication of the Variance, Save the Alewife Brook continues to raise concerns regarding floatables in the Alewife Brook. Several online articles have been published on the topic, including the following: Swans, Sewage, & Sediment: an Alewife Adventure. There is no information at this point to indicate that the floatables in question are associated with the SOM001A structure and may originate from a range of sources.

2.3 REPORT CONTENTS

Chapter 3: Overview of Floatables Controls – This section explains the process by which floatables enter sewer systems. It describes situations that improve or worsen floatables. It ends with a description of common floatable control BMPs used in wastewater collection systems.

Chapter 4: Existing Floatables Conditions – This section describes the configuration and condition of SOM001A. It includes a description of existing floatable controls at this CSO.

Chapter 5: Floatables Controls Evaluation – This section discusses the basis of design for the existing floatables control at the City’s CSOs. It assesses the applicability of empirical models to inform on conditions that may impact baffle efficiency and details site visits conducted to evaluate the presence of floatables during wet and dry weather periods.

Chapter 6: Considerations for System Floatables Control – This section presents existing regulations and permitting considerations that may impact floatables control within the City’s wastewater collection system. It provides insight into the public involvement component impacting floatables presence at CSOs.

Chapter 7: Findings and Recommendations – This section summarizes the findings from the floatables control evaluation and provides recommendations to further enhance floatable control.

3 OVERVIEW OF FLOATABLE CONTROLS BMPS

"Floatables" refers to debris, trash, and other floating solid material that may be present in CSO discharges and represent one of the most visible pollutants impacting receiving waters. Floatables enter the sewer system when debris left along roads and paths washes into storm drains during precipitation events. They consist of natural and man-made items, including leaves, plastic bottles, oil from vehicles, and food wrappers. There are no criteria for the minimum size of floatables. 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 in storm sewers are combined with sanitary sewer flow and brought to the wastewater treatment plant and filtered out with bar screens or similar technology during preliminary treatment. However, during wet weather, CSO events allow floatable debris to enter nearby waterways, leading to environmental contamination and creating unsightly conditions.

While this report focuses on floatables generation at CSOs, they are not the sole contributors to floatables in water bodies. Effective mitigation strategies must also account for other significant sources, including stormwater runoff from adjacent areas and littering.

BMPs for controlling floatables in combined sewers typically fall within three main categories:

1. Source Controls
2. In-System Controls
3. End-of-Pipe Controls

Source controls are focused on preventing trash and debris from entering the combined sewer system, either from non-structural BMPs or structural controls on inlets and catch basins. In-system controls are centralized floatable controls within the combined sewer system itself, such as at the regulator, that prevent floatables from leaving the system and discharging them to waterways. Lastly, end-of-pipe controls are located at the outfall location, external to the combined sewer system, and collect floatable debris before they are washed away into the receiving waterbody. Specific options for each type of floatable control BMP are presented below.

3.1 SOURCE CONTROL TECHNOLOGIES

Source control methods for reducing floatable debris fall into two categories: structural, which require physical modifications to the combined sewer system, and non-structural. A combination of structural and non-structural options for floatable control is discussed in Sections 2.1.1 – 2.1.3.

3.1.1 Structural - Catch Basin Modifications

Catch basins can serve as an entry point for floatables, sediments, and debris to the combined sewer system and therefore represent an opportunity to collect floatables closer to their source. Catch basin inlets are generally covered with a grate and are designed to limit large debris from entering the combined sewer system; however, additional steps can be taken to make catch basins more resistant to passing floatables downstream to outfalls. Modifications to catch basins aim to prevent floatables from entering the sewer lateral and making it into the combined sewer system. Examples include:

- Placing a hood (also called a trap) over the catch basin outlet
- Creating a submerged outlet that is connected to the combined sewer system via a riser
- Placing a trash bucket below the inlet grate to catch debris and allowing water to flow around

Catch basin hoods and submerged outlets both operate by raising the water surface in the catch basin above the fully submerged outlet point, taking advantage of the buoyant nature of floatable debris to keep floatable material from reaching the catch basin outlet. Trash buckets are slotted buckets that sit directly below catch basin openings, allowing water to freely pass through to the catch basin sump while retaining larger floatable debris that cannot pass through the bucket’s openings. Examples of all three catch basin modifications are included in **Figure 2**.

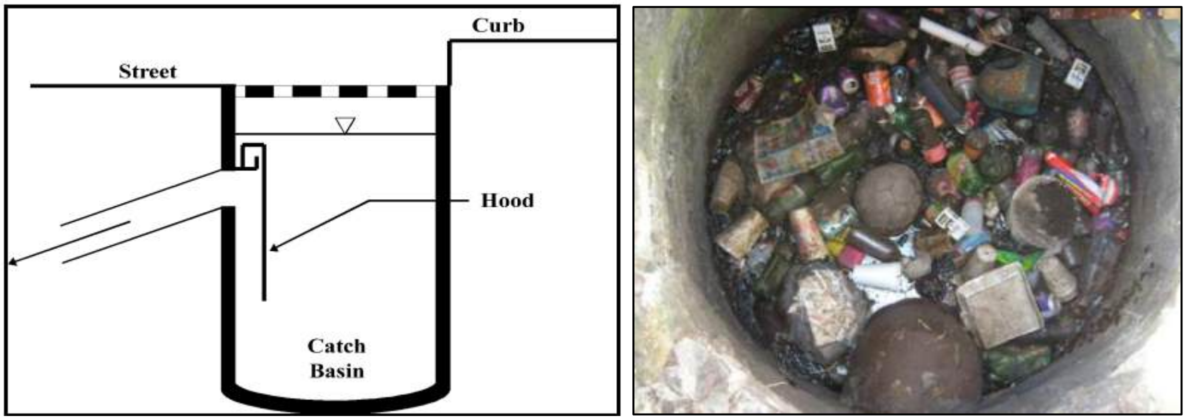

Figure 2 – Graphical depiction of a catch basin retrofitted with a hood (left) and an example of a catch basin hood (at 6 o'clock) installed with captured floatable debris (right)
Source: EPA 832-F99-008

Catch basin modifications are an effective floatable control and have demonstrated up to an 85% reduction in litter entering the combined sewer system per catch basin (EPA 1999); however, the method creates significant maintenance needs as debris is collected across the watershed at every inlet point. To avoid clogging and inlet restrictions, a robust program to clear the buildup of debris in catch basins is required if this method is used.

3.1.2 Non-Structural - Street Sweeping

Street sweeping of parking lots and curbed streets is an effective way to prevent trash and other debris from making it to the combined sewer system inlets and catch basins during storm events. Sweeping should be completed using vacuum sweepers, which can collect both large debris and fine dust and sediment, and (if possible) is recommended to be completed monthly for areas of concern. Street sweeping is typically a requirement of communities that have separated stormwater systems and need to comply with the Massachusetts General Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) permit.

While sweeping can effectively remove trash from entering the combined sewer system, because it is an intermittent practice, it is not recommended as the sole floatables control practice to be employed. Rather, sweeping can supplement structural practices to capture floatables and debris and help reduce the maintenance requirements by lowering the loading of floatables to the system.

3.1.3 Non-Structural - Public Education and Outreach

Another non-structural best management practice to prevent floatables and debris from making it to the combined sewer system is public education and outreach. Programs to educate the public about litter, stormwater runoff, and the potential impacts to downstream receiving bodies can help make residents aware of the importance of properly disposing of debris and help lessen the loading of floatables in the combined sewer system. This can include signage on catch basins to make it clear that runoff can drain to waterbodies, social media campaigns, or school programs to teach about the importance of pollution prevention. Similar to street sweeping, public education and outreach are not a standalone management practice to address floatables, but rather help lessen the loading to other structures. For communities that also have separated stormwater sewer systems and are regulated by the Massachusetts General MS4 NPDES permit, public education and outreach programs are required to be in place that cover similar topics within the separated sewer areas. These programs can be expanded to include relevant signage in the combined sewer service areas and include materials focused on floatable debris pollution.

3.2 IN-SYSTEM CONTROL TECHNOLOGIES

3.2.1 Baffles

Baffles are vertical panels, typically constructed of either steel or concrete, that are affixed to the top of a CSO regulator and placed at an elevation just below the height of the regulating weir. This forces the water surface above the baffle during discharge events, causing floatable materials to be caught behind the baffle. Following the discharge event, floatable material will remain within the combined sewer system and be conveyed to the wastewater treatment plant. Underflow baffles, where flow is forced below the baffle, are the only type of baffle applicable for floatable controls.

Baffles are a simple and low-cost technology that can be applied to most CSO regulators, including both new construction and retrofit of existing ones. Stainless steel baffles are typically used to retrofit existing regulators for ease of installation, while concrete is typically recommended for new construction. Because debris theoretically should be conveyed away from the regulator following an event, required maintenance is minimal.

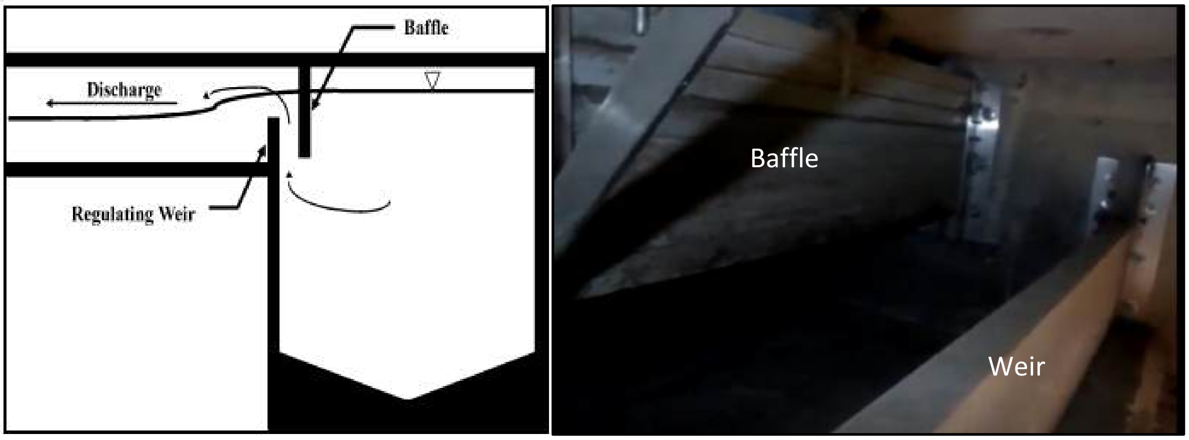

Figure 3 – Graphical depiction of baffle upstream of regulator weir (left) and example of baffle installed at a regulator weir (right)*; Source: EPA 832-F99-008 (left) and City of Somerville (right)*

3.2.2 Screens

Screens are placed within the combined sewer system to capture floatables and debris prior to reaching the regulator and outfall. Screens can be located within the collection system itself, placed in manholes or other drainage structures to capture debris before being flushed downstream, or as an end-of-pipe solution at the outfall point. In either case, maintenance access should be considered before installing a screen.

Screens are comprised of a grid of metal bars that physically prevent debris from flowing through the combined sewer system. The size of the grid can vastly change the capture potential of the system, with measured performance ranging between 25 and 90% of material captured, depending on the grid size. Typically, in combined sewer applications, a grid size opening larger than 1 inch is used because smaller sizes result in clogging and more frequent maintenance. Screens with these larger openings are typically referred to as bar screens.

Maintenance for screens is significant because the buildup of debris on the screens can reduce the hydraulic capacity of the system and cause clogging. Maintenance is recommended following every overflow event. Therefore, when placing a bar screen within a combined sewer system, access for maintenance should be considered.

Figure 4 – Example bar screen installation within a combined sewer system manhole; *Source: [OWEA Annual Conference 2010, Options for Solids and Floatables Control]*

3.2.3 Proprietary Controls

In addition to the technologies discussed thus far, proprietary products are available that employ technologies such as baffles, screens, and nets to control floatables and improve maintenance of the systems. Proprietary controls typically carry a higher cost than the other technologies discussed, but can come with a reduced need for maintenance, personnel, and higher performance. Some examples of products available include:

- Dynamic Baffles:
  Dynamic baffles are situated within combined sewer system structures and use a buoyant frame to adjust to the level of flow within the combined sewer system. This allows the floatables control to be employed in both low and high flow conditions. Unlike traditional baffles, which are typically placed at regulator weirs to ensure flow reaches the baffle, dynamic baffles can be used in-line with the combined sewer system to provide multiple points of floatable control. An example of a dynamic baffle is shown in **Figure 5**.

- Self-Cleaning Bar Screens:
  Self-cleaning screens are mechanically raked, typically using rakes attached to a looped chain, to remove the buildup of debris on the surface of the screen. These systems are typically paired

with a pressure transducer to measure the pressure in the system and indicate via pressure drops when clogging of the screen starts to occur, therefore triggering the need for the screen to be cleared.

- Hydrodynamic Separators

  Hydrodynamic separators, or swirlers and vortex units, use a cylindrical chamber to separate 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, paired with screens and baffles over the lower outlet, serves the dual purpose of removing solids and capturing floatables and trash within the system.

Figure 5 – Dynamic Baffle (Left), Mechanically Cleaned Screen (Center), and Hydrodynamic Separator (Right); *Source: OWEA Annual Conference 2010, Options for Solids and Floatables Control*

3.3 END-OF-PIPE CONTROL TECHNOLOGIES

3.3.1 Netting

Nets can be used as an end-of-pipe solution to capture any large debris or floatables that make it through the regulator during a CSO discharge. Nets can either be suspended via a metal frame within an outfall regulator to catch debris in-line, or installed floating in the receiving water body to capture debris outside of the regulator. If they are located in the receiving water body at the outfall point of a CSO regulator, permitting may be challenging due to the potential impact on aquatic habitat. Nets should also not be placed in locations with high recreational activity due to potential damage to the system.

Nets can be designed to a variety of sizes to reduce the frequency of maintenance needed to clear debris; however, if installed outside of the regulator buildup of floatables can be highly visible to the public. Regular maintenance is required to empty debris to avoid clogging of outfalls. Because they are an end-of-pipe solution, nets can work well in tandem with other in-system and source control solutions, providing a last line of defense against floatables reaching the receiving body of water.

Figure 6 – End-of-pipe netting system.
Source: Learn About Aquatic Trash | US EPA

3.3.2 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 bodies of water. Booms are typically anchored to structures installed on the shores and include curtains that extend below the surface of the water to act as a baffle across an open water body. In addition to floating debris such as trash, containment booms are highly effective at containing oils because of the continuous barrier created along the surface of the water. This is especially the case when installed in a location where waters are relatively calm and not subject to wave action, where the barrier may be disrupted. A study of containment booms installed at outfalls to Jamaica Bay, NY, found that the technology was effective at removing approximately 75% of all floatable materials over a two-year study period (EPA 1999).

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. As an end-of-pipe solution, containment booms are also effective in tandem with upstream solutions. This can minimize the frequency of required maintenance and allow the boom to serve as a last line of defense against floatables.

As with nets, containment booms located within the receiving water body can be an impediment to recreation due to the physical barrier on the surface that they pose. Additionally, containment booms cannot be used during winter months in water bodies that regularly freeze, as the boom is required to float on the water surface to be effective.

Figure 7 – Containment boom floating on the water surface. Floatables are trapped on one side of the boom.

Source: Learn About Aquatic Trash | US EPA

3.4 FLOATABLE CONTROLS BMP SUMMARY TABLE

Table 1 summarizes the BMPs detailed within Sections 3.1 – 3.3. The table includes the pros and cons of each BMP and capital costs, including construction. The costs do not include operation and maintenance.

Table 1 – BMP Summary Table

BMP	Description	Pros	Cons	Cost Range
Catch Basin Modifications	Source control. Raises the catch basin water surface above outlet point. Examples include: hood, outlet connected to combined sewer via riser, slotted bucket below inlet grate.	Up to 85% reduction in litter entering combined sewer system per catch basin.	Requires routine and distributed maintenance to clear debris buildup.	$1,000-$3,000 Capital cost, does not include installation
Street Sweeping	Source control. Vacuum sweepers which can collect both large debris and fine dust and sediment.	Existing programs could be expanded to aid combined sewer service area.	Requires consistent, high-frequency sweeping for BMP to be effective; cannot stand alone as a control.	Staff time
Public Education	Source control. Can include signage on catch basins, social media campaigns, or school programs.	Existing stormwater and sewer education programs could expand to include relevant signage and materials for combined sewer service areas.	Cannot stand alone as a control, only as a supplement to additional structural controls.	Staff time
Baffles	In-system control. Vertical panels (typically steel or concrete) affix to CSO regulators and extend below top of weir. Flow travels under baffle, which catches floatables.	Low-maintenance – self-flushing, and contained at single point at regulator. Simple and low-cost technology. Retrofitting existing systems is an option.	Likely to require structure modification to achieve required flow paradigm	$70,000 - $100,000 Capital costs, does not include installation and structure modifications where required
Dynamic Baffles	Proprietary in-system control. These baffles use a buoyant frame to adjust to the level of flow within the CSO, allowing floatables to control for varying flow heights.	Low-maintenance, self-flushing. Adjusts to low or high flow for continuous floatables control. Can be used in-line with the combined sewer system instead of just at regulator weirs like static baffles.	Likely to require structure modification to achieve required flow paradigm	$25,000 - $50,000 Capital cost, does not include installation and structure modifications where required
Screens	In-system control. Can be located within the collection system, in manholes or other drainage structures, or as end-of-pipe solutions. Bar screens (grid opening greater than 1”) typically used in combined sewers.	Maintenance only required at point locations. Measured performance between 25 and 90% of material captured depending on grid size.	Regular maintenance required, recommended after every storm event. Smaller grid sizes require more frequent maintenance and cause clogging. Access for maintenance must be considered.	$1,000 - $5,000 Capital cost, does not include installation
Self-Cleaning Bar Screens	Proprietary in-system control. These screens are mechanically raked with rakes attached to a loop chain, typically connected	Maintenance only required at point locations. Self-cleaning function reduces maintenance and clogging frequency, decreasing	More expensive than simple screen options. Self-cleaning screens systems larger and therefore less flexibly installed than other screen	$200,000 - $400,000 Capital cost, does not include installation and

BMP	Description	Pros	Cons	Cost Range
	to a pressure transducer which senses clogging.	reasonable grid size to catch finer materials.	options. Requires mechanical power source.	structure modifications where required
Hydrodynamic Separators	Proprietary in-system control. Also known as swirlers or vortex units, these are cylindrical chambers that induce circular flow to settle solids while capturing floatables with screens and baffles over the outlet.	Maintenance required only at point locations. Dual function of solid settling and floatables capture.	Regular maintenance required.	$70,000 - $100,000 Capital cost, including installation
Netting	End-of-pipe control. Can be suspended via metal frame within outfall regulators or floating in receiving water body to catch floatables.	Maintenance only required at point locations. Can work well in tandem with other in-system controls, providing last line of defense.	Regular maintenance required. May present permitting challenges due to potential impact on aquatic habitat. Unsuitable for locations with heavy recreational activity due to potential system damage. Floatable build-up can be highly visible if netting installed outside of regulators.	$700 - $1,500 Capital cost, does not include installation or maintenance
Containment Booms	End-of-pipe control. Floating structures create a continuous surface barrier to intercept floatables. Typically anchored to on-shore structures and include curtains extending below the water surface.	Maintenance only required at point locations. Can work well in tandem with other in-system controls, providing last line of defense.	Regular maintenance required. May impeded recreation due to physical surface barrier. Unsuitable for winter use in water bodies that regularly freeze. Buildup of floatables can be highly visible to the public.	$1,000-$2,000 Capital cost, does not include installation or maintenance

**Note: Cost are based on compiled information from vendor inquiries across April through August 2025 and prior construction projects. These costs are approximations for planning purposes and may not reflect actual costs from specific project improvements. For maintenance cost (performed by staff when possible), assumed $3,000 per day for a 2-person crew. Otherwise, vendor service and maintenance contracts may be available for each product at negotiated rates.*

4 EXISTING FLOATABLE CONTROLS

4.1 CITY OPERATIONS AND SOURCE CONTROLS

Non-structural controls serve as a major component of the City's floatable control strategy, with several programs helping reduce the amount of floatables that flow to the combined sewer system at the source. These controls include catch basin cleaning programs, street sweeping programs, public outreach and education, and volunteer programs that encourage residents to help in reducing floatable contributions. Additionally, catch basin hoods are used intermittently throughout the city as a distributed structural control that aims at source reduction of floatables.

Catch Basin Cleaning:

The City has developed a catch basin cleaning program that optimizes routine inspections, cleaning, and maintenance of catch basins to ensure that no catch basin within an MS4 area is more than 50% full at any given time. The program is a requirement of the MS4 NDPES permit, which regulates stormwater discharges from the City's separated stormwater system, but the maintenance aids in collecting and removing floatable debris at scale throughout the City. Catch basins within combined sewer system areas are cleaned as needed by City staff.

Catch Basin Hoods:

Catch basin hoods are used intermittently throughout the City and can help trap floatable debris in the catch basins and prevent it from flowing through the combined or separated stormwater systems. While not installed at scale in the combined sewer system service area, one of the two inlets directly to the SOM001A regulator is currently retrofitted with a catch basin hood.

Street Sweeping:

The City maintains a street sweeping program that runs from April 1st through December 31st, which aids in removing debris from the roadways and helps reduce the load of floatables that wash into catch basins during storm events. Sweeping occurs bimonthly for neighborhood streets and weekly for major rights-of-way. Street sweeping occurs in both the combined and separated sewer service areas and, in addition to aiding with floatables, is a requirement of the City's MS4 permit.

Public Outreach Programs:

The City of Somerville publishes public education, outreach materials, and program information on its Stormwater Management website, as highlighted in **Figure 7**. Information highlights ways that residents can reduce their pollutant load and keep floatable debris from entering the City's stormwater systems. Additionally, the City is installing signage on catch basins. The signs notify the public that items dumped into catch basins enter the river and contribute to pollution. At present, the City has installed a limited number of educational signs at catch basins. Sign installation is slated to continue throughout the year, specifically in the catchment area of the SOM001A outfall.

The City's "Adopt-a-drain" program is another public engagement program that encourages residents to sign up for a local catch basin and assume responsibility for checking on and removing surface debris from the catch basin prior to and following heavy rain, wind, and snow. This allows for high-frequency cleaning of individual catch basins, provides an opportunity for increased source control of floatable debris.

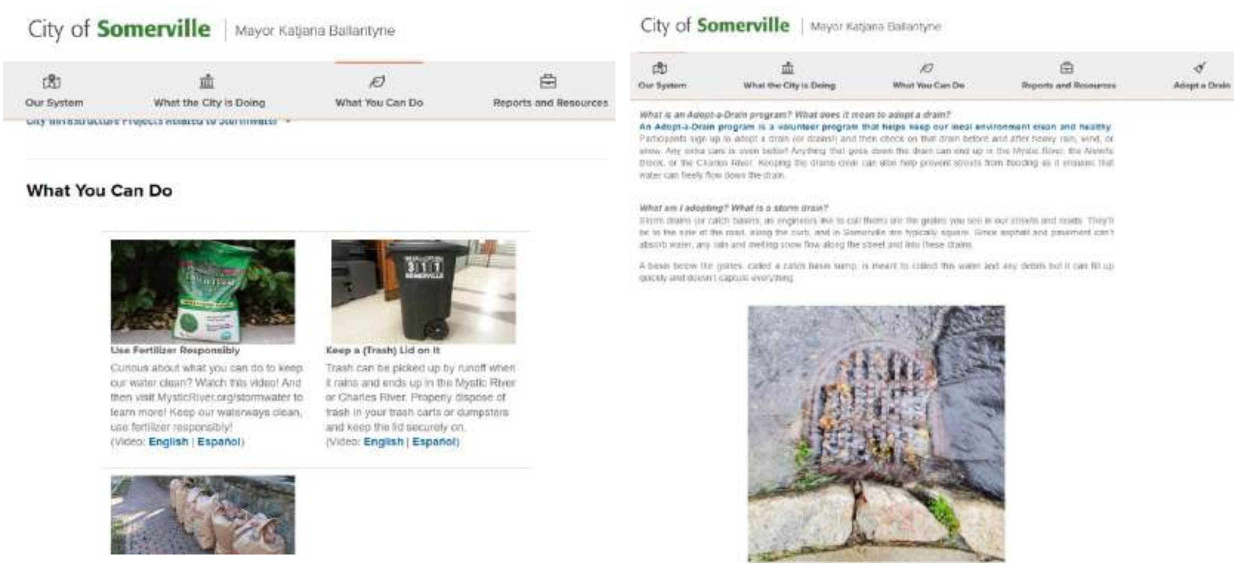

Figure 8 – Screenshots of the City of Somerville's Stormwater Management website (Stormwater Management | City of Somerville), highlighting existing public education and outreach programs that include responsible waste management (Left) and the city's Adopt-a-Drain program (Right).

4.2 EXISTING FLOATABLES CONTROL AT SOM001A

In addition to the non-structural controls described in Section 4.1, the City currently has an underflow baffle installed at the SOM001A outfall to help mitigate floatable debris from entering Alewife Brook.

The baffle spans the length of the outfall and extends from the top of the structure directly downstream of the regulator weir (**Figure 9**).

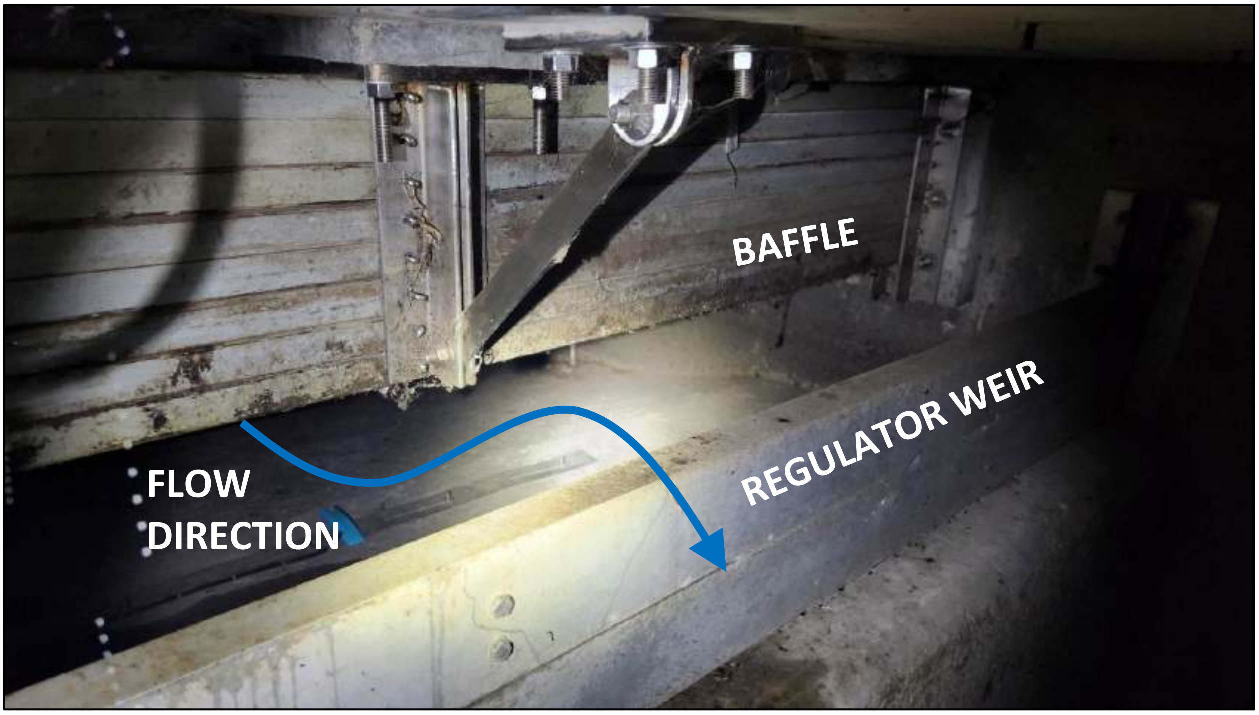

Figure 9 – Installed Baffle at SOM001A Outfall (Site visit 7/31/2025)

The outfall structure is approximately rectangular with a width of 96.75 inches, a height of 41 inches, and a length of 75 feet. During dry weather, flow exits the structure through a vertical drop into the MWRA interceptor below, conveying primarily wastewater to the MWRA interceptor. Downstream of the MWRA interceptor connection, the structure widens to a width of 167.75 and slopes upward. The structure ends at a rectangular weir at an elevation of 41.1 ft. During wet weather events, when flow levels exceed the capacity of the MWRA interceptor, combined flows surpass the weir and overflow into the Alewife Brook. Design sketches are shown in **Figure 10.**

The outfall opening is rectangular with dimensions of 167.75 inches by 18 inches. The outfall site is shown in **Figure 11**. A baffle is located immediately upstream of the weir to prevent the release of floatables. A manhole is located immediately downstream of the weir for access. Two catch basins convey runoff into the CSO structure and are located just north of the outfall on Alewife Brook Parkway.

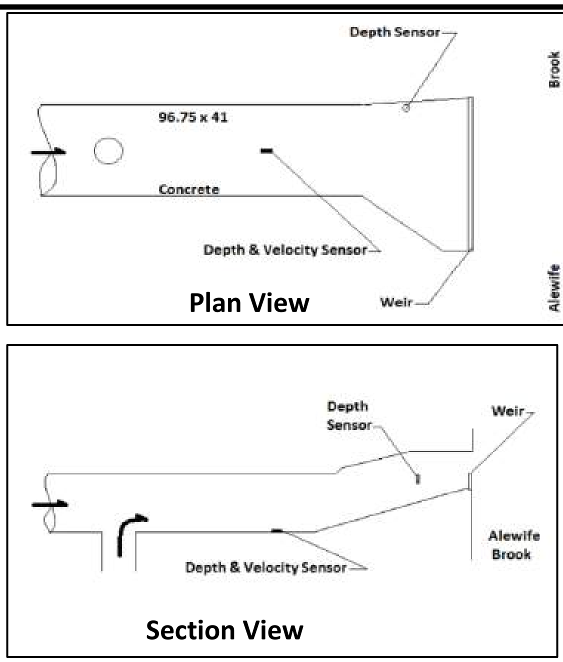

Figure 10 – SOM001A Sketch

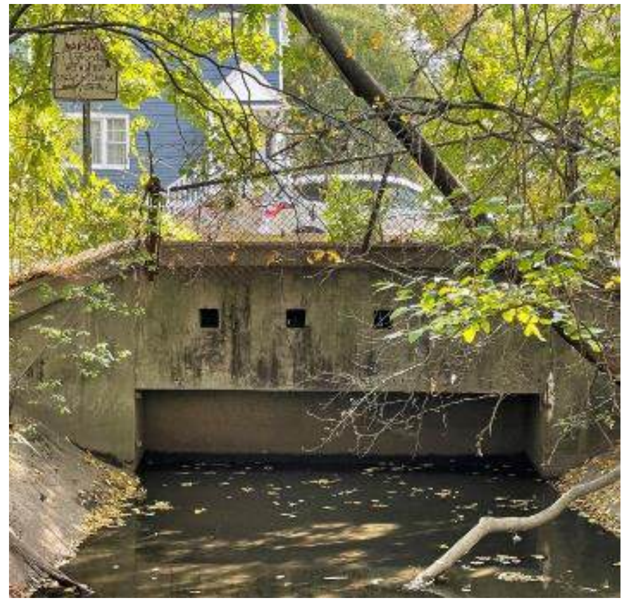

Figure 11 – Front View of SOM001A Outfall

5 FLOATABLE CONTROLS EVALUATION

5.1 BASIS OF DESIGN REVIEW

Existing floatable controls at SOM001A were selected based on an analysis completed for MWRA in 1996 that sought to control floatables throughout the MWRA system (Metcalf-Eddy, 1996). This evaluation report assessed all existing CSO outfalls that did not have treatment associated with them and reviewed the feasibility of installing common floatable control technologies. Floatable control technologies deemed feasible for installation at SOM001A included:

- Underflow baffles
- Manually-cleaned bar screen
- End-of-pipe nets
- In-line nets
- Nonstructural technologies

Because the Alewife Brook, where SOM001A discharges, is subject to freezing during winter months, some control technologies, such as surface skimmer vessels and containment booms, were not considered due to their reliance on surface water to function properly.

Of the structural controls considered in the Basis of Design report, underflow baffles were determined to be the most feasible option due to their relatively low cost, reduced maintenance requirements, and ease of installation within the existing regulator structure.

5.2 EMPIRICAL EVALUATION OF EFFECTIVENESS

Empirical equations used to predict baffle efficiency cannot precisely determine performance at SOM001A due to the outfall's unique geometry. However, these models still offer valuable insight into the key factors that influence baffle effectiveness.

One such model is described in *A Methodology to Design and/or Assess Baffles for Floatables Control* (Newman II, 2001). This approach begins by calculating the minimum rise velocity—the lowest vertical velocity a floatable particle must achieve to reach the baffle's capture zone. This zone extends upward from a few inches above the bottom of the baffle, where particles are no longer susceptible to being pulled beneath the baffle by undercurrents.

For turbulent flow conditions, the minimum rise velocity is calculated using the following equation: $V_{z,min} = (Z_0 + Z_d) \times \frac{V_x}{X_0} + C \times V^*$

$V_{z,min}$ = minimum rise velocity (m/s)

Z_0 = the distance the floatable must rise to meet the baffle (m)

Z_d = the height of the carry-under zone, where undercurrents pull floatables underneath the baffle (typically 0.15m) (m)

V_x = the velocity of water moving through the outfall structure (m/s)

C = an empirically derived constant, typically 1.2

V^*= root mean square velocity component of the vertical velocity, which is calculated based on the hydraulic radius of the structure, the roughness of the structure, and the velocity of flow through the structure. (m/s)

Minimum rise velocity results are compared to a distribution of rise velocities for floatables collected from CSO outfalls in Montreal, shown in Figure 11 below. Assuming similar materials make up the floatable objects in the CSO in question, the distribution of rise velocities can be used to predict the baffle's efficiency.

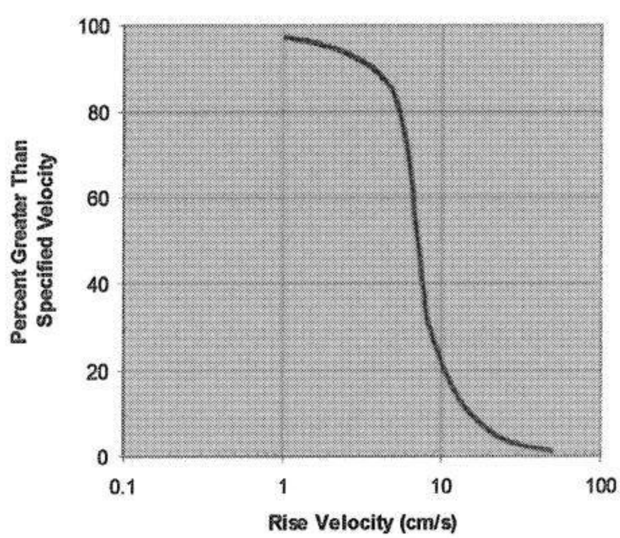

Figure 12 – Minimum rise velocity distribution (Newman II, 2001)

As the equation indicates, water velocity plays a critical role, since higher velocities reduce the time available for floatables to rise and increase the likelihood of carry-under losses. The effective capture zone, or vertical clearance between the bottom of the baffle and the crest of the overflow weir, is also of importance; if this distance is too small, floatables may bypass the baffle entirely. Additionally, the length of the regulator structure affects the horizontal travel distance and thus the time available for floatables to rise. According to this methodology, longer chambers generally allow for greater floatables separation, while shorter chambers may limit baffle effectiveness due to constrained rise trajectories.

While this approach provides a robust theoretical basis for assessing baffle performance, its direct application to the SOM001A structure is limited by the site's atypical geometry. The equation above is developed for a box-like structure, while SOM001A flattens and widens at the downstream end. This geometric variation alters the flow paradigm and complicates critical input values, including the hydraulic radius and flow velocity. As a result, significant further measurements and/or computer modelling would be required to conceptually evaluate the effectiveness of the baffle at SOM001A.

5.3 FIELD OBSERVATIONS

As part of the floatables BMP feasibility analysis required under the latest MassDEP water quality variances for Alewife Brook, a multi-phase field visit was conducted at the SOM001A regulator site in Somerville, MA. The purpose of the visit was to observe site conditions during and after a wet weather event and assess the behavior and presence of floatable materials potentially contributing to combined sewer overflows (CSOs). The inspection spanned three time windows between July 31 and August 1, 2025, capturing conditions before, during, and after a 1.65-inch rainfall event.

Observations during light and heavy rainfall indicated saturated ground and surface ponding, particularly near curblines and catch basins (as shown in **Figure 12**). During peak rainfall, further surface ponding was noted around SOM001A, but the outfall itself had yet to demonstrate conditions of hydraulic surcharging within the structure. The general site conditions throughout each site visit reflected a limited presence of surface floatable debris. And the slow-moving surface runoff during the peak of the rain event did not demonstrate any debris being conveyed into the collection system. While the observed conditions may not be representative of conditions at the SOM001A outfall during all times of the year, floatable discharge from SOM001A does not occur if there is no CSO activation.

Figure 12 – Conditions Adjacent to SOM001A During Rain Showing Runoff Near a Catch Basin

To date, the 2025 calendar year has had two CSO overflows at SOM001A. A 10-minute overflow occurred on August 29, 2025, and a 15-minute overflow occurred on September 6, 2025.

6 CONSIDERATIONS FOR SYSTEM FLOATABLES CONTROL

6.1 REGULATORY CONSIDERATIONS

6.1.1 Water Quality Standards Variance

In line with the Clean Water Act, Massachusetts has published the Massachusetts Surface Water Quality Standards. These standards are outlined in 314 CMR 400. The standard categorizes all water bodies into "classes" based on their intended use. Each class of water bodies must meet certain water quality metrics to ensure that it can support its intended use. MassDEP regulates the types and volumes of discharges into each water body to make sure that the required water quality standards are met.

In instances where it is infeasible to meet discharge requirements, MassDEP provides a Water Quality Standard Variance. As discussed in Section 2, the requirement of the Variance is the basis for this report.

As part of the Variance, the City must mitigate the effects of CSO outfalls and work to minimize CSO discharge volume and frequency. It requires that the City complete an "evaluation of floatables control for each of the City of Somerville's outfalls that discharge to Alewife Brook or the Upper Mystic River. The evaluation shall "assess the effectiveness of the current controls and identify recommendations for improvements." The Variance also requires that the City implement the "recommendations for improvements."

6.1.2 NPDES CSO Permit - Floatables

The NPDES program is a national program that regulates point-source pollutant discharges to waters of the United States. NPDES permits establish both acceptable pollutant levels in a discharge and establish specific technologies that must be used to limit a pollutant. The permits also set forth monitoring and reporting requirements for discharges. In Massachusetts, the NPDES program is administered by the EPA.

In 2012, the EPA issued a NPDES permit to the City of Somerville for its CSOs. The permit contains no requirements with the primary purpose of addressing floatables control. However, some requirements may reduce the release of floatables as a secondary benefit. The permit requires periodic inspection of the CSO structure. With such frequent inspection, the City can ensure trash does not build up and then get released during overflow events. Furthermore, the permit sets specific CSO volume and frequency limits, and reducing CSO overflow volume in the Alewife will reduce odors at the outfall. Finally, the NPDES permit orders that the City remain in compliance with Water Quality Standards Variances issued by MassDEP, which mandates that floatable control measures be identified and implemented.

6.1.3 NPDES CSO Permit - Maintenance

The City is also required to adhere to its NPDES CSO Permit (No. MA0101982). This permit mandates that the City continue to implement the Nine Minimum Control measures and lists specific activities that must be undertaken to meet these measures. As part of the City's program to address the nine minimum control measures, the City conducts catch basin cleaning to keep all catch basins less than 50% full. This reduces the quantity of floatables in the sewer system, reducing the likelihood of floatable release. Finally, the permit requires that the city conduct regular street sweeping, which removes trash on the road before it can enter catch basins. Somerville sweeps the main streets weekly and side streets bi-weekly from April through December.

6.2 PERMITTING CONSIDERATIONS

SOM001A is located within the City of Cambridge, on Department of Conservation and Recreation (DCR) land, as shown in **Figure 13**. The sewer pipes entering the outfall are located under the Alewife Brook Parkway, a DCR right of way, but the twin pipes directly upstream traverse across City of Cambridge property. Work in this location must be coordinated with the City of Cambridge and DCR (as needed).

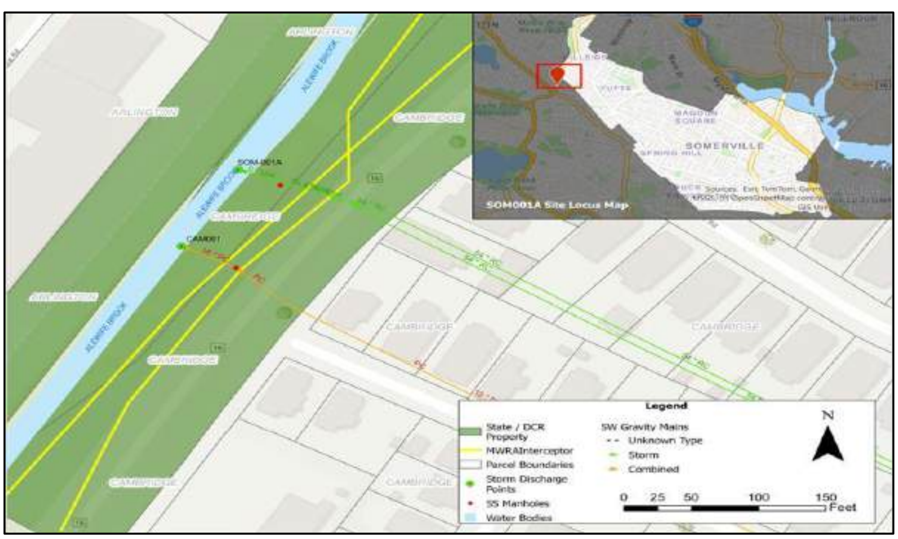

Figure 13 – SOM001A Map of Land Ownership

SOM001A is located on land managed by the DCR. As such, a DCR construction permit must be obtained for any work on the land surrounding the outfall. Permitting requirements for DCR construction permits are outlined in 302 CMR 11.08.

6.3 PUBLIC COLLABORATION

Floatables in sewer systems originate from a variety of sources, including improperly flushed items such as wipes, sanitary products, and packaging materials; debris washed into storm drains during rainfall; and litter discarded along streets and sidewalks. As such, addressing this issue requires a coordinated effort between municipal agencies and the public. Increasing public awareness is a critical component of source control. The City could enhance its outreach by expanding educational campaigns that highlight the consequences of littering and improper disposal practices. This may include targeted social media messaging, visual infographics, and interactive content that encourages responsible behavior. Additionally, updating the city's website to include clear guidance on floatables prevention, sewer system impacts, and community involvement opportunities would further support public engagement and long-term pollution reduction. In addition, the City has planned work to install placards adjacent to catch basins within the MS4 tributary to Alewife Brook, as shown in **Figure 14**.

Figure 14 – Catch Basin Placard to be Installed by the City

7 FINDINGS AND RECOMMENDATIONS

A theoretical evaluation of the SOM001A outfall is not possible given the geometry of the regulator structure, as discussed in Section 5.2. Furthermore, due to the lack of CSO activations with durations longer than 15 minutes since the issuance of the updated Variance and the relative infrequency of activations recorded at SOM001A, there is no indication that the SOM001A outfall is currently a considerable source of floatables in the Alewife Brook. The limited field observations corroborated this understanding with very little empirical evidence, but they may suggest that the existing floatable controls at SOM001A are functioning as designed.

Regardless of how the existing structural controls function at SOM001A, enhancements to the existing source control program for floatables will aid in reducing floatable debris in the Alewife Brook and Mystic River from both combined and separated sources throughout Somerville. To improve upon the existing controls, the following recommended actions are proposed:

1. Installing one hood in the catch basin adjacent to SOM001A (requiring coordination with DCR) and continued installation of hoods throughout the City on any new and replacement sewer projects;
2. Continuing the public education program and messaging around public trash and debris; and
3. Install an internal camera within the SOM001A CSO regulator structure to observe floatable activity.

7.1 CATCH BASIN HOODS

Currently, only one of the two catch basins directly connected to the SOM001A outfall structure is equipped with a hood. Installing a hood on the second catch basin could reduce the amount of floatable debris entering the structure. Installation of this hood should be coordinated with DCR, as the structure is located on DCR property.

In addition to hoods for catch basins directly connected to the SOM001A outfall structure, the City will continue installing catch basin hoods at new and replacement catch basins within the combined and separated stormwater service areas. This will aid in reducing floatable debris from entering Alewife Brook and the Mystic River. In line with NPDES permitting requirements, the City already conducts routine inspection and cleaning of all catch basins, ensuring any captured floatables are removed regularly without incurring additional maintenance costs.

7.2 PUBLIC EDUCATION

Public education plays a vital role in controlling floatable debris, as street litter is a common source of pollution in combined sewer systems. The City currently shares information on its Stormwater Management webpage, highlighting the importance of proper trash disposal. To strengthen community awareness, the City could amplify this message through social media channels, making it easier for residents to access and engage with the information. The City will also continue with plans to install placards adjacent to catch basins within the MS4 areas tributary to Alewife Brook.

7.3 SOM001A MONITORING

Additional field observation focused on wet weather conditions at the SOM001A outfall would improve the City's understanding of potential impacts during storm events. These observations should include the installation of a camera within SOM001A to continuously monitor for floatable activity. Camera installation inside the CSO structure is preferable, as external cameras require City Council and City of Cambridge approval per Ordinance 2019-20, Section 10-64 Surveillance Use Policy. At least two (2) months of continuous video monitoring at any time between March and November is recommended. The vendor-provided cost associated with the camera installation at SOM001A for two months is $3,500.

In tandem, field inspections of the banks of Alewife Brook should be performed both before and after storm events to assess any visible changes or pollutant accumulation.

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