

# CSO Control Plans Update Tools and Alternatives Development

October 24, 2023



DRAFT

# Today's Agenda

Welcome and introductions

Status of CSO Control Plans

Preview the Nov 15th public meeting

Discussion about projects progress and content

- [ CSO control tools
- [ Bookend scenario development
  - Alternatives development process
  - Unified Model preliminary results with 2050 typical year

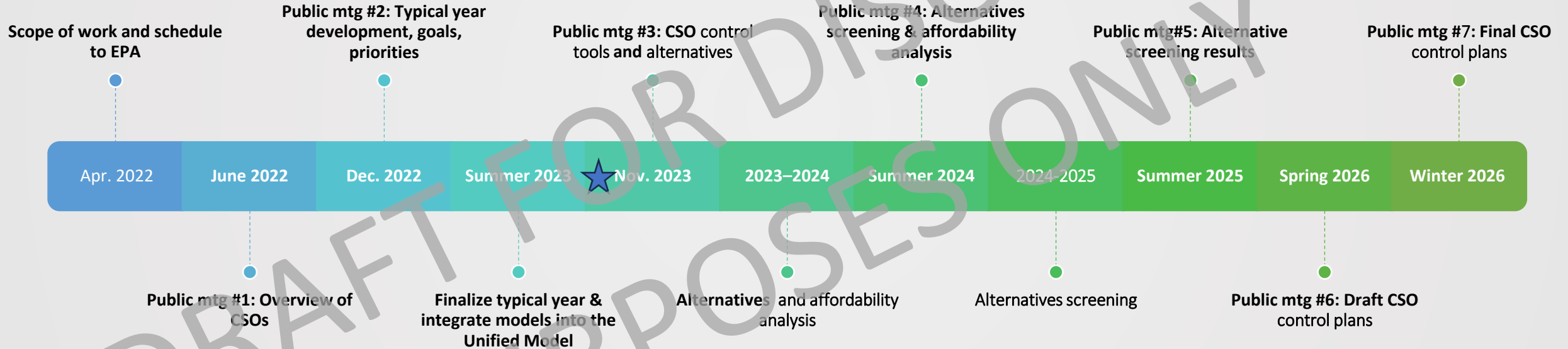
# Introductions

Name & affiliation

In small groups: Why does the Mystic / Charles / Alewife or this work matter to you?

DRAFT FOR DISCUSSION  
PURPOSES ONLY

# CSO Control Plans - Timeline






<b>November 15</b>	<b>Public meeting details</b>
Purpose	Provide a chance for the public to learn what we are doing and give input
Format	Virtual
Audience	General public
Language	Interpreting into at least 2 languages, maybe more
Outreach	Spreading the word now, please help!



# CSO Control Toolbox

# CSO Control Toolbox

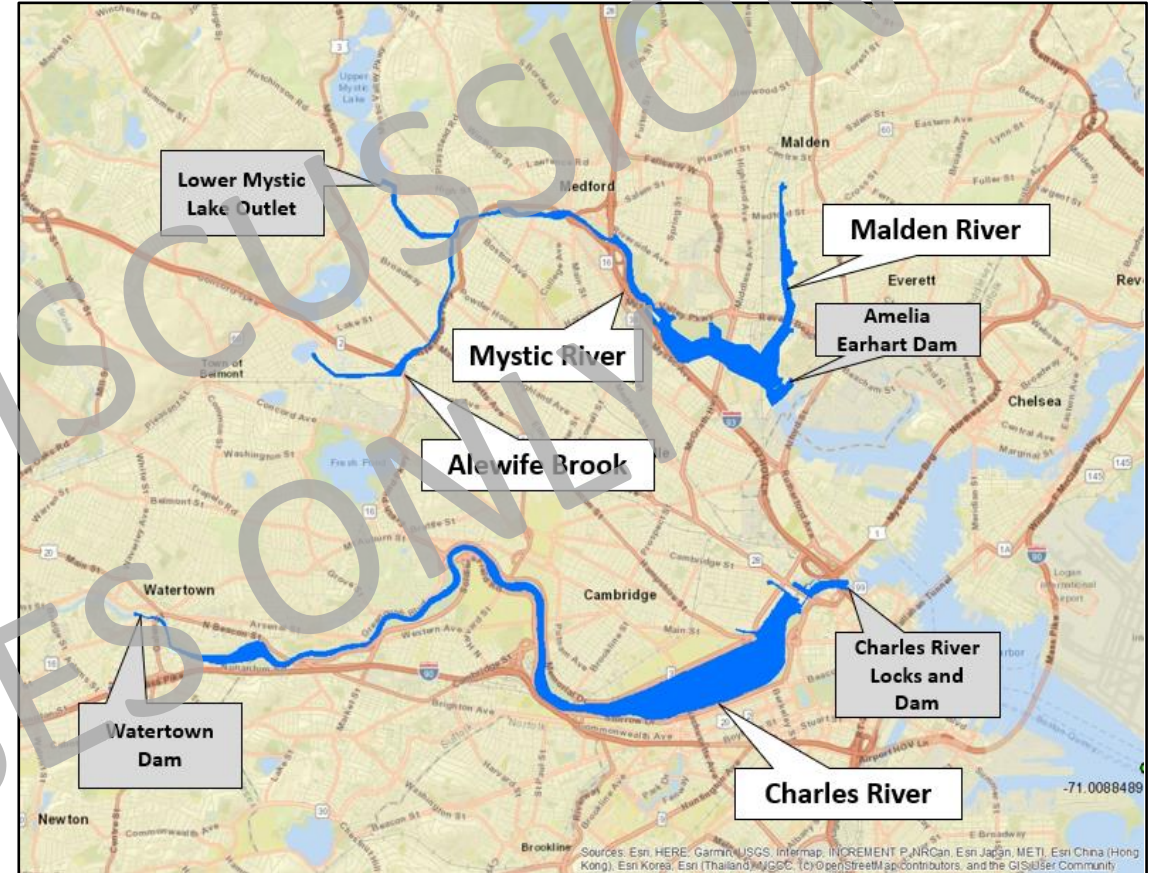
## 1. Source Control

- a) Sewer separation 
- b) Green stormwater infrastructure 
- c) Inflow/infiltration reduction 

## 2. Storage

## 3. Treatment

## 4. Conveyance



"Bookend evaluations" were performed with the Unified Model Baseline Conditions, quantifying CSO performance with theoretical, full-coverage implementation in the 2050 Typical Year.

# CSO Control Tool #1: Source Control

Reducing CSOs to the variance waters through:

**a) Sewer separation**



Build separate/ parallel pipe network; route stormwater directly to waterways.

**b) Green stormwater Infrastructure (GSI)**



Construct decentralized features to capture and infiltrate runoff before it enters the combined system.

**c) Infiltration/Inflow Reduction**



Rehabilitate old, leaky pipes to minimize groundwater and stormwater entering the combined system.



Sheeting for Drain MH on Concord Avenue  
Cambridge Sewer Separation Contract 9



Concord Avenue Drain Installation  
Cambridge Sewer Separation Contract 9



Constructed Bioretention Basin,  
Somerville 2022



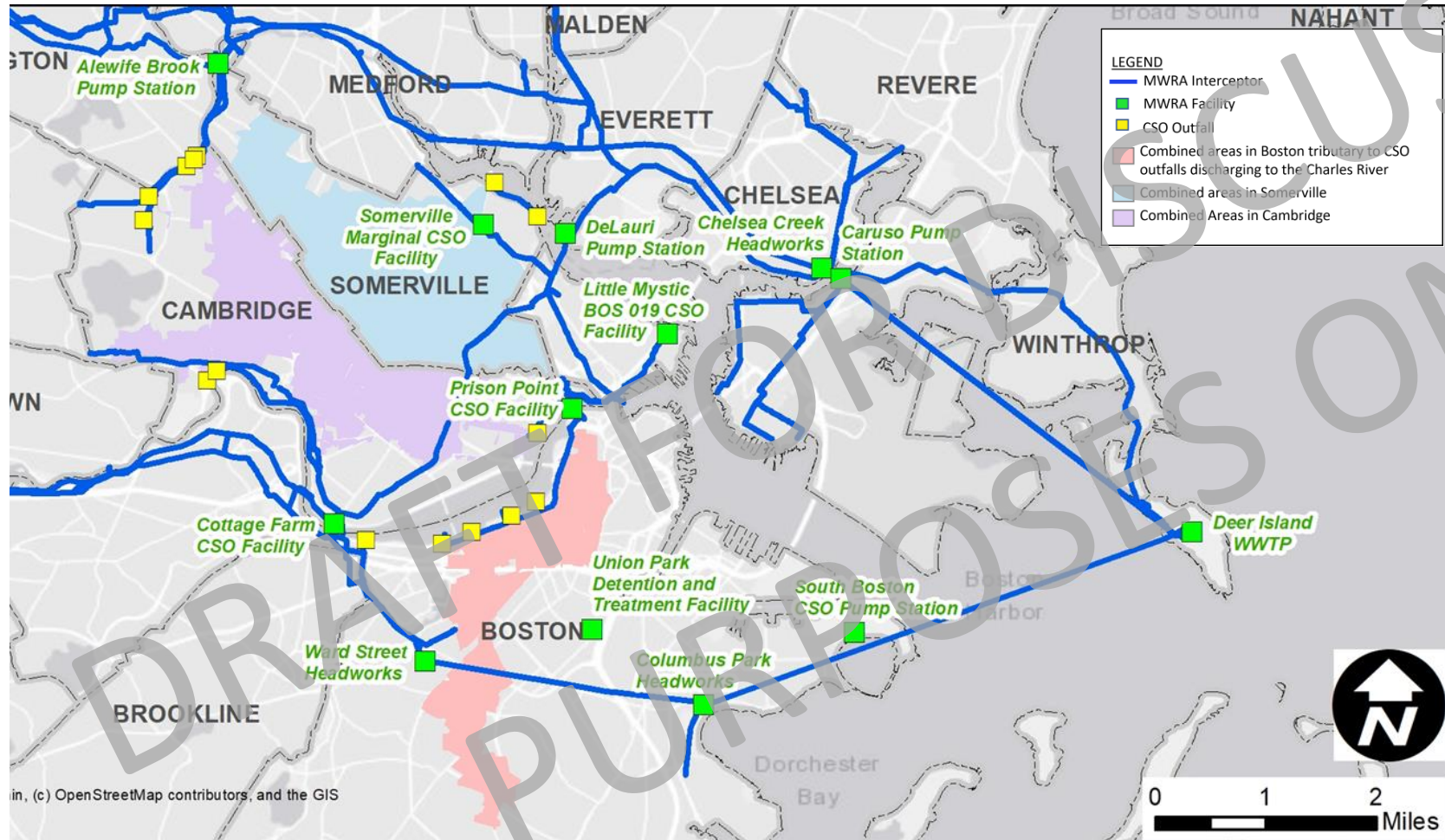
Root Intrusion in sewer pipe



# CSO Control Tool #1a: Sewer Separation



**Sewer Separation Bookend Scenario:** fully separate combined areas in Cambridge, Somerville, and Boston; discharge stormwater to waterways.



Areas to separate stormwater and route to waterways:

- 2,600 acres in Cambridge
- 2,100 acres in Somerville
- 1,200 acres in Boston

When discharging more stormwater, we must consider:

- Stormwater quality
- Stormwater quantity

# CSO Control Tool #1a: Sewer separation



## Bookend results by Outfall



BWSC Community Managed Projects:  
Bulfinch Triangle Sewer Separation Project

Installation of storm drain on Merrimac Street

Outfall	2050 Typical Year* - Baseline Conditions		2050 Typical Year* - Baseline Conditions + Regional Sewer Separation	
	Activation Frequency	Volume (MG)	Activation Frequency	Volume (MG)
<b>ALEWIFE BROOK</b>				
CAM001	1	0.02	0	0.00
CAM002	0	0.00	0	0.00
CAM401A	12	10.97	0	0.00
CAM401B	3	0.30	0	0.00
MWR003	3	1.08	0	0.00
SOM001A	13	8.51	0	0.00
<b>Alewife Total</b>	<b>13</b>	<b>20.87</b>	<b>0</b>	<b>0.00</b>
<b>MYSTIC RIVER</b>				
SOM007A/MWR205A	8	29.32	0	0.00
<b>Mystic Total</b>	<b>8</b>	<b>29.32</b>	<b>0</b>	<b>0.00</b>
<b>CHARLES RIVER</b>				
CAM005	6	0.74	0	0.00
CAM007	0	0.00	0	0.00
CAM017	3	0.72	0	0.00
MWR010	0	0.00	0	0.00
MWR018	4	1.85	0	0.00
MWR019	3	1.33	0	0.00
MWR020	3	3.07	0	0.00
MWR201 - Cottage Farm	4	29.80	1	0.13
MWR023	6	0.12	6	0.14
<b>Charles Total</b>	<b>6</b>	<b>37.63</b>	<b>6</b>	<b>0.27</b>

\* The Unified Model is still being developed and reviewed. Model results provided in this presentation are preliminary and are subject to change.

# CSO Control Tool #1a: Sewer separation



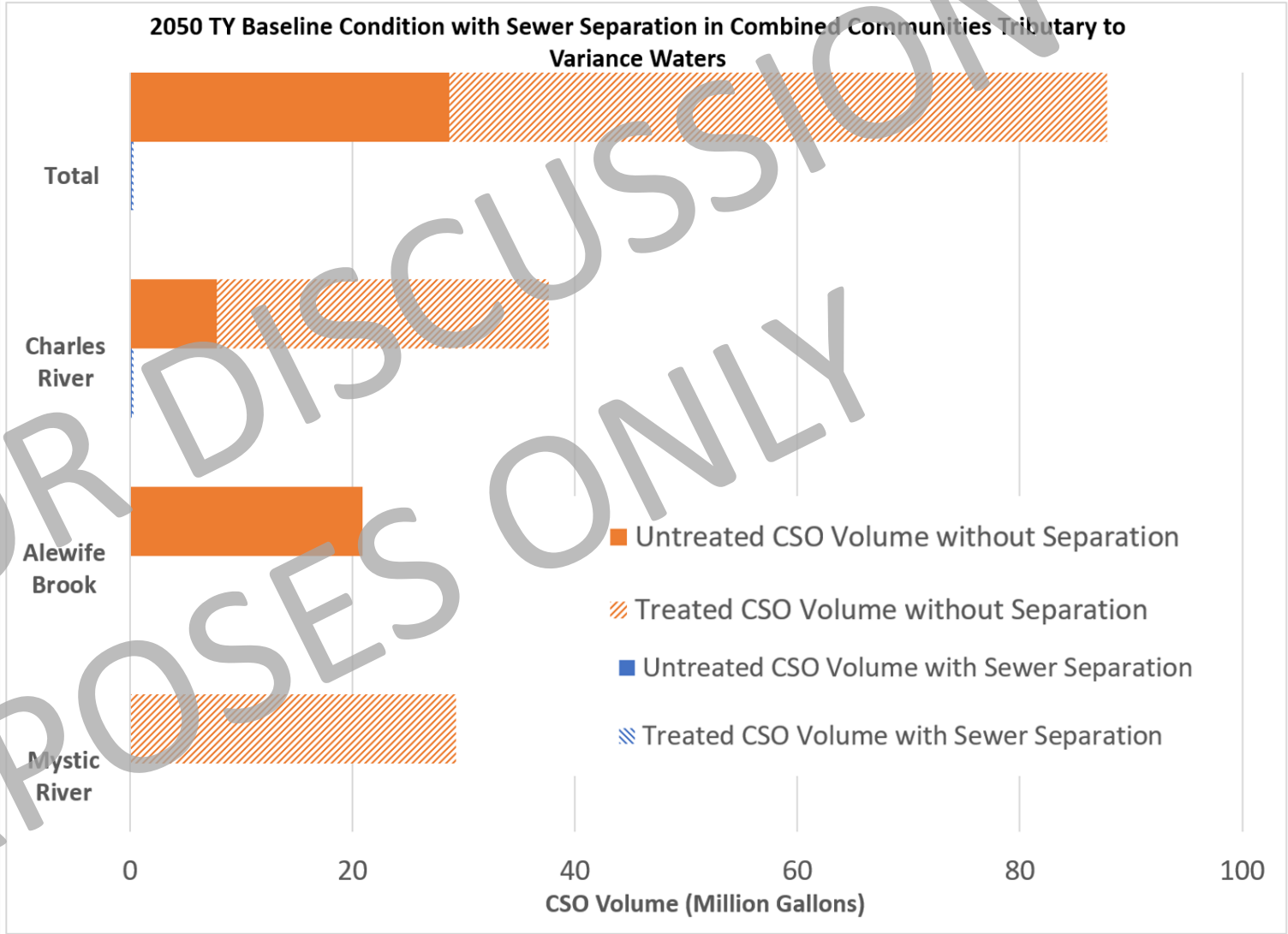
## Bookend results



Special Structure 6, Beacon Street, Brookline, June 2012



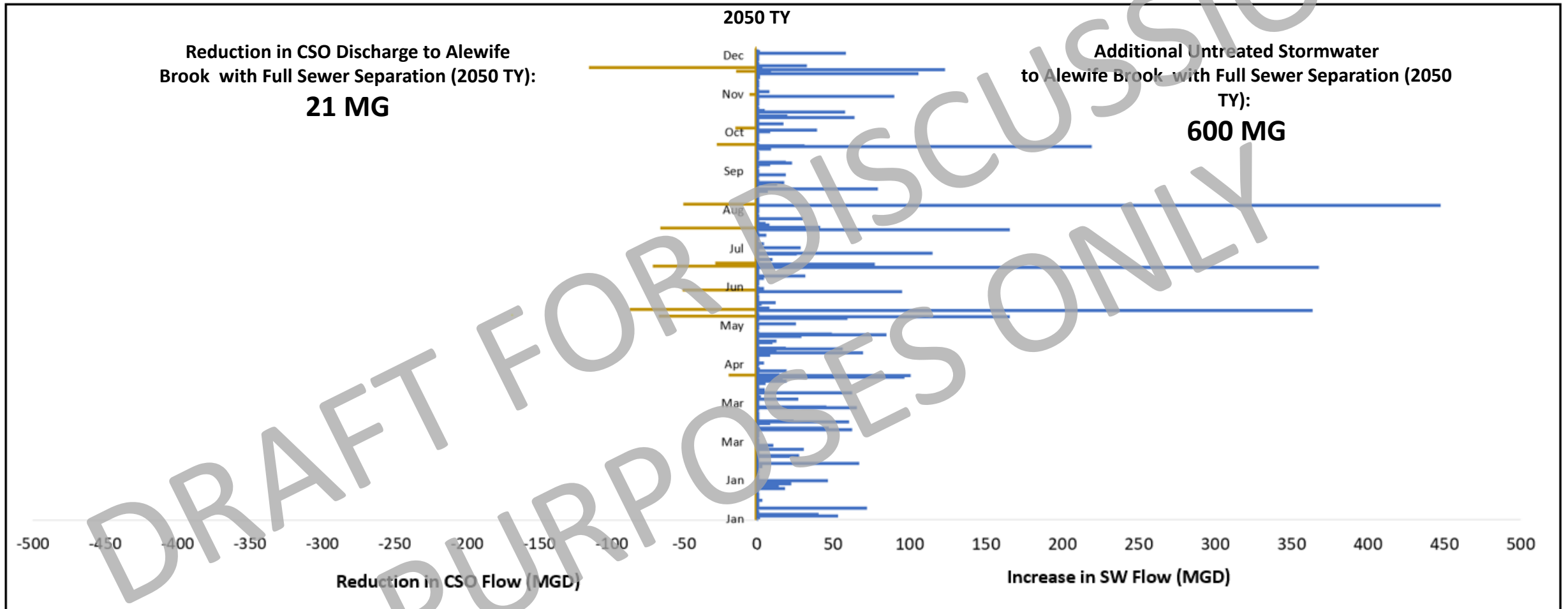
Trenching along Beacon Street, Brookline, August 2012



# CSO Control Tool #1a: Sewer separation



## Case Study: Stormwater Increase with Full Separation to Alewife Brook 2050 TY



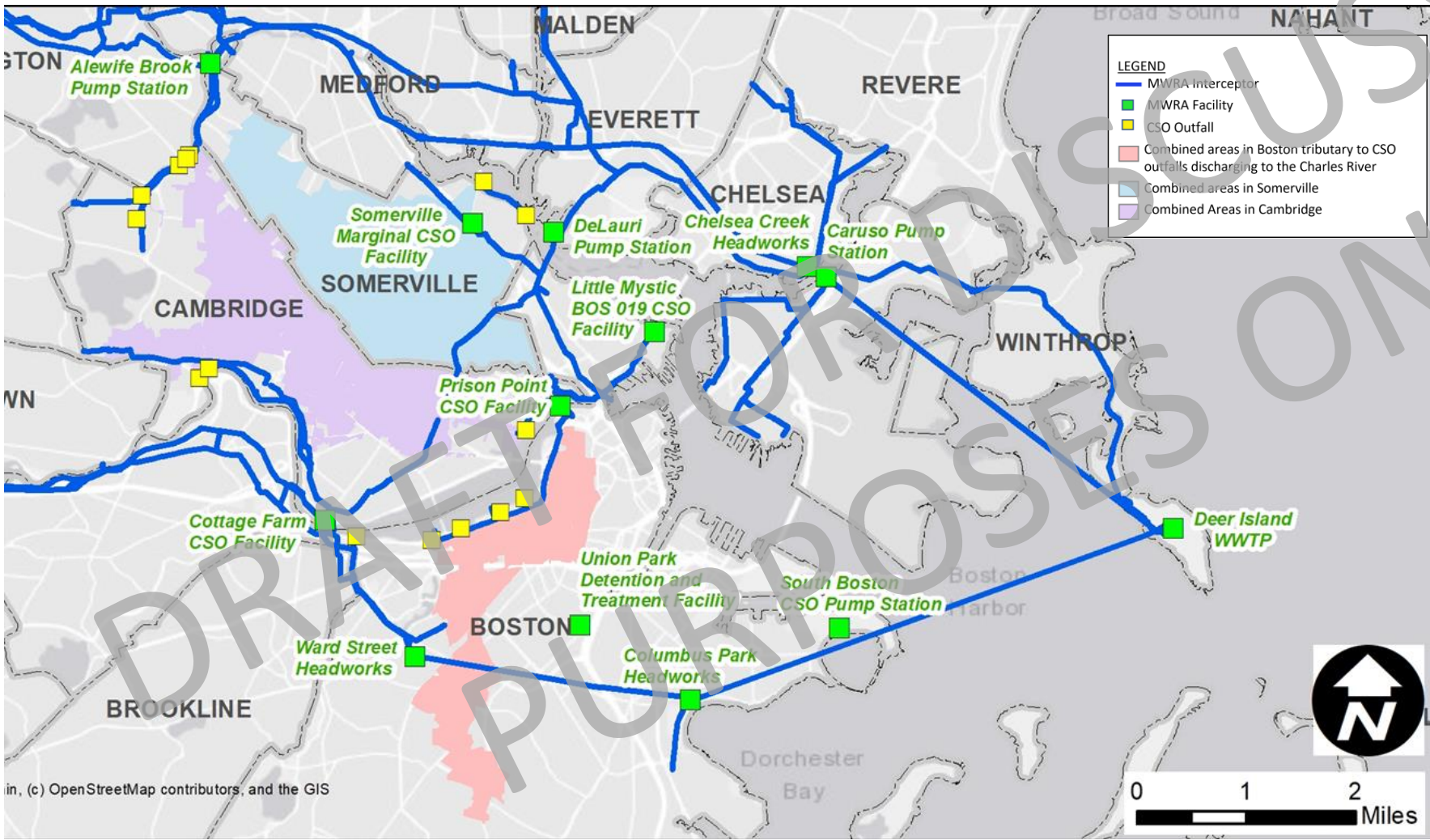
Reduction in CSO Discharge to **Variance Waters** with Full Sewer Separation (2050 TY):  
**88 MG**

Additional Untreated Stormwater to **Variance Waters** with Full Sewer Separation (2050 TY):  
**3,200 MG**

# CSO Control Tool #1b: Green Stormwater Infrastructure (GSI)



**GSI Bookend Scenario:** route runoff from 10% of impervious surface in combined areas (excluding roofs) to GSI systems; GSI captures the first 1-inch of rain and infiltrates in 48 hours.



- Representative number of GSI projects\* by community:
- Cambridge: 350-400 projects
  - Somerville: 300-350 projects
  - Boston: 150-200 projects

\*assuming 1,000 cubic feet (cf) storage capacity per GSI project

in, (c) OpenStreetMap contributors, and the GIS

# CSO Control Tool #1b: Green stormwater infrastructure (GSI)



## Bookend results by Outfall



Stormwater Bumpout on Somerville Ave, Somerville  
(200 sf footprint, 250 cf storage)

Outfall	2050 Typical Year* - Baseline Conditions (Preliminary Draft)		2050 Typical Year* - Baseline Conditions + Regional GSI	
	Activation Frequency	Volume (MG)	Activation Frequency	Volume (MG)
<b>ALEWIFE BROOK</b>				
CAM001	1	0.02	1	0.01
CAM002	0	0.00	0	0.00
CAM401A	12	10.97	12	10.06
CAM401B	3	0.30	3	0.26
MWR003	3	1.08	3	1.05
SOM001A	13	8.51	12	6.18
<b>Alewife Total</b>	<b>13</b>	<b>20.87</b>	<b>12</b>	<b>17.56</b>
<b>MYSTIC RIVER</b>				
SOM007A/MWR205A	8	29.32	8	27.38
<b>Mystic Total</b>	<b>8</b>	<b>29.32</b>	<b>8</b>	<b>27.38</b>
<b>CHARLES RIVER</b>				
CAM005	6	0.74	6	0.63
CAM007	0	0.00	0	0.00
CAM017	3	0.72	2	0.57
MWR010	0	0.00	0	0.00
MWR018	4	1.85	4	1.82
MWR019	3	1.33	3	1.28
MWR020	3	3.07	3	3.02
MWR201 - Cottage Farm	4	29.80	4	29.35
MWR023	6	0.12	6	0.12
<b>Charles Total</b>	<b>6</b>	<b>37.63</b>	<b>6</b>	<b>36.79</b>

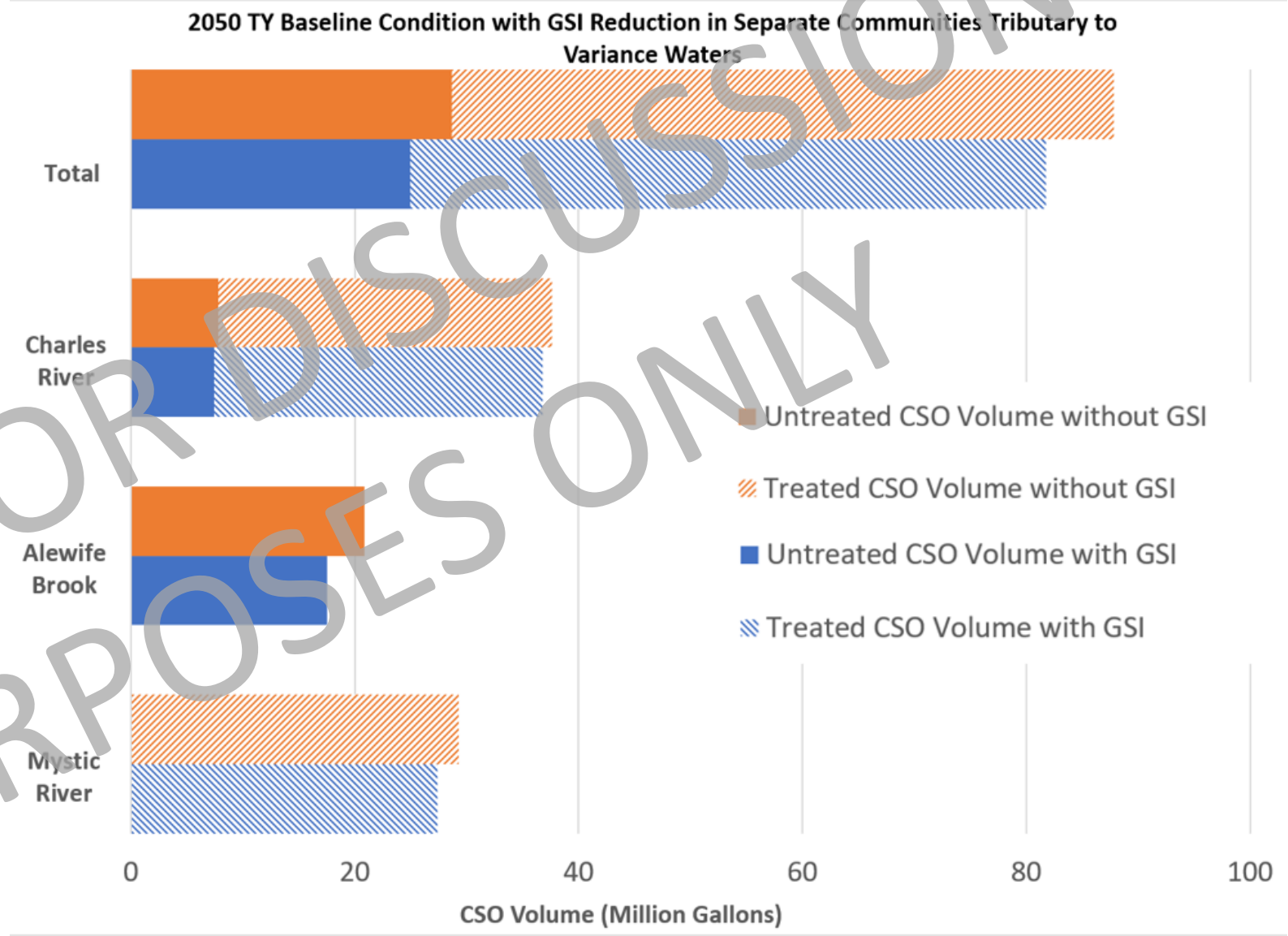
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# CSO Control Tool #1b: Green Stormwater Infrastructure



Stormwater Tree Planter on Somerville Ave (100 sf footprint, 100 cf storage)

## Bookend results



# CSO Control Tool #1b: Green Stormwater Infrastructure



## Case study

2050 TY Baseline	
GSI Features	0
CSO Activations	6
CSO Volume (MG)	0.74
Storage Volume (gal)	0

GSI Bookend	
GSI Features	~7
CSO Activations	6
CSO Volume (MG)	0.63
Storage Volume (gal)	0



GSI + Storage	
GSI Features	~7
CSO Activations	0
CSO Volume (MG)	0
Storage Volume (gal)*	220,000



Storage	
GSI Features	0
CSO Activations	0
CSO Volume (MG)	0
Storage Volume (gal)*	260,000

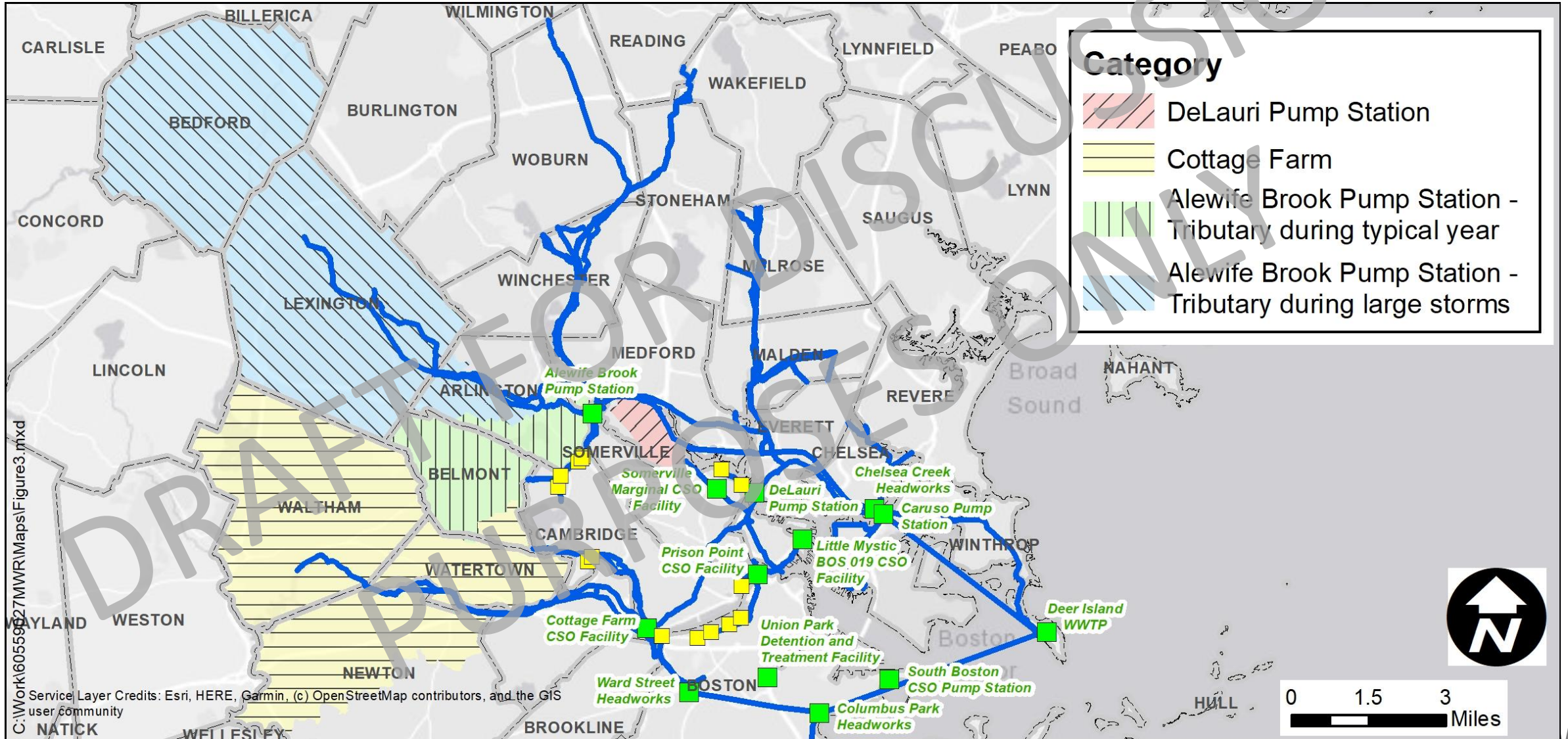
\* Storage volume corresponds to largest single-event CSO volume.



# CSO Control Tool #1c: Infiltration/Inflow Reduction



**I/I Reduction Bookend Scenario:** reduce 30% of I/I from upstream communities tributary to variance waters



# CSO Control Tool #1c: Infiltration/Inflow Reduction



## Bookend results by Outfall



Pipe Inspection Equipment Entering  
Pipe to Assess Condition & Identify I/I



Groundwater Infiltration

Outfall	2050 Typical Year* - Baseline Conditions		2050 Typical Year* - Baseline Conditions + 30% Regional I/I Reduction	
	Activation Frequency	Volume (MG)	Activation Frequency	Volume (MG)
<b>ALEWIFE BROOK</b>				
CAM001	1	0.02	0	0.00
CAM002	0	0.00	0	0.00
CAM401A	12	10.97	12	10.84
CAM401B	3	0.30	3	0.21
MWR003	3	1.08	3	0.67
SOM001A	13	8.51	13	8.14
<b>Alewife Total</b>	<b>13</b>	<b>20.87</b>	<b>13</b>	<b>19.86</b>
<b>MYSTIC RIVER</b>				
SOM007A/MWR205A	8	29.32	8	28.99
<b>Mystic Total</b>	<b>8</b>	<b>29.32</b>	<b>8</b>	<b>28.99</b>
<b>CHARLES RIVER</b>				
CAM005	6	0.74	6	0.68
CAM007	0	0.00	0	0.00
CAM017	3	0.72	3	0.82
MWR010	0	0.00	0	0.00
MWR018	4	1.85	4	1.85
MWR019	3	1.33	3	1.33
MWR020	3	3.07	3	3.09
MWR201 - Cottage Farm	4	29.80	4	24.66
MWR023	6	0.12	6	0.12
<b>Charles Total</b>	<b>6</b>	<b>37.63</b>	<b>6</b>	<b>32.55</b>

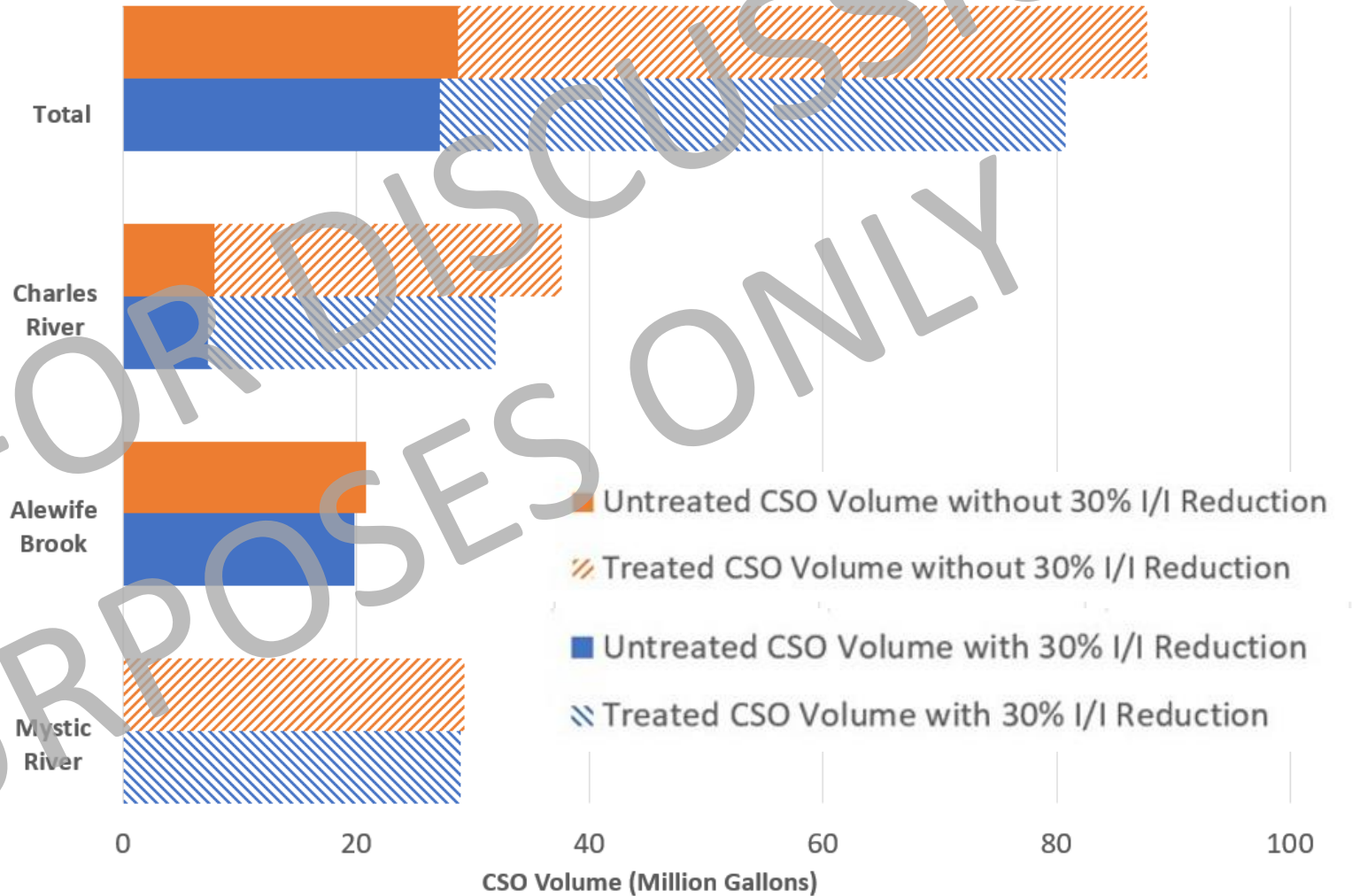
\* The Unified Model is still being developed and reviewed. Model results provided in this presentation are preliminary and are subject to change.

# CSO Control Tool #1c: Infiltration/Inflow (I/I) Reduction



## Bookend results by Receiving Water

2050 TY Baseline Condition with 30% I/I Reduction in Separate Communities Tributary to  
Variance Waters

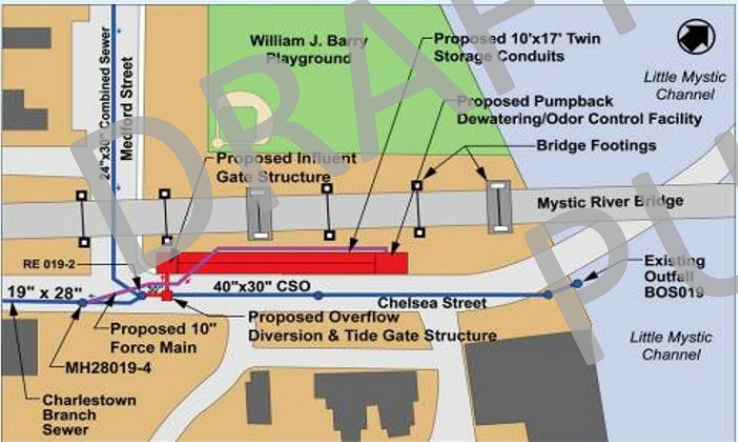


# CSO Control Tool #2: Storage



Providing a means to store peak flows until the system can accept them after the storm, through:

- Adjusting Weirs
- Expanding pipe capacity
- Implementing/optimizing real-time controls
- Building a new storage tank or tunnel



BOS019 CSO Storage Conduit – 670,000 gallons

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# CSO Control Tool #2: Storage

## CSO Storage: MWRA Bookend results:



Estimated Storage Volumes by Region	
Outfall	Largest Discharge 2050TY (MG) <i>Based on Preliminary Modeling Results</i>
Alewife	4.3
CAM005&CAM007	0.3
CAM017	0.3
MWR018/019/020	4.8
Cottage Farm	11.2
SOM007A/MWR205A	10.5



North Dorchester Bay Storage Tunnel

- Existing MWRA Facilities:

Storage Facility	Storage Type	Storage Volume (MG)	Facility Site Area (acres)
BOS019	Box Conduit	0.67	0.3
Cottage Farm	Tank	1.3	0.76
Prison Point	Tank	1.3	1.3
Union Park	Tank	2.2	1.3
North Dorchester Bay	Tunnel	18	10,832 ft. long 17 ft. inside diameter + Dewatering Pump Station = 0.82 acres +Odor Control= 0.36 acres



Union Park CSO Facility Storage Basins: Photo Credit: Simpson Gumpertz & Heger (SGH)

# CSO Control Tool #3: Treatment



Providing a means to treat CSOs prior to discharge up to the following levels of treatment:

- Screening and disinfection
- Screening, settling, and disinfection
- High rate clarification with disinfection
- Treatment at Deer Island Treatment Plant



Somerville Marginal CSO Facility



Cottage Farm CSO Facility

# CSO Control Tool #3: Treatment –



## CSO Treatment: MWRA Bookending Evaluation

### • MWRA CSO Facilities

Existing MWRA CSO Facilities	Capacity (MGD)	Treatment Process	Site Area (acres)
Cottage Farm (MWR201)	233	Screening, settling, disinfection	0.76
Prison Point (MWR203)	323	Screening, settling, disinfection	1.3
Union Park (MWR215)	288	Screening, settling, disinfection	1.3
Somerville Marginal (MWR205 and MWR205A)	245	Screening, disinfection	0.75



### • MWRA Bookend results:

CSO Treatment Location	Approximate Peak Flows in UM 2050 TY (MGD) <i>Based on Preliminary Model Results</i>
Alewife (CAM001, CAM002, MWR003, CAM401A, CAM401B, SOM001A)	140
CAM005 & CAM007	11
CAM017	28
MWR018/019/020	130

# CSO Control Tool #4: Conveyance



Improving conveyance of CSO flows through:

- Upsizing pipelines
- Improving hydraulic control structures
  - Improve hydraulics at siphons or internal regulators
- Expanding/optimizing pump stations
  - Increase pump capacity
  - Modify pump station operations



**48-inch Storm Drain Installation on E. Third Street  
Reserved Channel Sewer Separation Contract 3B**



**18-inch Sewer Installation on E. Third Street  
Reserved Channel Sewer Separation Contract 3B**



# CSO Control Tool #4: Conveyance

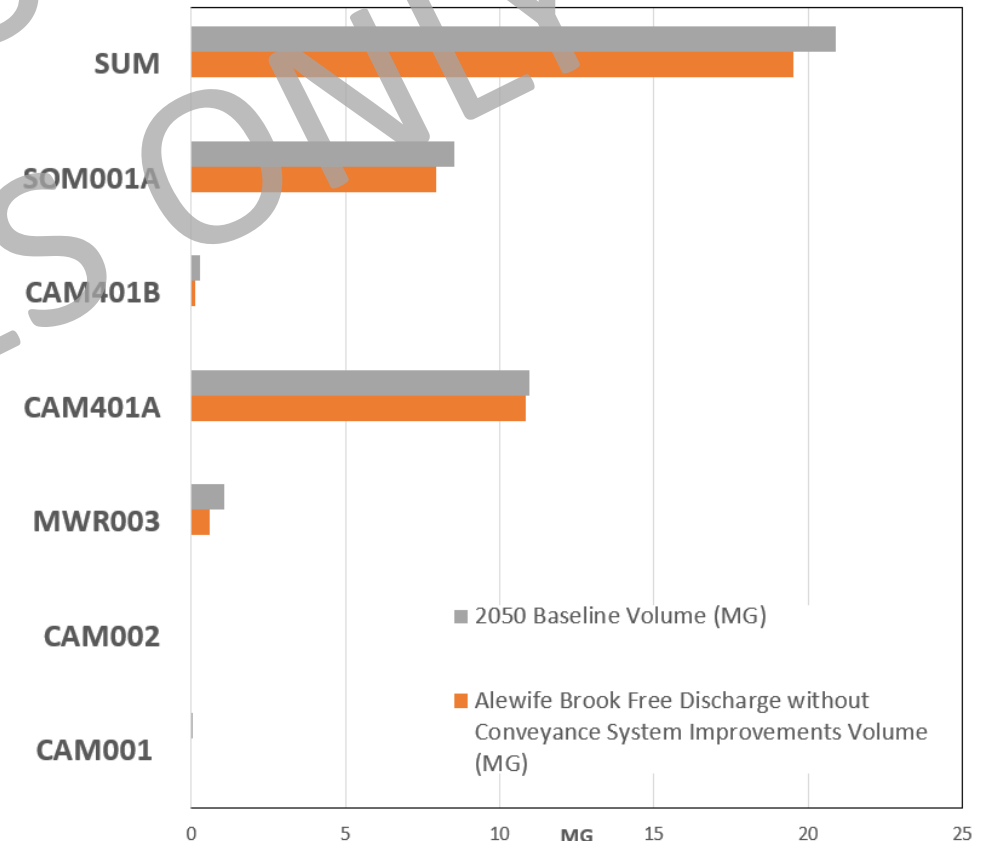
## Conveyance Bookend Scenario: Alewife Brook Pump Station (ABPS) Unlimited Pumping Capacity



- Model run was conducted to simulate ABPS with unlimited pumping capacity beyond 90 MGD
- Modifications would need to be made to the upstream conveyance systems to improve the benefit
- Downstream modifications would be required to convey the additional flow to Deer Island WWTP

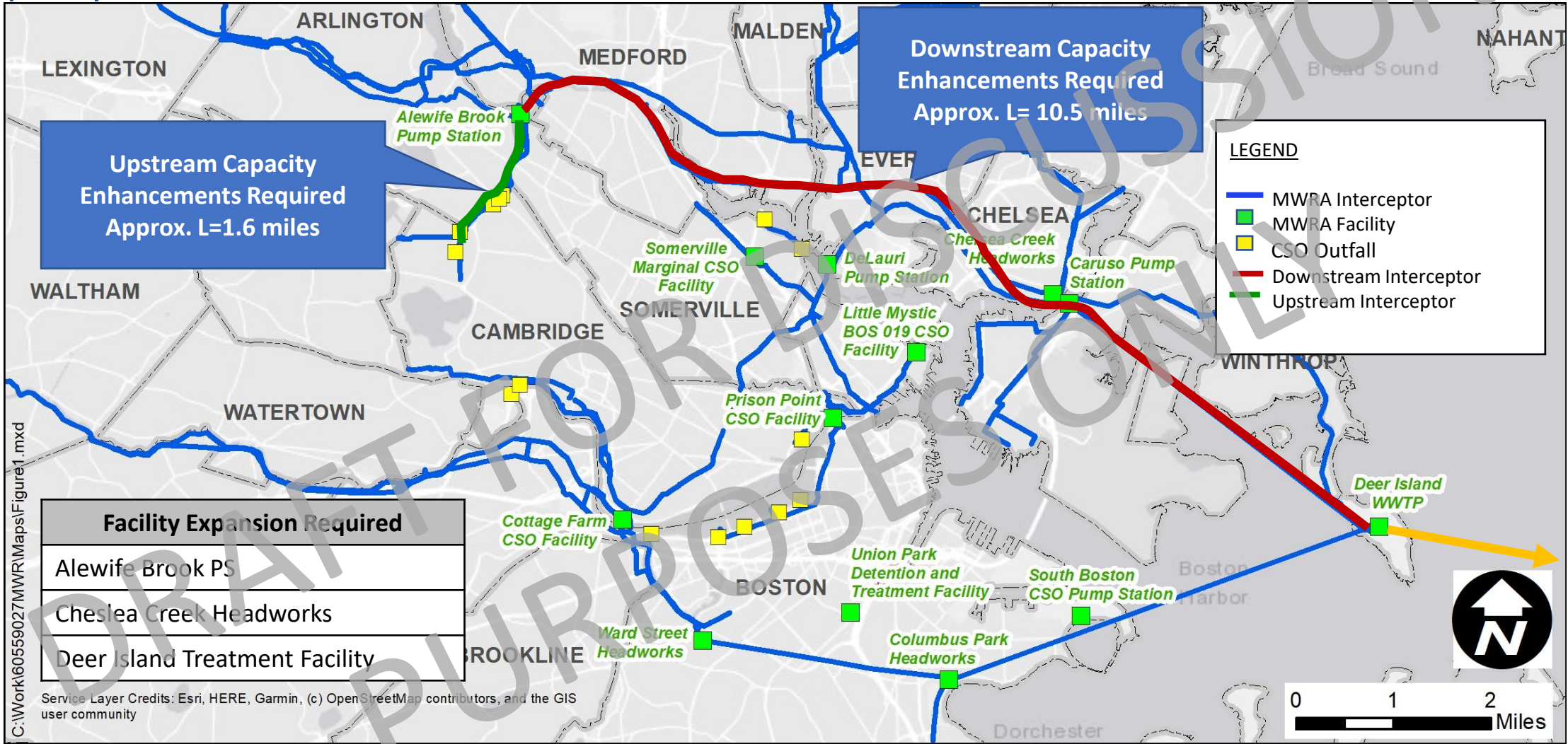
ABPS System Condition	2050TY	
	Peak Flow at ABPS (MGD)	CSO Volume to Alewife (MG)
Current Configuration	90	20.8
Unlimited pump capacity with no conveyance system modifications	109	19.5
Unlimited pump capacity with modifications to upstream and downstream conveyance systems	261	0

CSO Volume to Alewife Brook



# CSO Control Tool #4: Conveyance




## Conveyance Bookend Scenario: Alewife Brook Pump Station (ABPS) Unlimited Pumping Capacity



Modifications to existing conveyance system to accommodate increased pump station capacity from 90 MGD to 260 MGD.

# CSO Tools - Summary

## 1. Source Control

- a) Sewer separation 
- b) Green stormwater infrastructure 
- c) Inflow/infiltration reduction 

## 2. Storage

## 3. Treatment

## 4. Conveyance

# CSO Control Alternatives and Evaluation Criteria

# Developing CSO Control Alternatives

## What are CSO control alternatives?

A suite of CSO control tools that, in combination, meet a range of CSO reduction targets.



 Sewer separation  
  Green stormwater infrastructure  
  Inflow / infiltration reduction  
  Storage  
  Conveyance  
  Treatment

Tools are the building blocks for Alternatives.

## How do we evaluate and compare CSO control alternatives?

### ALTERNATIVE EVALUATION CRITERIA:

<input checked="" type="checkbox"/>	CSO reduction
<input checked="" type="checkbox"/>	Flooding impacts
<input checked="" type="checkbox"/>	SSO impacts
<input checked="" type="checkbox"/>	Water quality impacts to waterways
<input checked="" type="checkbox"/>	System resilience
<input checked="" type="checkbox"/>	Community co-benefits
<input checked="" type="checkbox"/>	Construction impacts to neighborhoods
<input checked="" type="checkbox"/>	Cost and affordability
<input checked="" type="checkbox"/>	Impacts to Environmental Justice (EJ) communities

Unified Model Preliminary Results  
with 2050 Typical Year

# Unified Model Preliminary Results with 2050 Typical Year

- Unified model was developed as part of the Updated CSO Control Plan by combining the MWRA, Cambridge and Somerville hydraulic models to provide consistent results
- Unified Model results for the 2050 TY were used for bookend analysis and will be used for alternatives analyses.

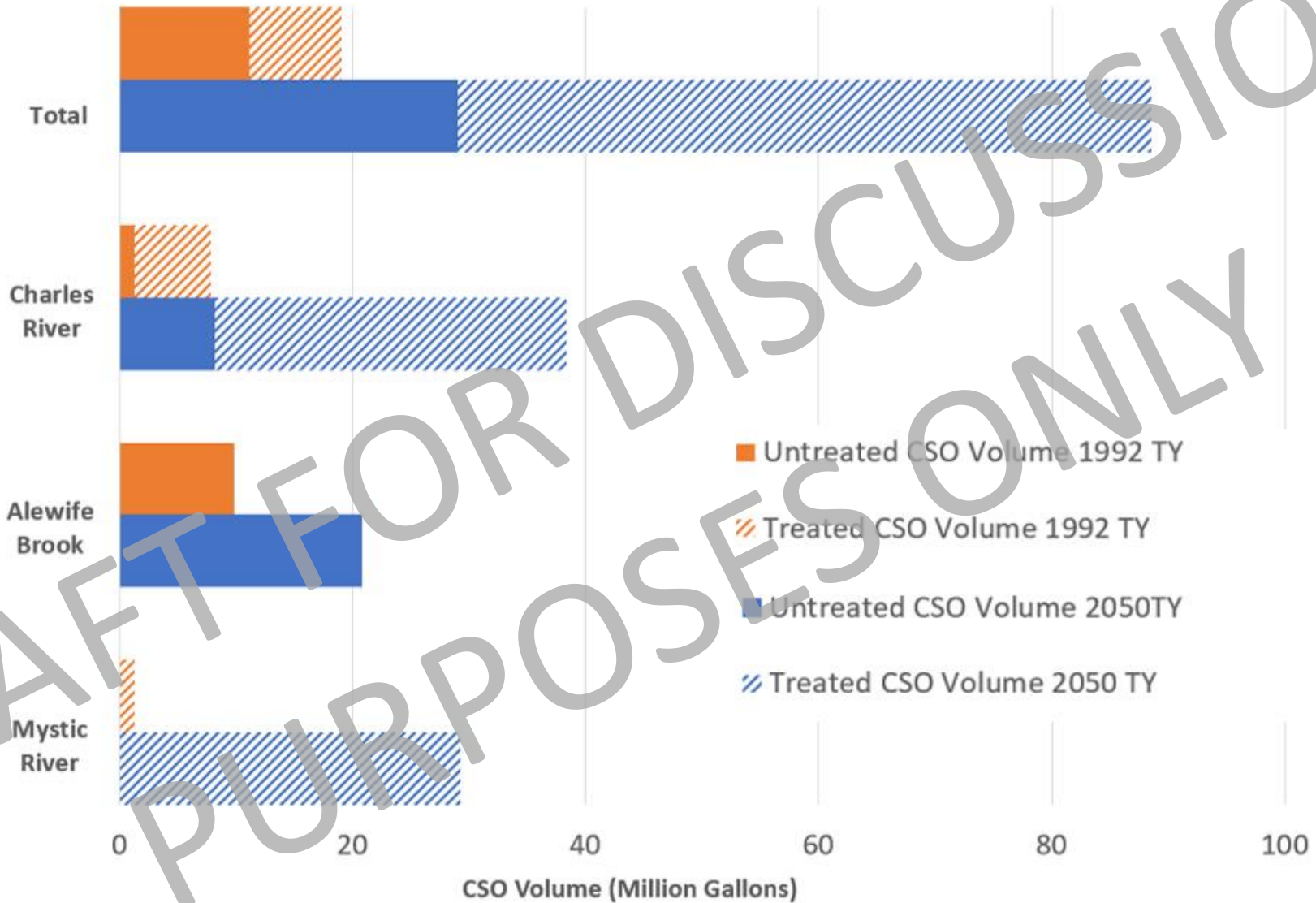
Additional information on the 2050 TY can be found: [2050 TY](#)

Outfall	1992 Typical Year - Future Baseline Conditions*		2050 Typical Year - Future Baseline Conditions*	
	Activation Frequency	Volume (MG)	Activation Frequency	Volume (MG)
<b>ALEWIFE BROOK</b>				
CAM001	0	0.00	1	0.02
CAM002	0	0.00	0	0.00
CAM401A	8	5.29	12	10.95
CAM401B	1	0.02	3	0.30
MWR003	2	0.13	3	1.08
SOM001A	8	4.45	13	8.51
<b>Alewife Total</b>	<b>8</b>	<b>9.89</b>	<b>13</b>	<b>20.85</b>
<b>MYSTIC RIVER</b>				
SOM007A/MWR205A	2	1.30	8	29.31
<b>Mystic Total</b>	<b>2</b>	<b>1.30</b>	<b>8</b>	<b>29.31</b>
<b>CHARLES RIVER</b>				
CAM005	1	0.19	6	0.73
CAM007	0	0.00	0	0.00
CAM017	0	0.00	3	1.04
MWR018	3	0.50	4	1.86
MWR019	2	0.26	3	1.33
MWR020	2	0.28	3	3.14
MWR201 - Cottage Farm	2	6.59	4	30.12
MWR023	3	0.05	6	0.13
<b>Charles Total</b>	<b>3</b>	<b>7.87</b>	<b>6</b>	<b>37.61</b>

\* The Unified Model is still being developed and reviewed. Model results provided in this presentation are preliminary and are subject to change. Model run 06FC

# Volume Comparison 1992 and 2050 TY Baseline Conditions

## 1992 TY and 2050 TY CSO Discharges to Variance Waters





# Questions & Feedback

Submit further questions, comments, and feedback via email by Monday, October 30th, 2023:

- *Cambridge:* Catherine Woodbury - [cwoodbury@cambridgema.gov](mailto:cwoodbury@cambridgema.gov)
- *Somerville:* Lucica Hiller - [lhiller@somervillema.gov](mailto:lhiller@somervillema.gov)
- *MWRA:* Brian Kubaska - [brian.kubaska@mwra.com](mailto:brian.kubaska@mwra.com)