



CAMBRIDGE  
DEPARTMENT  
OF PUBLIC  
**THE  
WORKS**

**City of Cambridge**  
Department of Public Works

# Ten Year **Sewer and Drain** Infrastructure Plan

April 2022



# 10 YEAR PLAN | TABLE OF CONTENTS

	<u>Page</u>
<b>INTRODUCTION</b>	Our System Fast Facts   Our Watersheds 2-3
<b>PRIORITIES</b>	Objectives   Scheduling & Constraints   Sewer Condition   Drain Condition   Sewer Separation   Climate Change   Funding 4-10
<b>10 YEAR PLAN</b>	Scope of Work   Completed Projects   Ongoing & Planned Construction   Future Investigation/Planning Areas 11-14
<b>PROGRAMS</b>	Sewer Separation   CSO Notification & Reporting   CSO Planning   Climate Change Planning   Annual Capital Repairs & Maintenance   Regulations & Requirements   Permitting 15-24
<b>DESIGN</b>	Sewer   Drain   Stormwater & Sanitary Tanks   Green Infrastructure   Infiltration   Stormwater Overflow System 25-30
<b>CONSTRUCTION</b>	Site Management 31
<b>NEXT STEPS</b>	Conclusion 32

# INTRODUCTION | OUR SYSTEM FAST FACTS

## 98

### MILES OF SEPARATED STORMWATER MAINS

Transport stormwater to a receiving body of water such as a river, lake or ocean. Cambridge stormwater mains discharge to Alewife Brook or the Charles River.

## 111

### MILES OF SEPARATED SANITARY SEWER MAINS

Transport water carrying human and domestic wastes to the Massachusetts Water Resources Authority (MWRA) collection system for processing at the wastewater treatment facility at Deer Island.

## 37

### MILES OF COMBINED SEWER MAINS

Transport water carrying human and domestic wastes during dry weather and a combination of wastewater and stormwater during wet weather to MWRA, or to the Alewife Brook or the Charles River through permitted CSOs.

## 8,605

### SEWER AND DRAIN MANHOLES

Provide an access point to inspect and perform maintenance.

## 6,069

### CATCH BASINS

Collect and transport runoff to the drain and combined sewer systems.

## 38

### SEWER AND DRAIN PUMPING STATIONS

Collect and pump sewer or stormwater from a low to high area of the system or from a storage tank into the sewer or drain system. A structure consists of pumps, wetwell and control system.

## 43

### STORMWATER OUTFALLS

14 outfalls in Alewife watershed and 29 outfalls in the Charles watershed.

## 9

### CSO OUTFALLS

5 outfalls to Alewife Brook (one is temporarily closed) and 5 outfalls to the Charles River (two are temporarily closed).



# INTRODUCTION | OUR WATERSHEDS

Cambridge is part of the Charles River and Alewife Brook watersheds, and the community uses these water bodies for recreational use, such as boating and fishing. Untreated discharges of stormwater or combined sewer overflows (CSOs) can impact the watershed and water bodies.

The City works with the following to ensure projects address environmental objectives of multiple federal, state, and local agencies, and improve water quality of the Charles River and Alewife Brook:

- U.S. Department of Environmental Protection (EPA)
- Massachusetts Department of Environmental Protection (MassDEP)
- Massachusetts Water Resources Authority (MWRA)
- City departments and local community groups





# PRIORITIES | OBJECTIVES

The objectives of the 10 Year Plan are to:

1. Address high-risk infrastructure conditions
2. Remove infiltration/inflow (I/I) from sewer systems
3. Eliminate sanitary sewer overflows (SSOs) and reduce CSOs
4. Manage stormwater quality and quantity
5. Reduce flooding and protect neighborhoods
6. Address fats, oils, and grease (FOG) in the sewer system
7. Conduct operation and maintenance activities





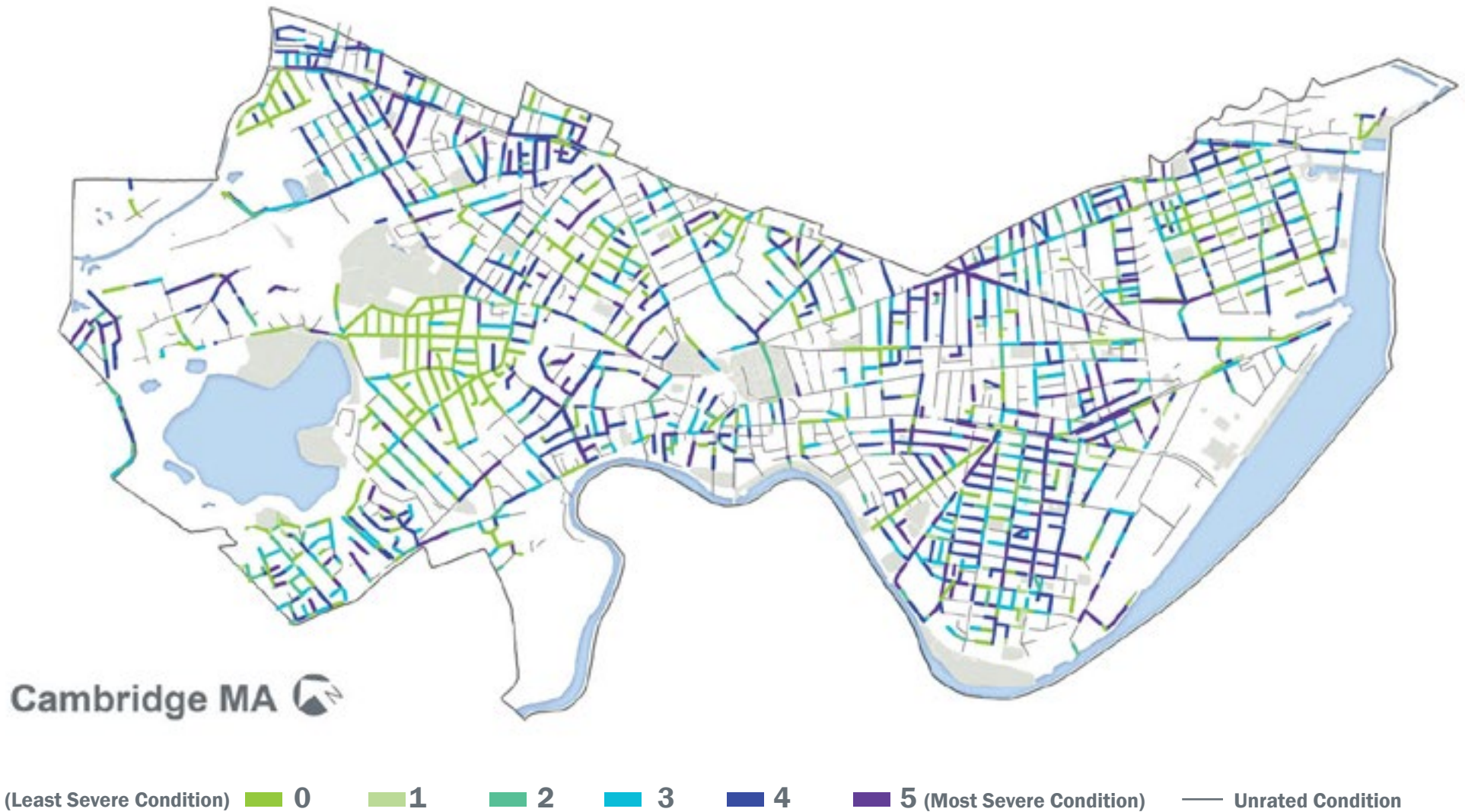
# PRIORITIES | SCHEDULING & CONSTRAINTS

Infrastructure projects in the 10 Year Plan are influenced by:

- Aging infrastructure reaching the end of its service life and needs replacement or rehabilitation
- Planned private development projects
- Climate change impacts
- Public health impacts
- Available budget/funding
- Projects planned as part of the 5 Year Sidewalk and Street Reconstruction Plan
- Regulatory initiatives and enforcement actions or permit requirements that change



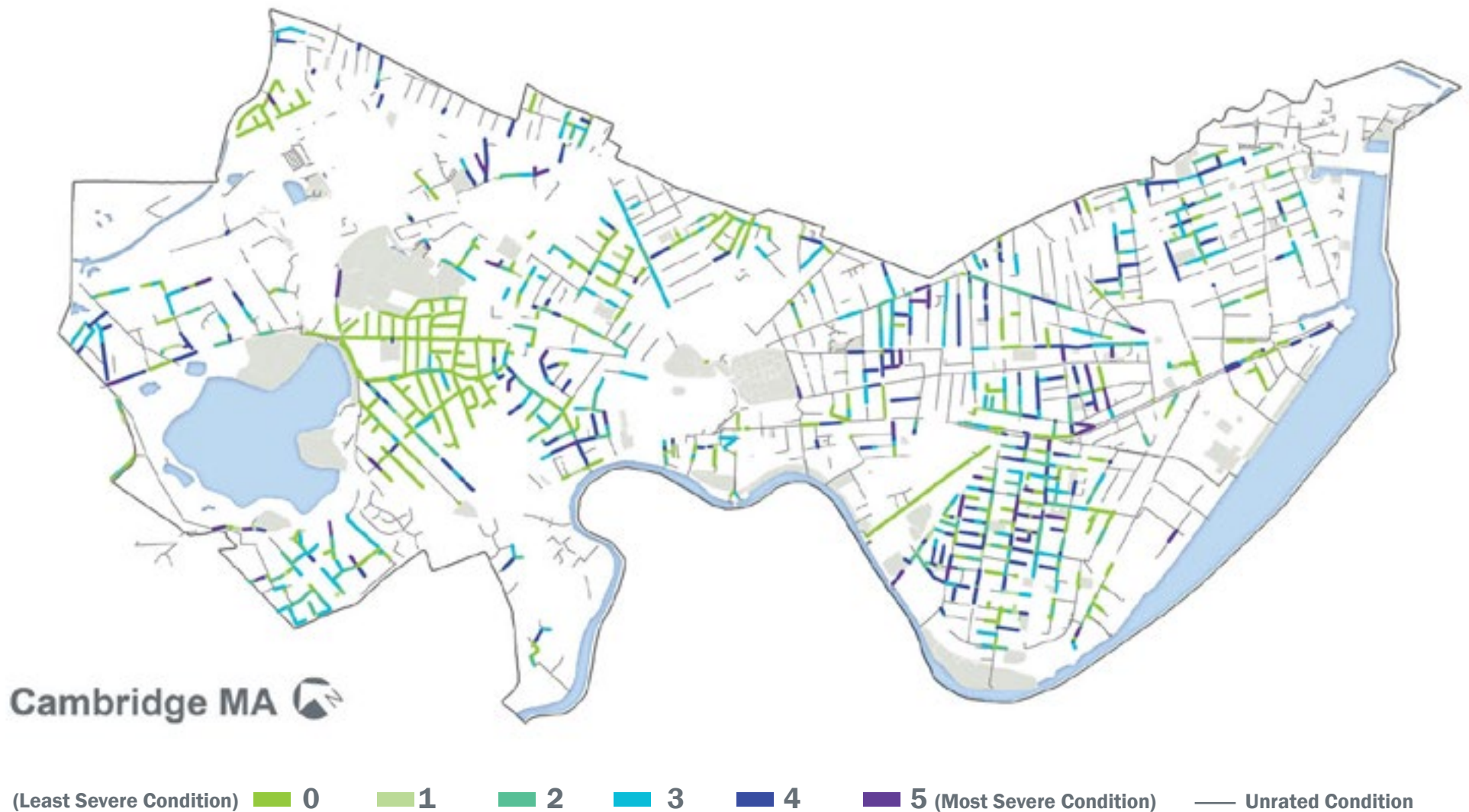
# PRIORITIES | SEWER CONDITION



These maps on pages 6 and 7 show areas of major pipe replacement or rehabilitation (0 rating), the condition (1-5 rating) of pipes inspected since 2005, and pipes that have not yet been inspected (unrated). The City continues to inspect its infrastructure through a dedicated program and as part of public and private projects.

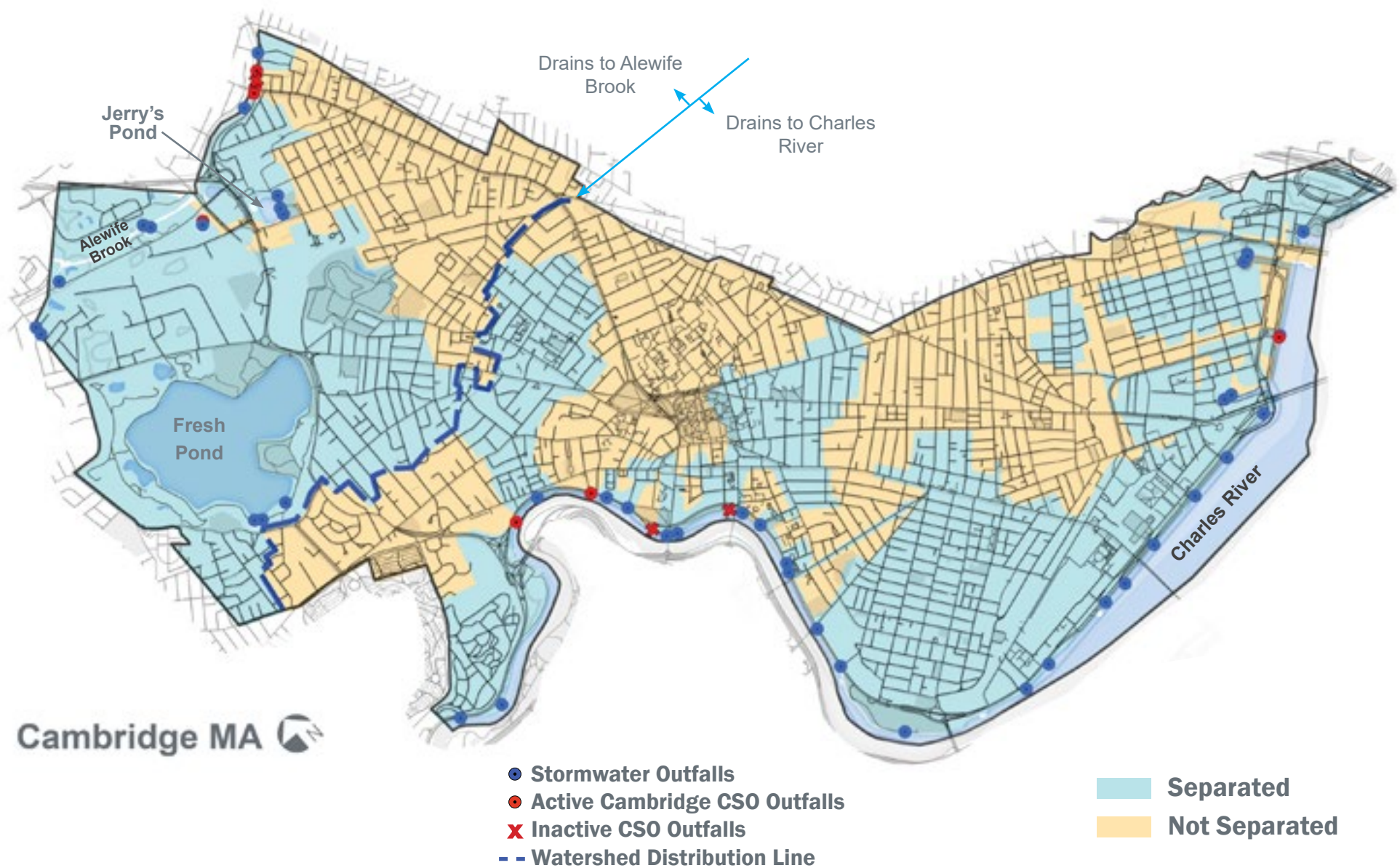


# PRIORITIES | DRAIN CONDITION



In 2009, the City adopted the Pipeline Assessment Certification Program (PACP) as the standard method for inspecting, identifying, and assessing pipes. This program provides the City with a consistent method to evaluate its infrastructure condition and identify high-risk assets to be addressed.

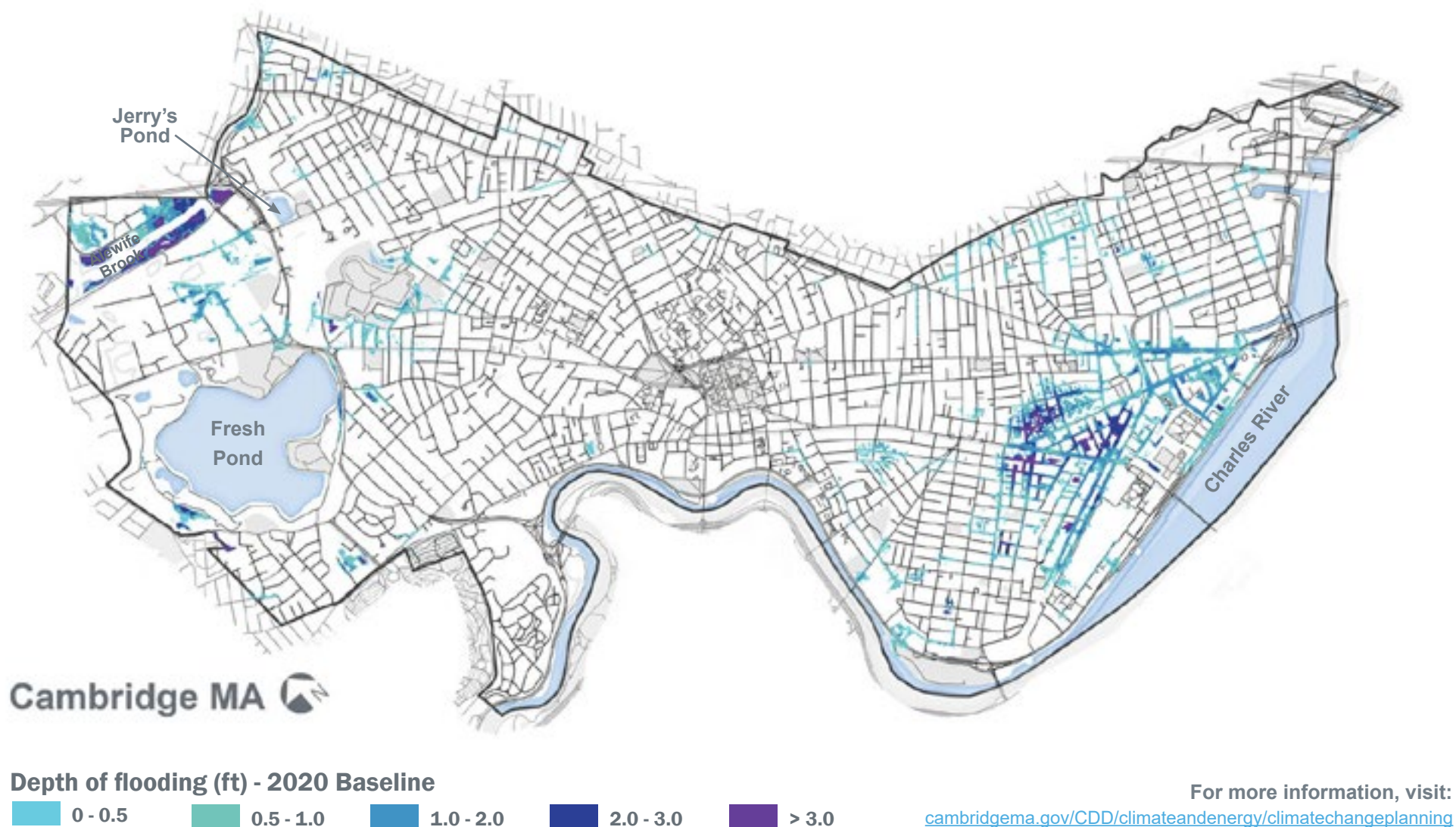
# PRIORITIES | SEWER SEPARATION



This map shows the areas of Cambridge's sewer system that are separated and are not separated and the active City-owned outfall locations. The City is 55% separated and 45% not yet separated.



# PRIORITIES | CLIMATE CHANGE



From the Climate Change Vulnerability Assessment, this map shows the precipitation flooding scenario under the 10-year 24-hour storm by 2070s (updated March 2022 with data from the FloodViewer).

# PRIORITIES | FUNDING

## PROJECT TYPES:

- Sewer separation
- Repair or replacement of infrastructure
- Inflow/infiltration removal
- Pump stations, including storage tanks
- New stormwater outfalls
- Climate change and resiliency planning

## MORE DEMAND THAN FUNDING OR ABILITY TO CONSTRUCT:

- Inspect and clean pipes to target localized infrastructure repairs and restore designed pipe capacity
- Utilize innovative measures, such as pipe lining and spot repairs, to extend the life of infrastructure
- Identify pipes in or around high priority locations that may impact the most people
- Identify streets that have overlapping needs/benefits





# 10 YEAR PLAN | SCOPE OF WORK

Our approach requires the effort of both the public and private sectors to achieve the regulatory, infrastructure, and water quality improvements to make Cambridge a **clean** and **healthy community**.

## REGULATORY



Reduce CSOs, Pollutants of Concern, and Total Suspended Solids (TSS) to surface waters

## INFRASTRUCTURE



Address at-risk or high-risk infrastructure in high-priority areas through rehabilitation or replacement

## WATER QUALITY



Use green infrastructure solutions where possible

PUBLIC



Comply with Stormwater Regulations to reduce erosion, nonpoint source pollution, and flooding



Design and build to the 2070 10-year and recover to the 2070 100-year storm climate projection



Implement Best Management Practices (BMPs)

PRIVATE

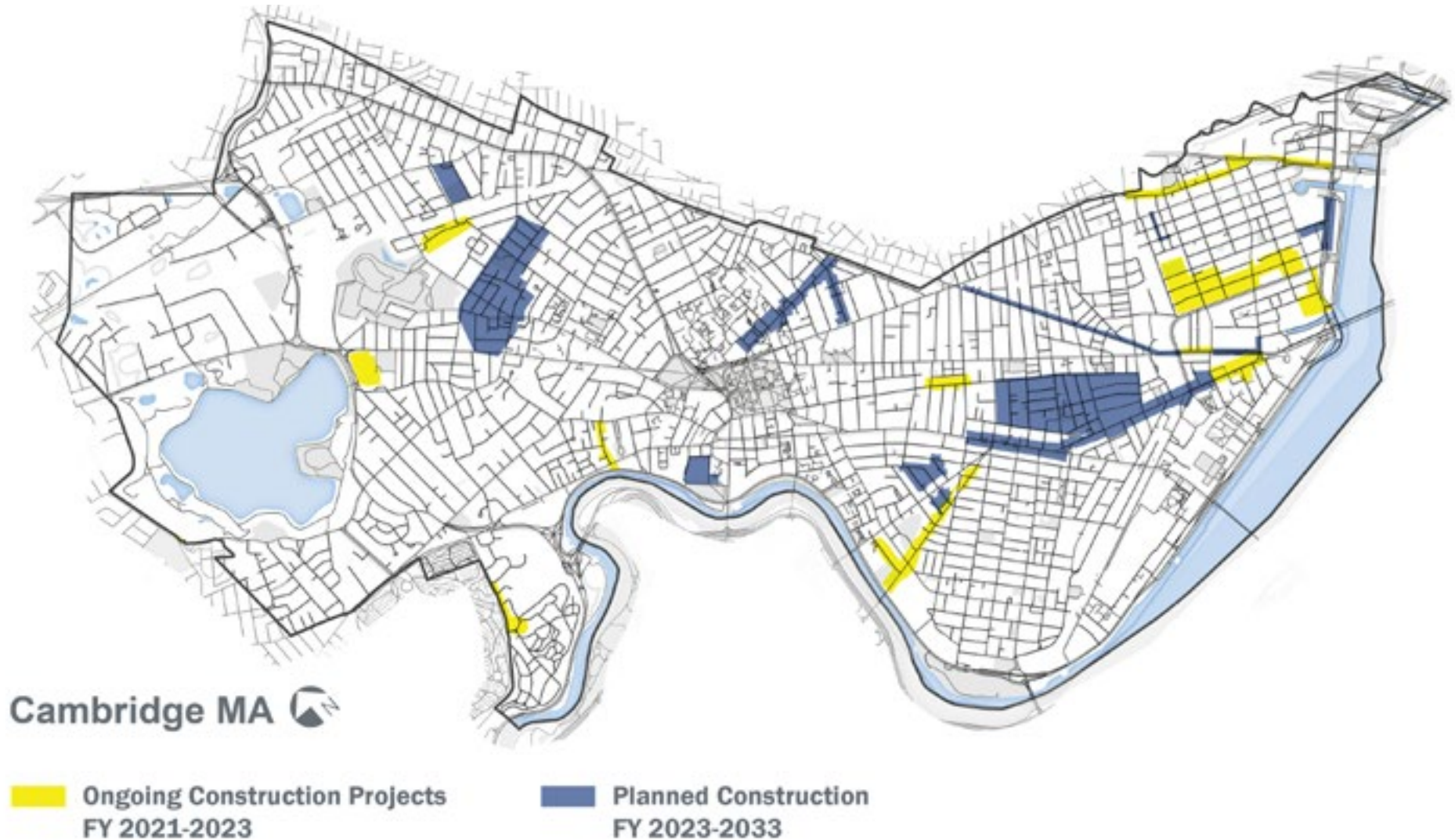
# 10 YEAR PLAN | COMPLETED PROJECTS



Completed projects include Cambridge Greenway Green Infrastructure, Alewife Wetland, Whittemore Area Sewer Separation, Talbot Street Sewer Separation and Outfall, Inman Square Sewer Separation, and the separation of common manholes throughout the City.

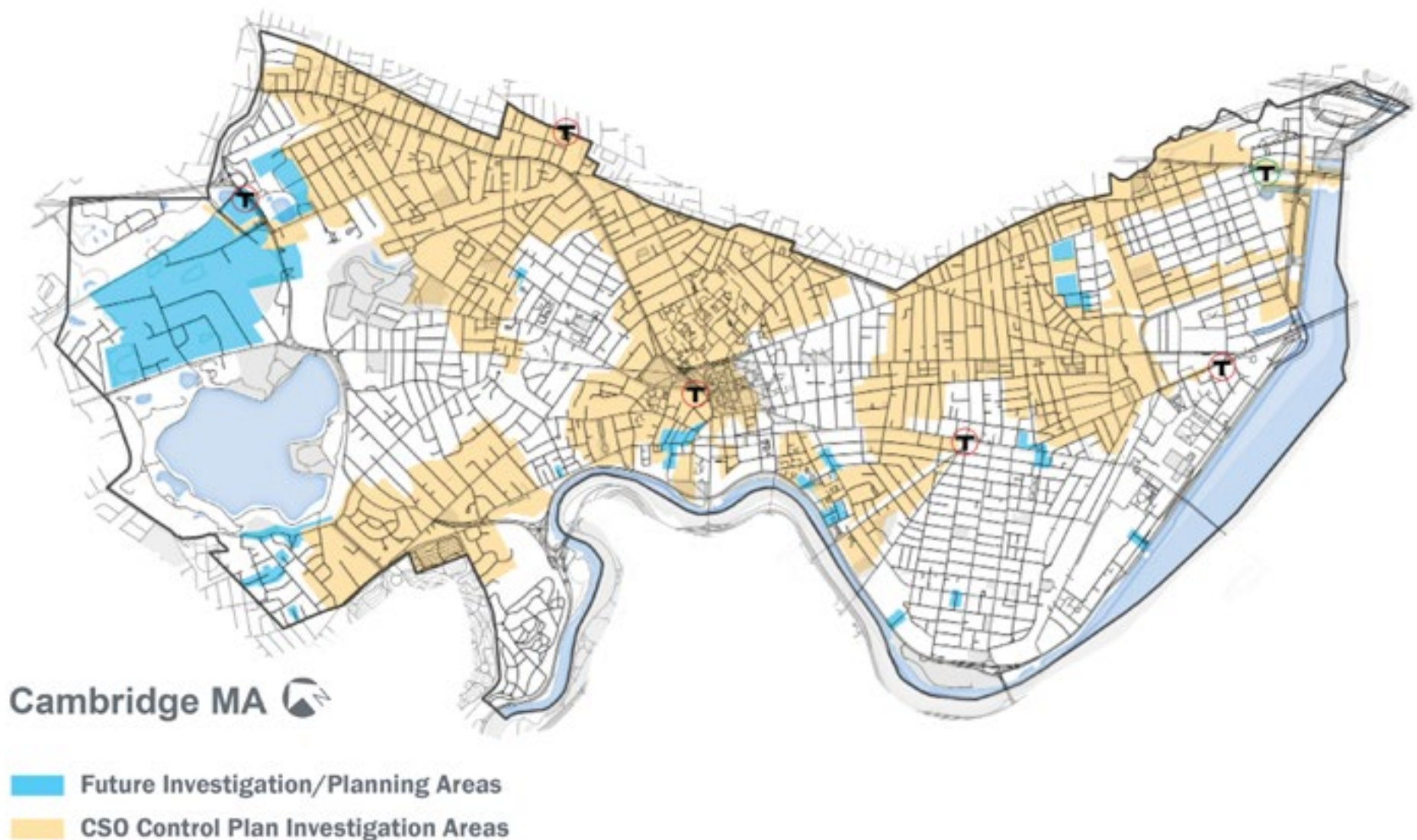


# 10 YEAR PLAN | ONGOING & PLANNED CONSTRUCTION



Ongoing and planned construction projects include the Tobin School stormwater tank, The Port infrastructure projects, and sewer separation of Willard Street and River Street.

# A LOOK AHEAD | FUTURE INVESTIGATION/ PLANNING AREAS



Investigation/planning areas include evaluating the system to understand the areas for improvement. Future projects will be evaluated and incorporated into the 10 Year Plan as investigations proceed.



# PROGRAMS | SEWER SEPARATION

Cambridge's sewer system is approximately 55% separated, where sewage goes to the MWRA for treatment and the stormwater discharges directly to Alewife Brook or the Charles River.

The remaining system is combined sewer, where the sewer and stormwater share a common pipe and can be directed to the MWRA for treatment during dry and wet weather, and to the Alewife Brook or the Charles River during wet-weather CSOs.

Sewer separation provides benefits by:

- **Improving the quality of waterways in and around Cambridge**
- **Reducing CSOs**
- **Eliminating sanitary sewer backups that cause SSOs**
- **Reducing flooding**
- **Maintaining compliance with regulations**

Separating the sewer introduces additional considerations. Challenges can present themselves related to water quality, flooding, increased SSOs, and other public health factors.

## Combined



## Separated



# PROGRAMS | CSO NOTIFICATION & REPORTING

A combined sewer overflow (CSO) occurs when a large storm overwhelms the combined sewer system, causing rainwater to mix with wastewater and discharge to a nearby water body. This is a relief measure that prevents sewage backups into homes and businesses.

When a CSO occurs, public health officials recommend avoiding contact with water bodies during and 48 hours after storms to avoid potential increased health risks due to bacteria or other pollutants associated with stormwater runoff and CSO discharges.

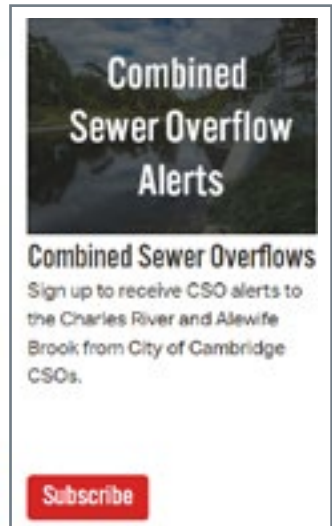
When a CSO occurs at a Cambridge-owned outfall, residents can sign up to be notified.

Register to be notified by visiting [www.cambridgema.gov/Subscribe](http://www.cambridgema.gov/Subscribe) - click on "Combined Sewer Overflow Alerts"

To learn more about CSOs and what is being done to address CSOs, visit:

[www.cambridgema.gov/Departments/publicworks/Services/combinedseweroverflows](http://www.cambridgema.gov/Departments/publicworks/Services/combinedseweroverflows)

## Subscription Center



Combined  
Sewer Overflow  
Alerts

Combined Sewer Overflows  
Sign up to receive CSO alerts to  
the Charles River and Alewife  
Brook from City of Cambridge  
CSOs.

Subscribe





# PROGRAMS | CSO PLANNING



In accordance with the **Variances for CSO Discharges** to the Charles River Basin and to the Alewife Brook/Upper Mystic River Basin, the City is developing a CSO Control Plan for the 12 CSO outfalls that the City owns and operates through its NPDES CSO Permit. Two CSOs have been permanently closed (and one outfall temporarily) in the Alewife Brook watershed, while two more are temporarily closed pending hydraulic evaluations along the Charles River. The **City's CSO Control Plan** will be developed from April 2022 through December 2023 through a process that includes:

- **Coordination with MWRA and the City of Somerville**
- **Development of additional CSO control measures**
- **Collaboration through public participation**
- **Evaluation of benefits to water quality and system performance**

# PROGRAMS | CLIMATE CHANGE PLANNING

The City is committed to **Climate Change Vulnerability and Preparedness Planning**, a summary of which can be viewed in the City's Resilient Cambridge plan. Planning efforts include:

- Identifying vulnerabilities to flooding due to increasing precipitation and sea level rise/ storm surge
- Identifying adaptation and resiliency strategies, including strategies for sewer and drain infrastructure
- Informing changes to regulations
- Evaluating project impacts to climate change
- Coordinating federal, state, and regional efforts
- Preparing community through education and outreach





# PROGRAMS | CLIMATE CHANGE PLANNING

The City developed the FloodViewer as an informational tool for the community to assess climate change threats from flooding and to make properties and neighborhood spaces more resilient by implementing specific strategies.

The FloodViewer data comes from the latest simulation results from the City's hydraulic/hydrologic flood model and the latest sea level rise/storm surge statewide flood model results from the Massachusetts Coast Flood Risk Model.

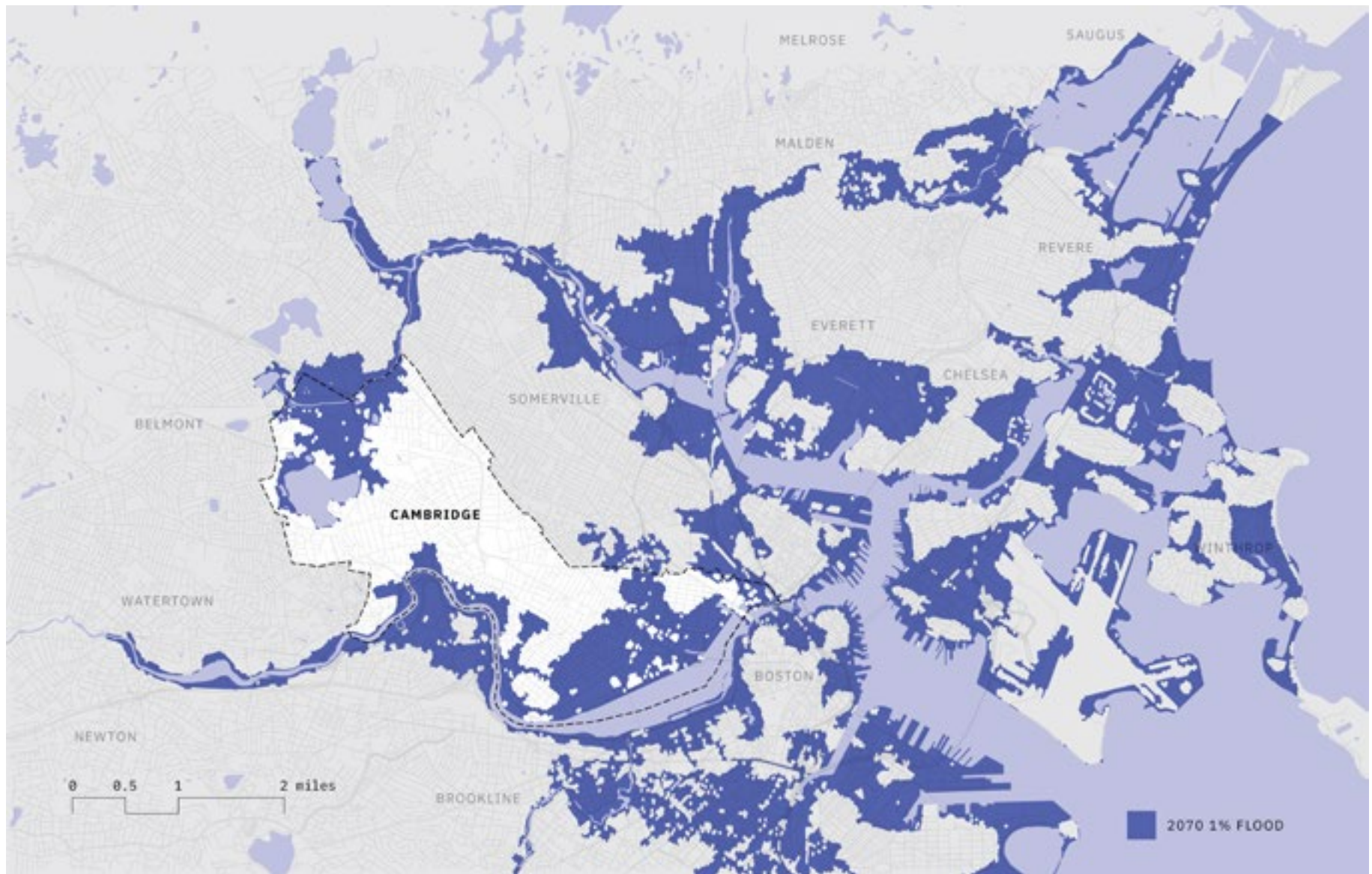
## How to use the FloodViewer:

- Visit [www.cambridgema.gov/services/floodmap](http://www.cambridgema.gov/services/floodmap)
- Type in the property address
- Select the Flooding Scenario to see the flooding simulation at the address



*The FloodViewer shows that Cambridge DPW on Hampshire Street is at risk of flooding from a 2070 storm that has a 10% chance of happening.*

# PROGRAMS | CLIMATE CHANGE PLANNING



The dark blue area on this map shows the probable flooding from sea level rise and storm surge during a storm in 2070 that has a 1% chance of occurring. Ten interventions have been identified that address upstream flooding in the Charles and Mystic rivers. View them on Page 21.



# PROGRAMS | CLIMATE CHANGE PLANNING

Protection for a 2070 1% coastal storm:

- 10 target interventions
- 12 communities
- 108,000 residents
- \$60 billion in real estate value



The City is working with regional partners to implement these interventions including raising the Amelia Earhart and Charles River dams, both circled in red, which are critical to protecting the region from a 2070 1% coastal storm.

# PROGRAMS | ANNUAL CAPITAL REPAIRS & MAINTENANCE

The City actively maintains City-owned sewer and stormwater infrastructure and manages the following programs:

- **Pipeline Inspection & Cleaning:** Perform condition assessments of infrastructure using multi-sensor technology (CCTV, sonar, and laser scanning)
- **FOG Program:** Work with food establishments to limit fats, oils, and grease in sewer system preventing clogs/backups
- **Illicit Discharge Detection and Elimination (IDDE):** Inspection program to identify and eliminate sanitary connections to the drainage system
- **Pipe Rehabilitation:** Improve longevity/useful life of existing infrastructure without excavation
- **Pump Maintenance:** Maintain infrastructure that controls flooding and SSOs
- **Routine System Maintenance & Cleaning:** Remove sediment and debris captured in catch basins and pipes to improve water quality and maintain capacity
- **Structure & Pipe Repairs:** Address point source problems, like pipe collapses





# PROGRAMS | REGULATIONS & REQUIREMENTS

The City must ensure that the Infrastructure Plan meets or exceeds federal and state regulations, including:



## Infrastructure Improvements and Maintenance:

- MassDEP (inflow and infiltration)
- EPA



## Untreated discharges regulated through the NPDES Program:

- Municipal Separate Storm Sewer System (MS4)
- Combined Sewer Overflow (CSO)
- Total Maximum Daily Load (TMDL)



## Activities related to floodplain areas:

- Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP)
- Wetlands Protection Act
- Zoning Flood Plane Overlay

# PROGRAMS | PERMITTING

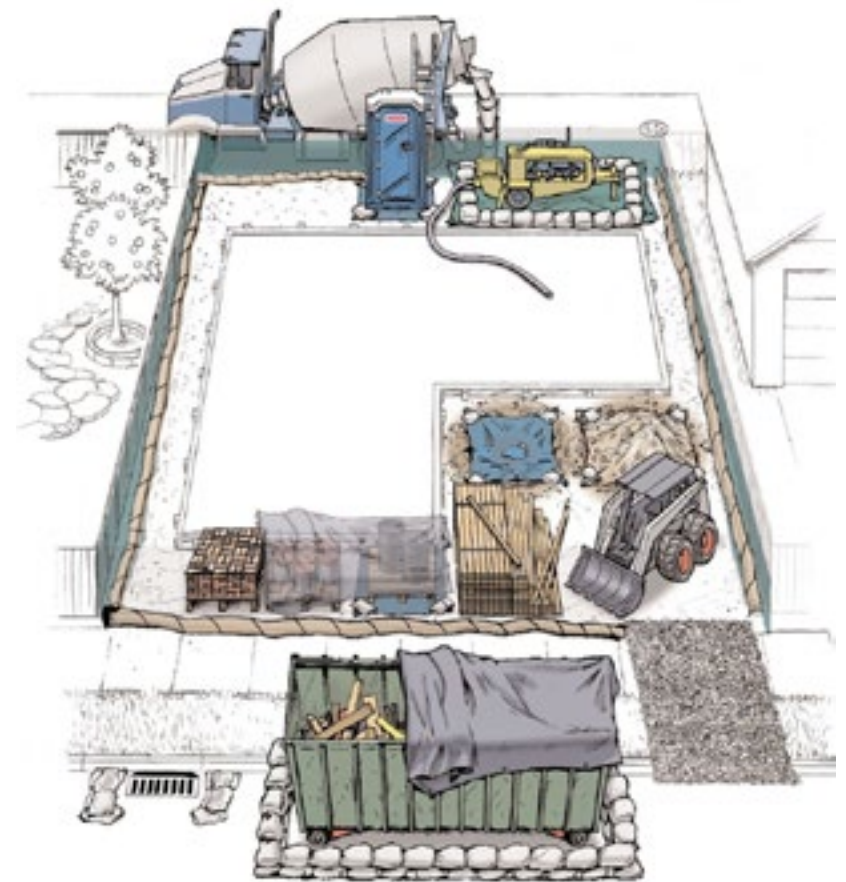
The City requires a **Stormwater Control Permit** for larger projects (among other permits) for construction, development, and redevelopment projects in the City. This permit ensures measures are taken throughout the project to address erosion, nonpoint source pollution, flood control, and future climate projections.

The City provides guidance documents to support the permit application process so that projects:

- **Protect City infrastructure**
- **Protect natural water resources**
- **Comply with regulatory requirements**

The City's requirement for development and redevelopment projects to provide on-site detention storage for the stormwater volume difference between the **2070 2-year 24-hour** and the **2070 25-year 24-hour** storm event hydrographs enables the stormwater system to be resilient against larger storm events.

The permitting process ensures current and future development projects complement the City's stormwater management goals.



*Permitting ensures construction sites, like this one, include measures to protect our physical and natural resources.*



# DESIGN | SEWER

Considerations when the City undertakes design of the sewer system include:

## Eliminate Sanitary Sewer Overflows

- Ensure pipe is properly sized (consider new development)
- Design greater than minimum pipe slopes
- Use of proper pipe materials
- Maintain adequate access for cleaning and maintenance
- Eliminate groundwater infiltration
- Redirect stormwater inflow



# DESIGN | DRAIN

Considerations when the City undertakes design of the stormwater system include:

## Reduce flooding

- System-wide modeling (consider climate change)
- Properly sized pipes
- Adequate detention and pumping

## Water quality impact

- Sumped catch basins and drain manholes
- Increase pervious areas
- Consider first flush deflection or treatment where possible
- Removal of illicit connections
- Adequate access for cleaning and maintenance





# DESIGN | STORMWATER & SANITARY TANKS

The City utilizes stormwater tanks to help manage flooding during large storm events. Similarly, the City employs sewer holding tanks to protect sewer service during larger storm events. The adjacent table lists the number of stormwater and sewer tanks in service throughout the City (as of January 2022).

Owner	Stormwater Tanks	Sewer Tanks	Total
City	13	1	<b>14</b>
Private	33	30	<b>63</b>
<i>Subtotal</i>	46	31	<b>77</b>

The Parking Lot 6 (PL6) Stormwater Tank, for example, went online in May 2021 and diverted more than 3.5-million gallons of stormwater in summer 2021, the third-wettest summer on record. The tank significantly reduced flooding in The Port neighborhood.



# DESIGN | GREEN INFRASTRUCTURE



Green infrastructure is an approach to stormwater management that protects, restores, and mimics the natural water cycle. Green infrastructure can address both quantity and quality of stormwater, reduce impervious surfaces, and increase plantings in a neighborhood.

Examples of green infrastructure include:

- **Street trees and planter boxes**
- **Bio basins/rain gardens**
- **Rainwater harvesting (rain barrels)**
- **Infiltrating catch basins and other structures**



# DESIGN | INFILTRATION

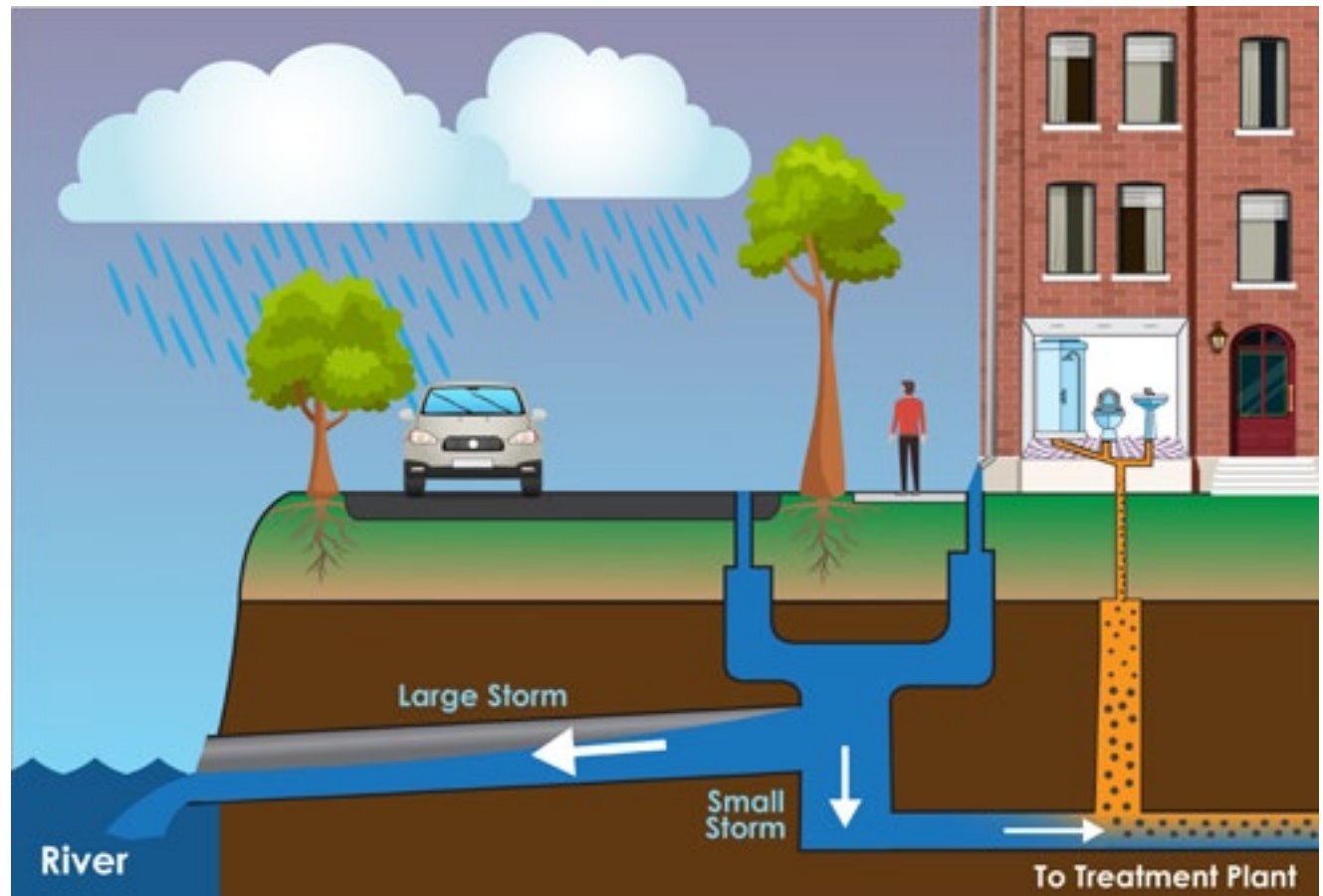
Infiltration systems do not always look like green infrastructure. Infiltration systems built in the City usually serve multiple purposes above ground given space constraints and competing surface needs. The surface above the below-ground infiltration system may be used in many ways, including as a road or a park, like Longfellow Park shown below during construction.



# DESIGN | STORMWATER OVERFLOW SYSTEM

Stormwater isn't as clean as one thinks. Pollutants such as phosphorous and suspended solids need to be treated prior to the stormwater being discharged into receiving waters. One way Cambridge has approached this is with a stormwater overflow system, also called partial sewer separation. An example of this is the Talbot Street Outfall.

- Partial sewer separation reduces impact of phosphorus and other nutrients from stormwater on receiving waters
- By capturing base stormwater flows, the partial separation allows more treatment of the stormwater and reduced CSO volumes at Cottage Farm
- During large storm events, stormwater goes directly to the Charles River to limit surface flooding and not contribute to CSOs





# CONSTRUCTION | SITE MANAGEMENT

All construction projects require implementation of:

## Erosion & Sedimentation Control

- Reduce soil from entering the drain system and discharging to receiving waters by protecting catch basins and properly disposing construction materials
- Store construction materials properly on site
- Manage dust generated by construction activities



# NEXT STEPS | CONCLUSION

The 10 Year Plan is a living document that will be updated regularly. As part of that process, the Department of Public Works will:

- Review the Plan annually based on the sewer and drain system assessments
- Update sewer and drain infrastructure condition data and corresponding maps
- Update 10 Year Plan to account for changing conditions and climate change impacts
- Update 10 Year Plan to include priorities from the CSO Control Plan and other regulatory changes





# GLOSSARY OF TERMS

<b>BMP</b>	best management practice
<b>CCTV</b>	closed-circuit television
<b>CSOs</b>	combined sewer overflows
<b>EPA</b>	U.S. Department of Environmental Protection
<b>FEMA</b>	Federal Emergency Management Agency
<b>FOG</b>	fats, oils, and grease
<b>IDDE</b>	illicit discharge detection and elimination
<b>I/I</b>	infiltration/inflow
<b>MASSDEP</b>	Massachusetts Department of Environmental Protection
<b>MS4</b>	Municipal Separate Storm Sewer System
<b>MWRA</b>	Massachusetts Water Resources Authority
<b>NFIP</b>	National Flood Insurance Program
<b>NPDES</b>	National Pollutant Discharge Elimination System
<b>PACP</b>	Pipeline Assessment Certification Program
<b>SSOs</b>	sanitary sewer overflows
<b>TMDL</b>	total maximum daily load
<b>TSS</b>	total suspended solids



**For more information:**

City of Cambridge  
Department of Public Works  
147 Hampshire Street  
Cambridge, MA 02139  
617-349-4800  
[www.cambridgema.gov/theworks/tenyearplan](http://www.cambridgema.gov/theworks/tenyearplan)

