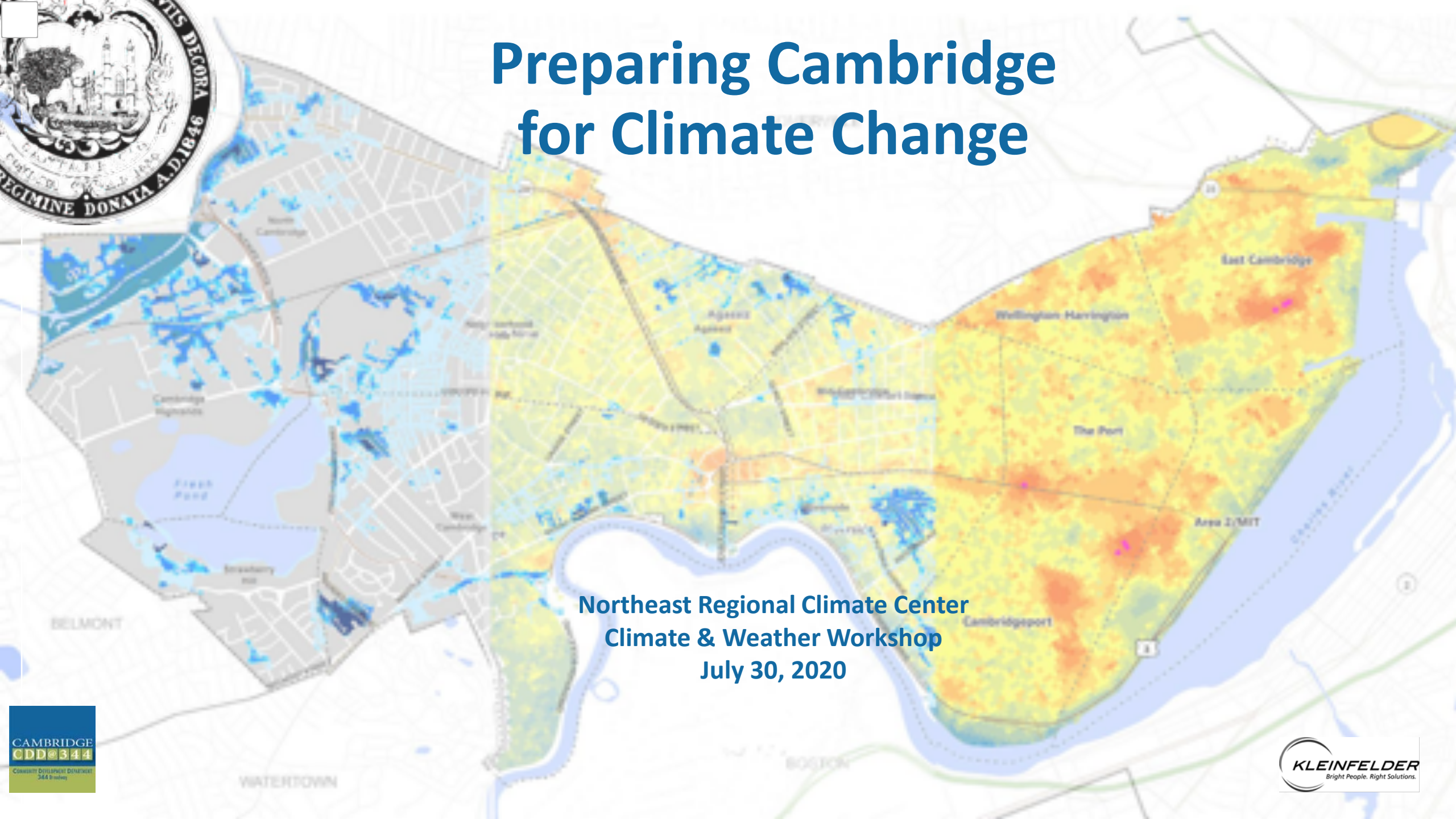




Preparing Cambridge for Climate Change



Northeast Regional Climate Center
Climate & Weather Workshop
July 30, 2020

About Cambridge

Population (2017)	113,630 27% foreign born Over 70 languages spoken
Density (2010)	26 people/acre 12 units/acre 10 th densest city in US
Ethnicity (2010)	67% White 15% Asian/Pacific Islander 11% Black 8% Hispanic
Housing (2018)	54,713 units 63% rental 93% multifamily units
Economy (2018)	130,000 workers 5,000 businesses 65% employed in Professional & Business Services, Education, Health Care



Total land area	6.4 sq. mi.
Total water surface	0.7 sq. mi.
Impervious surface	58%
Urban forest canopy	26%
Watersheds	Charles River - 2/3 Mystic River - 1/3

Planning Challenge: Uncertainty

What We Know

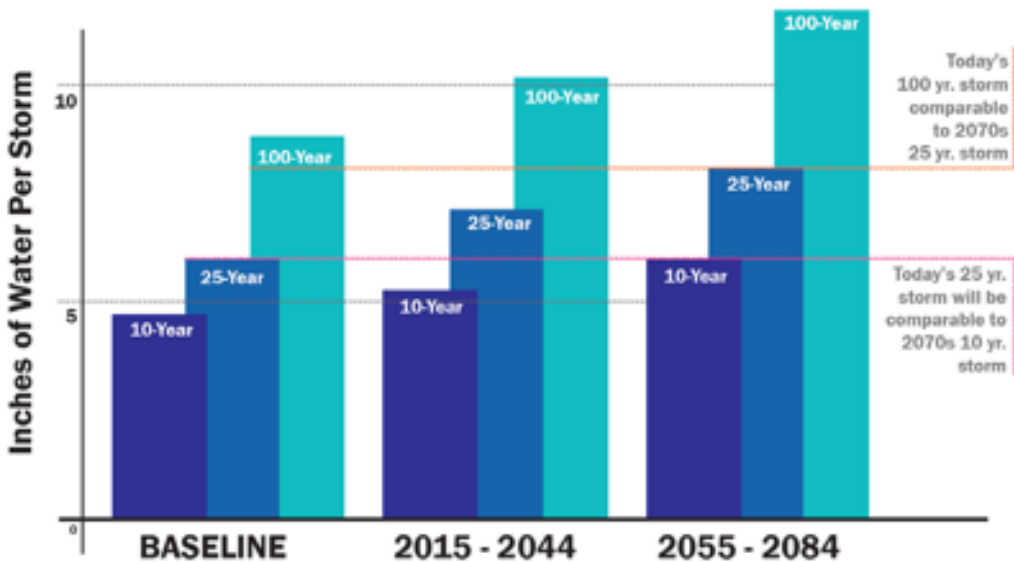
- Future climate will be different than the present and will continue shifting toward a warmer, wetter regime
- Climate is no longer stable; ***the past does not predict the future***; temperature, precipitation rates, and sea level will continue to shift; ***there is no single scenario to plan for***
- ***The City is designed and built for the past***; it is not prepared for future climate conditions

Sources of Uncertainty

- Science is evolving; projections change
- Models continue to be refined and input data continues to improve
- Some potential sources of risk are not understood, e.g. joint probabilities of storm surges and heavy precipitation, catastrophic precipitation
- How will greenhouse gas reductions alter future climate parameters and when
- How will actions to reduce risk modify flooding and heat vulnerability, e.g. blocking flows at the dams and in Charlestown

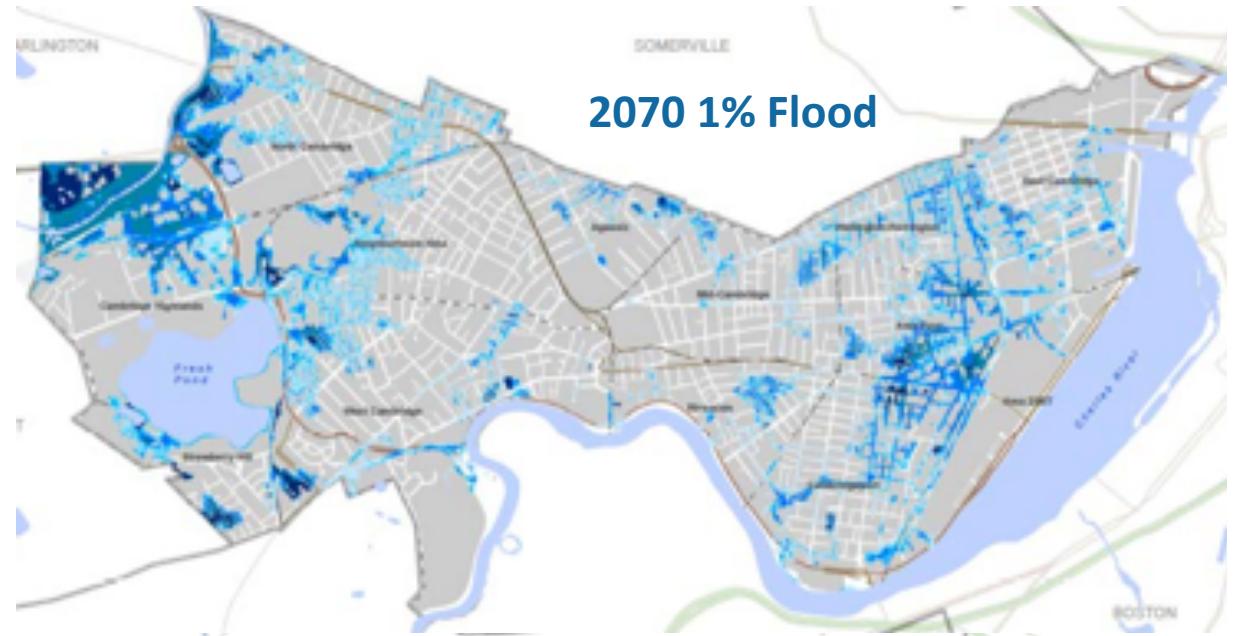
Rates of Precipitation Increasing

- For 24-hour storms, 1% annual risk is associated with ~8 inches in the present and ~12 inches in 2070
- Frequency of larger storms increases – today’s 1% annual event becomes 4% by 2070
- Cumulative risk for 1% annual event over 50 years is 39%; 10% annual is 99+% cumulative
- Extent and depth of flooding increases if we do nothing
- Cannot fully store and convey floodwater

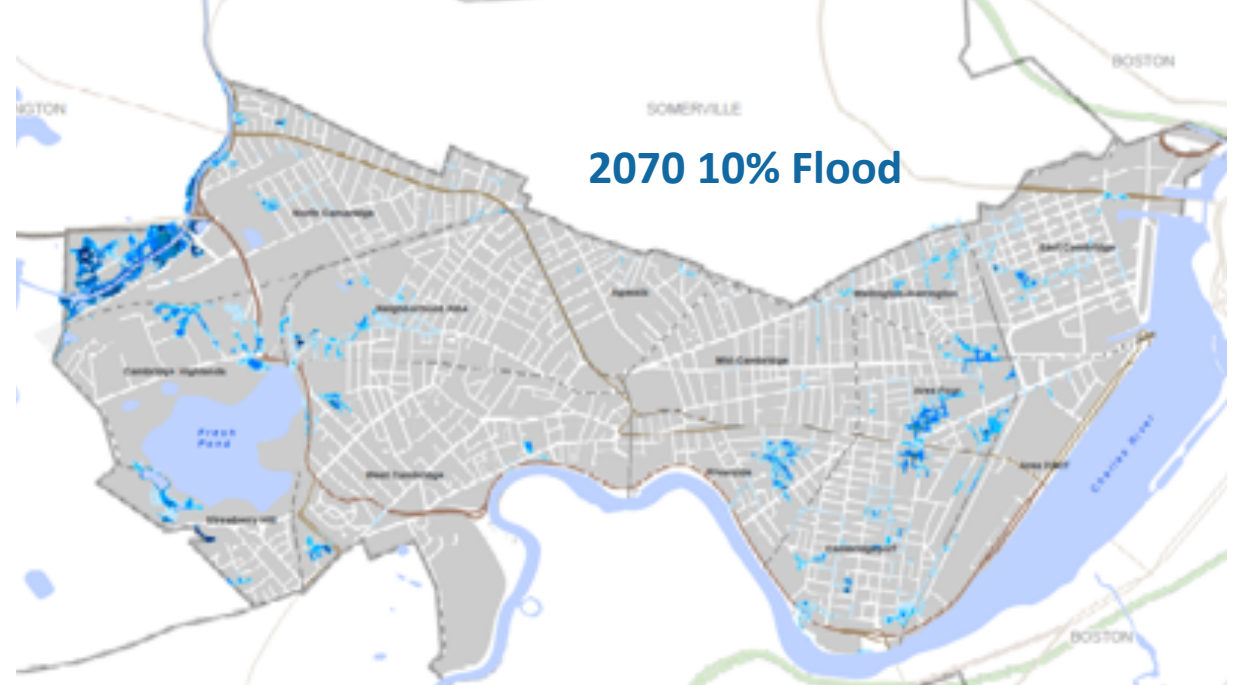


(Source: Kleinfelder based on ATMOS projections November 2015)

(per 24 hr. event)

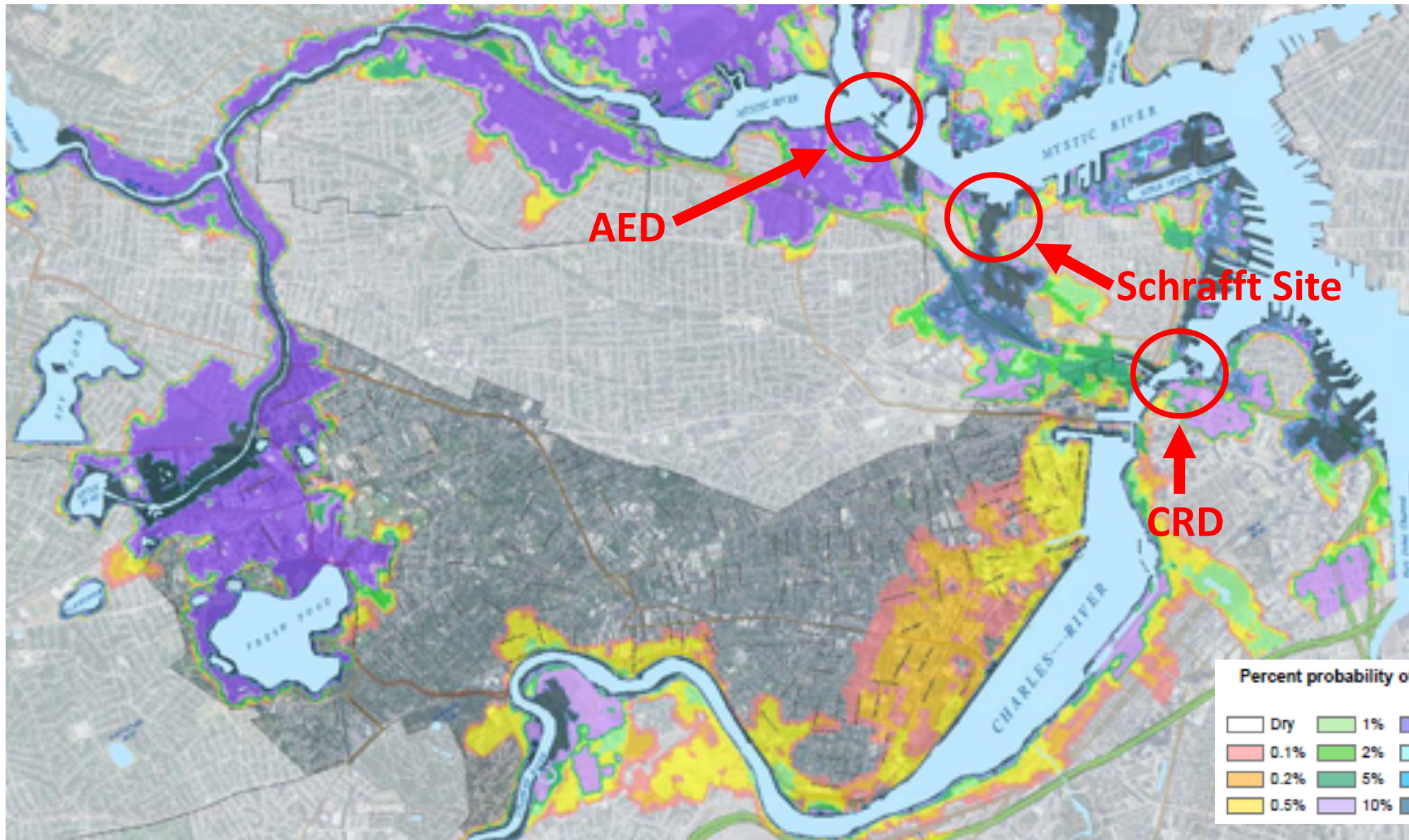


(per 24 hr. event)



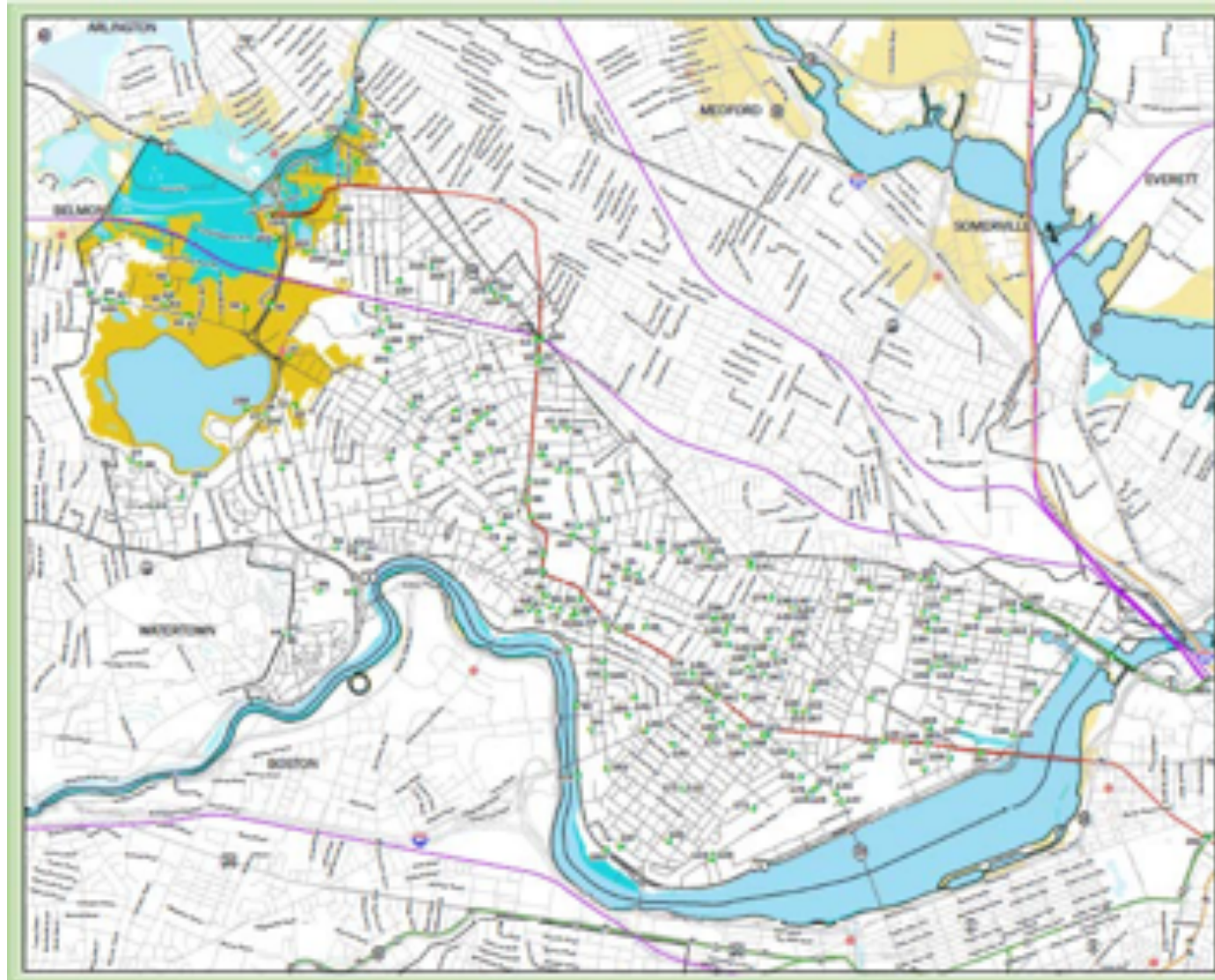
Storm Surge Risk Becomes a Significant Risk Mid-Century

Storm Surge Flooding Probabilities in 2070 with 3.4 feet SLR



Based on Boston Harbor Flood Risk Model (BHFRM)
MassDOT & Woods Hole Group
• ADCIRC & SWAN

FIRM Maps Limited to Riverine & Historic



FEMA maps showed limited precipitation based flooding, but did not account for future climate conditions

Flooding Happens Already

July 10, 2010 Extreme Precipitation

3.58 Inches in 1 Hour



Bishop Allen Dr. & Columbia Street



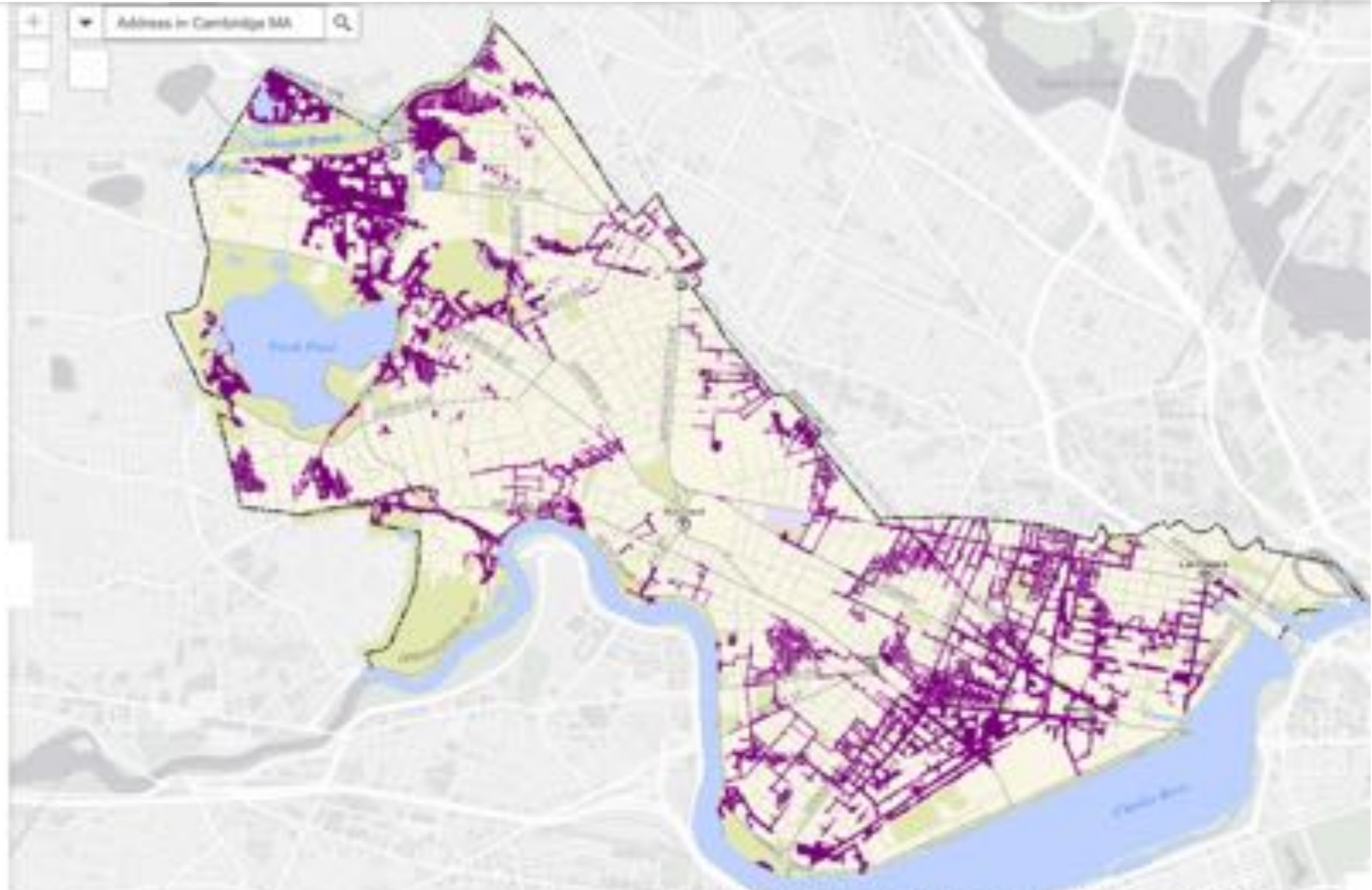
Sidney Place & Green Street



Broadway & Portland Street

Cambridge Has Existing Flood Risks, Will Worsen

- Precipitation Flooding - 2070 - 100-Year Storm
2070 - 100 Year Precip - Extent of Flooding
■
- Precipitation Flooding - 2070 - 10-Year Storm
2070 - 10 Year - Extent of Flooding
■
- Precipitation Flooding - Present Day - 100-Year Storm
Present Day - 100 Year - Extent of Flooding
■
- Precipitation Flooding - Present Day - 10-Year Storm
Present Day - 10 Year - Extent of Flooding
■



Emerging Risk: Storm Surge Flooding From Boston Harbor + Precipitation

Sea Level Rise / Storm Surge Flooding - 2070 - 100-Year Storm

2070 - 100 Year - SLSR Flooding Extent



Precipitation Flooding - 2070 - 100-Year Storm

2070 - 100 Year Precip. - Extent of Flooding



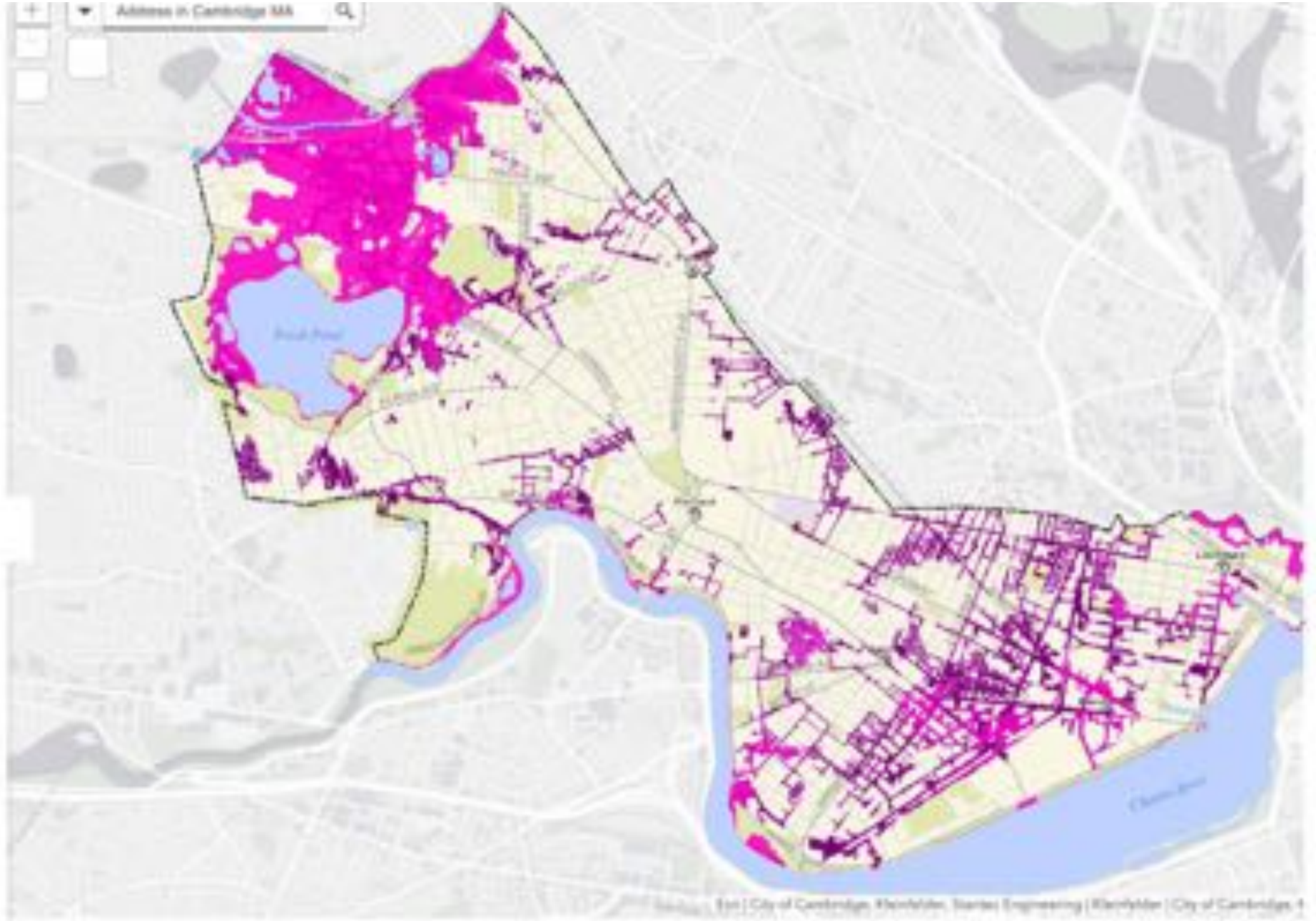
Sea Level Rise / Storm Surge Flooding - 2070 - 10-Year Storm

2070 - 10 Year - SLSR Flooding Extent



Precipitation Flooding - 2070 - 10-Year Storm

2070 - 10 Year - Extent of Flooding



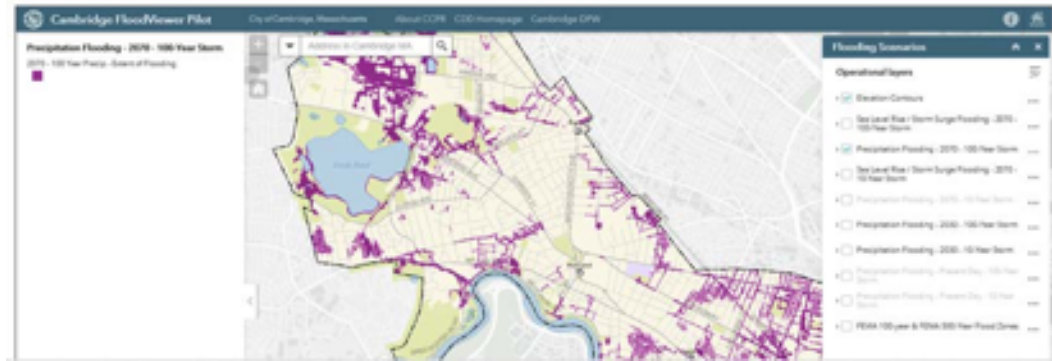
Current City Flood Protection Guidance

Cambridge FloodViewer – Accessible Flood Extent & Elevation Data

UNDERSTANDING FLOOD RISKS & PROTECTING YOUR PROPERTY

Public Works

Use this tool to help understand the risk of flooding to your property and how to protect against it. The Flood Viewer has been developed as an informational tool for the Cambridge community to assess climate change threats from flooding and to prepare for it by implementing specific strategies. The City is in the process of developing a practical guide for climate change preparedness and resilience. It is recognized that projected flood information presented in the Flood Viewer are based on climate change scenarios that are drawn from the best available science but involve ranges of uncertainty. The provided flood information will need to be revisited frequently to ensure that our community preparedness efforts continue to reflect updated projections specific to local climate change. Please contact FloodViewer@cambridgema.gov with questions or help using the map.



Address: 197 Vassal Ln
 Map-Lot: 260-80



(Elevations in ft-CCB)¹ Flood Elevation Data

Minimum Ground Elevation:	16.9
Maximum Ground Elevation:	28.6
2070 100-Year SLR/SS Flooding:	22.5
2070 100-Year Precipitation Flooding:	24.1
2070 10-Year SLR/SS Flooding:	22.1
2070 10-Year Precipitation Flooding:	22.6
2030 100-Year Precipitation Flooding:	23.9
2030 10-Year Precipitation Flooding:	22.2
Present Day 100-Year Precipitation Flooding:	23.5
Present Day 10-Year Precipitation Flooding:	21.9
FEMA 100-year Flood Elevation:	N/A
FEMA 500-year Flood Elevation:	22.4



The Flood Viewer has been developed as an informational tool for the Cambridge community to assess climate change threats from flooding and to prepare for it by implementing specific strategies.

Use this tool to help understand the risk of flooding to your property and how to protect against it.

Learn more at:
CambridgeMA.gov/FloodViewer

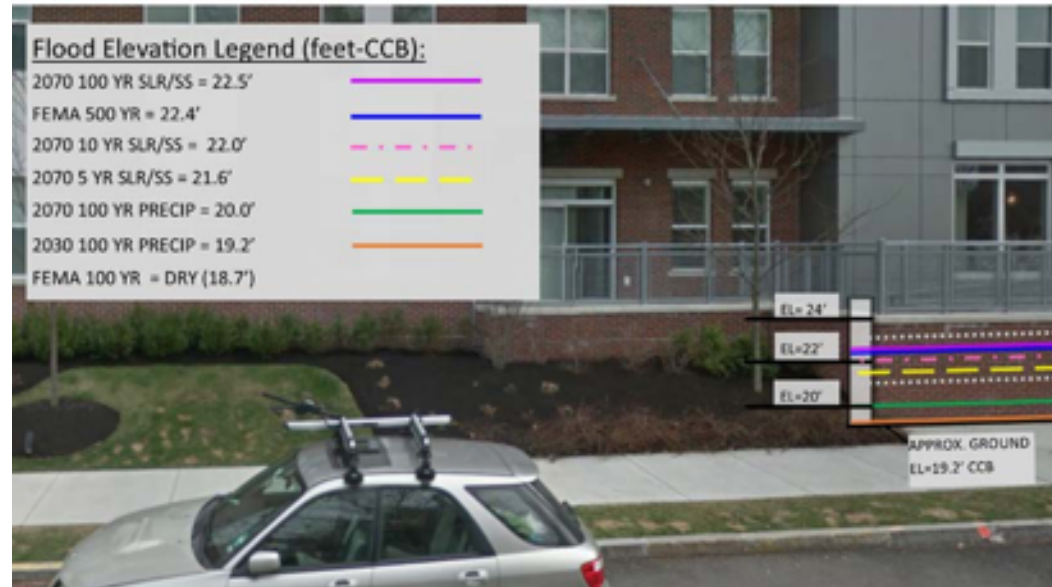
Selected Parcel Buildings Parcel Boundary Extent of Flooding - 2070 - 100-Year Precip



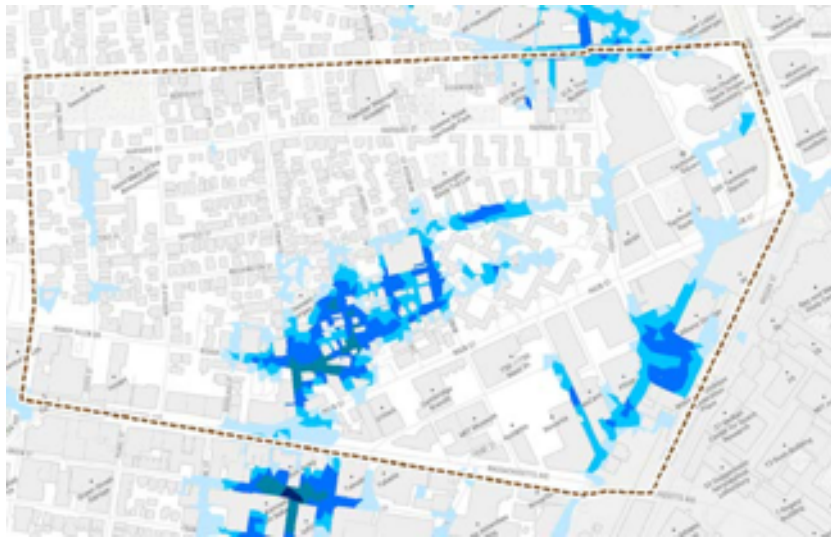
Cambridge Design Flood Elevation Guidance

- Build/protect to 2070 10% annual risk
- Recover from 2070 1% annual risk

<https://www.cambridgema.gov/Services/FloodMap>



Event Comparison: 2070 10-Year 24-Hour Storm



Anticipated flooding for a 2070, 10 year / 24 hour storm

Existing conditions
baseline

infrastructure condition
(2020 system)

With Gray Infrastructure
Improvements

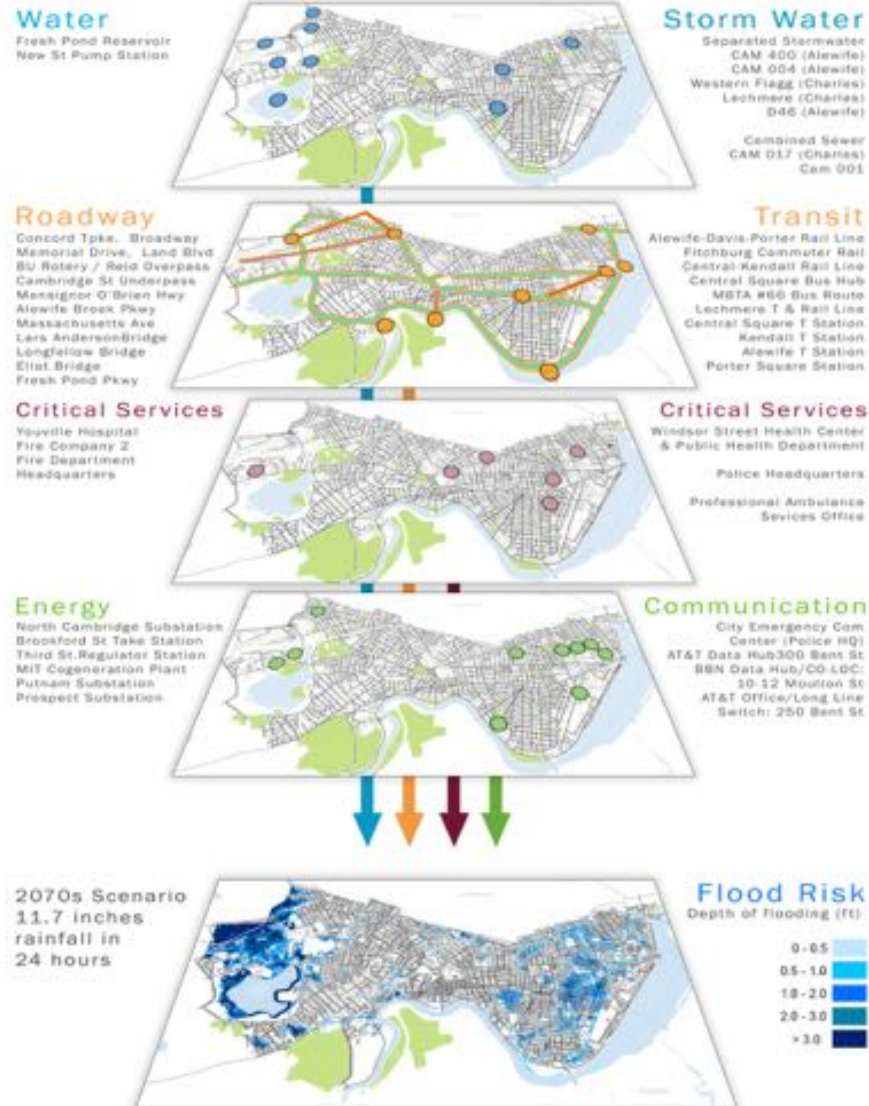
Harvard Street sewer separation +
Flow rerouting to Mass. Av

With Gray & Green Infrastructure
Improvements

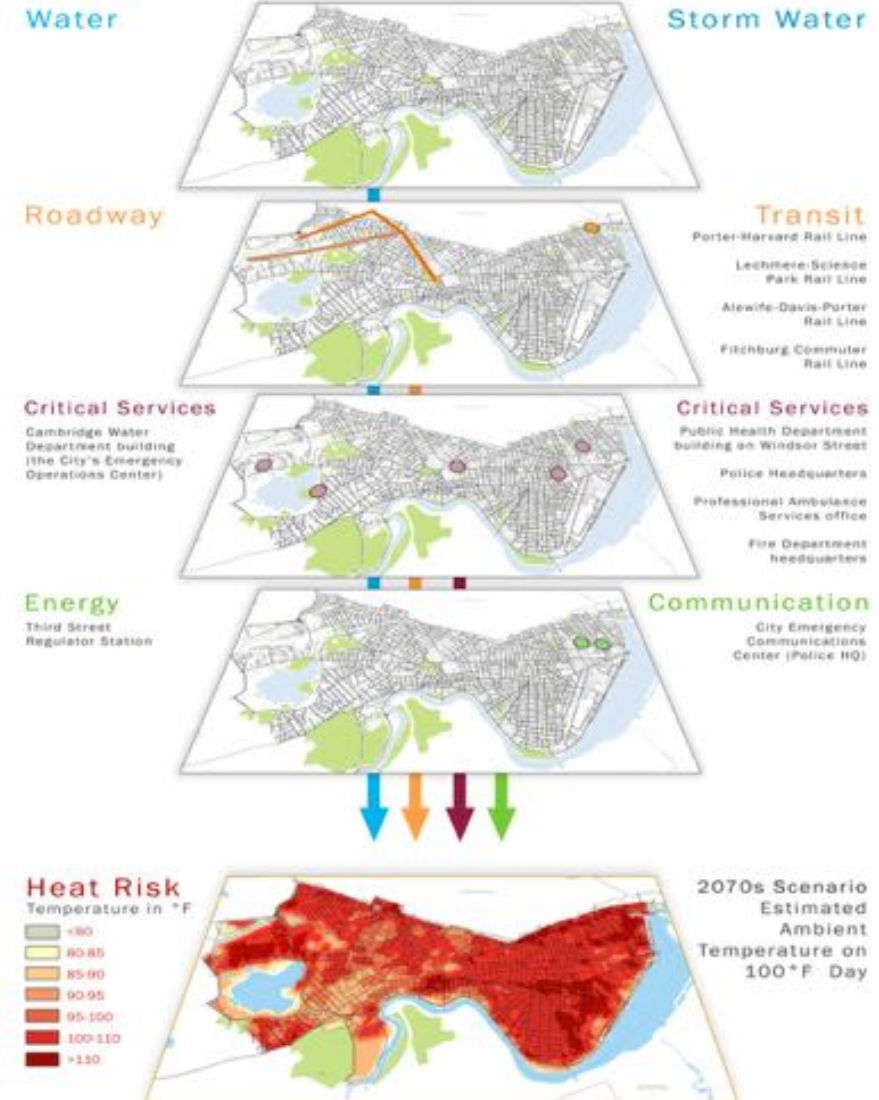
Harvard Street sewer separation +
Flow rerouting to Mass. Av +
Opportunistic GI implementation

Climate Stress Test: What Happens If No Action Taken

Flooding stress test



Heat stress test



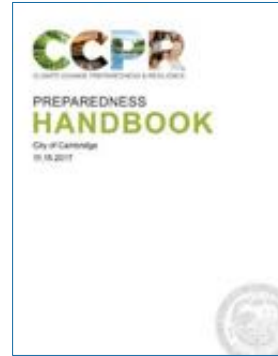
The City is Planning for Change



2017 - Alewife Pilot

A transformed neighborhood

- The Quadrangle
- Blue & green infrastructure



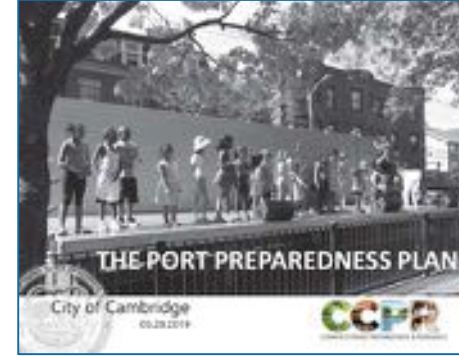
2017 - Alewife Handbook

A Community

B Buildings

C Infrastructure

D Ecosystems



2019 - The Port Prepared Plan

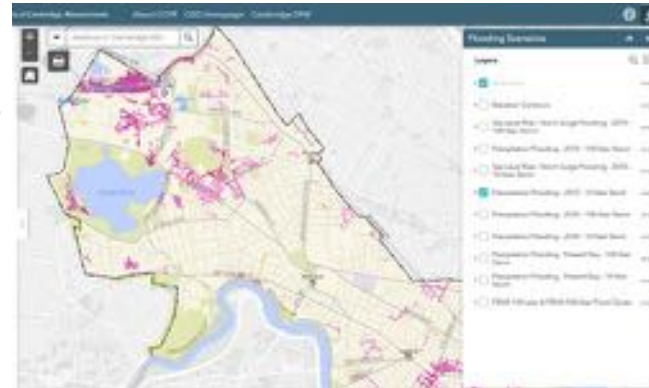
3 Ideas for Change

- Gray & green infrastructure
- Super resilient blocks
- Resilient people

MVP Toolkits

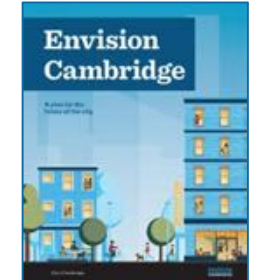


FloodViewer



Also...

- Cambridge Net Zero
- Urban Forest Master Plan
- Envision
- Regional Collaboration
- Climate Resilience Zoning Task Force



Cambridge is Building for Change

Sample of built & upcoming projects integrating Cambridge Climate Change Vulnerability Assessment (CCVA) key findings and the Climate Change Preparedness and Resiliency (CCPR) recommendations from The Port and Alewife plans.

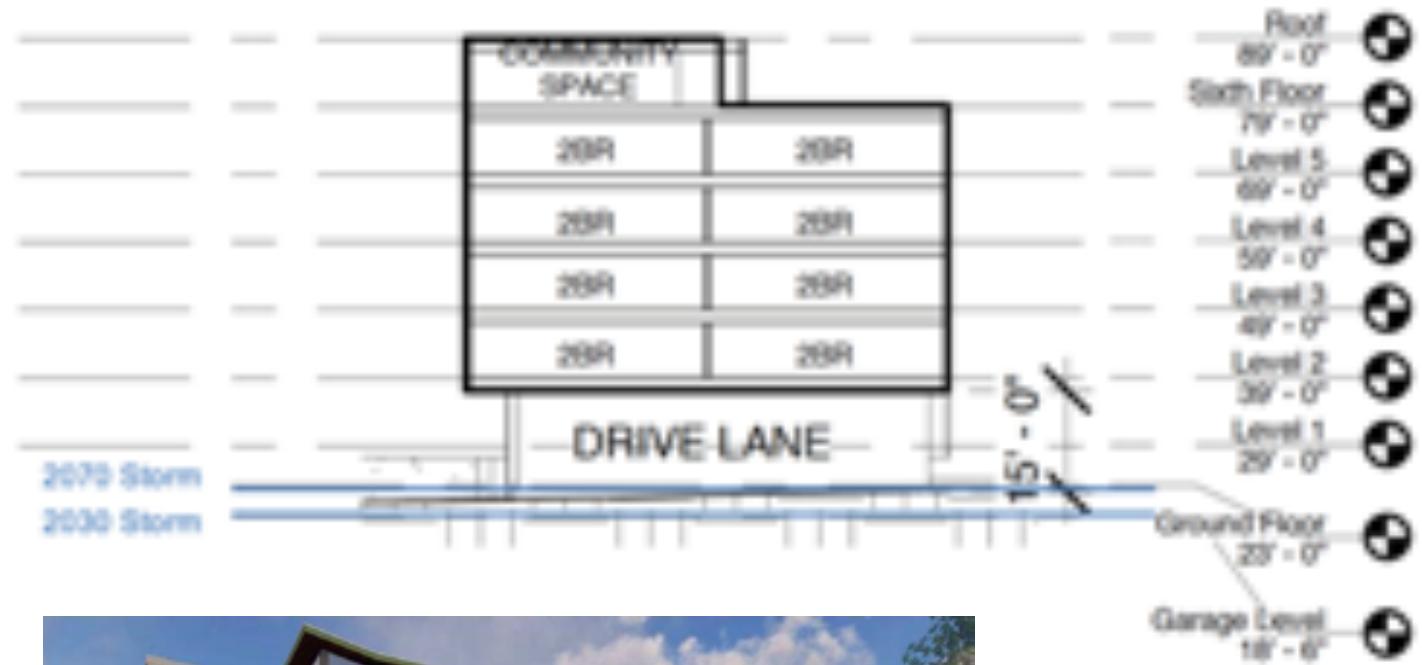


Envision Cambridge - Alewife Coordinating Building and Street Design



Better Buildings: HRI Finch Cambridge Affordable Housing

1. High performance building envelope and cool roof (**project will be Passive House certified** under the PHIUS+ 2015 system); **can stay in 55-85° F range for 4 days passively.**
2. Heat recovery ventilation system
3. VRF heat pump and efficient central hot water system
4. **83 kW Solar PV on roof Sub-metered utilities and separate sub-panel for life safety loads** (above flood elevation)
5. Sub-metered utilities and **separate sub-panel for life safety loads (above flood elevation)**
6. Building energy management
7. **Top floor community room and residential units elevated above flood elevation**






HRI's Finch Cambridge project
ICON Architecture
NEI Energy Expertise

Better Buildings

Retrofit existing building and site for enhanced flooding protection



GI Storage Options:

- 1. Bioretention Basin 
- 2. Rain Barrel 
- 3. Above-Ground Planter 
- 4. Other GI Storage Options

Building's flood protection:

- 1. Use Flood Resistant Materials
- 2. Build Exterior Floodwalls
- 3. Install Backwater Valves
- 4. Elevate/ Relocate Utilities

Stronger Infrastructure

Creating infrastructure to reduce flooding risk for the neighborhood



480,000 gallon stormwater tank currently under construction in Central Square. \$20M+ project funded by City and MWRA II funds.

Regional Climate Change Adaptation Collaborations

Metro Mayors Climate Preparedness Task Force

- Agreement signed in 2015
- 15 inner core municipalities
- Administered by MAPC

Resilient Mystic Collaborative

- Convened in 2018 by the Mystic River Watershed Association
- Covers 21 watershed communities

Charles River Climate Compact

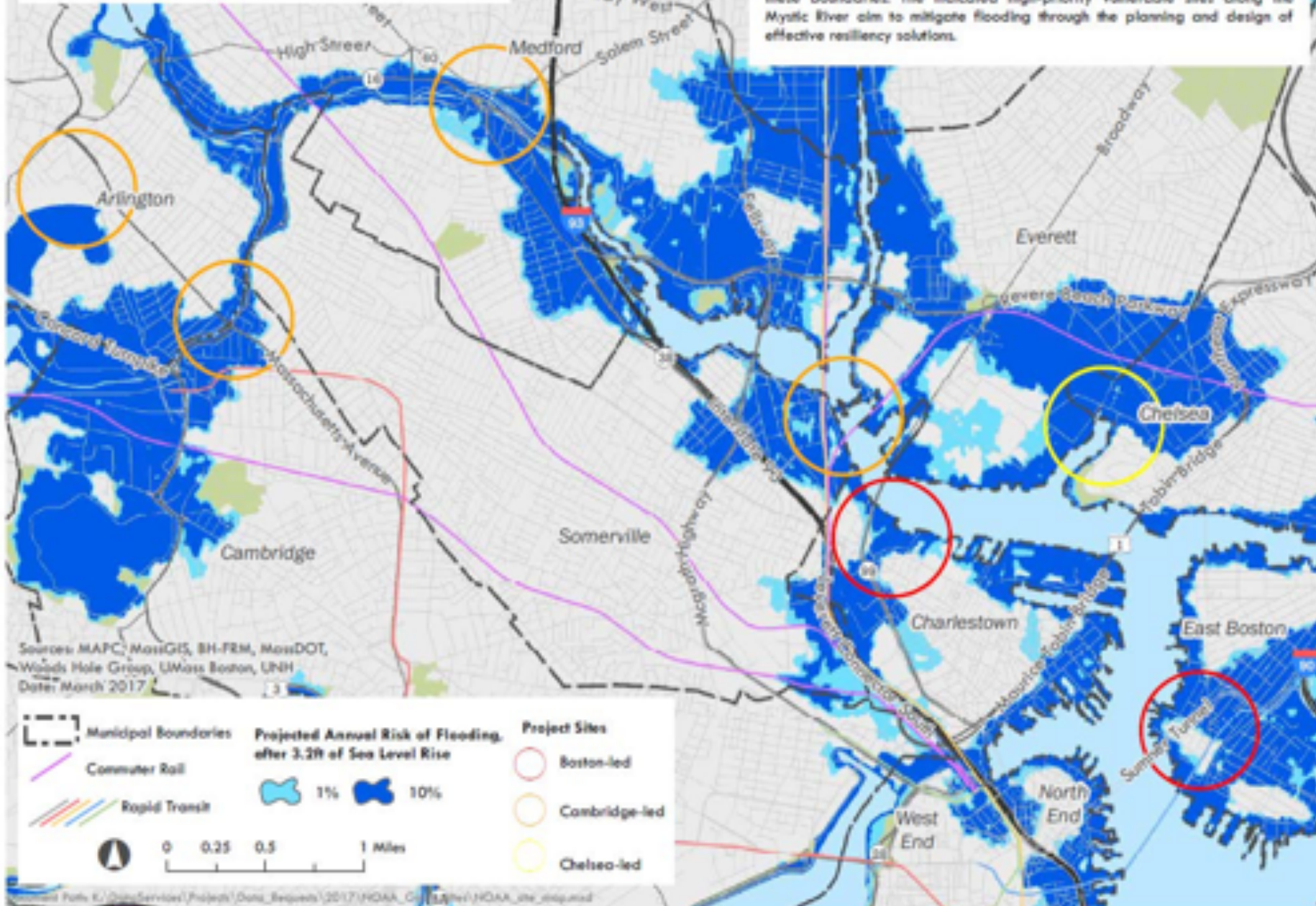
- New, being convened by Charles River Watershed Association

Regional Climate Issues

- Enhancements at Amelia Earhart Dam on Mystic River and Charles River Dam to protect against future storm surges
- Food supply, regional produce market in Chelsea/Everett is vulnerable to storm surge flooding
- MBTA regional transit system
- Regional energy systems including electricity grid and natural gas distribution
- Regional healthcare system
- Impacts in other communities can affect Cambridge (e.g., Red Line disrupted in Boston)

Climate Resilience on the Mystic River Building Regional Capacity for Implementation

Focus areas for resiliency projects include locations within the three partner cities—the City of Chelsea, the City of Cambridge, and the Charlestown and East Boston neighborhoods in the City of Boston—but also extend outside of these boundaries. The indicated high-priority vulnerable sites along the Mystic River aim to mitigate flooding through the planning and design of effective resiliency solutions.



Regional Flood Risk Mitigation Planning



Amelia Earhart Dam (Source: MaUSHarbors.com)

Contact Information

John Bolduc, Environmental Planner
Cambridge Community Development Department

jbolduc@cambridgema.gov
(617) 349-4628

<https://www.cambridgema.gov/climateprep>