



RESILIENT CAMBRIDGE

Preparing for Climate Change

January 11, 2022



Climate Change: Shifting Risks

Extreme Heat



Days over 90°F to triple by 2030. By 2070, there could be more than 2 months in a year over 90°F.

Extreme Rain



Flooding from rain more frequent and more severe

Sea Level Rise/ Storm Surge

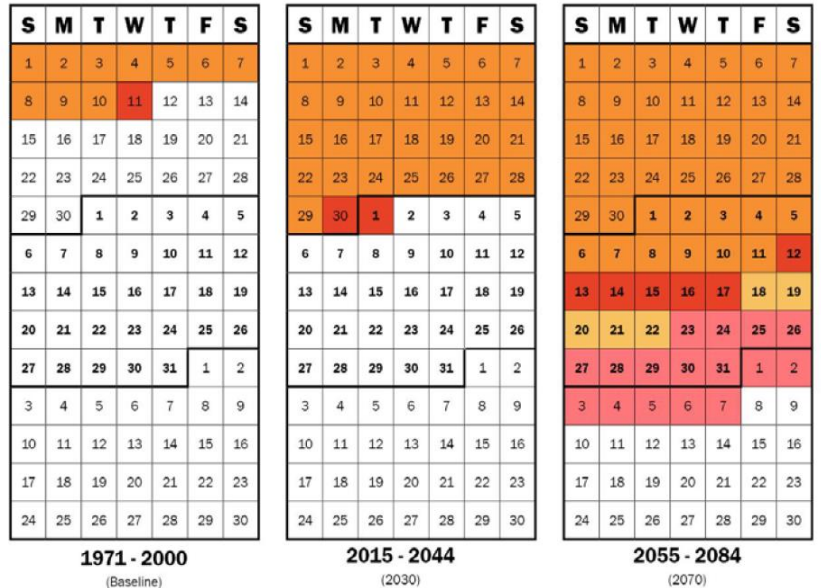


Sea level rise and larger storm surge in Boston Harbor will overtop and flank the Mystic and Charles River dams



Increasing Heat

Warm Averages, Higher Temps, More Heat Waves



■ Above 90°F - Low Scenario
 ■ Above 90°F - High Scenario
 ■ Above 100°F - Low Scenario
 ■ High 100°F - High Scenario

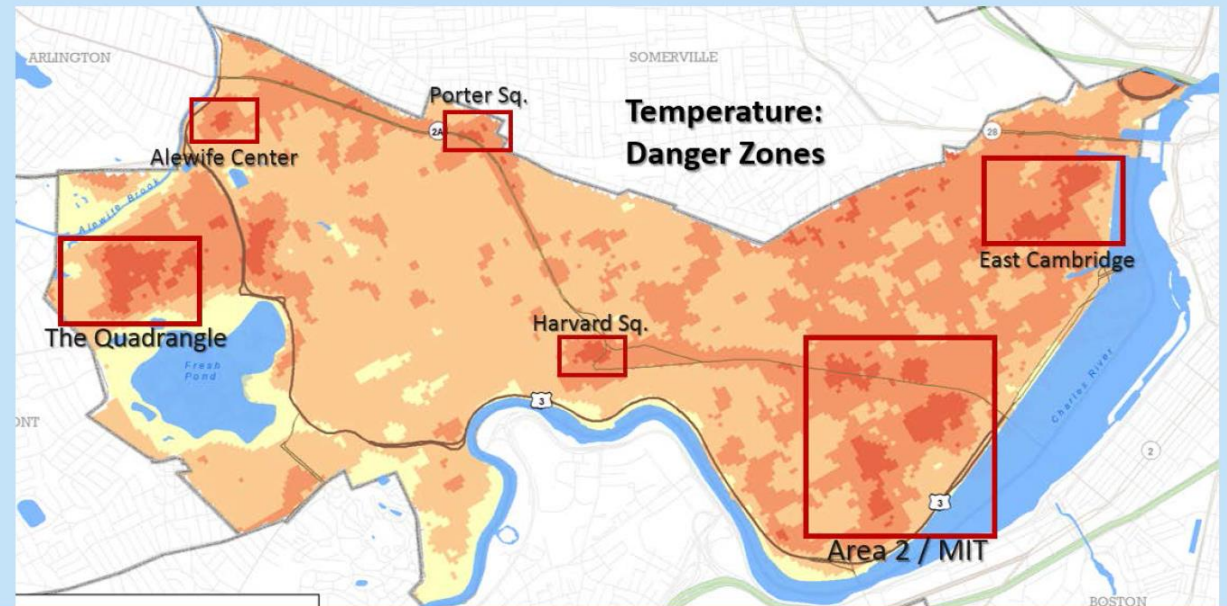
*Summer is considered to be the 91 days of June through August

By 2030, the number of days above 90° F could triple

- Stress on human health
- Stress on infrastructure

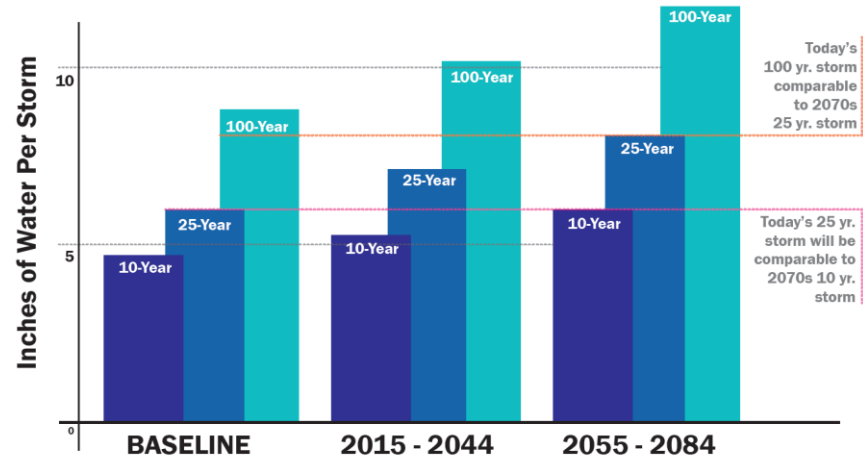
Urban Heat Island Effect Magnifies Ambient Temperature

- Darker impervious surfaces – pavement & roofs -- absorb heat
- Areas with large amounts of impervious surface and lacking tree canopy tend to be heat islands

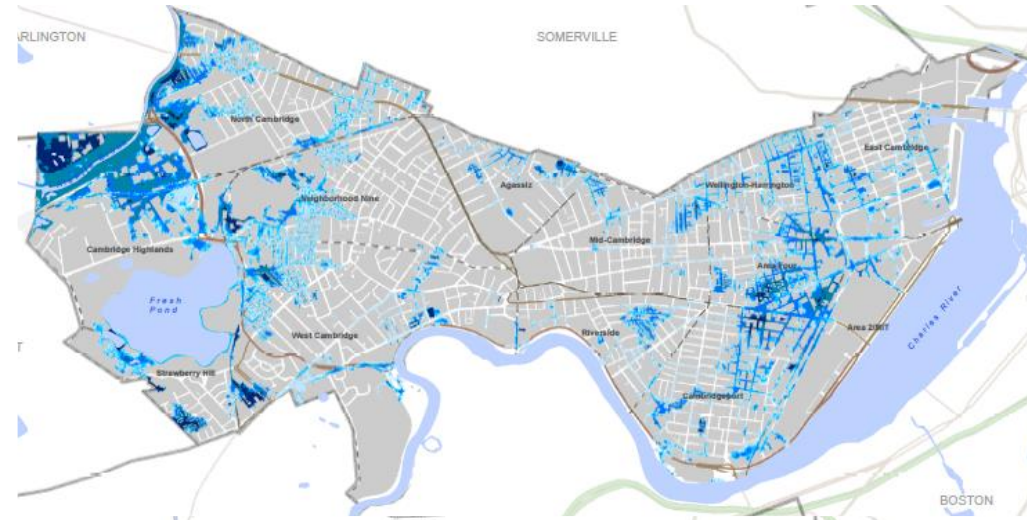


Increasing Precipitation

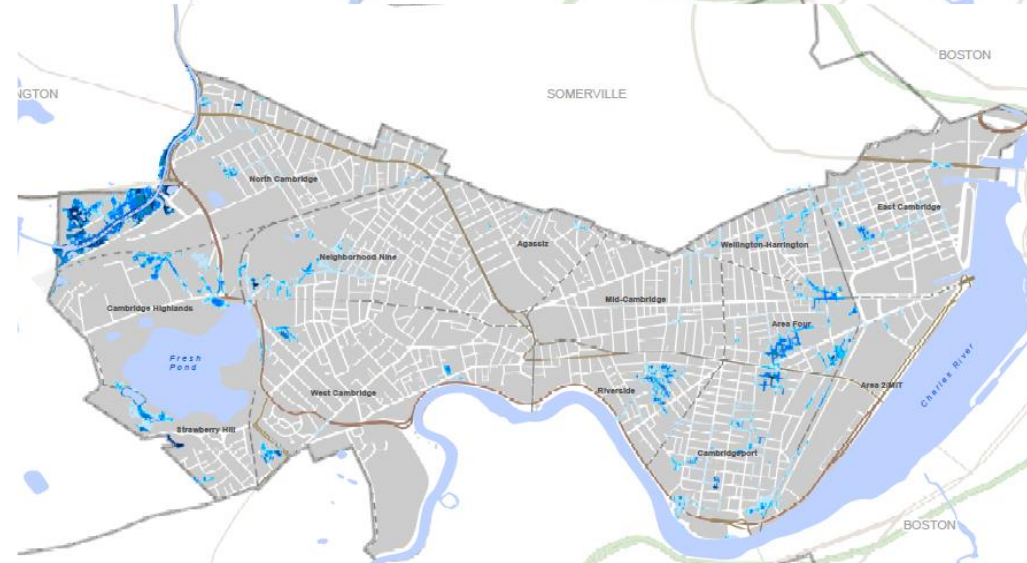
Extreme rates, Increasing frequency



(per 24 hr. event)



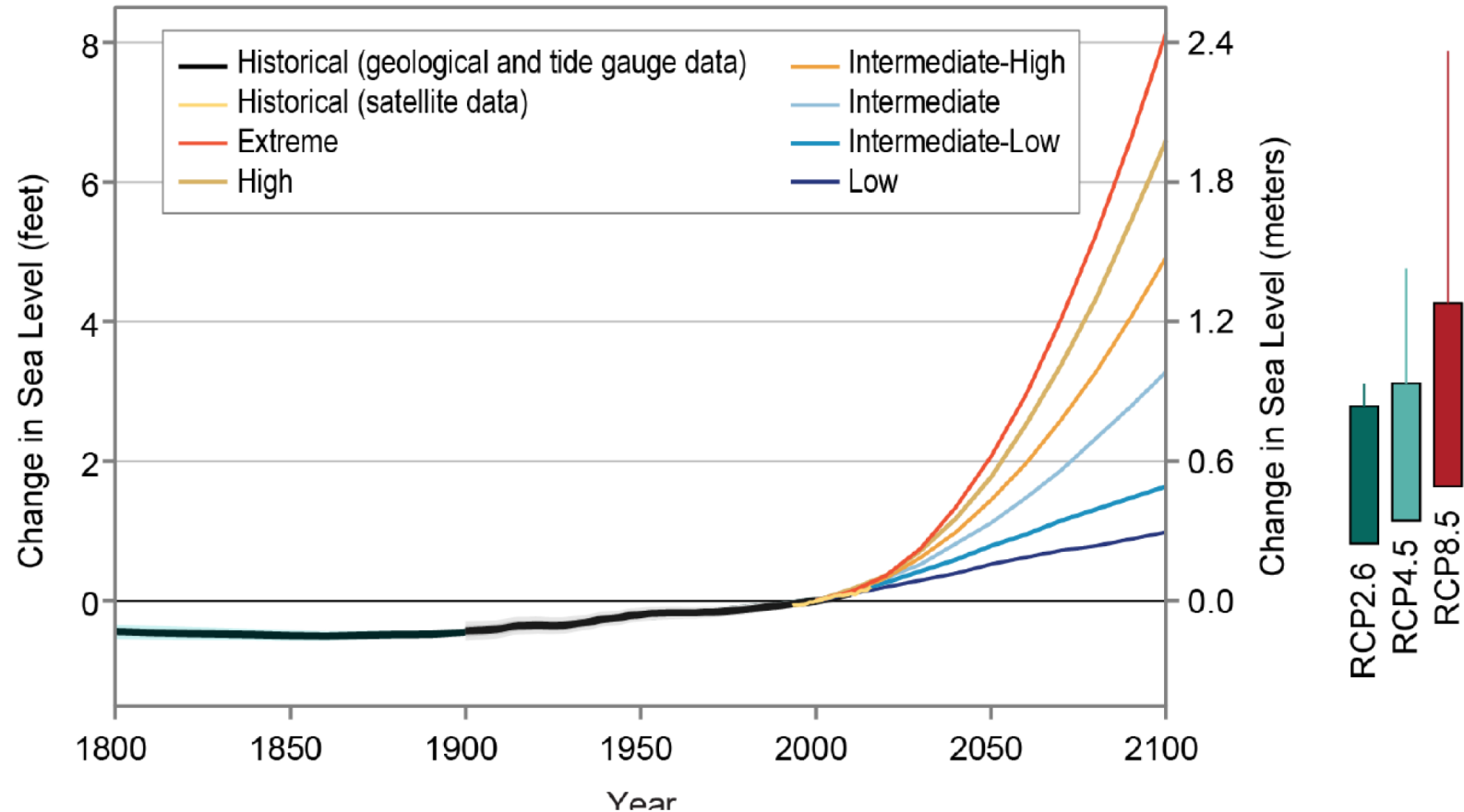
(per 24 hr. event)



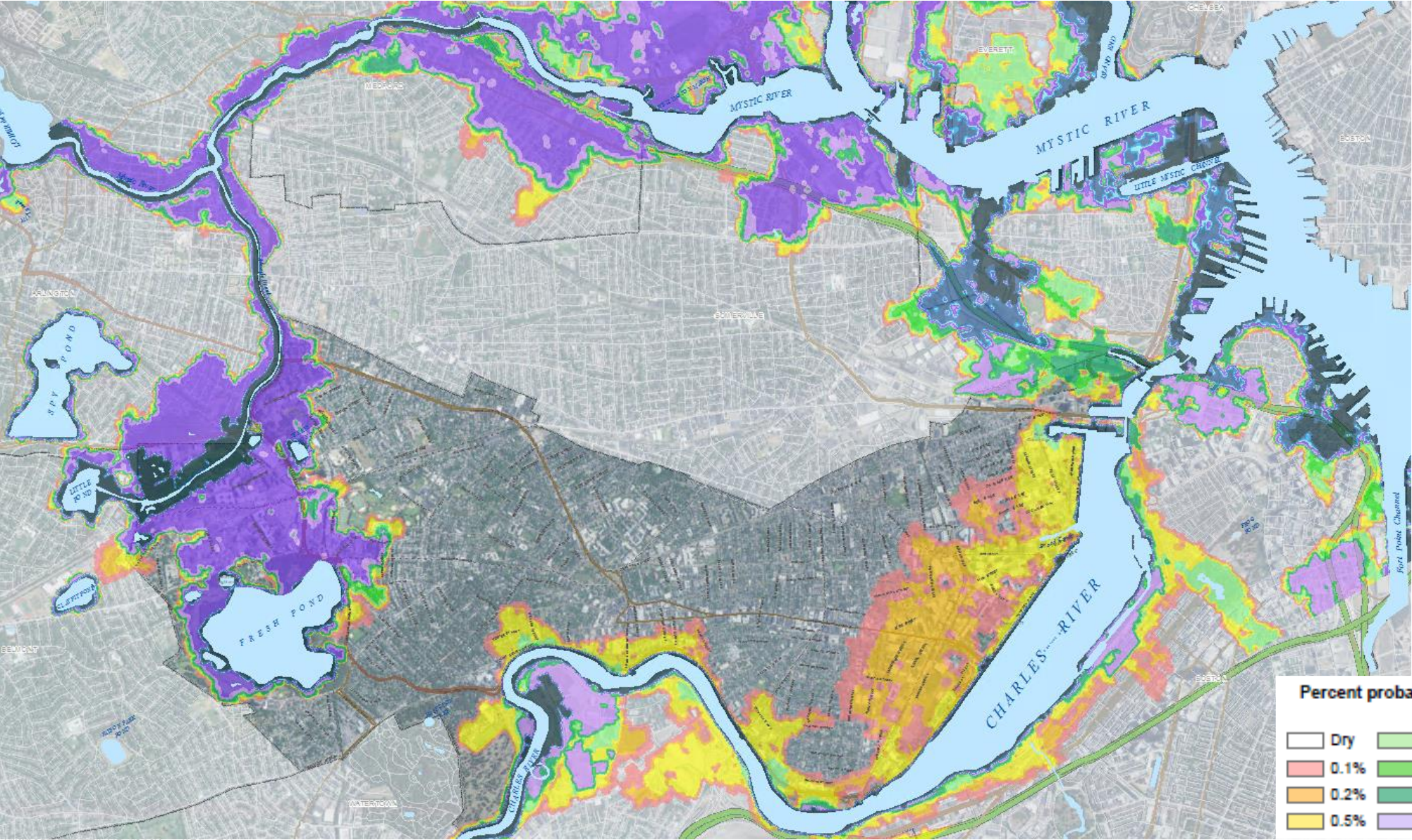
Rising Sea Levels

Higher Tides and Storm Surges

Historical and Projected Global Average Sea Level Rise



Rising Sea Level: Emergence of storm surge flooding risk by 2070

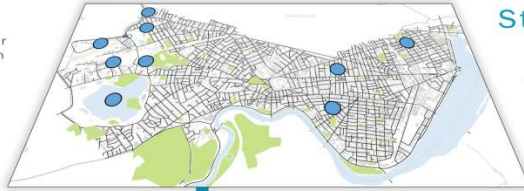


Based on Boston Harbor Flood Risk Model (BHFRM)
MassDOT & Woods Hole Group
• ADCIRC & SWAN

Climate Stress Test: What Happens If No Action Taken

Water

Fresh Pond Reservoir
New St Pump Station

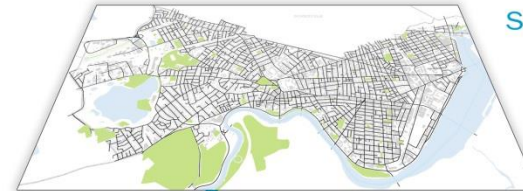


Storm Water

Separated Stormwater
CAM 400 (Alewife)
CAM 004 (Alewife)
Western Flagg (Charles)
Lechmere (Charles)
D46 (Alewife)

Combined Sewer
CAM 017 (Charles)
Cam 001

Water



Storm Water

Roadway

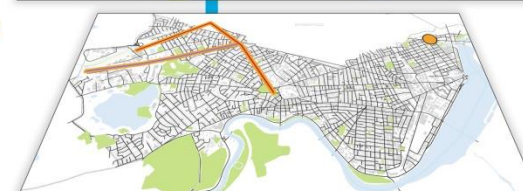
Concord Tpke, Broadway
Memorial Drive, Land Blvd
BU Rotery / Reid Overpass
Cambridge St Underpass
Monsignor O'Brien Hwy
Alewife Brook Pkwy
Massachusetts Ave
Lars Anderson Bridge
Longfellow Bridge
Eliot Bridge
Fresh Pond Pkwy



Transit

Alewife-Davis-Porter Rail Line
Fitchburg Commuter Rail
Central-Kendall Rail Line
Central Square Bus Hub
MBTA #66 Bus Route
Lechmere T & Rail Line
Central Square T Station
Kendall T Station
Alewife T Station
Porter Square Station

Roadway

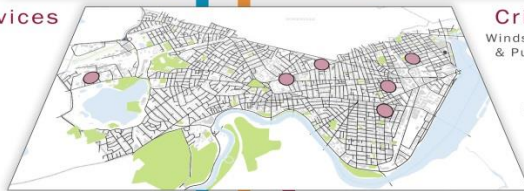


Transit

Porter-Harvard Rail Line
Lechmere-Science
Park Rail Line
Alewife-Davis-Porter
Rail Line
Fitchburg Commuter
Rail Line

Critical Services

Youville Hospital
Fire Company 2
Fire Department
Headquarters

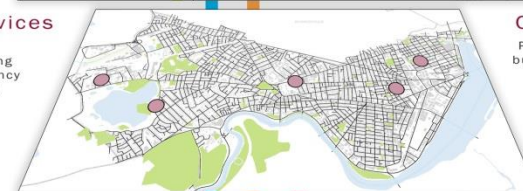


Critical Services

Windsor Street Health Center
& Public Health Department
Police Headquarters
Professional Ambulance
Services Office

Critical Services

Cambridge Water
Department building
(the City's Emergency
Operations Center)

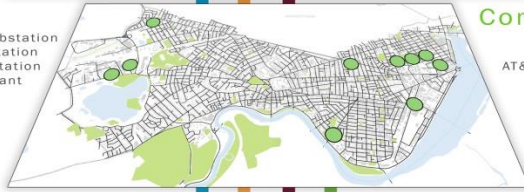


Critical Services

Public Health Department
building on Windsor Street
Police Headquarters
Professional Ambulance
Services office
Fire Department
headquarters

Energy

North Cambridge Substation
Brookford St Take Station
Third St. Regulator Station
MIT Cogeneration Plant
Putnam Substation
Prospect Substation

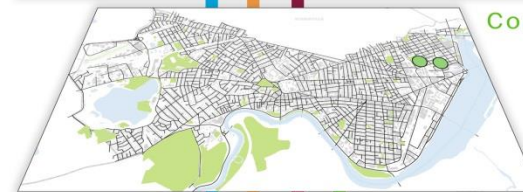


Communication

City Emergency Com
Center (Police HQ)
AT&T Data Hub/300 Bent St
BBN Data Hub/CO-LOC:
10-12 Moulton St
AT&T Office/Long Line
Switch: 250 Bent St

Energy

Third Street
Regulator Station

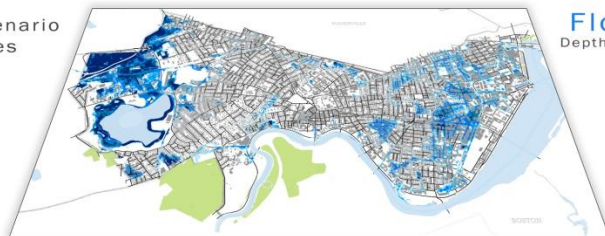


Communication

City Emergency
Communications
Center (Police HQ)



2070s Scenario
11.7 inches
rainfall in
24 hours



Flood Risk

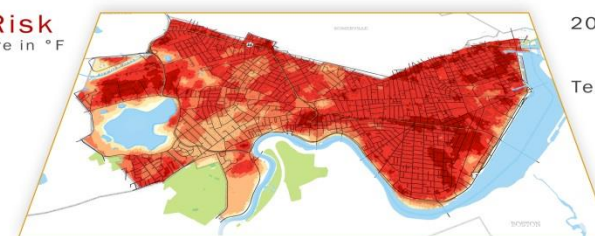
Depth of flooding (ft)

0 - 0.5	Lightest Blue
0.5 - 1.0	Light Blue
1.0 - 2.0	Medium Blue
2.0 - 3.0	Dark Blue
> 3.0	Darkest Blue

Heat Risk

Temperature in °F

<80	Lightest Yellow
80-85	Light Yellow
85-90	Yellow
90-95	Light Orange
95-100	Orange
100-110	Dark Orange
>110	Red



2070s Scenario
Estimated
Ambient
Temperature on
100 °F Day



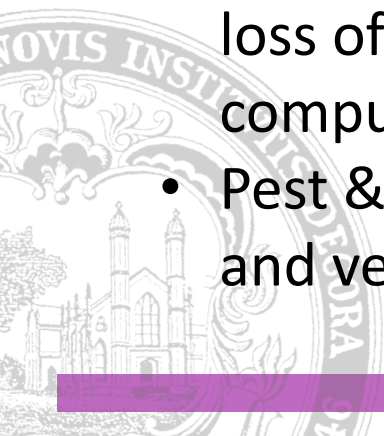
Impacts of Concern

Direct

- Flood damage to building structures and systems
- Flood damage to vehicles
- Flood damage to documents, paper & digital
- Health impacts, e.g. heat stroke, respiratory effects from mold, vector-borne disease
- Power outage to buildings, e.g., loss of refrigeration, AC, computers
- Pest & disease effects on trees and vegetation

Indirect

- Loss of business continuity, i.e. office or retail closures, lost wages, lost revenue
- Transportation disruption, i.e. MBTA shutdown
- Supply chain disruptions
- Employee personal impacts, e.g. property damage, access to childcare or school, health effects
- Internet & communications outage



Approach to climate change preparedness & resilience

Reduce Risk



Prepare for Unavoidable Risks

- Reduce urban heat islands
- Increase flood storage & conveyance
- Install storm surge barriers
- Elevate structures

- Be transparent and open about risks, share data
- Plan for extremes and new normals
- Coordinate planning initiatives
- Engage stakeholders & community
- Develop strategies for people, buildings, infrastructure, and ecosystem
- Implement at different scales
- Coordinate and engage regionally

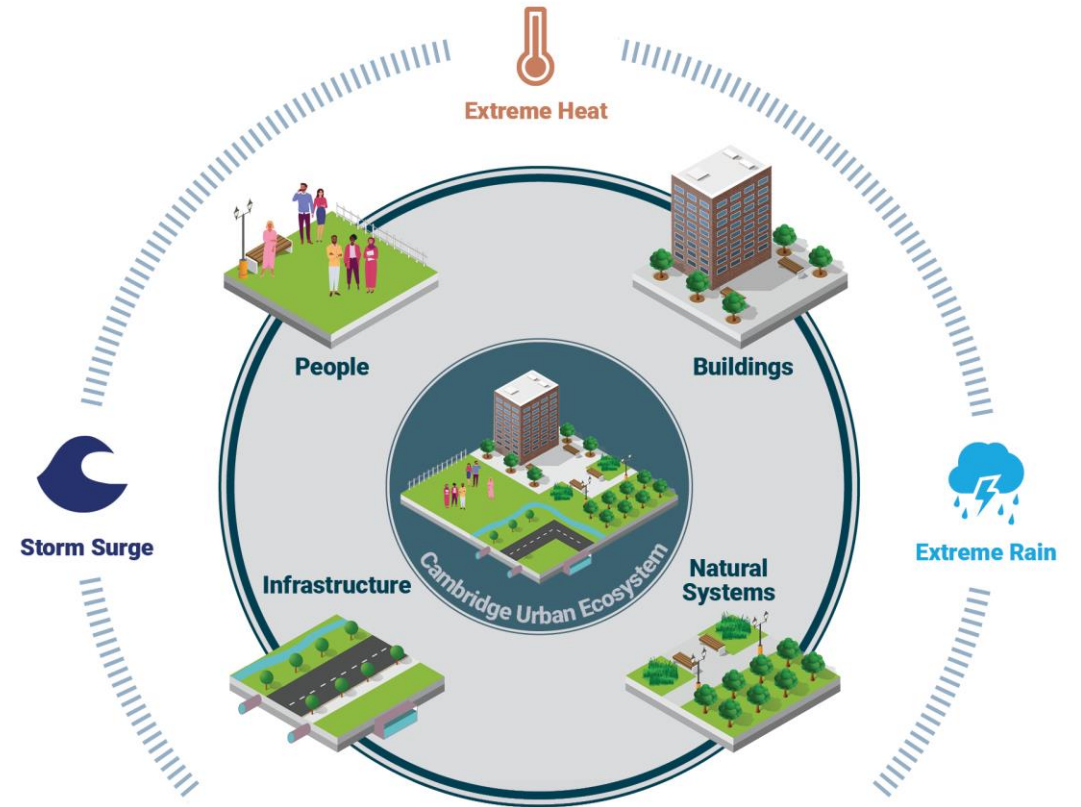


Resilient Cambridge Strategies

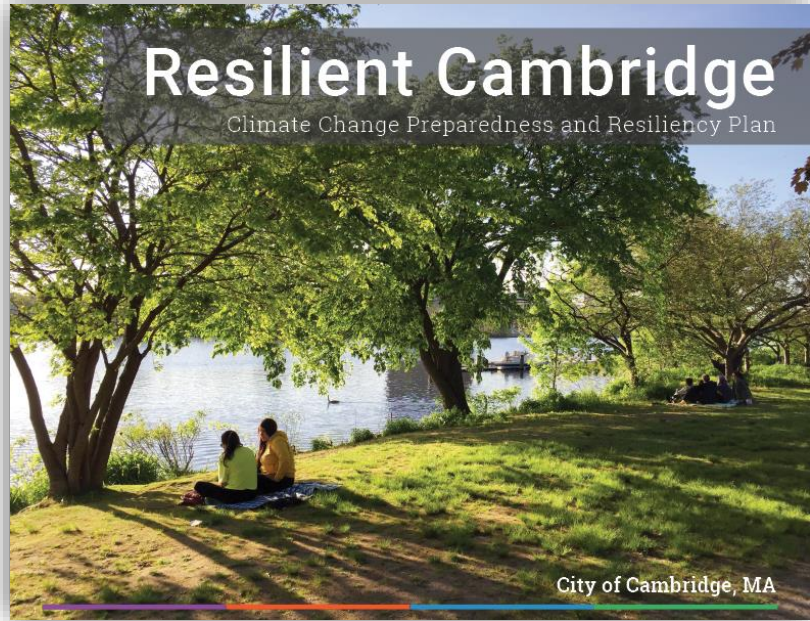
34 strategies organized around four categories

- Closer Neighborhoods
- Better Buildings
- Stronger Infrastructure
- Greener City

Discusses regional considerations



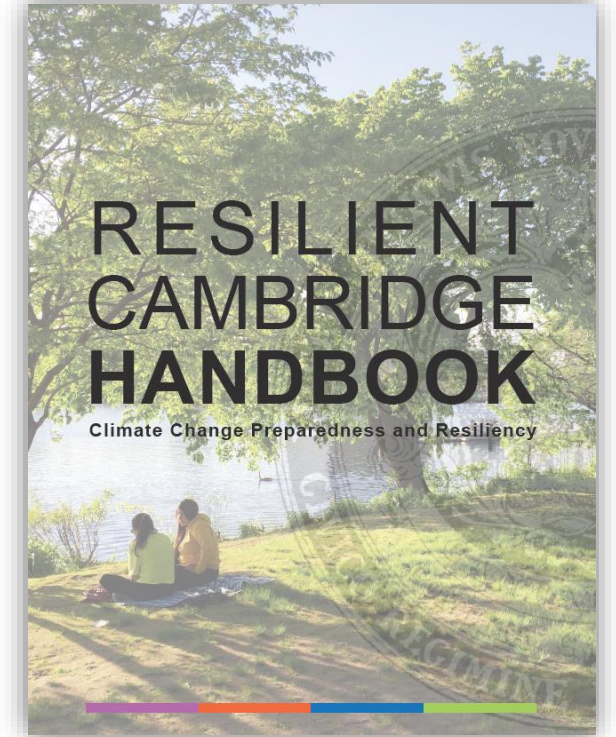
What we produced: Resilient Cambridge



Plan



Technical reports



Handbook



What we produced: Additional materials



Public summary report

Story Maps



Flood Risk



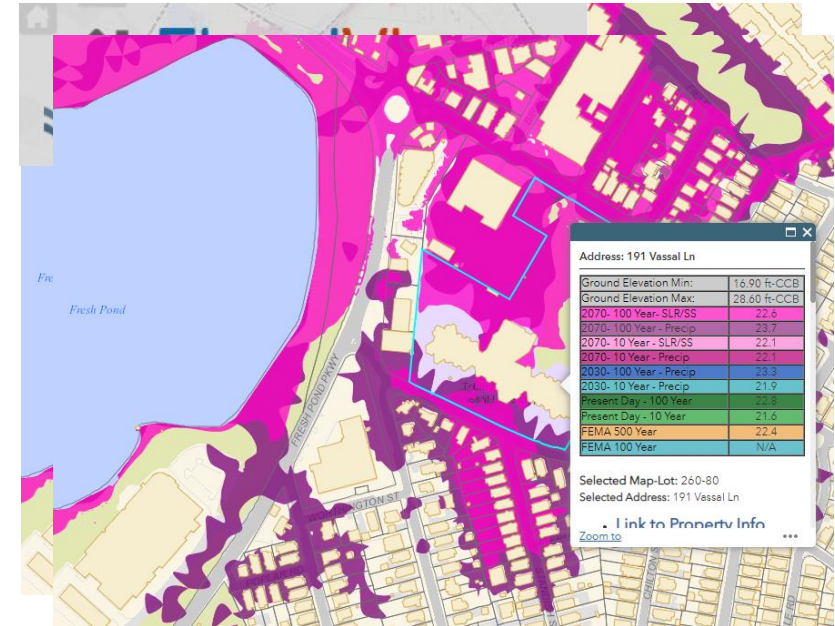
Heat Risk



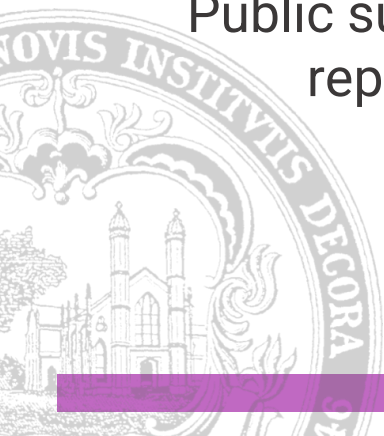
Flood Strategies



Heat Strategies



FloodViewer:
potential flooding
by parcel



Related Processes

Envision Cambridge – Community Development Department

- Climate Resilience Zoning Task Force
 - Proposing codification of 2070 flood risk standards and Cool Factor
- Cambridge Street Planning Study

Urban Forest Master Plan – Public Works Department

- Expanded urban forest staff and budget
- Update to Tree Protection Ordinance
- Increased tree plantings
- Witness Tree project with Harvard Forest
- Miyawaki micro-forests
- Ongoing urban forest assessments

Community Health Improvement Plan – Public Health Department

- Community social resilience priority
- Community Resilience Manager



Social Resilience

Social infrastructure

- the assets that shape our social interactions
- Sociologist Eric Klinenberg loosely defines *social infrastructure* “as the physical elements of community that act as a conduit to bring people together and build social capital.”

- Parks
- Plazas
- Libraries
- Streetscapes
- Retail
- Community centers



Social Capital/Connectedness



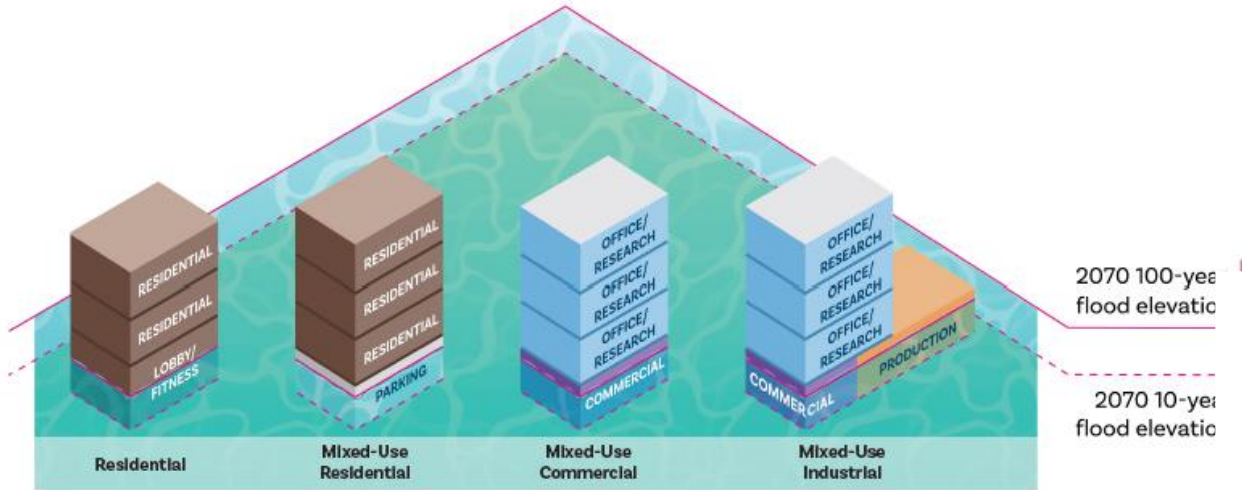
Cambridge Community Corps



Cambridge Community Center

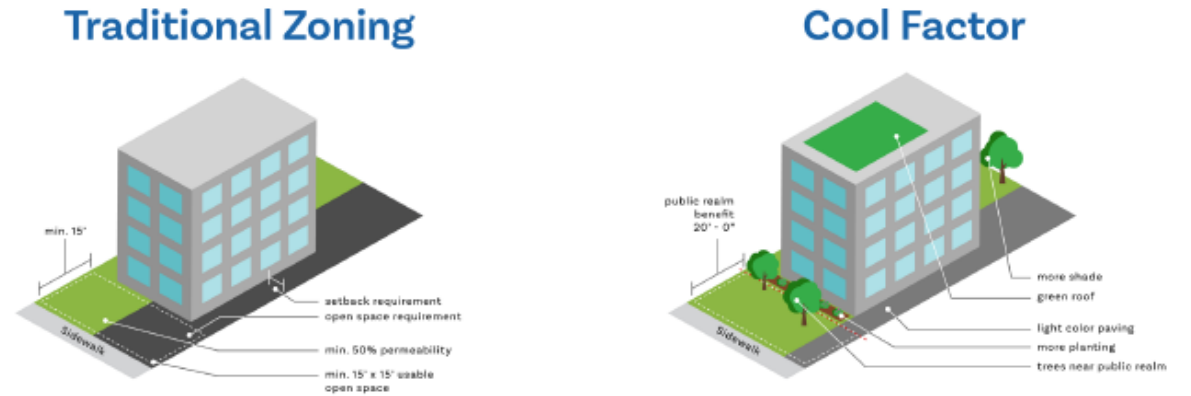
Climate Resilience Zoning

Residential		Non-Residential		Envision Prototypes
Residential	Mixed-Use Residential	Mixed-Use Commercial	Mixed-Use Industrial	
<ul style="list-style-type: none"> Housing must be elevated or floodproofed Garage levels can be floodproofed or floodable Elevate or protect utilities and major equipment 	<ul style="list-style-type: none"> Housing must be elevated Commercial or retail uses can be floodproofed Elevate or protect utilities and major equipment 	<ul style="list-style-type: none"> Office uses can be floodproofed Commercial or retail uses can be floodproofed Elevate or protect utilities and major equipment 	<ul style="list-style-type: none"> Office uses can be floodproofed Commercial, industrial, or retail uses can be floodproofed Elevate or protect utilities, major equipment, and chemical storage 	



Codify Future Flood Elevations

Cool Factor Site Rating System



✓ Open Space
 ✓ Permeability
 +
 ✓ Shade
 ✓ Cool Surfaces
 ✓ Planting



New Construction



- Designed to 2070 flood elevations
- All residential units second floor and higher
- Community room on top floor
- Passive House standards for energy efficiency and passive thermal resilience

HRI/Finch Cambridge Affordable Housing Project, Concord Avenue

Stronger Infrastructure/Gray Infrastructure



The Port Infrastructure Project



Springfield Street High Solar Reflectance Coating

Greener City/Green Infrastructure



Urban Forest Master Plan



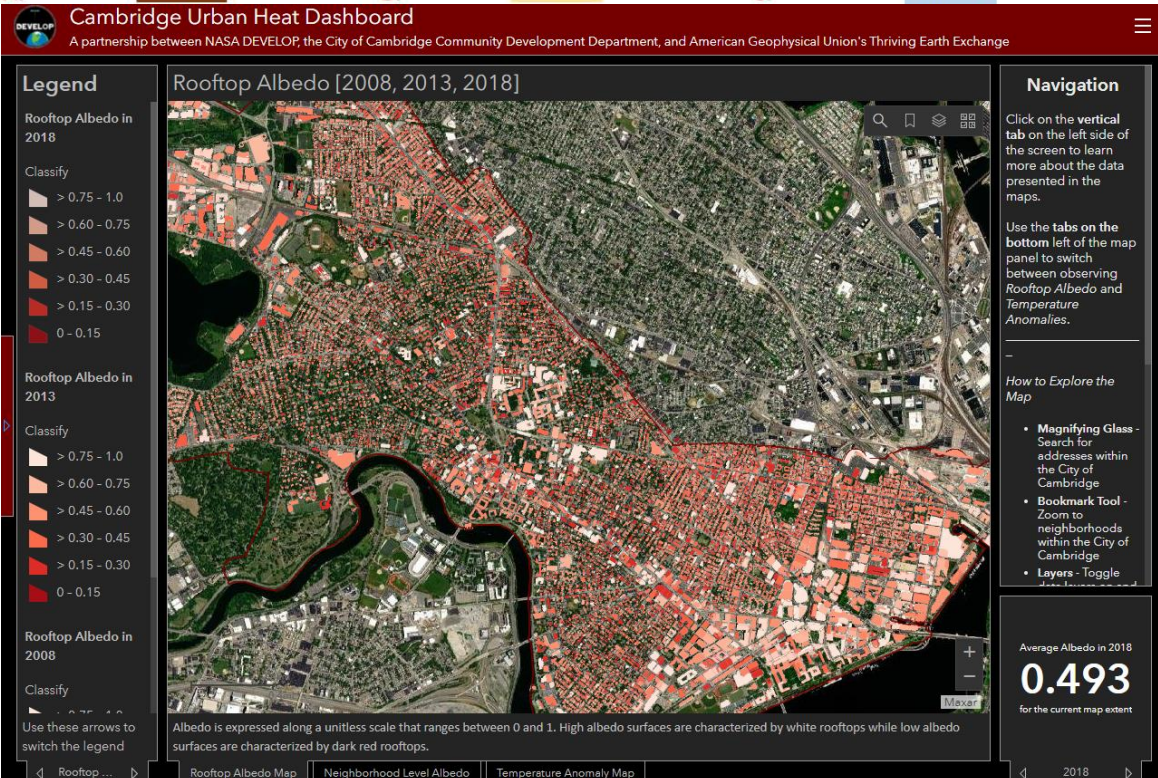
Triangle Park

- Binney Street, First Boulevard, Land Boulevard
- 1 acre
- Naturalized forest habitat
- 400 new trees, 15 species
- In construction

Shade & Solar Reflectance



- On a 90 degree day, tree canopy cools streets up to 10 degrees F or more
- Based on urban heat island mapping



- Rooftop albedo mapped for 2008, 2013, 2018
- 30% increase in albedo, 2008-2018
- LEED green building requirement & availability of high SRI roofing products
- Dr. Mehdi Heris, American Geophysical Union/Thriving Earth Exchange, & NASA Develop

A vision for a healthy forest

Shaded Storefronts

People chat on the streets and shop longer at their local businesses.

Cool Corridors

People walk, bike and run to work because the streets are shaded and comfortable.

Energy Efficiency

Trees help reduce energy costs related to heating and cooling throughout the year.

Collective Action

Private property owners plant and care for trees, collectively contribute to a resilient urban forest.

Engaged Homeowners

Homeowners take advantage of the Back-of-Sidewalk program, planting front-yard trees that provide shade on sidewalks too narrow for street trees.

Habitat Connectivity

Birds, insects and small mammals find homes and food in the robust urban forest.

Reduced Heat

38% of the city is significantly cooled from additional tree planting.

CAMBRIDGE COMMON

PORTER SQUARE

CHARLES RIVER

Coastal flooding – regional is key

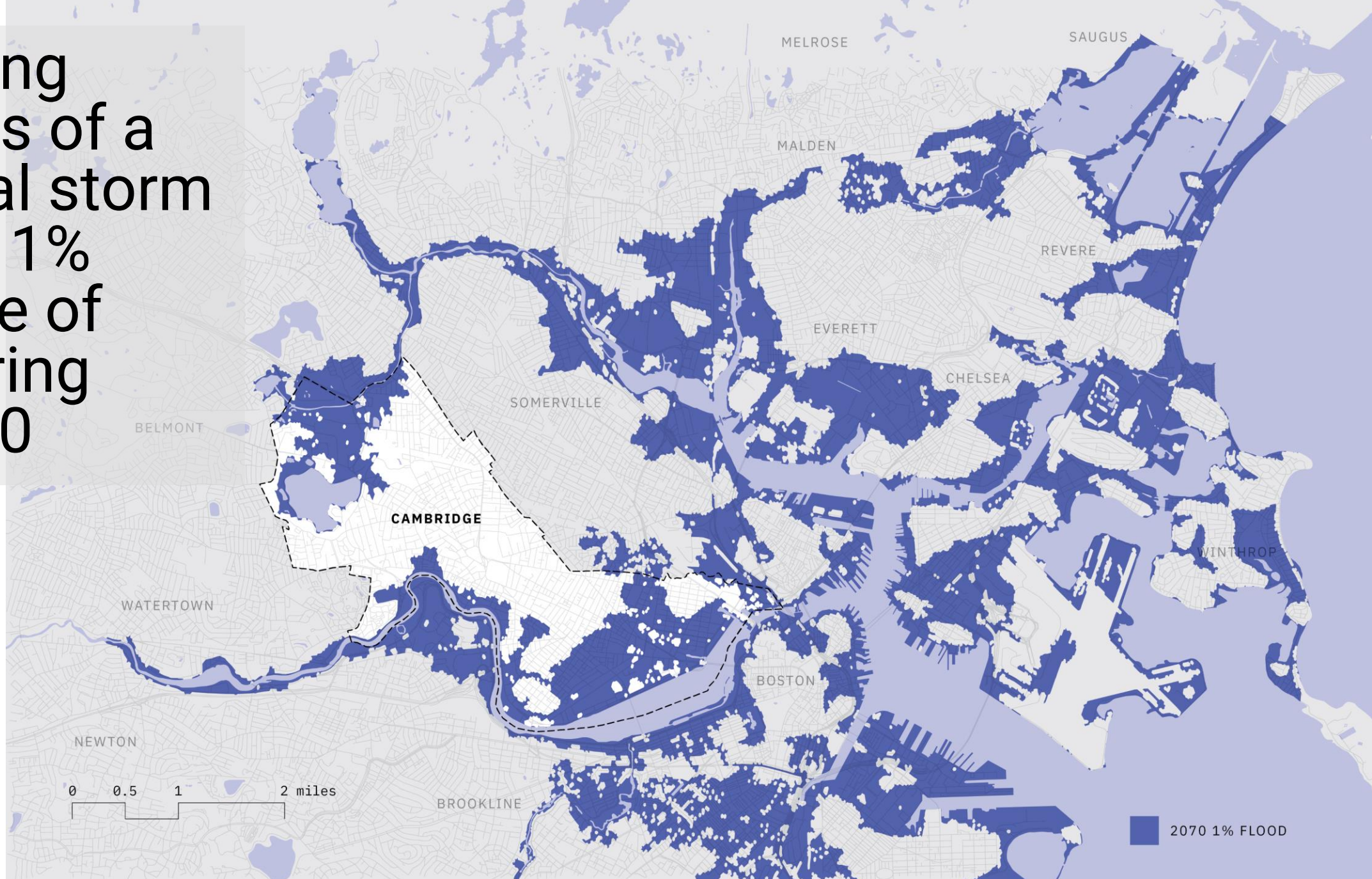
Larger than any individual community



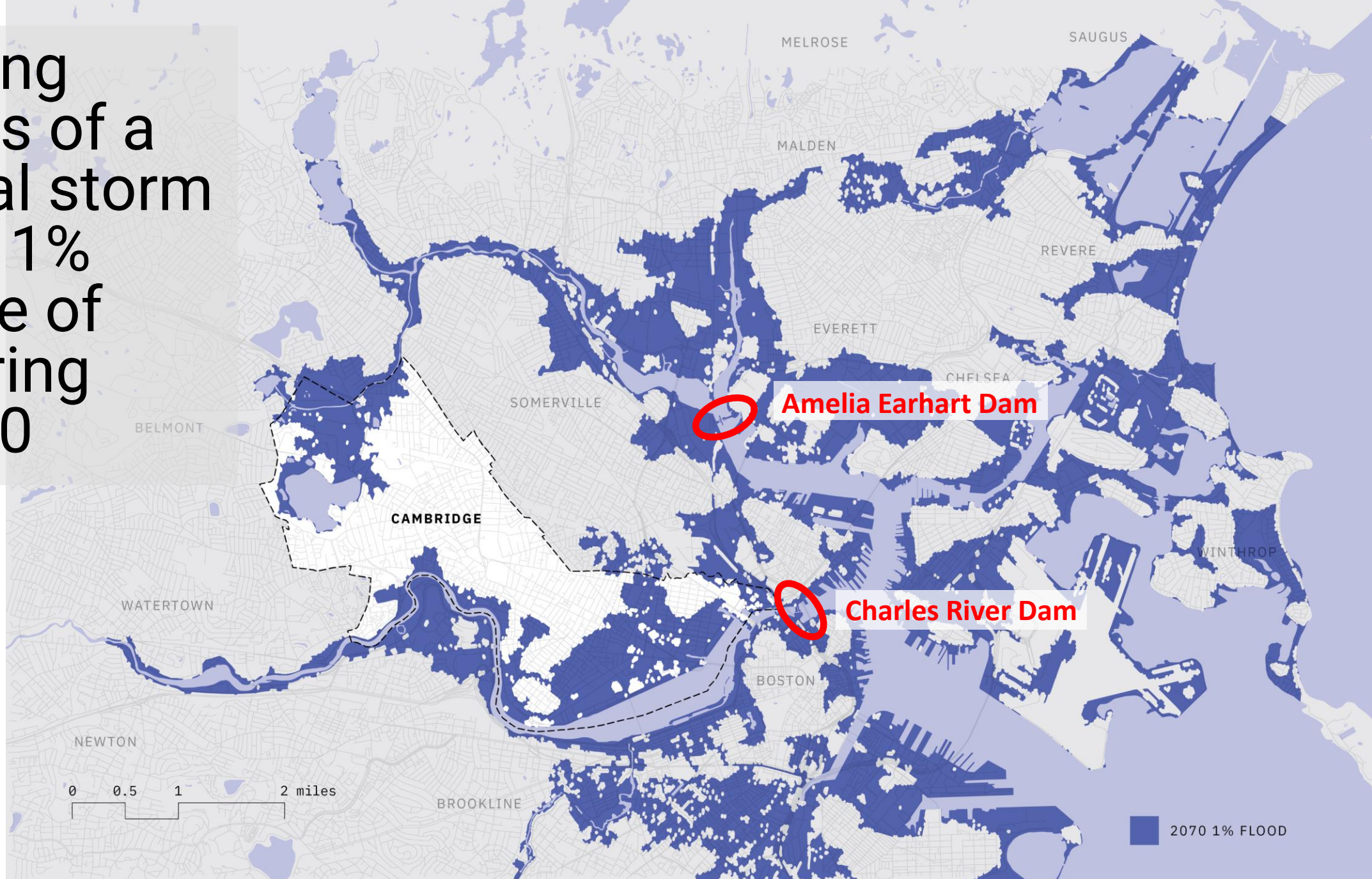
Photo credit: Bryan Gammond



Flooding extents of a coastal storm with a 1% chance of occurring in 2070



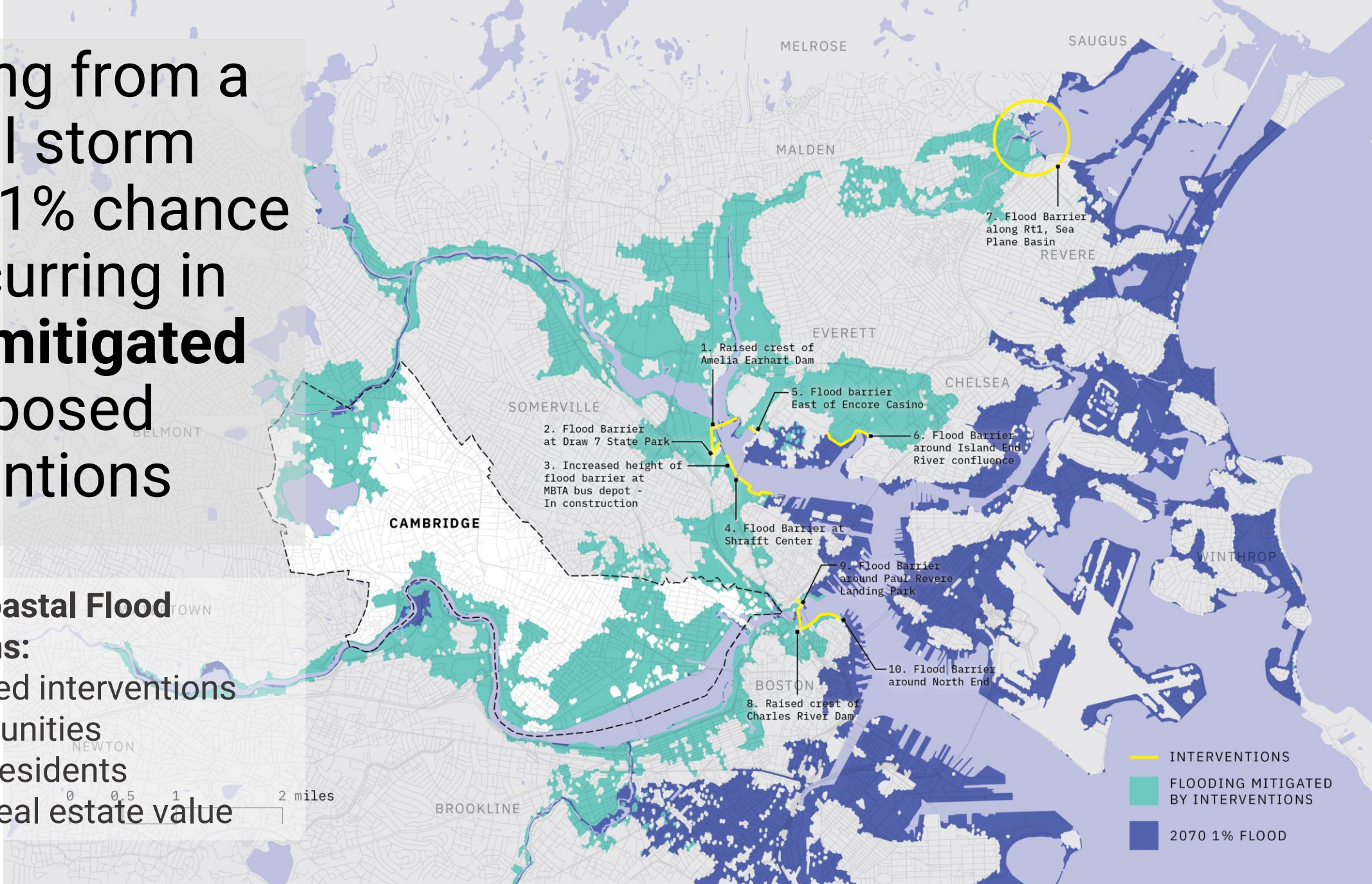
Flooding extents of a coastal storm with a 1% chance of occurring in 2070



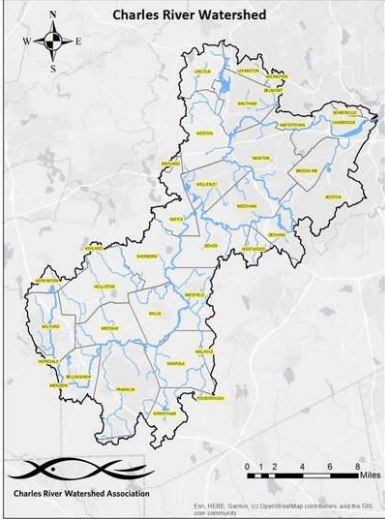
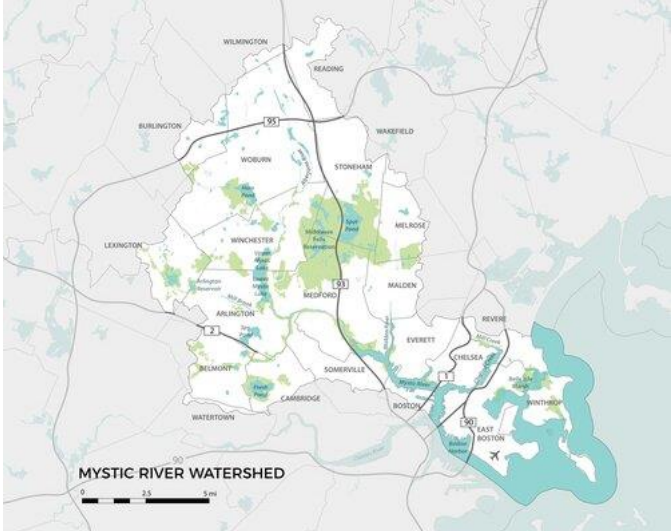
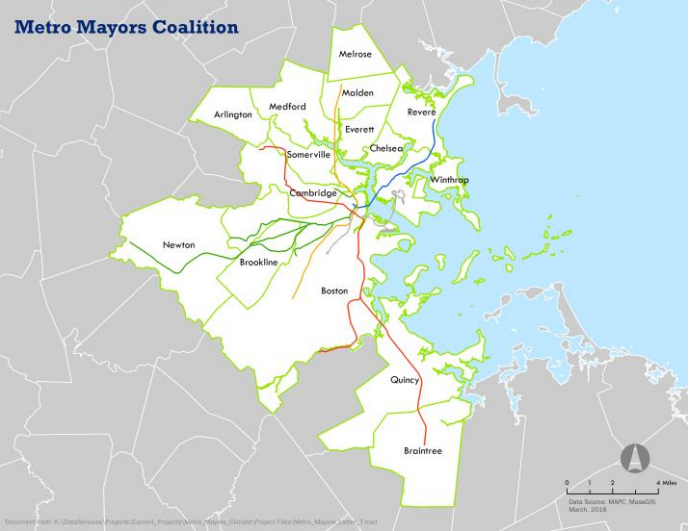
Flooding from a coastal storm with a 1% chance of occurring in 2070, mitigated by proposed interventions

Regional Coastal Flood Interventions:

- 10 targeted interventions
- 12 communities
- 108,000 residents
- \$60B of real estate value



Regional Climate Collaborations



Metro Mayors Climate Task Force

- 15 inner core communities
- Coordinated by MAPC
- Building Resilience to Climate-driven Heat in Metro Boston

Resilient Mystic Collaborative

- 21 watershed communities
- Coordinated by MyRWA
- Upper Mystic Stormwater Project
- Social resilience work group
- Lower Mystic Storm proofing critical infrastructure
- Regional storm surge protection

Charles River Climate Compact

- 23 communities
- Coordinated by CRWA
- Current focus is on upper watershed stormwater management

Before

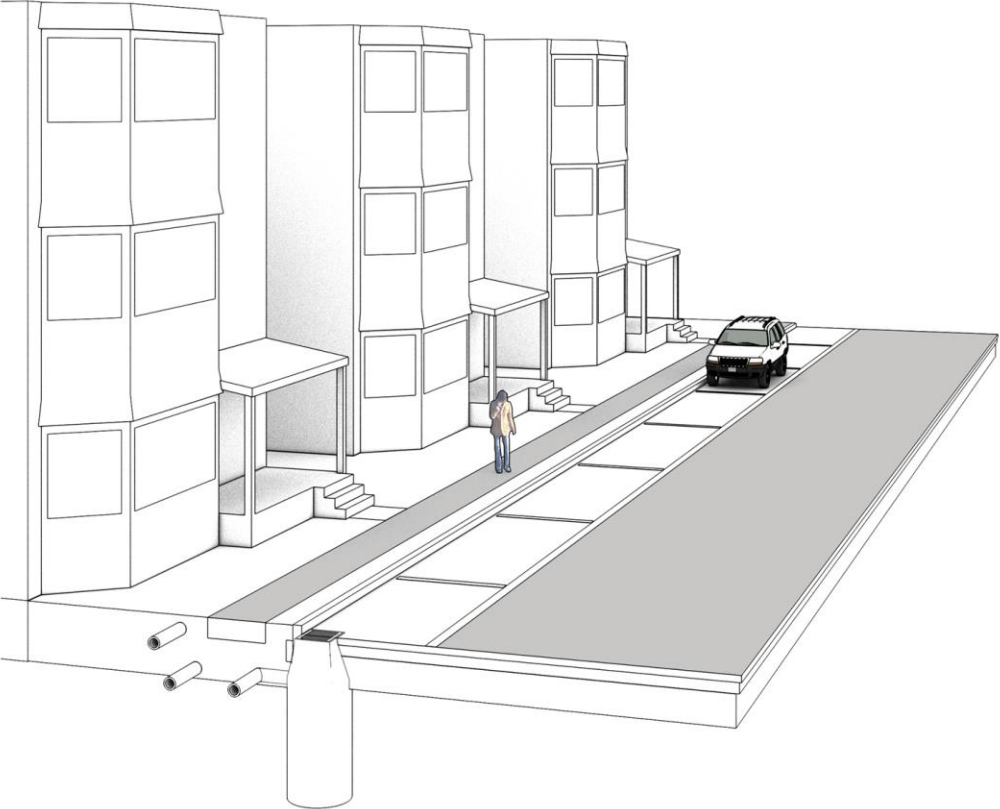
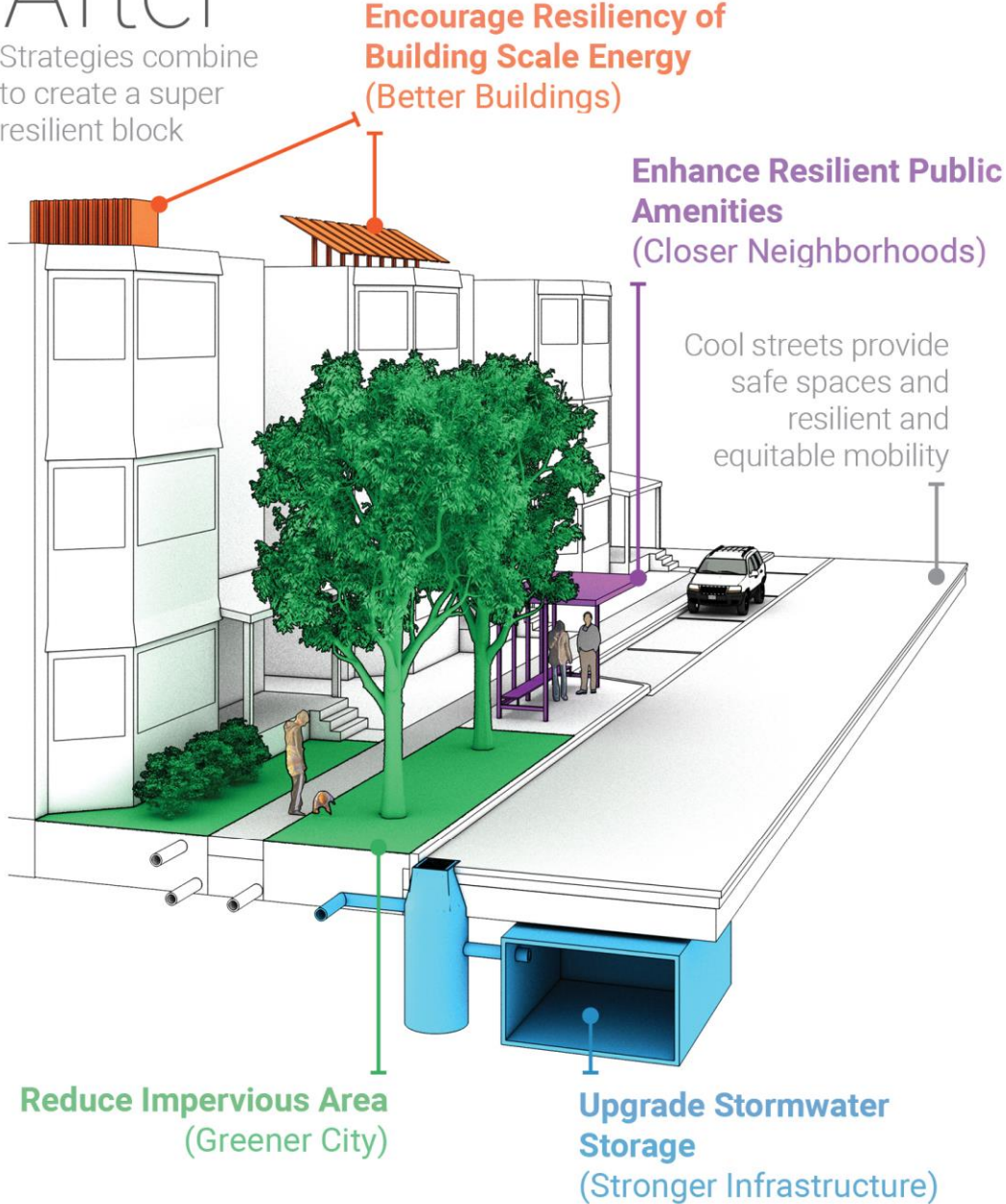


Illustration not to scale

After

Strategies combine to create a super resilient block



Encourage Resiliency of Building Scale Energy (Better Buildings)

Enhance Resilient Public Amenities (Closer Neighborhoods)

Cool streets provide safe spaces and resilient and equitable mobility

Reduce Impervious Area (Greener City)

Upgrade Stormwater Storage (Stronger Infrastructure)



Additional Thoughts: Fresh Pond and Water Supply

- Some potential impacts of climate change not considered in Resilient Cambridge
 - Drought
 - Groundwater levels
- Effects on watershed outside Cambridge not considered
- Regulations are evolving to account for climate change
- Regional storm surge barrier concept proceeding faster than anticipated; berm at Fresh Pond less urgent
- Fresh Pond Reservation plays a role in urban heat island reduction and increasing social resilience
- Climate science continues to evolve, so monitoring new information and reassessing risks is a continuous task

Thank you!

To learn more, visit:

www.cambridgema.gov/ResilientCambridge

or contact John Bolduc, jbolduc@cambridgema.gov

