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
- 10th 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)
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

Source: Kleinfelder & Woods Hole Group for the City of Cambridge, February 2017 based on Boston Harbor Flood Risk Model, MassDOT
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
Emerging Risk: Storm Surge Flooding From Boston Harbor + Precipitation
Current City Flood Protection Guidance

Cambridge FloodViewer – Accessible Flood Extent & Elevation Data

Cambridge Design Flood Elevation Guidance

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

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

City of Cambridge - Community Development Department
Event Comparison: 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

Also...
• Cambridge Net Zero
• Urban Forest Master Plan
• Envision
• Regional Collaboration

MVP Toolkits
FloodViewer
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
Better Buildings

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

Source: City of Cambridge
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)
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