

Charlestown

Charlestown, located on a peninsula just northwest of Downtown Boston, is surrounded by water on three sides. It is bounded to the south by the Charles River, to the north by the Mystic River, and to the east by Boston Harbor. It is connected to Downtown Boston by the Charlestown Bridge and the Leonard P. Zakim Bridge, to Chelsea by Maurice J. Tobin Bridge, and to Everett by the Malden Bridge.

Founded in 1629, Charlestown is the oldest neighborhood in Boston. It was originally a separate town before being annexed by Boston in 1874. Charlestown was originally surrounded almost completely by water, with an inlet of the Charles River (Miller's River) running along its southwest edge before intersecting with the Charlestown Neck, a thin strip of land connecting Charlestown Peninsula to East Somerville near Sullivan Square. This inlet has since been largely filled.

In 1800, the U.S. Navy established a shipyard along the eastern waterfront, promoting the growth of marine industrial uses in Charlestown, along with worker housing. The Charlestown Navy Yard was extensively used during World War II. The neighborhood then experienced some decline before becoming subject to urban renewal efforts in the 1960s and 1970s, which led to the Navy Yard's

redevelopment for office, research, and residential uses and removal of the Charlestown Elevated rail line (running along Main Street from City Square to Sullivan Square).

Today, Charlestown is a thriving residential community, with a mixed housing stock consisting of brick and wood-framed row houses and waterfront condominiums and apartments. Charlestown also hosts the largest public housing development in Boston, the Bunker Hill Apartments, with 1,100 units for low- to moderate-income households. Due to its proximity to Downtown and historic housing stock, Charlestown has become attractive to young professionals.

Charlestown's main commercial corridors lie along Bunker Hill Street and Main Street. It also has major employment hubs at Bunker Hill Community College, the Navy Yard, Spaulding

Rehabilitation Hospital, and the Boston Autoport. The Boston Autoport is located on an 80-acre site at the northeast corner of Charlestown, between the Mystic River and the Little Mystic Channel. To promote and protect water-dependent industrial uses along the Mystic River, the Commonwealth has established a Designated Port Area there. Charlestown also has industrial and commercial uses concentrated south of Rutherford Avenue. It also includes a number of historic landmarks, such as the Bunker Hill Monument/Monument Square National Register District and the *U.S.S. Constitution* and *U.S.S. Cassin Young* on the waterfront.

The City is currently planning roadway design improvements to Rutherford Avenue and Sullivan Square to create a more pedestrian-friendly environment and create opportunities for transit-oriented development adjacent to Sullivan Square.



Image courtesy of Sasaki

FLOOD PROGRESSION

DEFINITIONS

Near term: Beginning 2030s, assumes 9 inches of sea level rise

Midterm: Beginning 2050s, assumes 21 inches of sea level rise

Long term: Beginning 2070s or later, assumes 36 inches of sea level rise

Exposure: Can refer to people, buildings, infrastructure, and other resources within areas likely to experience hazard impacts. Does not consider conditions that may prevent or limit impacts.

Vulnerability: Refers to how and why people or assets can be affected by a hazard. Requires site-specific information.

Consequence: Illustrates to what extent people or assets can be expected to be affected by a hazard, as a result of vulnerability and exposure. Consequences can often be communicated in terms of economic losses.

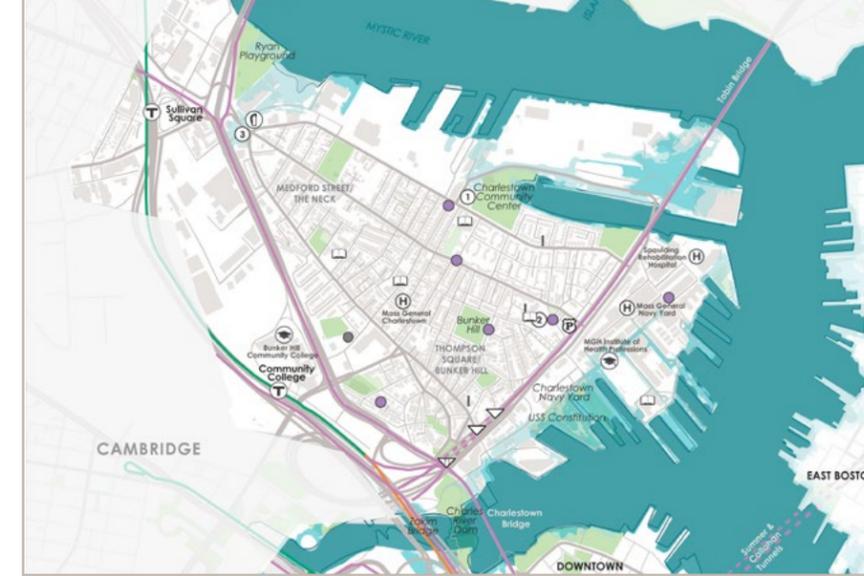
Annualized losses: The sum of the probability-weighted losses for all four flood frequencies analyzed for each sea level rise scenario. Probability-weighted losses are the losses for a single event times the probability of that event occurring in a given year.

*For a full list of definitions, refer to the Glossary in the Appendix.

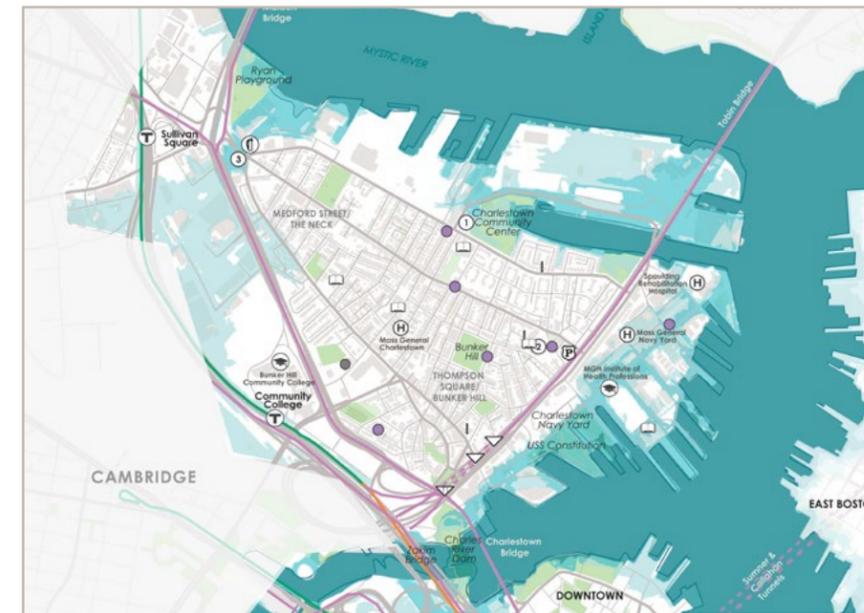
Charlestown is exposed to climate change impacts including heat, increased precipitation and stormwater flooding, and sea level rise and coastal and riverine flooding. Exposure to heat and stormwater flooding are addressed in the Citywide Vulnerability Assessment (see p.12), while exposure and consequences to coastal and riverine flood risk are further discussed in this section.

Charlestown's exposure to near-term impacts is limited to pockets of flooding near the Charlestown Navy Yard, the Boston Autoport near the Tobin Bridge, and low-lying land east of Sullivan Square.

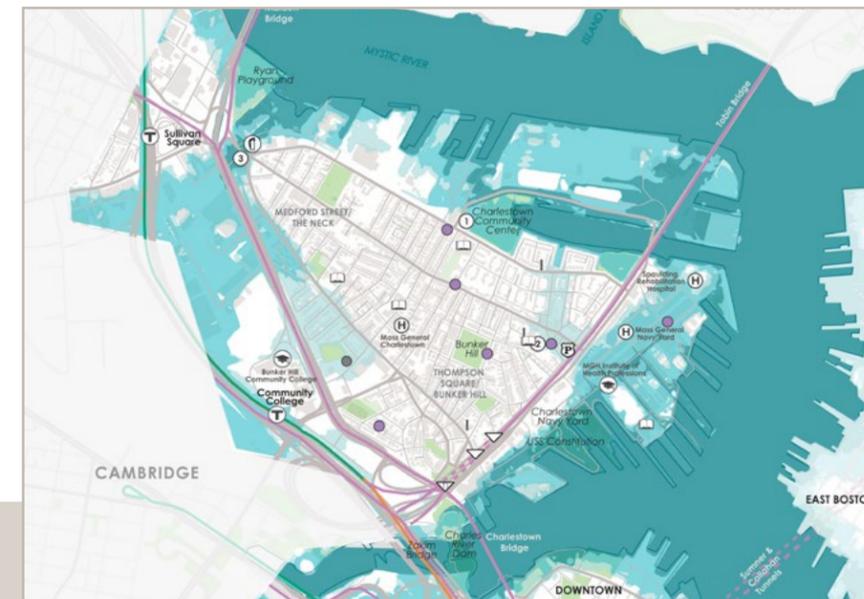
Significant coastal flooding is likely by later in the century, with most of Charlestown's waterfront area extending from Cambridge to Somerville projected to be inundated during major coastal storms. Inland flooding would be greatest through low-lying land immediately east of Sullivan Square, and flooding would also extend through the Charles River Basin if the Charles River Dam were flanked.



9 INCHES SEA LEVEL RISE



21 INCHES SEA LEVEL RISE



36 INCHES SEA LEVEL RISE

LEGEND

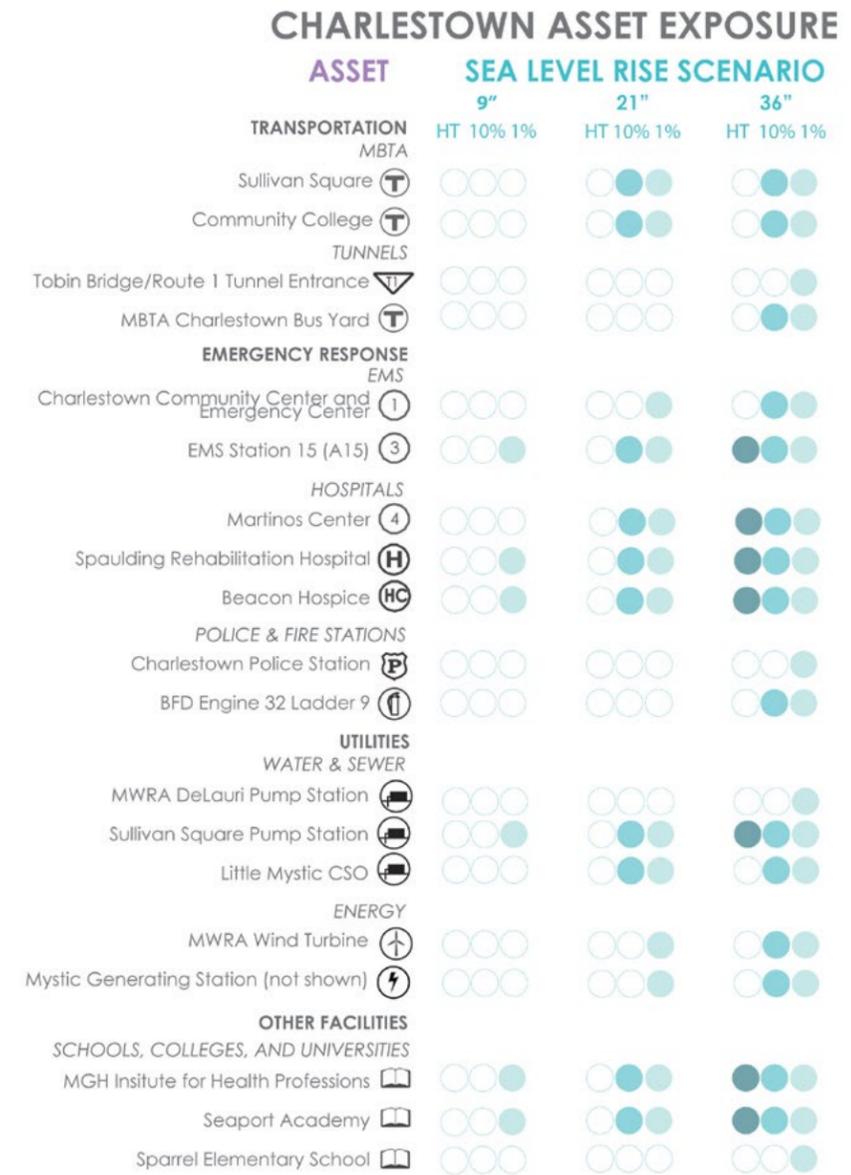
- Average Monthly High Tide
 - 10% Annual Chance Storm
 - 1% Annual Chance Storm
 - Parks
 - Roads
 - Major Roads
 - - - - Major Tunnels
 - Evacuation Route
 - - - - Evacuation Route Tunnels
 - MBTA Blue Line
 - T MBTA Station
 - ▽ Tobin Bridge Tunnel Entrance
 - Ⓢ College or University
 - Ⓜ School
 - Ⓟ Police Station
 - Ⓡ Fire Station
 - Ⓜ Hospital
 - Ⓜ Health Care Facility
 - Ⓜ MWRA DeLauri Pump Station
 - Ⓜ Wind Turbine
- Other Essential Facilities and Shelters
- ① Charlestown Community Center
 - ② Kent Community Center
 - ③ EMS Station 15 Ambulance 15
 - BHA Public Housing
 - Senior Housing
 - Longterm Care Facility
 - DCR Spray Deck or Pool

Land area in Charlestown exposed to flooding is in the top three for all coastal neighborhoods throughout the century. Over 50 percent of Charlestown will be exposed to coastal flooding during low-probability storms expected as soon as the 2070s (1 percent annual chance event).

Climate resilience planning must consider the broad flood extents near the waterfront that may affect the diverse mixture of buildings and industries, as well as the entry points for inland flooding near Sullivan Square and the Charles River Dam.

Prior to fill placement, Charlestown was a peninsula of relatively high ground, including the Bunker Hill neighborhood. In the late 1800s, Charlestown was built outward in all directions, including along the Mystic and Charles Rivers. **The majority of Charlestown's waterfront, composed largely of fill, will be exposed to coastal flooding, especially late in the century.**

In the near term, coastal flood extents remain largely along the waterfront edge, with the broadest flood extents near the Charlestown Navy Yard, the Boston Autoport near the Tobin Bridge, and low-lying land east of Sullivan Square. **As soon as the 2050s, the areas flooded in low-probability storms will increase by over 150 percent, mostly due to a large expansion of the floodplain inland via low-lying land near Sullivan Square.** Once coastal floods coming from the Mystic River cross Rutherford Avenue, a large expansion of the floodplain is expected to the south, along low-lying area that was filled. More frequent and expansive coastal flooding in inland areas of Charlestown is expected in the late century, with a higher probability of both flooding inland east of Sullivan Square and flooding associated with flanking or overtopping of the Charles River Dam. Areas exposed to low-probability events in the near term will be exposed to high tides later in the century, limiting access to or causing damage in areas like the Charlestown Navy Yard and Boston Harborwalk near Ryan Playground and the Malden Bridge.



EXPOSURE

POPULATION & INFRASTRUCTURE

POPULATION AND SOCIAL VULNERABILITY

Charlestown is currently home to more than 16,000 people. Charlestown has relatively lower concentrations of socially vulnerable populations than Boston at large. The exception is households with children, which make up 20 percent of households in the neighborhood compared to 17 percent citywide. The Seaport Academy and Sparrel Elementary School are exposed to low-probability events in the near term and low-probability late-century events, respectively. Impacts to schools may result in lost school days for children, and parents of small children may opt to miss work and stay home on these

days. Charlestown has three senior housing developments, one long-term care facility, and six public housing developments where concentrations of elderly, medically ill, and low- to no-income residents live. Portions of two Boston Housing Authority developments, the Charlestown Apartments and Basilica Condos, are expected to be at risk for low-probability flood events later in the century.

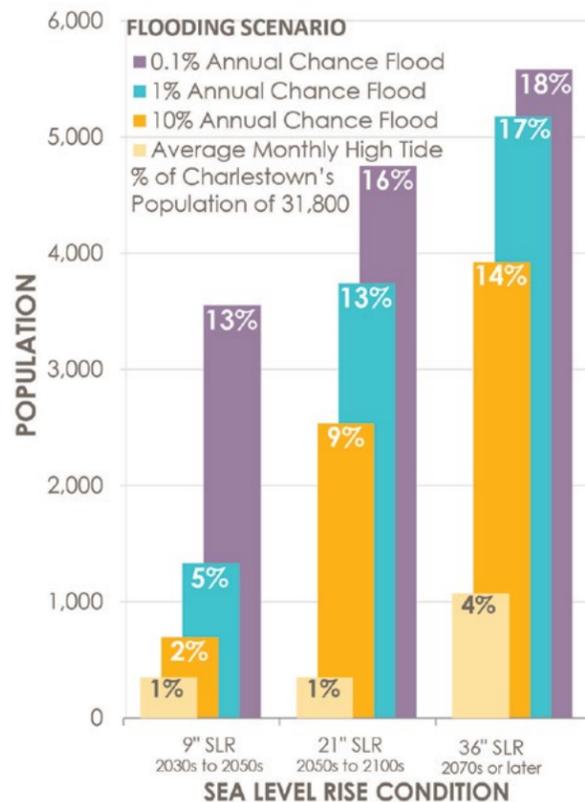
In the near term, roughly 350 people currently live in areas expected to be flooded by monthly high tides, the second largest of all neighborhoods. In addition, over 420 people live in areas expected to be flooded by a high-probability flood event (10

percent annual chance), and 1,330 people live in areas expected to be flooded by a low-probability flood event (1 percent annual chance), making Charlestown the fourth most-exposed focus area, behind East Boston, Downtown, and South Boston.

In a significant expansion of risk, over 1,070 people currently live in areas expected to be flooded by monthly high tides as soon as the 2070s, an increase of roughly three times over the near term. Over 3,920 individuals live in areas expected to be flooded by high-probability events (10 percent annual chance), and 5,180 people live in areas expected to be flooded by low-probability events (1 percent annual chance). As soon as the 2070s,

close to 500 people may require emergency shelter under low-probability events (1 percent annual chance), a number that outstrips Charlestown's current 300-person shelter capacity. Furthermore, Charlestown's existing shelter capacity will be exposed to lower probability events later in the century. The Charlestown Community Center and emergency shelter will be exposed to low-probability (1 percent chance) mid-century storms, potentially reducing the neighborhood's current shelter capacity by about 175 people. Available and accessible public shelters and effective communication regarding shelter alternatives will thus be critical to Charlestown residents.

CHARLESTOWN POPULATION EXPOSURE



INFRASTRUCTURE

Exposure of Orange Line MBTA stations and I-93 to low-probability mid-century storms and sea level rise may compromise connectivity between Charlestown and Downtown Boston.

Charlestown is separated from the rest of Boston by the Charles River and the Boston Harbor. The neighborhood is connected to Downtown Boston by the MBTA Orange Line, I-93, and Rutherford Avenue. Flooding at both Orange Line stations in Charlestown would not only restrict Downtown access but also access to Bunker Hill Community College, especially for students who rely on the light rail to attend class. If both the Community College and Sullivan Square Stations are rendered inoperable, over 15,000 individuals¹ that enter at those stations would be in need of alternative transportation options. This does not include potential impacts and service disruption if flooding penetrates into the transportation corridor.

I-93 and Rutherford Avenue are also two of Charlestown's three major evacuation routes. Flooding of these areas presents complications to safe evacuation, and avoidance of flooded areas can lead to overstressed and crowded side streets when drivers seek alternative routes. Rutherford

Avenue near Sullivan Square, and the BWSC Sullivan Square stormwater pump station that protects it, are also expected to be exposed to floodwaters in the near future.

The Mystic Generating Station and Charlestown Wind Turbine, which contribute to Greater Boston's power supply and wastewater operations, will be exposed to low-probability storms in the second half of the century, and frequent storms in the late century.

The Mystic Generating Station is one of Massachusetts's major non-nuclear electricity generating plants. The facility is expected to be exposed to low-probability events by the second half of the century and more frequent (high-probability) storms later in the century. The station has a sophisticated emergency response plan in place to protect public health and safety in case of a disaster. Nevertheless, liquid natural gas currently from the Everett marine terminal, located across the Mystic River, is critical for operation.²

The Charlestown Wind Turbine generates three million kilowatt hours of electricity per year, and the power generated is net-metered to offset MWRA electricity costs, savings ratepayers approximately \$350,000 a year. Though the turbine

¹Based on 2014 MBTA ridership and service statistics. Number only captures station entries and does not include all passengers traveling on the line as it passes through the station.

²Everett's exposure to coastal storms and sea level rise are not considered within the scope of this project.

itself is not directly exposed to damage from coastal storms and sea level rise, it is expected to be surrounded by water during frequent storm events late century, potentially causing damage to underground infrastructure that transmits energy generated, as well as affecting safe access. Direct flood exposure is not expected at the DeLauri sewer pump station (where the wind turbine is located) during this century. The Little Mystic Combined Sewer Overflow facility may be exposed to frequent mid-century flooding but is expected to be able to continue operations throughout the century, based on MWRA's assessment.³

Charlestown may experience reduced emergency response capacity as a result of sea level rise.

Charlestown's only EMS station, the Charlestown Police Station, and one of two fire stations are expected to be exposed to flood impacts at various points throughout the century. Maintaining operations at these essential facilities is critical in Charlestown to ensure that public health and safety needs are met during and after a flood event, especially considering that the neighborhood's physical connections to the Boston mainland may also be compromised.

All of Charlestown's hospital and medical research facilities will be exposed to high-probability flood impacts as soon as the 2050s, as well as late-century tides, impacting access to healthcare as well as some of the neighborhood's top economic drivers.

Four hospitals and medical research facilities are located on Charlestown's waterfront: Beacon Hospice, Spaulding Rehabilitation Hospital, MGH Institute of Health Professionals, and the Martinos Center for Biomedical Imaging. Spaulding Rehabilitation Hospital is a 132-bed rehabilitation teaching hospital owned by Partners HealthCare that opened in 2013. It was designed to be resilient and is expected to be protected in a low-probability event in the near future. Existing flood mitigation measures at the site are expected to cut late-century annualized storm impacts in half.⁴

³Inferred from critical flood elevation data provided by MWRA.

⁴Based on Climate Ready Boston analysis.

EXPOSURE AND CONSEQUENCES

BUILDINGS AND ECONOMY

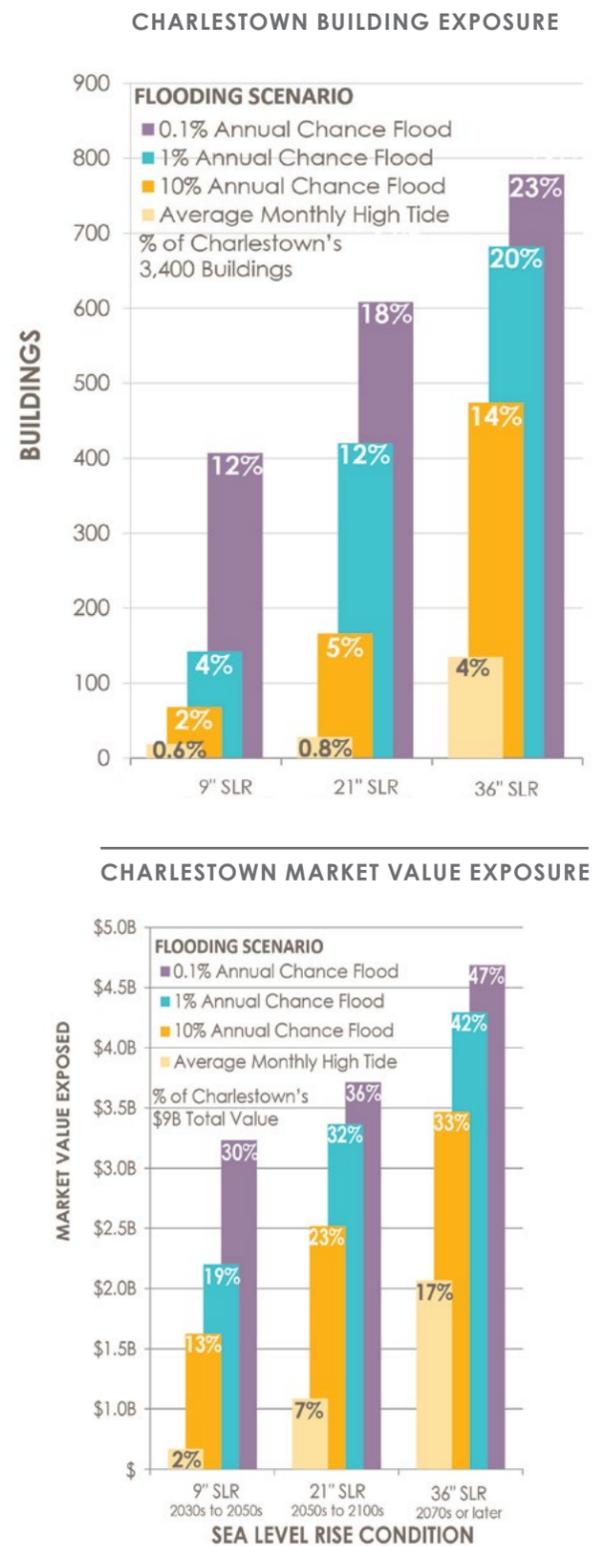
RISK TO BUILDINGS

The majority of exposed buildings in Charlestown are residential and mixed-use structures.

Charlestown is mostly residential in character; residential-only properties make up nearly 60 percent of the neighborhood's total number of structures and 60 percent of the current real estate market value.⁵ Charlestown's housing stock is made up of primarily low-rise row houses and wood-framed two- or three-family buildings. Though much of Charlestown's housing is elevated, structures typically have basements or below-grade finished space and are often vulnerable through windows at grade.

Charlestown faces risk from both coastal storms and rising sea levels. In the near term, the community can expect 20 structures exposed during monthly high tides and 140 structures exposed to flooding during a low-probability flood event (1 percent annual chance). As soon as the 2070s, over 50 percent of the land area is expected to be exposed to flooding from a low-probability flood event (1 percent annual chance event), with close to 700 structures potentially exposed. More than half of the exposed structures are residential or mixed-use in nature. In addition, as soon as the 2070s, over 130 existing structures are expected to be exposed to monthly high tides.

⁵These statistics do not include residential space in mixed-use buildings.



While Charlestown is a smaller-scale neighborhood than some of the other focus areas considered, it is still in the top four focus areas for expected annualized structure and content losses in the near term, with \$8.5M, compared to \$62.6M in South Boston, \$42.7M in Downtown, and \$11.8M in East Boston.



RISK TO THE ECONOMY

As of 2014, there are over 12,200 jobs in Charlestown, and associated industries contribute over \$2.5 billion of output (sales and revenues) into the city’s economy annually. The Charlestown economy is well balanced, as no single industry comprises more than an 8 percent share of employment or output within the neighborhood.

Charlestown’s economy is most vulnerable in medium- and long-term climate scenarios. Based on the neighborhood’s current economy and building stock conditions, \$8 million in annualized output loss and approximately 50 positions in annualized employment loss are expected toward the end of the century. Scientific research and development, accounting, and insurance-related services rank among top industries expected to be impacted. Losses have been calculated strictly based on expected flooding to structures, as opposed to egress and utility lines, and cascading loss of function impacts are not considered in the analysis.⁶ In the second half of the century, the site of a current martial arts training center is expected to be heavily impacted by floodwaters and joins top industries expected to be affected by coastal storm events.

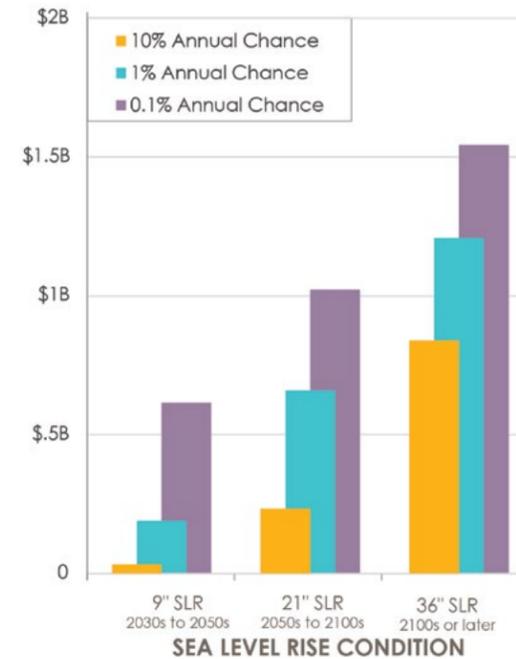
⁶More-detailed analysis would be required to quantify expected loss of function impacts to utilities and transportation outside of economic loss derived from direct physical damage to structures.

ECONOMIC RISK ASSUMPTIONS

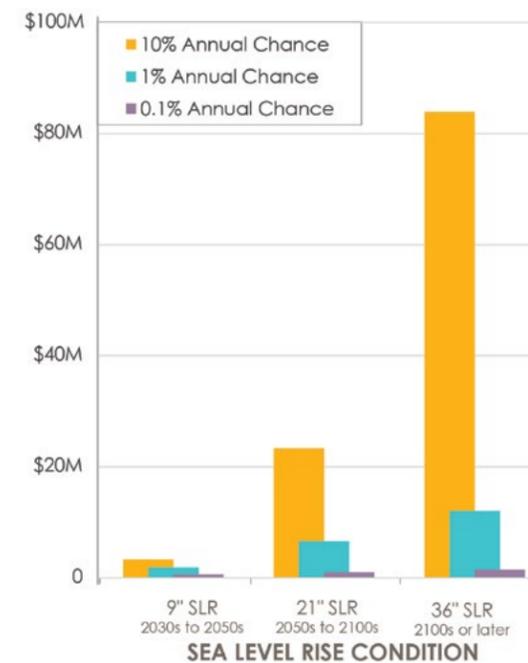
Job and output loss includes direct, indirect, and induced consequences of flood impacts. Direct results are impacts felt within a neighborhood, while indirect and induced results are those expected to be felt throughout Suffolk County as a result of changes in spending patterns. Results for both job and output losses are the sum of annualized values for the four flood frequencies analyzed for each sea level rise scenario. This represents a lower-bound estimate for several reasons. First, not all probabilistic events are considered. Second, the analysis assumes that all impacted businesses eventually reopen, though FEMA estimates that almost 40 percent of small businesses—and up to 25 percent of all businesses—never reopen after experiencing flood impacts. Third, only building areas directly impacted by floodwater are assumed to experience business interruption. This does not consider interruptions of businesses due to loss of power or utility functions. Finally, the analysis only considers existing populations, businesses, and buildings and does not include projections for future growth. Refer to the Appendix for a more detailed explanation of the exposure and consequence analysis.

INDUSTRY	ANNUALIZED LOSS OF ECONOMIC OUTPUT
Scientific research	\$500,000
Accounting services	\$400,000
Insurance agencies	\$300,000
Fitness and recreation	\$300,000
Restaurants	\$200,000
All other industries	\$6,700,000
Total	\$78,900,000

CHARLESTOWN ECONOMIC LOSSES



CHARLESTOWN ANNUALIZED LOSSES

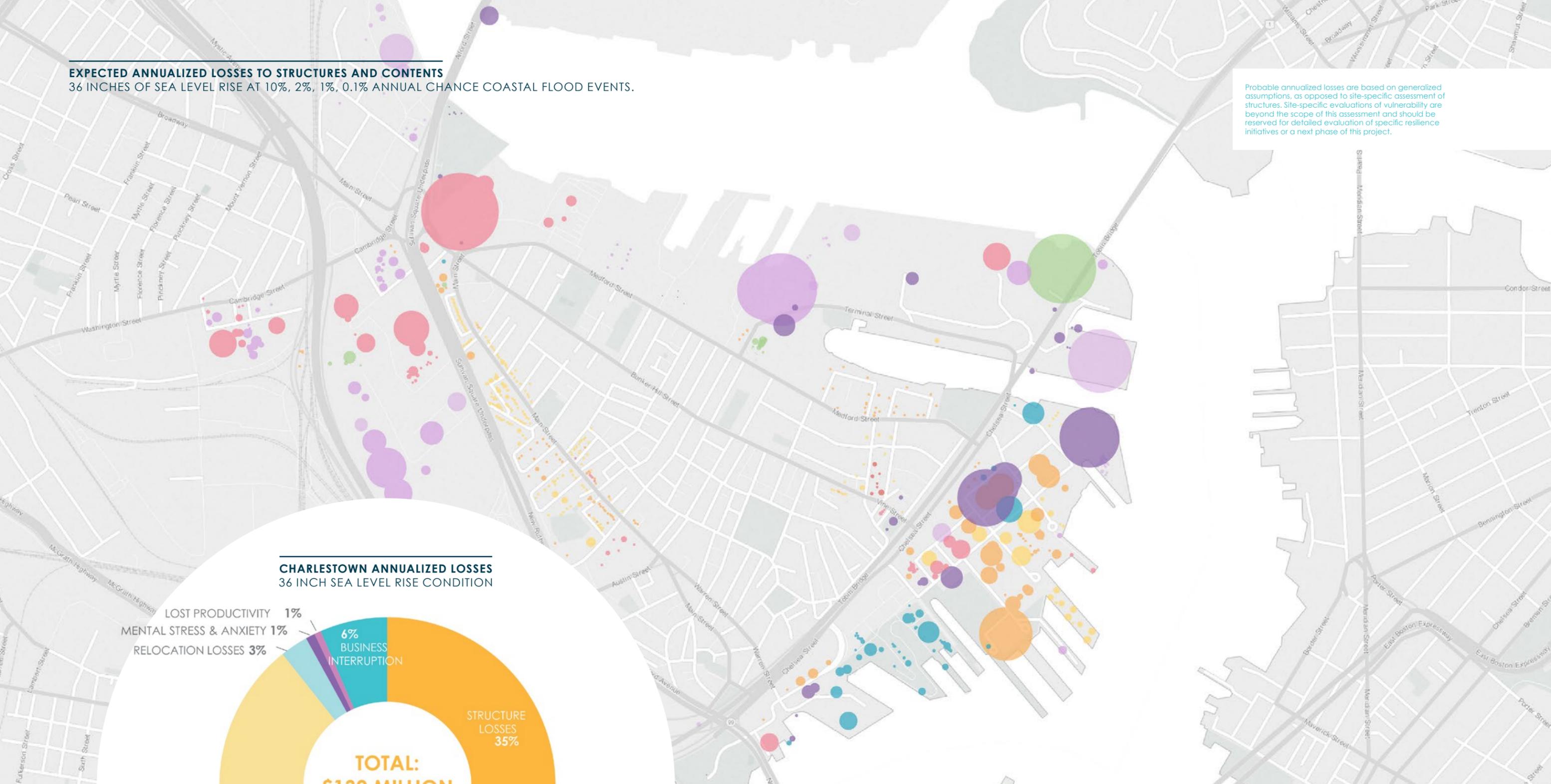


Charlestown is consistently expected to be among the top five focus areas most at risk to coastal flooding throughout the century in terms of land area, people, and buildings exposed.

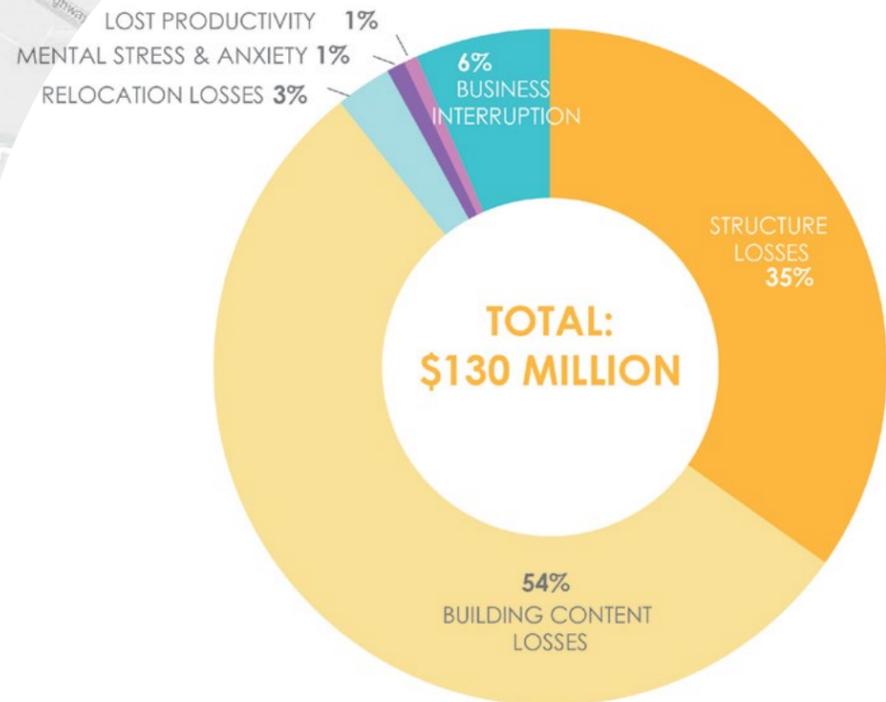
Due to the prevalence of residential structures exposed to coastal flood impacts, Charlestown’s economy is most vulnerable to medium- and long-term sea level rise scenarios.

EXPECTED ANNUALIZED LOSSES TO STRUCTURES AND CONTENTS
 36 INCHES OF SEA LEVEL RISE AT 10%, 2%, 1%, 0.1% ANNUAL CHANCE COASTAL FLOOD EVENTS.

Probable annualized losses are based on generalized assumptions, as opposed to site-specific assessment of structures. Site-specific evaluations of vulnerability are beyond the scope of this assessment and should be reserved for detailed evaluation of specific resilience initiatives or a next phase of this project.



CHARLESTOWN ANNUALIZED LOSSES
 36 INCH SEA LEVEL RISE CONDITION



- Commercial (\$23.4M)
- Cultural/Religious, Edu, Rec (\$8.9M)
- Essential Services (\$19.6M)
- General Government (\$5.5M)
- Industrial/Transportation (\$36.5M)
- Mixed Use (\$20.6M)
- Residential (\$5.5M)
- Total (\$120M)



Each circle represents annualized losses suffered by an individual building. Larger circle size indicates higher contents and structures losses. Annualized losses take into consideration the annual probability of an event occurring, as well as the projected impacts of such an event.

CHARLESTOWN

APPLICATION OF RESILIENCE INITIATIVES

PROTECTED SHORES

DEVELOP LOCAL CLIMATE RESILIENCE PLANS TO SUPPORT DISTRICT-SCALE CLIMATE ADAPTATION

The City should develop a local climate resilience plan for Charlestown to support district-scale climate adaptation.

The plan should include the following:

- **Community engagement** through a local climate resilience committee, leveraging existing community organizations, and efforts such as Boston Harbor Now’s series of adaptation planning workshops in Charlestown.
- **Land-use planning for future flood protection systems**, including Flood Protection Overlay Districts in strategically important “flood breach points” identified below (see Potential Flood Protection Locations).
- **Flood protection feasibility studies**, evaluating district-scale flood protection, including at locations identified below (see Potential Flood Protection Locations).
- **Infrastructure adaptation planning** through the Infrastructure Coordination Committee. For Charlestown, the Massachusetts Department of Conservation and Recreation is a key partner, as it controls the New Charles River Dam.
- **Coordination with other plans**, including Imagine Boston 2030, GoBoston 2030, Special Planning Areas, and any potential Municipal Harbor Plan process.
- **Development of financing strategies and governance structures** to support district-scale adaptation.
- **Partnering with Cambridge and Somerville**, which are adjacent to Charlestown and connected to Charlestown by inundation pathways.

ESTABLISH FLOOD PROTECTION OVERLAY DISTRICTS AND REQUIRE POTENTIAL INTEGRATION WITH FLOOD PROTECTION

The Boston Planning and Development Agency (BPDA) should petition the Boston Zoning Commission to create new Flood Protection Overlay Districts in areas that are strategically important for potential future flood protection infrastructure (see Potential Flood Protection Locations below). Within a Flood Protection Overlay District, a developer would be required to submit a study of how a proposed project could be integrated into a future flood protection system; options may include raising and reinforcing the development site or providing room for a future easement across the site.

PRIORITIZE AND STUDY THE FEASIBILITY OF DISTRICT-SCALE FLOOD PROTECTION

To reduce the risk of coastal flooding at major inundation points, the City should study the feasibility of constructing district-scale flood protection at the primary flood entry points in Charlestown (see Potential Flood Protection Locations below for a preliminary identification of locations and potential benefits).

These feasibility studies should take place in the context of local climate resilience plans, featuring engagement with local community stakeholders, coordination with infrastructure adaptation, and considerations of how flood protection would impact or be impacted by neighborhood character and growth. Examples of prioritization criteria include the timing of flood risk, consequences for people and economy, social equity, financial feasibility, and potential for additional benefits beyond flood risk reduction.

POTENTIAL DISTRICT-SCALE FLOOD PROTECTION LOCATIONS⁷

See the District-Scale Flood Protection Systems Overview section (p.330) for a citywide perspective on district-scale flood protection. District-scale flood protection is only one piece of a multilayered solution that includes prepared and connected communities, resilient infrastructure, and adapted buildings.

In the near term, exposure to coastal flooding is limited to specific waterfront areas. As soon as the 2050s, combined flood protection at two key locations will become critical:

- **North Charlestown**, addressing a major flood entry point between I-93 and Bunker Hill Street, near Sullivan Square
- **The New Charles River Dam**, addressing future overtopping or flanking of the dam

SLR SCENARIO	DISTRICT SCALE FLOOD PROTECTION FOR 1% ANNUAL CHANCE FLOOD ⁸
9" SLR (2030s–2050s)	None ⁹
21" SLR (2050s–2100s)	North Charlestown and New Charles River Dam Locations combined
36" SLR (2070s or later)	North Charlestown and New Charles River Dam Locations combined

LOCATIONS

- **The North Charlestown Location** focuses on a major flood entry point at low ground between I-93 and Bunker Hill Street, near Sullivan Square. Potential flood protection solutions could include the following elements: permanent boundary protection along Bunker Hill Street; regraded and elevated streets near flood entry points; integrated flood protection and transportation improvements at Sullivan Square; a deployable barrier for the Route 99 trench; and temporary barriers at the intersection of Medford Street and Bunker Hill Street, the Engine 32/Ladder 9 entrance, and the Schrafft Center driveway.
- **The New Charles River Dam Location**, also described in the Downtown focus area section (see p. 216), addresses flooding by the Zakim Bridge / New Charles River Dam. Potential flood protection solutions could include a tide barrier across the mouth of Miller’s River, a tide gate and connecting flood protection system just west of Littoral Way, or a deployable barrier across the railroad right-of-way connecting Charlestown and North Station.

⁷These preliminary coastal flood protection concepts build off of recommendations of the MassDOT-FHWA Pilot Project Report and are based on a high-level analysis of existing topography, rights-of-way, and urban and environmental conditions. Important additional factors, including existing drainage systems, underground transportation and utility structures, soil conditions, and zoning as well as any potential external impacts as a result of the project have not been studied in detail. As described in Initiatives 5-2 and 5-3 (pp. 106, 110), detailed feasibility studies, including appropriate public and stakeholder engagement, are required in order to better understand the costs and benefits of flood protection in each location.

⁸Additional flood protection may be required for flood events more severe than the 1 percent annual chance flood. See Appendix for more detailed information on expected effectiveness of flood protection systems, including analysis of additional flood protection locations and flood frequencies.

⁹Benefits of district-scale flood protection would be modest.



1% Annual Chance Flood with 9" SLR
 1% Annual Chance Flood with 21" SLR
 1% Annual Chance Flood with 36" SLR
 Local Flood Defense District

DETAILED CONSIDERATIONS

- **Modest near-term benefits for North Charlestown protection:** At 9 inches of sea level rise (SLR), flood protection at North Charlestown provides modest benefits in terms of economic losses avoided for the 1 percent annual chance event. To protect against near-term lower-probability events (0.1 percent annual chance event) in Charlestown, interventions at both North Charlestown and the New Charles River Dam may be needed,¹⁰ as flooding from the Charles River and Boston Harbor proceed inland. At 21 inches of SLR or above, protection at Locations 5 and 7 will likely be necessary to provide protection beyond high-probability flood events (10 percent annual chance).
- **Industrial areas protected at North Charlestown:** Since the area benefitting from independent flood protection at North Charlestown without the New Charles River Dam protection is relatively small and primarily industrial, direct impact on population is likely limited. Evaluation of flood protection options may require consideration of possible brownfield mitigation and reduction of environmental contaminants.

- **Many neighborhoods benefit from dam flood protection:** Flood protection at the New Charles River Dam could simultaneously protect parts of northern Downtown, southern Downtown, Charlestown, the Charles River neighborhoods, and the South End and Roxbury.
- **Requirement for multiple protection locations in the late century:** A flood protection system at the New Charles River Dam is expected to provide significant protection in other neighborhoods against the 1 percent chance event until later in the century. However, to protect Charlestown from near-term to mid-century flooding, interventions at North Charlestown will likely be required.

¹⁰While it is expected that flood protection that would not be independently effective would have some effect on flood loss, this effect could be positive or negative, and understanding the extent of the effect would require more detailed evaluation. As such, any benefits or costs above the identified level of protection (the point beyond which the flood protection measure can no longer maintain independent effectiveness) have not been evaluated.

PREPARED & CONNECTED COMMUNITIES

CONDUCT AN OUTREACH CAMPAIGN TO PRIVATE FACILITIES THAT SERVE VULNERABLE POPULATIONS TO SUPPORT PREPAREDNESS AND ADAPTATION

The City should conduct outreach to managers of facilities in Charlestown that serve significant concentrations of vulnerable populations and are not required to have operational preparedness and evacuation plans under current regulations. Targeted facilities will include affordable housing complexes, substance abuse treatment centers, daycare facilities, food pantries, and small nonprofit offices, for example. An illustrative example of the type of facilities to which the City might conduct outreach include Bright Horizons Preschool at the Schrafft Center near Sullivan Square, which will be exposed to near-term damage from sea level rise and coastal flooding and access issues associated with near-term stormwater flooding.¹¹

EXPAND BOSTON'S SMALL BUSINESS PREPAREDNESS PROGRAM

The City should reach out to small businesses in Charlestown exposed to stormwater flooding risk in the near term or coastal flooding risk under a 1 percent annual chance event at 9 inches of SLR to help them develop business continuity plans, evaluate insurance coverage needs, and identify low-cost physical adaptations. While Main Street, Charlestown's primary commercial corridor, is not exposed to flooding under a 1 percent annual chance event at 9 inches of SLR, there are 19 commercial buildings and 16 mixed-use buildings potentially hosting small businesses exposed.

RESILIENT INFRASTRUCTURE

ESTABLISH INFRASTRUCTURE COORDINATION COMMITTEE

The Infrastructure Coordination Committee (ICC) should support coordinated adaptation planning for Charlestown's key infrastructure systems, including transportation, water and sewer, energy, telecommunications, and environmental assets. The City should support the MBTA in conducting a full asset-level vulnerability assessment of its system, including the Orange Line. While Charlestown's two Orange Line stops (Community College and Sullivan Square) are not directly exposed to coastal flooding at 9 inches of SLR under the 1 percent annual chance event, flooding of tunnels and stations in Downtown Boston could impede residents' ability to access jobs and essential services during flood events.

PROVIDE GUIDANCE ON PRIORITY EVACUATION AND SERVICE ROAD INFRASTRUCTURE TO THE ICC

The Office of Emergency Management should work with the Boston Transportation Department, Department of Public Works, and private utilities to provide guidance on critical roads to prioritize for adaptation planning, including those that are part of the city's evacuation network and are required to restore or maintain critical services. With 9 inches of SLR under a 1 percent annual chance flood event, Interstate 93, North Washington Street, and Alford Street will all be exposed to coastal flooding.

CONDUCT FEASIBILITY STUDIES FOR COMMUNITY ENERGY SOLUTIONS

The 2016 Boston Community Energy Study identified Charlestown's Main Street corridor as a potential location for an emergency microgrid, based on its concentration of critical facilities. The study also identified an area near Sullivan Square as a location for an Energy Justice microgrid. Small portions of the Main Street corridor site may be exposed to coastal flooding from the 1 percent annual chance event in the near term. The Sullivan Square site has a small area exposed under the 1 percent annual chance event with 9 inches of SLR, with exposure significantly increasing with 21 and 36 inches of SLR. The Environment Department can work with local stakeholders and utility providers to explore these locations.

¹¹The City did not review the extent of existing preparedness planning as part of this study.

ADAPTED BUILDINGS

PROMOTE CLIMATE READINESS FOR PROJECTS IN THE DEVELOPMENT PIPELINE

Upon amending the zoning code to support climate readiness (see Initiative 9-2, p.135), the Boston Planning and Development Agency (BPDA) should immediately notify all developers with projects in the development pipeline in the future floodplain that they may alter their plans in a manner consistent with the zoning amendments (e.g., elevating their first-floor ceilings without violating building height limits), without needing to restart the BPDA permitting process.

Currently, 17 residential and 8 commercial buildings are under construction or permitted in Charlestown, representing 267 additional housing units and 1.8 million square feet of new commercial space.

INCORPORATE FUTURE CLIMATE CONDITIONS INTO AREA PLANS AND ZONING AMENDMENTS

The Boston Planning and Development Agency should incorporate future climate considerations (long-term projections for extreme heat, stormwater flooding, and coastal and riverine flooding) into major planning efforts in Charlestown. These efforts include the planned transportation improvements to Rutherford Avenue and Sullivan Square and the redevelopment of the Bunker Hill Apartments.

ESTABLISH A CLIMATE READY BUILDINGS EDUCATION PROGRAM FOR PROPERTY OWNERS, SUPPORTED BY A RESILIENCE AUDIT PROGRAM

The City should develop and run a Climate Ready Buildings Education Program and a resilience audit program to inform property owners about their current and future climate risks and actions they can undertake to address these risks. To prepare for the most immediate risks, the City should prioritize audits for buildings with at least a 1 percent annual chance of exposure to coastal and riverine flooding in the near term, under 9 inches of sea level rise. In Charlestown, this includes 142 structures, with 17 percent of these consisting of residential and mixed-use buildings that house residents. A resilience audit should help property owners identify cost-effective, building-specific improvements to reduce flood risk, such as backflow preventers, elevation of critical equipment, and deployable flood barriers; promote interventions that address stormwater runoff or the urban heat island effect, such as green roofs or “cool roofs” that reflect heat; and encourage owners to develop operational preparedness plans and secure appropriate insurance coverage. The resilience audit program should include a combination of mandatory and voluntary, market-based and subsidized elements.

PREPARE MUNICIPAL FACILITIES FOR CLIMATE CHANGE

The Office of Budget Management should work with City departments to prioritize upgrades to municipal facilities in Charlestown that demonstrate high levels of vulnerability (in terms of the timing and extent of exposure), consequences of partial or full failure, and criticality (with highest priority for impacts on life and safety) from coastal flooding in the near term. In the near term, at 9 inches of SLR, EMS Station 5 will be exposed to flooding under the 1 percent annual flood event. The Charlestown Navy Yard, which is owned by the BPDA, is also exposed in the near term under monthly high tide. To address extreme heat risks, the City should prioritize backup power installation at municipal facilities that demonstrate high levels of criticality, including specific Boston Centers for Youth and Family and Boston Public School facilities that serve as emergency shelters.