

3.4 The City of Boston: Tackling Rising Waters, One Neighborhood at a Time

Since 1991, Boston has experienced 21 events that triggered federal or state disaster declarations. That rising tide of emergencies helped form the Climate Ready Boston initiative in 2015 at the direction of Mayor Martin J. Walsh. Its final report, completed in 2016, focused largely on the primary climate threats to Boston’s communities and to energy systems – stormwater and coastal flooding as shown in Figure 18. The Climate Ready Boston plan was coordinated with Imagine Boston 2030, the first citywide plan in 50 years, with support from the Rockefeller Foundation’s 100 Resilient Cities initiative. The effort sought to mitigate today’s flooding threats while also addressing concerns like extreme heat and rolling blackouts, which the region’s grid manager, the New England Independent System Operator, was signaling as rising risks. The plan sought to address these threats while guiding Boston toward a more broadly affordable, equitable, connected, and resilient future.

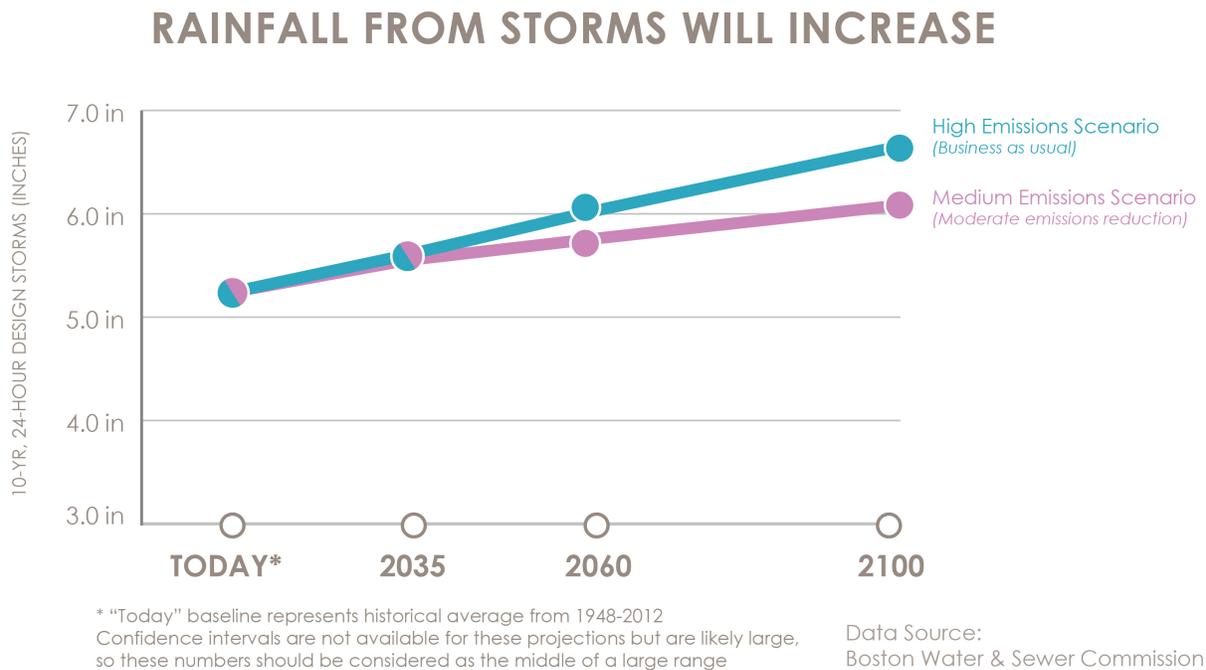


Figure 18: Rainfall projection

How the plan was developed

Boston’s Environment Department led the effort to develop the Climate Ready Boston plan. This plan was an adaptation-focused partner to the Boston Climate Action plan, which was focused on carbon reduction. Their effort spent considerable time and resources developing updated climate projections and detailed planning scenarios. University of Massachusetts Boston assembled a team of climate scientists, named the Boston Research Advisory Group (BRAG), to develop these projection scenarios. Their work included not just city-wide estimates, but considered how the microclimates of each area might impact weather or flooding events. This was followed by a neighborhood-by-neighborhood vulnerability analysis (see Figure 19 and 20), informed by sea level rise analysis supported by external consultants Woods Hole Group and Arcadis.



Figure 19: Neighborhoods

COMMUNITY	TOTAL POPULATION	OLDER ADULTS		CHILDREN		PEOPLE OF COLOR		PEOPLE WITH LIMITED ENGLISH PROFICIENCY ^a		LOW-TO NO-INCOME		DISABILITY		MEDICAL ILLNESS ^b	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%
Allston/ Brighton	75,000	6,100	8%	4,600	6%	25,400	34%	9,700	13%	21,000	28%	6,200	8%	29,200	n/a
Back Bay/ Beacon Hill	22,600	2,800	12%	1,900	8%	3,600	16%	600	3%	2,600	11%	1,000	5%	9,500	n/a
Charlestown	16,400	1,800	11%	3,300	20%	4,000	24%	1,600	10%	4,200	25%	1,500	9%	6,500	n/a
Dorchester	87,400	8,500	10%	21,000	24%	62,500	72%	35,100	40%	26,600	30%	12,400	14%	31,800	36%
Downtown	30,000	4,100	14%	2,000	7%	9,400	31%	4,000	13%	6,800	23%	2,600	9%	12,400	n/a
East Boston	40,500	4,100	10%	8,700	21%	25,500	63%	17,400	43%	13,700	34%	5,200	13%	14,800	n/a
Fenway/ Kenmore	44,300	2,100	5%	600	1%	14,400	33%	3,700	8%	11,200	25%	2,700	6%	16,000	n/a
Harbor Islands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hyde Park	32,300	4,200	13%	7,000	22%	23,200	72%	4,600	14%	5,700	18%	3,800	12%	12,500	n/a
Jamaica Plain	42,100	4,100	10%	6,300	15%	19,200	46%	4,900	12%	14,500	34%	4,200	10%	16,400	n/a
Mattapan	33,700	3,900	11%	9,600	29%	32,100	95%	5,800	17%	11,900	35%	6,000	18%	12,500	n/a
Roslindale	37,700	3,800	10%	7,100	19%	16,700	44%	5,400	14%	6,800	18%	4,100	11%	12,500	n/a
Roxbury	71,600	5,800	8%	16,700	23%	59,200	83%	11,400	16%	27,700	39%	10,400	15%	24,000	n/a
South Boston	31,800	3,200	10%	4,900	15%	7,100	22%	2,600	8%	8,200	26%	3,000	9%	13,500	n/a
South End	38,600	3,300	9%	4,900	13%	16,500	43%	5,800	15%	11,600	30%	4,300	11%	12,800	n/a
West Roxbury	30,400	5,400	18%	6,100	20%	8,100	27%	3,000	10%	3,500	11%	3,000	10%	12,400	n/a
Boston Total	634,400	63,200		104,700		327,300		98,200		176,100		70,700		236,900	
Percent of Boston	100%	10%		17%		52%		15%		28%		11%		37%	

Figure 20: Socially vulnerable groups by neighborhood

The Climate Ready team then convened an infrastructure advisory committee, composed of representatives from 11 city agencies, eight state and regional agencies, five utilities, and eight non-profit organizations. The team also convened a community advisory group consisting of five city offices focused on community needs and eight community non-profit organizations. These committee members engaged in groups set up for each of the plan’s strategies to generate ideas around how those strategies can best address identified risks and vulnerabilities. Those groups were all guided by five operating principles agreed upon for this effort, which included:

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1. Generate multiple benefits. Multiple-benefit approaches enabled Boston to build additional support for initiatives while addressing other pressing challenges beyond climate risks.
 2. Incorporate local involvement in design and decision-making. Local stakeholders can illuminate critical resilience opportunities in their communities and generate creative ideas for solving multiple challenges at once.
 3. Create layers of protection by working at multiple scales. Layers that are independently effective can also work together to provide mutual support and reduce the risk of a failure associated with a single line of defense.
 4. Leverage building life cycles. Taking adaptation actions within the context of the building life cycle can reduce disruption and cost. New construction and major renovation, for example, are key stages in the building life cycle where resilience upgrades are most feasible and economical.
 5. Design in flexibility and adaptability. Climate conditions will continue to change over time, and climate resilience initiatives must be designed to adapt to them.

This proactive engagement also helped generate additional financial opportunities for plan development. Funding came from the City of Boston, but also from the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, the Barr Foundation, and the Sherry and Alan Leventhal Family Foundation. By leveraging these external funding sources Climate Ready Boston was able to secure the university and consulting support that was key to making the effort so successful. As Alison Brizius, Commissioner of the Environment Department noted:

“There was a moment where supportive third parties, this group of institutional leaders, convened in support of the mayor’s Climate Action Plan and Climate Ready Boston. It was truly helpful both in the funding and in pulling stakeholders together.”

How the plan will improve resilience

“There’s a spot in East Boston where a simple barrier can prevent flooding for miles down an old rail trail.”

The plan includes the five resilience principles shown above, plus four layers of resilience initiatives bundled into 11 targeted strategies that include 37 specific actions targeted for nine neighborhoods. It’s a complex approach, but one that makes sense in studying the plan. The layers represent four key facets of Boston: the community, the shoreline, infrastructure assets, and buildings. The plan’s elements, while they focus on these specific layers, are also designed to support and reinforce each other. Its strategies and initiatives are designed to allow for flexibility in meeting the needs of each of the nine target neighborhoods.

That neighborhood-specific approach is a critical element of how Climate Ready Boston focuses its effort. Seven of the nine target neighborhoods contain shoreline zones that face significant risks from coastal and riverine flooding. Boston conducted considerable analysis to target the most at-risk areas, as exemplified in Figure 21’s analysis of economic impacts due to sea level rise. This flooding threat is not theoretical, but actively impacts Boston today. Bradford Swing, Director of Energy Policy and Programs, highlighted this impact:

“In the 28 years that I worked with the city, it’s only been recently that our King high tides and storm surges flood our downtown and sometimes quite badly. Like with news trucks floating down the street level bad. And so that was really the big mandate.”

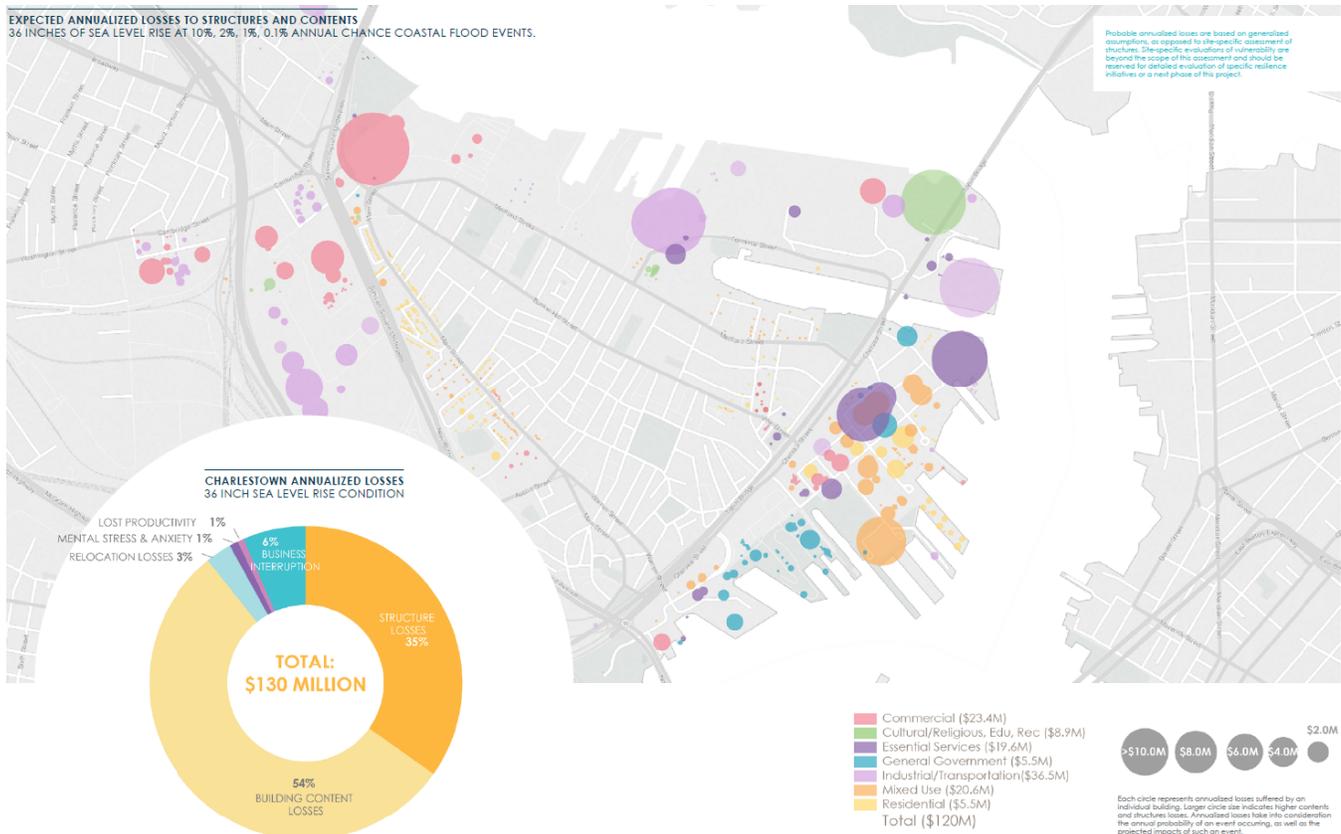


Figure 21: Expected annualized losses to structure and contents due to sea level rise

Sensitivity to Community Concerns

Past efforts to expand Boston’s electric utility substations created significant pushback from environmental and social justice groups. At the same time, electric loads on local circuits continued to increase, creating increasing reliability and resilience concerns.

Given such opposition and growing electricity loads, the Climate Ready Boston effort looked for alternatives to substation expansion, known as “non-wires alternatives” options, to alleviate stress on the local grid. The city also obtained a grant from a local foundation to do a pilot study under the equitable electrification approach, which includes community-driven insights into what kind of resilience features will work for residents.

Plan Highlights

The Climate Ready Boston team was bold in its targets, but also put a great deal of emphasis on future flexibility and the importance of continued collaboration. Highlights of ways this plan attempted to address climate threats include:

- **Working toward more resilient building codes.** The plan acknowledges that current zoning and building codes do not yet institutionalize climate readiness. Fortunately, Massachusetts is one of very few states that allows localities to adopt ‘stretch’ codes that go beyond state minimum legal requirements. The stretch code is predefined, however, and while it increases stringency, it limits flexibility. To address such limitations, Initiative 9-4 in the plan proposes pursuing state building code amendments to promote climate readiness. It proposes prioritizing areas in which it has independent authority, such as zoning. It also identifies potential pathways to incorporate future flood conditions into the state building code. As with other solutions, Boston’s approach here focuses on external partnerships and building understanding of highly localized needs. Travis

Anderson, Senior Infrastructure and Energy Planner in Boston's Planning & Development Agency explained one of the approaches the city is taking, using the Passive House superinsulated building envelope design approach:

“Passive House design is a vital method for housing development, providing durability and increased comfort, particularly in power outage situations. Understanding how buildings withstand these conditions is crucial, and it's essential to promote projects that meet these standards. The BPDA uses Article 37 and the stretch code in the building permitting process to evaluate these factors. Embracing Passive House principles not only supports the city's goals but also creates more resilient developments for emergencies.”

- **Determining a consistent evaluation framework for flood protection system prioritization.** As flooding was a primary concern for Boston, you would expect the plan to include multiple ideas on how to tackle that threat. It does, but it also acknowledges that the threats (and solutions to meet them) will change over time. This is why one plan action is to develop a framework through which alternative flood protection systems would be consistently evaluated. This framework, which is directed to be compatible with the framework used by the U.S. Army Corps of Engineers (a key implementation and funding partner) provides Boston government agencies with a clear and consistent way to identify flood mitigation efforts far into the future.
- **4Expanding the availability and functionality of public shelters.** The plan (and the updated Heat Resilience Plan) goes beyond flooding issues to address another major threat identified by the BRAG. The city and community organizations currently operate many facilities throughout Boston that offer cooling capacity during heat waves. The existing emergency shelters located in these neighborhoods have a combined capacity of just over 1,000 people. Future estimates based on climate change forecast a drastically increasing need for this kind of shelter. The city will work with community organizations to ensure that these facilities are open whenever necessary, accessible to all who need them, and feature backup power in case of power outages.

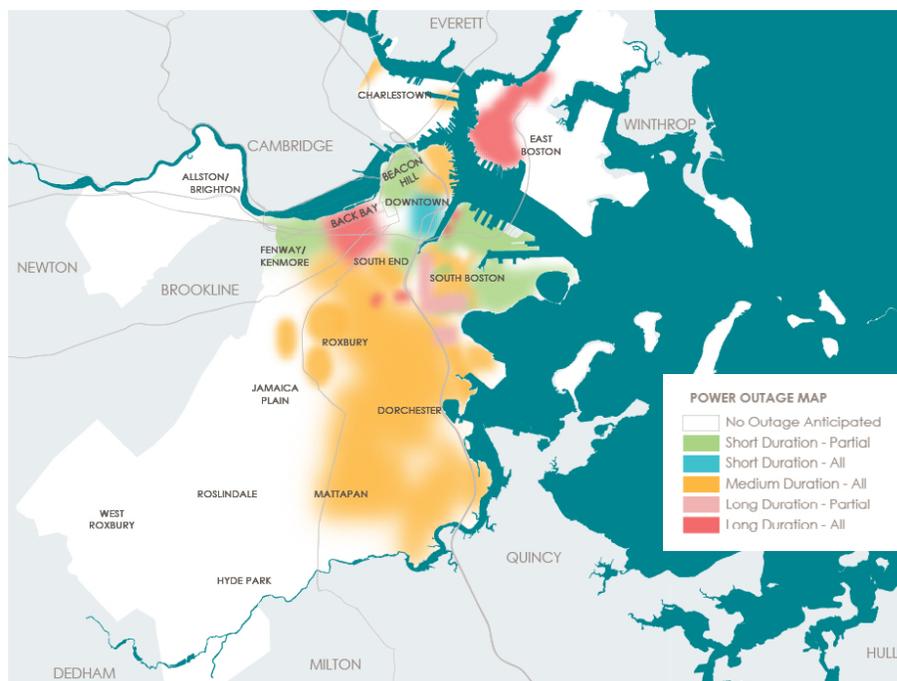


Figure 22: Power outage vulnerability and durations for late-century severe coastal storms

Moving forward

Even with the Climate Ready plan's complexity, local government players have been hard at work adding tactical details to its strategies. The plan's roadmap presents a timeline and designated lead agency for undertaking each proposed initiative. Alison Brizius, Commissioner of the Environment Department, explained how the city is continuing to use the plan as a guidance document to steer implementation:

"Part of the implementation of each plan and piece was figuring out how to fund it, how to finance it. Everything in that plan was at a very high level. It was a broad, sweeping plan with a number of very high-level strategy buckets that needed to happen. A lot of the work of the next years has been, "Okay, we know broadly that this action is zoning. What does that truly mean?" How do we make that more detailed plan to operationalize and actually implement that item on the To Do List?"

In 2019, Mayor Walsh announced that 10% of the city's capital budget would be for municipal projects that implement sea level rise planning; he focused one of his three major speeches that year on this concept. It was a significant commitment that kept the ideas in the Climate Ready plan moving forward at an impressive pace. For upgrades in city buildings, the budget office also uses bonds to fund performance contracts that are repaid based on realized energy savings. The energy service companies that perform under these contracts take on the technical analysis and resulting capital investments and guarantee that repayments will be less than energy savings, so that the city avoids capital expenditures and reduces operating costs.

The Boston team is also thinking carefully about the order of implementation, as certain projects need to be completed before others can be started. Some of this was built into the original plan and some of it is being discovered along the way. Continuous communication and reevaluation keep the various departments involved nimble in their implementation efforts. Newer efforts, such as the recent Heat Resilience Plan that was developed to amend the Climate Ready plan, include more abstract thinking about funding and timelines, but those plans are following the path blazed by the plan's focus on identification, specification, iteration, and steady progress toward more specific timing and funding sources.

Alison Brizius believes that the most challenging part of making Boston climate ready is still ahead of them:

"It's hard to do all this elaborate planning, but at some point you need to stop doing the planning and move on with the information. That's the place where we're right now because structurally being set up as an organization to do planning is very different than structurally being set up as an organization to do enormous at-scale infrastructure projects."

Keeping this work moving, for Boston, hinges on communication, collaboration, and community engagement. As Ms. Brizius summed it up, "These projects work at the speed of trust."

What can we learn from the City of Boston's planning effort?

Climate Ready Boston offers lessons learned around building the right team, acknowledging neighborhood needs, effective plan design, and strong follow through with funding identification.

Leveraging the right support is critical. From the start, the City of Boston looked to the best and brightest talent at local universities and consulting groups to build a team that could develop an ambitious plan with a laser focus on addressing impending threats.

Boston did not treat itself as a monolith. The implementation team recognized that even within their own city, the needs of neighborhoods would be different, and their plan reflects that by identifying neighborhood-specific solutions and putting areas at highest risk first in the order of implementation. The planners also recognized that targeted efforts at critical points can have resilience benefits for large swaths of the city.

The plan's complexity has turned out to be a strength. While its content included many different pieces (principles, layers, strategies, actions, and communities), these were developed in a coordinated manner to inform and reinforce each other instead of getting in each other's way. The Climate Ready Boston plan was built to be flexible, and its many constituent parts continue to provide guidance for how new initiatives can contribute to this framework.

The best plans still need resources to be implemented. So on completing the plan, Boston's leadership quickly turned their focus to ways they could fund plan efforts, including serious commitments of city budget, issuing bonds, leveraging performance contracts, and soliciting support from outside groups.

There is no perfect resilience plan. The Climate Ready Boston team understood that and designed (and is implementing) its plan to pair flexibility with dogged resolve. Bostonians are reaping the benefits.