Building Resilience in Beachmont:
A Plan to Reduce Flood Risk Near Belle Isle Marsh

Study Team & Partners

City of Revere
North Suffolk Office of Resilience & Sustainability
Massachusetts Coastal Zone Management
Woods Hole Group

The City of Revere received a grant from the Massachusetts Office of Coastal Zone Management to evaluate and develop potential near- and long-term adaptation measures for a flood-prone residential area in Revere, Massachusetts, bordering Belle Isle Marsh. Focused on Pearl Ave, Summer St, Crystal Ave, Crescent Ave, and Winthrop Ave in the Beachmont neighborhood, the effort seeks to identify practical solutions to mitigate risk and build resilience in response to increasing coastal flooding threats.

Mayor Patrick M. Keefe Jr.

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What This Report is About

This plan presents a community-centered planning effort aimed at reducing flood risk for residents in the Beachmont neighborhood of Revere, MA, adjacent to Belle Isle Marsh. It explores near- and long-term strategies to address flooding from coastal storms and sea level rise. Through site analysis, community outreach, and a vulnerability assessment, this plan aims to identify practical, feasible actions to enhance neighborhood resilience and outlines how residents and the City can adapt to a changing climate.

Aerial Image of the Beachmont Neighborhood
Source: MassGIS

Why This Study Matters for Beachmont Residents

The Beachmont neighborhood, particularly along Pearl Avenue, Summer Street, Crystal Avenue, and Winthrop Avenue, is increasingly vulnerable to tidal flooding and storm surge, with residents already experiencing infrastructure and property impacts from sunny-day flooding. As a dense residential area designated as an Environmental Justice (EJ) community, meaning it has higher proportions of low-income households, people of color, non-English speakers, or other populations historically overburdened by environmental hazards, Beachmont faces heightened exposure and has limited resources to respond. This project aims to develop solutions that are informed by community input, rooted in science, and achievable under current regulations.

Quick Facts: Study Area, Funding Source, And Key Partners

Location: Beachmont neighborhood, Revere, MA, fringing Belle Isle Marsh

Streets of Focus: Pearl Ave, Summer St, Crystal Ave, Crescent Ave, and Winthrop Ave

Designated as: 2020 Environmental Justice Community

Funding Source: Massachusetts Office of Coastal Zone Management (CZM) FY25 Coastal Resilience Grant

Lead Agency: City of Revere, with support from the North Suffolk Office of Resilience and Sustainability (NSORS)

Technical Team: Woods Hole Group, with sub-consultant Community Resilience Consulting

What You will Find in This Report

This report includes a clear summary of:

- Input residents shared during meetings
- The influence of Belle Isle Marsh on neighborhood flooding
- The causes and extent of flood risk now and into the future
- Options for near-term improvements and long-term adaptation
- The potential costs and benefits of action—or inaction
- Recommendations for next steps, funding, and staying involved

This plan aims to equip residents and City leaders with the tools, data, and recommendations to make informed, locally grounded decisions about infrastructure adaptation.

Listening to the Community

The Beachmont Neighborhood Abutting Belle Isle Marsh

Who We Talked to and How

What We Heard from Residents During Site Walks and Meetings

The Beachmont Neighborhood Abutting Belle Isle Marsh

Beachmont is a coastal residential neighborhood located in the southeastern corner of Revere, Massachusetts. It is bordered by Revere Beach to the north, the Atlantic Ocean and Winthrop Parkway to the east, the Belle Isle Marsh Reservation to the south, and East Boston to the West. Historically developed as a working-class and transit-connected neighborhood, Beachmont today reflects a mix of single- and multi-family homes. The neighborhood is served by the MBTA Blue Line, with the Beachmont station providing a critical transit connection to downtown Boston and Logan Airport. Its housing stock includes older structures, often built before modern building codes were in place, leaving them more exposed to coastal flooding.

The project area includes populations that meet the criteria for Environmental Justice (EJ) under Massachusetts guidelines based on factors such as income, language, and minority status. These designations are determined using census data and reflect neighborhoods where many residents may earn below 65% of the statewide median income, speak limited English, or are part of communities of color. In Beachmont, these characteristics are present and signal a need for thoughtful, community-informed planning. Recognizing EJ communities helps ensure that public investments are directed where they are most needed, supporting neighborhoods that may face greater challenges recovering from storms, flooding, and other coastal hazards

The area surrounding the Beachmont Neighborhood study area
Source: MassGIS

How Community Voices Shaped This Plan

Community input played a central role in informing the recommended strategies for both near- and long-term resilience. Residents provided firsthand insight into the realities of living in a flood-prone neighborhood, from repeated disruptions during high tides to uncertainty around future property values. Municipal staff also contributed important context regarding capacity and staffing limitations that may affect the timing and implementation of various approaches.

The study team recognizes the diversity of community needs, risk tolerance, and circumstances, which is reflected in the plan's flexible framework. The plan includes immediate actions as well as recommendations for feasibility studies of larger-scale interventions, such as neighborhood-scale flood barriers, voluntary buyout programs, and floodplain bylaw changes. The goal of this study was to elevate community voices early and often to ensure the resulting strategies are responsive to local needs and feasible within existing regulatory frameworks.

Who We Talked to and How

The City of Revere gathered community input for the Beachmont Resilience Plan through a series of outreach and engagement events. These included neighborhood public meetings, small group discussions, and a site walk. Participants represented a diverse cross-section of the community, including long-term and newer residents of flood-prone areas near Belle Isle Marsh, municipal staff, advocacy groups, and members of the City Council.

Four public meetings were held as part of this process:

- January 29, 2025,
- February 5, 2025,
- June 11, 2025, and
- June 25, 2025.

The first two meetings (one in person, one virtual) focused on hearing directly from Beachmont residents about their experiences with flooding from Belle Isle Marsh and the impacts on their homes and daily lives. The June meetings (one in person, one virtual) provided an update on the project, demonstrating how resident feedback shaped the draft Beachmont Resilience Plan. The meeting also introduced potential short- and long-term strategies and offered one-on-one property consultations. These consultations helped homeowners understand the elevation and flood risk of their specific properties, along with possible mitigation measures.

Outreach for the project was conducted with the support of the City's Community Liaison Department, the Diversity, Equity & Inclusion Department, and Councilor Joanne McKenna. Community liaisons went door-to-door in the project area and distributed flyers at Mobile City Hall events. Major community partners in the Beachmont neighborhood – such as the Beachmont Improvement Committee - also helped promote the project. Broader outreach included social media posts, flyering at the Beachmont MBTA stop, and a RevereTV announcement. The City of Revere values public input and remains committed to ensuring

What We Heard from Residents During Community Meetings

Key Takeaways from Participants

Individual Preparedness and Response: Residents are already taking personal steps to prepare for flooding, including moving cars and maintaining emergency supplies. Neighbors also share information about flooding in group chats, and help one another during flood events. There was general interest in receiving more explicit guidance on how to protect their homes and reduce financial risk.

Desire for City Support: There are no alert systems for sunny-day flooding; there is a desire for more timely and location-specific notifications. Opinions were split: some expressed a desire to stay in their homes and focus on reducing the impacts of flooding, while others expressed interest in voluntary buyout options. Conversations about relocation often intersected with concerns about the real estate market and affordability.

Infrastructure and Structural Concerns: Several residents mentioned that they would support constructing a berm south of Pearl Ave as a form of flood protection.

Flood Insurance Confusion and Cost: Participants raised concerns about flood insurance, especially high deductibles and the inability to claim damages for partial loss. Many were unaware of available resources or techniques to lower their premiums, and requested step-by-step guidance on residential retrofits that could qualify them for reduced rates. A lack of upfront capital was repeatedly cited as a major obstacle to implementing retrofits, or other adaptive measures.

Real Estate Market and Disclosure: Residents expressed worry about the long-term value of their homes and the ability to "stay on the real estate ladder." There was significant concern about the lack of transparency regarding flood risks during property transactions and a desire to improve disclosure laws.

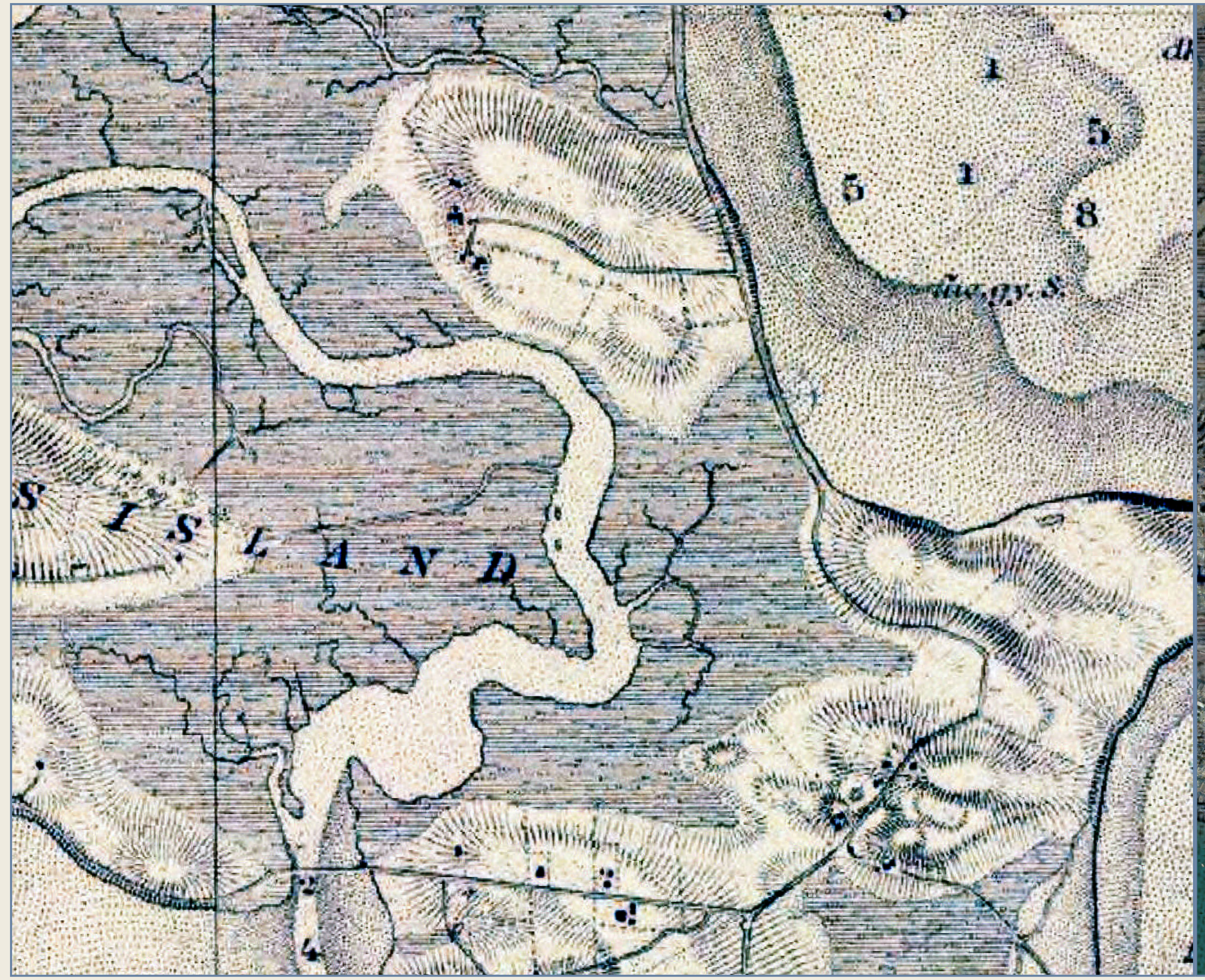
Stormwater Management: During rain events, many noted frequent standing water and overwhelmed drain systems. Participants asked for improved drainage maintenance by DPW and questioned whether gravity-fed systems provided sufficient outflow pressure, especially in low-lying areas. The idea of redirecting or piping stormwater into the marsh was raised and merits further evaluation.

Exploring the Natural Landscape

- Beachmont's Geology and History of Fill
- What Makes Belle Isle Marsh Important?
- Mapping Local Wetlands and Low Spots (Elevation)
- Wetland Resource Area Delineation

Beachmont's Geology and History of Fill

The City of Revere is primarily a low-lying coastal landscape, shaped by two clusters of small, rounded hills called drumlins, or hills formed by glaciers. These drumlins are located the western and southeastern portions of Revere. In the southeast, Young's Hill (134 feet) and Beachmont Hill rise prominently above the surrounding marshes, creating steep elevation gradients. These natural hills contrast sharply with the artificially elevated lowlands that were created through extensive infill in the late 19th century. The 1878 Boston Harbor Chart below shows the variation in elevation prior to that infill. When that chart is overlayed on an 2023 aerial the topography of Beachmont shows the pattern of development.

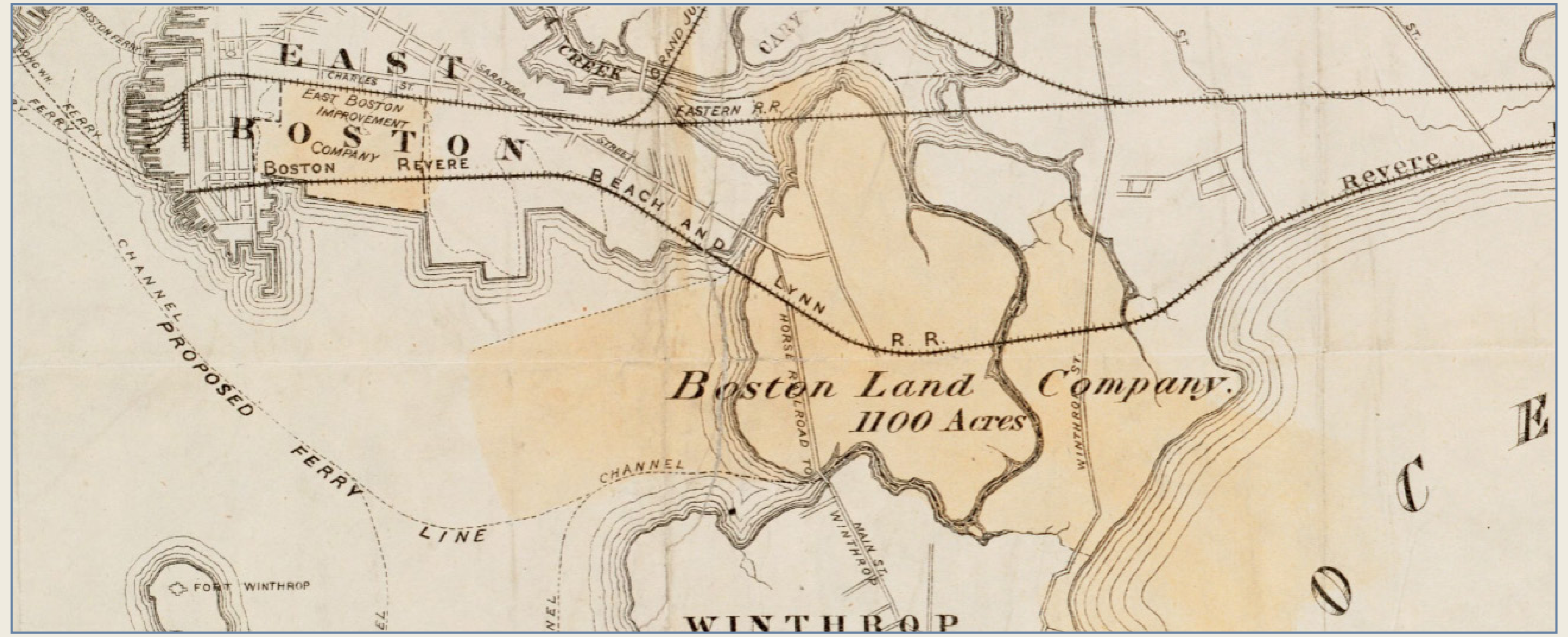


1878 Boston Harbor Chart NOAA
Source: Boston Public Library

1878 Boston Harbor Chart layered on a MassGIS 2023 aerial photo
Source: Boston Public Library/MassGIS

Beachmont's Geology and History of Fill

1874 Atlas of Suffolk, County, Vol. 4, Plate Q
Source: State Library of Massachusetts



Plan of estate of the Boston Land Co. and surroundings 1873
Source: Boston Public Library

Historically, Beachmont and the surrounding area consisted of estate farms on coastal marshes, with minimal development through the early 1800s. To expand the area beyond the naturally elevated drumlins, developers undertook large-scale infill operations in adjacent marshes and tidal flats. Much of the infill in Beachmont occurred between the 1870s and 1890s, spearheaded by private developers such as the Boston Land Company, which purchased the James Sale Farm, a large agricultural tract which can be seen on the 1874 atlas below prior to fill being added to the area.

This created flat, buildable land out of former salt marsh, which the company quickly subdivided into residential lots and laid out a street grid. The rapid development of Revere Beach as a seaside destination began in the 1870s, with the railroad providing convenient access to the coastline for middle-class Bostonians seeking recreation and seasonal residences. The Beachmont Neighborhood and broader Revere began to change with the arrival of new transportation infrastructure — first the Salem Turnpike and later the Boston, Revere Beach & Lynn Railroad, which provided direct rail connections to Boston and Lynn.

1906 Atlas of the towns of Revere and Winthrop, Suffolk County, Massachusetts
Source: Boston Public Library

What Makes Belle Isle Marsh Important?

The streets of Pearl Ave, Summer Street, and Crystal Ave overlook the Belle Isle Marsh Reservation, part of the greater Rumney Marsh Area of Critical Environmental Concern and owned primarily by the MA Department of Conservation and Recreation (DCR). Belle Isle Marsh is the largest remaining salt marsh in Boston Harbor, encompassing 359-acres of natural habitat and recreation space. Historically, the marsh was wide, undeveloped, and hydraulically connected to Chelsea Creek and the greater Boston Harbor system, as seen in the plan from 1774 below. Today, human impacts, environmental stressors, and climate change threaten the health, function, and benefits of the marsh. Belle Isle Marsh provides value to the region through benefits to:

- **Coastal Resilience:** Salt marshes act as natural buffers against coastal storms and erosion by dampening wave energy, reducing potential flood damage to communities.
- **Water Filtration:** Marsh grasses and peat layers act as a filter, removing pollutants from runoff and purifying the water that drains into waterways.
- **Fish & Wildlife Habitat:** The marsh provides nursery habitat for commercially and recreationally important juvenile shellfish and finfish, and supports over 260 different birds, 7 of which are threatened or endangered. Belle Isle Marsh in particular is a critical rest point for migratory birds along the Atlantic flyway.
- **Carbon Storage:** Salt marsh soils, plants, and sediments take in Carbon Dioxide from the atmosphere and convert it into stored organic matter, reducing the amount of Carbon Dioxide in the atmosphere. This helps to slow down global climate change by weakening the greenhouse effect.

Map of north Boston Harbor pre-development - 1775 Plan of the Bay and Harbor of Boston.
Source: Library of Congress Geography and Map Division

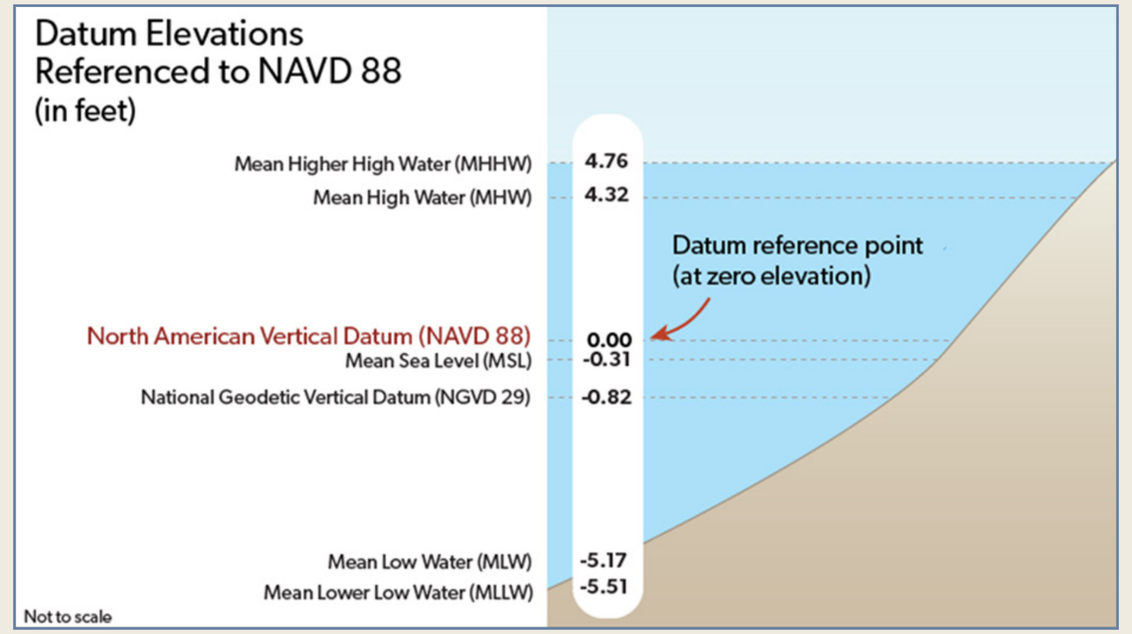
Mapping Local Wetlands and Low Spots (Elevation)

On January 17th and 22nd, 2025, Woods Hole Group surveyed the Belle Isle Marsh shoreline adjacent to Beachmont both by drone and on foot. The surveys were intended to: (1) acquire high resolution imagery of the study area, (2) measure critical elevations of the ground surface and buildings in the flood zone, and, (3) delineate wetland resources which play a role in design and permitting of any construction project.

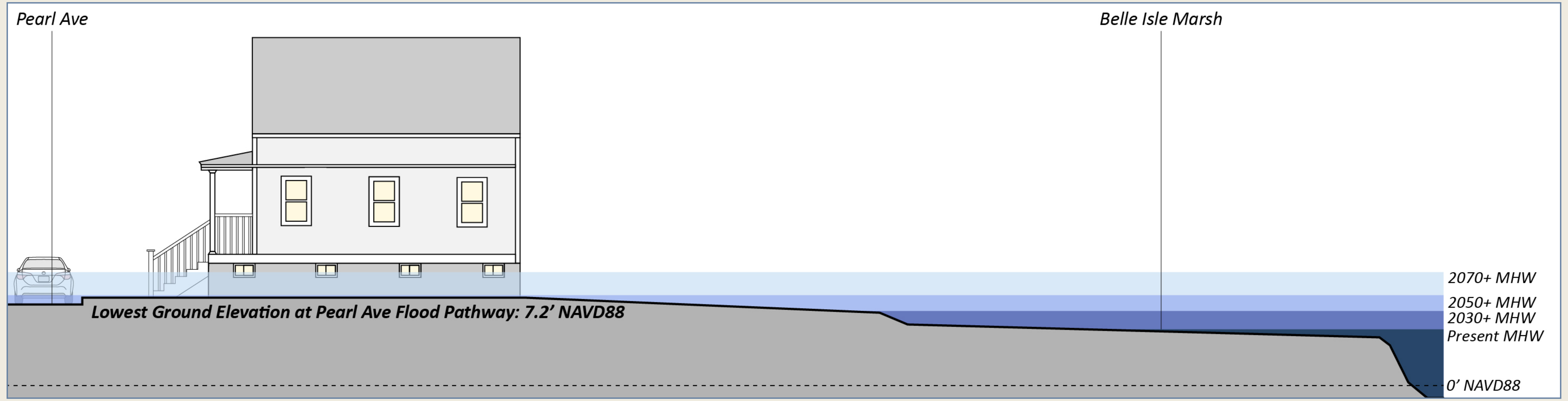
Critical elevations refer to specific height thresholds, usually measured in feet above a vertical datum (like NAVD88). Vertical datums are reference systems used to measure elevation relative to a fixed "zero" point. In the U.S., the standard is NAVD88 (North American Vertical Datum of 1988). It provides a consistent baseline for comparing elevations across maps, surveys, and flood models.

The figure on the right shows a comparison of common datums relative to the NAVD 88 datum at the NOAA tide gauge station in Boston. The different datums have different relative zero elevation points (the starting points from which elevations are measured).

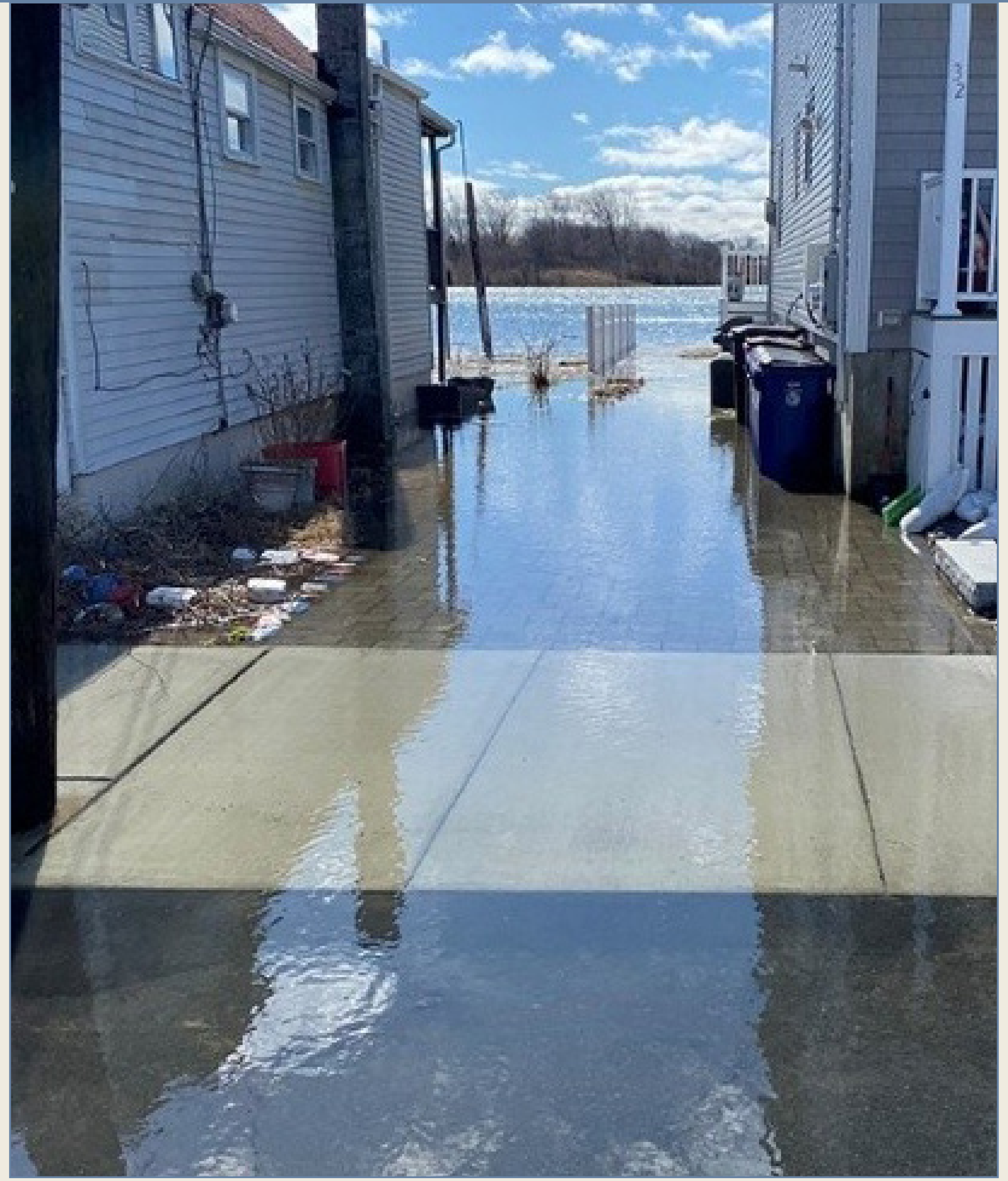
Critical elevations are important for evaluating flood risk, coastal vulnerability, and infrastructure design. These elevations are considered "critical" because they serve as decision points for planning, engineering, and permitting. The figure below shows the ground elevation compared to the elevation of the marsh.



Comparison of common datums relative to NAVD 88
Source: Massachusetts Office of Coastal Zone Management



Projected mean high water flood depth along Pearl Ave Flood Pathway



Looking at 32 Pearl Street which sits in the most prominent flood pathway, experiencing sunny-day flooding (March 10th, 2024)
Source: Councillor McKenna

This study examined two types of critical elevations that play a role in flood risk:

- **Flood Pathways:** Water levels associated with coastal storms rise up as high tide, storm surge, and waves combine to extend inland and upland. Low spots along backyards and roadways that provide entry points for flood waters can be considered critical elevations for flood pathways.
- **Building Critical Elevation:** This is the elevation at which flood water would first damage a building. This study assumed that damage would occur once flood waters entered a building, and did not consider damage to exterior utilities such as air conditioning units. Entry point elevations were developed for each level of each building in the study area, and the elevation of each building's lowest occupiable level was used as the critical elevation for that building.

Understanding critical elevations, such as basement floor levels, entryways, and roadway low points, helps to identify where floodwaters are most likely to enter the built environment. In Beachmont, this relationship between topography and structure elevation plays a key role in how and where flooding occurs. The Beachmont neighborhood is built on a hill that slopes down toward Belle Isle Marsh to the south and the Atlantic Ocean to the north and east. As ground elevation decreases near the coast, low-lying areas become entry points for floodwaters.

One of the most significant flood pathways identified in this study is **between 12 and 32 Pearl Avenue,** where water from Belle Isle Marsh frequently flows into the neighborhood, causing street flooding, road closures, and vehicle damage. This flood pathway serves as a clear example of how critical elevation data, such as the road points and buildings' critical elevations, was used to pinpoint vulnerable areas and prioritize adaptation approaches.

Wetland Resource Area Delineation

Coastal resource areas in Massachusetts are protected by the Wetlands Protection Act (WPA), which provides rules and standards that local conservation commissions and MassDEP use to review and regulate activities in these areas. A coastal resource area delineation was conducted at the intersection of Belle Isle Marsh and upland areas within the Beachmont neighborhood study area. The delineation focused on a 3,000-linear-foot stretch extending west from Winthrop Parkway along the northern shoreline of Belle Isle Marsh, terminating at Frederick Park. Field survey efforts identified resource areas where the marsh transitions to upland or Land Subject to Coastal Storm Flowage (310 CMR 10.04), including Tidal Flat (310 CMR 10.27), Coastal Bank (310 CMR 10.30), Salt Marsh (310 CMR 10.32), and Priority Habitat of Rare Species (310 CMR 10.37). A wetland delineation memo can be found in Appendix A.

Orientation of coastal features in the study area (January 17th, 2025)
Source: Woods Hole Group

Tidal Flat in Belle Isle Marsh (January 17th, 2025)
Source: Woods Hole Group

Tidal Flat

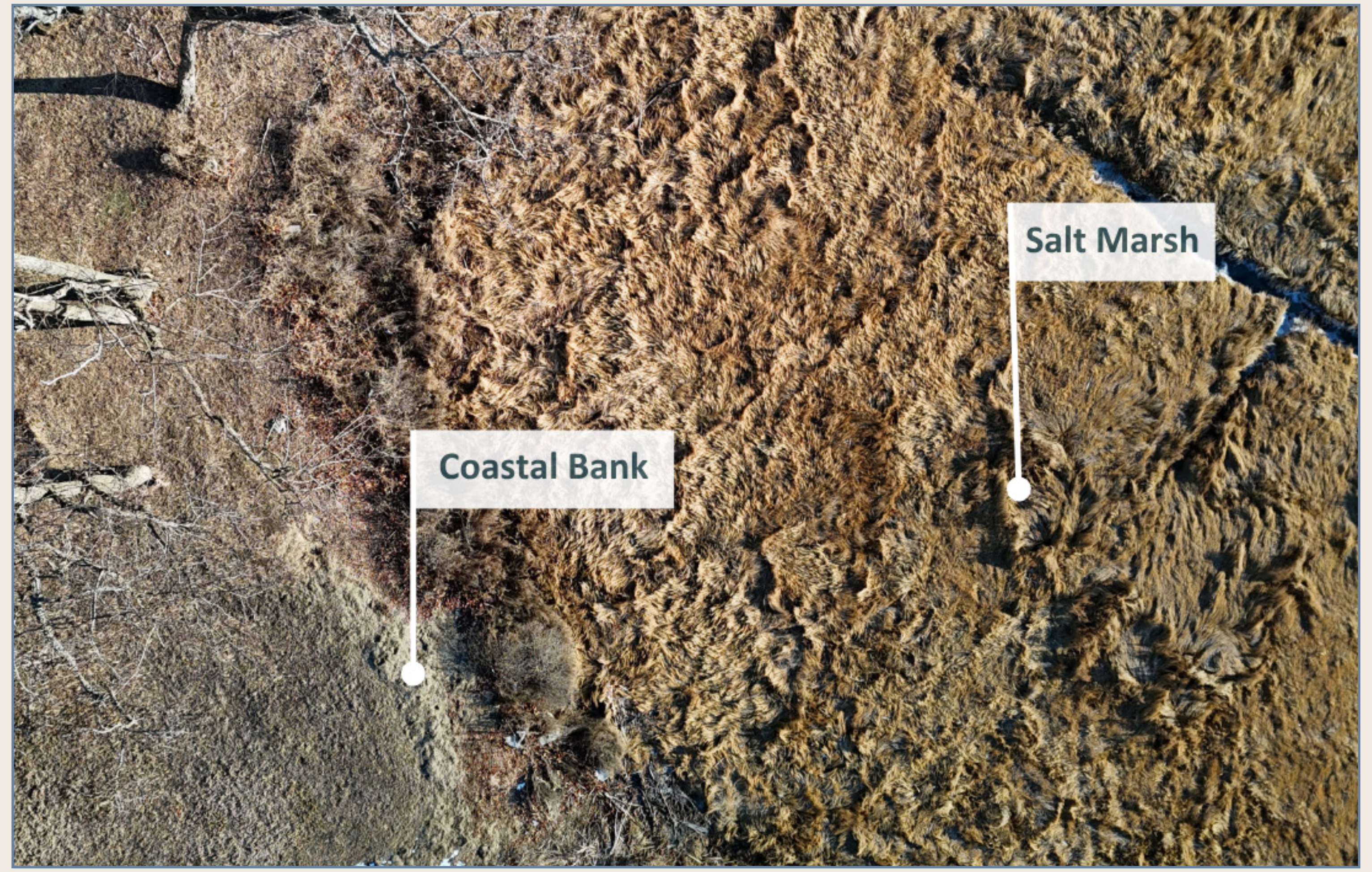
Tidal flats are defined under 310 CMR 10.27 as part of the coastal beach resource area. They are described as "any nearly level part of a coastal beach which usually extends from the mean low water line landward to the more steeply sloping face of the coastal beach, or which may be separated from the beach by land under the ocean."

Tidal flat was present along the western end of the study area, terminating at the berm that extends south from Summer Street. The landward extend of tidal flat transitions either to fringing salt marsh or directly to the toe of the coastal bank, depending on the location, while the seaward edge of the tidal flat transitions to open water at the Mean Low Water (MLW) line.

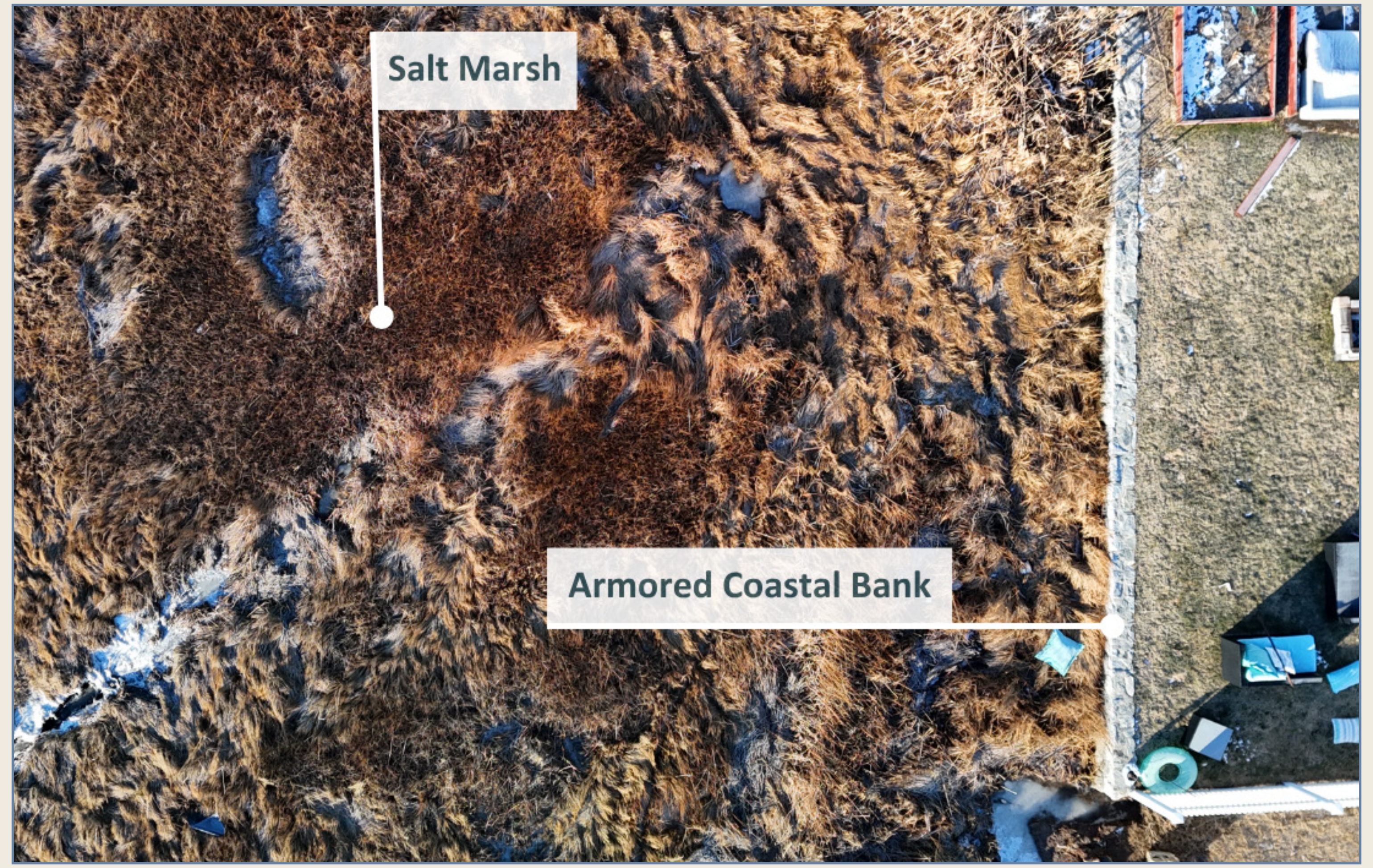
Coastal Bank

The Massachusetts Wetland Regulations 310 CMR 10.30 define Coastal Bank as "the seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action, or other wetland." Coastal banks are often made up of glacial material, though some consist of bedrock or sediment that was formed or deposited prior to glacial activity. Coastal banks can also consist of artificially deposited fill, as long as they serve the functions of storm damage prevention and flood control. Coastal banks also provide a sediment source to seaward resource areas such as beaches and dunes when eroded. When armored with seawalls or revetments, coastal banks cannot be eroded and serve their function as a sediment source. Therefore, current regulations strongly discourage hard armoring of coastal banks.

Low-lying coastal bank was present along the majority of the shoreline within the study area. The condition of unarmored sections of coastal bank varied considerably from one property to the next, with some sections of bank containing woody vegetation, or dense stands of common reed. Other sections of the coastal bank were armored with coastal engineering structures, including vertical seawalls or rip-rap stone and construction debris placed on the landform.



Unarmored sections of coastal bank (January 17th, 2025)
Source: Woods Hole Group



Armored coastal bank abutting salt marsh (January 17th, 2025)
Source: Woods Hole Group

Properties showing the proximity of salt marsh to abutting properties(January 17th, 2025)
Source: Woods Hole Group

Salt Marsh

As defined in the 301 CMR 10.32 regulations, salt marsh is "a coastal wetland that extends landward up to the highest high tide line, that is, the highest spring tide of the year, and is characterized by plants that are well adapted to or prefer living in, saline soils". Continuous salt marsh was present from the eastern extent of the study area near the Winthrop parkway westward to Fredericks Park.

Salt marsh vegetation observed in this location was primarily spikegrass (*D. spicata*), and sea pickle (*Salicornia sp.*) in the high marsh, and smooth cordgrass (*S. alterniflorus*) in the low marsh and along existing ditches and tidal creeks. The seaward edge of the fringing salt marsh quickly transitioned to tidal flat, and the landward edge directly abutted the toe of the coastal bank, coastal engineering structures, and/or landscape features as seen above. In a few select locations, gaps in the coastal bank along Crystal Avenue allowed salt marsh to extend landward into the backyards of (6) six homes located west of the Crystal Avenue and Summer Street intersection.

Land Subject to Coastal Storm Flowage

Land subject to coastal storm flowage is defined at 310 CMR 10.04 as "land subject to any inundation caused by coastal storms up to and including that caused by the 100-year storm, surge of record or storm of record, whichever is greater." Land subject to coastal storm flowage is inclusive of the AE and VE zones designated by FEMA and encompassed all resource areas that were documented on site including salt marsh, tidal flat, and coastal bank.

The Federal Emergency Management Agency (FEMA) published a set of Flood Insurance Rate Maps (FIRMs) on March 16, 2016. The study area is primarily within the AE zone, with elevations of 9 to 11 feet NAVD88. AE Zones are areas at high risk of flooding from a storm that has a 1% chance of happening each year, also called the base flood. Being in an AE Zone affects how the area can be built or rebuilt, there are stricter building standards, and a property is likely to require flood insurance to qualify for a mortgage.

FEMA Flood Insurance Rate Maps (Effective March 16, 2016)
Source: Federal Emergency Management Agency

How the Marsh, Land, and Water Interact in This Neighborhood

The Beachmont neighborhood sits atop a drumlin (hill) surrounded by water on three sides: Roughan's Point to the north, Short Beach to the east, and Belle Isle Marsh to the south. These shorelines represent various entryways for coastal storm flooding. Furthermore, the hill conveys groundwater and sheds rainfall downslope which can cause flooding independently, or combine with storm tides to worsen conditions.

The Atlantic Ocean and Broad Sound bring large wave events, often associated with nor-easters. These waves increasingly overtop the seawall and Winthrop Parkway, from where water runs downhill to pool at the base of Pearl Ave and Winthrop Ave. Belle Isle Marsh is a sheltered tidal estuary, where high wave events are less of a concern. However, as a result, development has pushed the limit out of a false sense of security. Low-lying residential properties abut the marsh, and experience the impact of large storm tides (storm surge coinciding with high tide), and even sunny-day king tide events (astronomical high tides). The marsh provides a benefit to these abutting communities, as the marsh platform and vegetation dampen wave energy. Additionally, the marsh serves as an area to store rainfall and convey it to Boston Harbor through its tidal creeks.

Winthrop Avenue properties and Short Beach (January 17th, 2025)
Source: Woods Hole Group

Understanding the Challenge

What's Causing Coastal Flooding in the Beachmont Neighborhood?

What Areas are Most Affected?

Stories and Photos from Past Flood Events

What's Causing Coastal Flooding in the Beachmont Neighborhood?

Three main sources contribute to coastal flooding in the Beachmont Neighborhood study area:

1. ***Coastal flow through Belle Isle Marsh,***
2. ***Wave overtopping of the seawall at Short Beach, and***
3. ***Water from rain and snow backing up in the drainage system.***

All three of these factors contribute to flooding during coastal storms, but flooding also happens in Beachmont during unusually high tides and heavy rain events. Flooding in the absence of a storm is sometimes called "sunny day flooding" or "nuisance flooding". Flooding due to heavy rain or snow is usually called "stormwater flooding". This section discusses the types and sources of flooding that affect the study area, as well as how they interact with each other.

Coastal Storms

Coastal storms cause the deepest and most damaging flooding in Beachmont. During a storm, water can enter the neighborhood from rising water levels in Belle Isle Marsh, which can be caused by the low atmospheric pressure of the storm pulling on the ocean. Southerly winds can also push more water into Belle Isle Marsh. Most commonly, and especially during nor'easters, waves also crash into the seawall at Short Beach, splashing water onto the road and into the marsh as a result of wave overtopping. Wave overtopping refers to the interaction between waves, wind, and hard coastal infrastructure that can cause water to splash over that infrastructure while water levels remain lower than the infrastructure's crest elevation. As a note, in this location, storms with northeast wind are most likely to overtop the seawall. In a large storm, water levels in Broad Sound rise high enough (approximately 12ft NAVD88) to flow over Winthrop Parkway and into Belle Isle Marsh even without the help of waves.

Flooding on Pearl Avenue during a coastal storm – January 13th, 2024. Note the waves overtopping along Winthrop Parkway. Source: Councillor McKenna

What's Causing Coastal Flooding in the Beachmont Neighborhood?

Sunny-Day Flooding

Every day, the water in Belle Isle Marsh rises and falls twice. The water's peak elevation is not always the same. When the moon and sun are aligned, they work together to create higher tides. Wind can also push extra water into Belle Isle Marsh, increasing the water's elevation even more. Storms far out to sea can also pull on the ocean or create waves that cause higher or lower tides in Beachmont, even without causing any bad weather, locally. When these factors lead to high water levels, the resulting inundation is often called "sunny-day" flooding, referencing the fact that it is not linked to stormy weather. The residents in the Beachmont Neighborhood are familiar with sunny-day flooding seen on the right on March 10th, 2024.

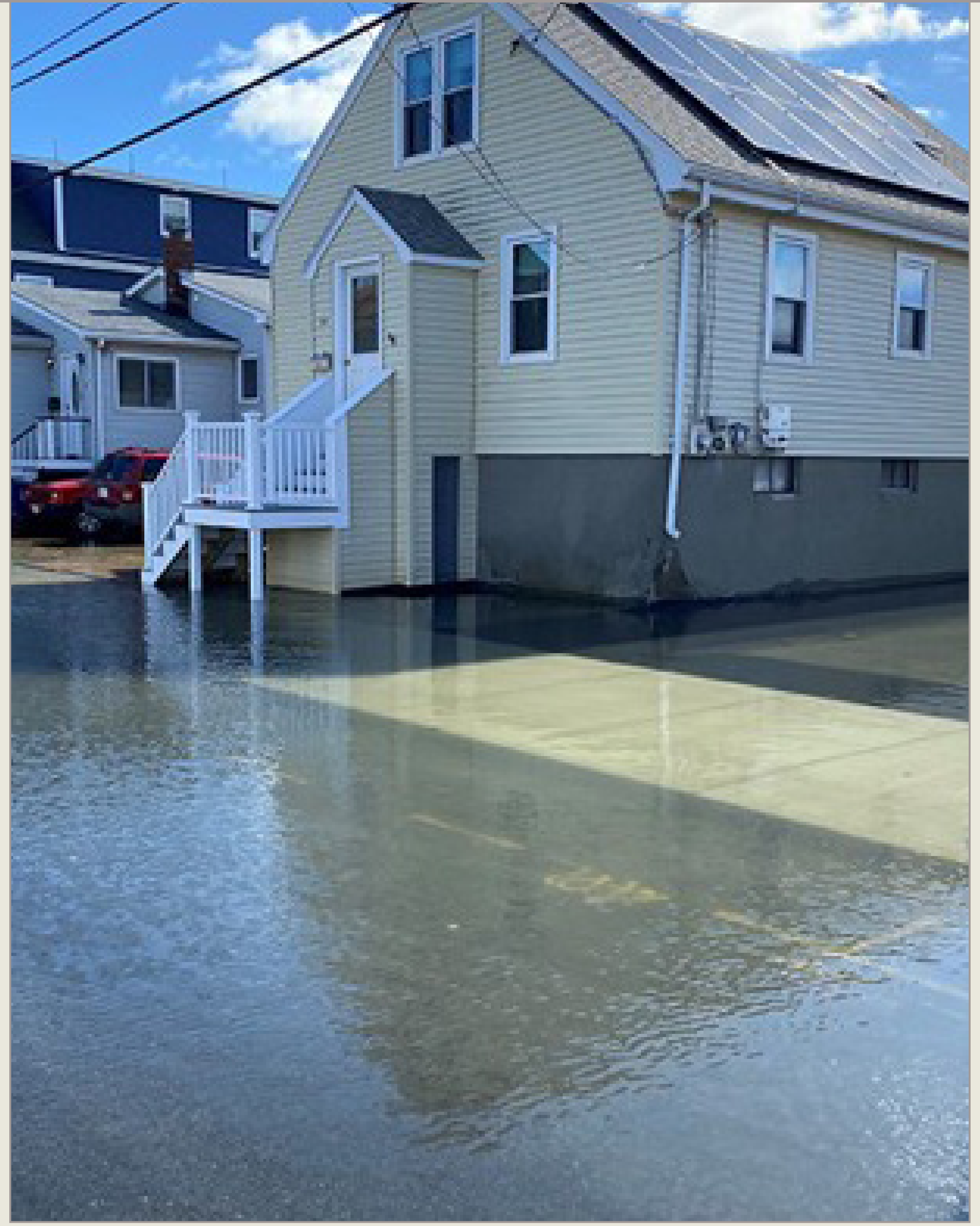
Stormwater Flooding

Stormwater flooding refers to flooding caused primarily by rain, sleet, or snow. Heavy precipitation can overwhelm drainage infrastructure and cause water to pond in low-lying areas. Seawater can also back up through drainage outfalls, preventing rainwater from exiting the system. When water can't exit the stormwater system, water from all sources flows downhill to pool in the same area.

Compound Flooding

Coastal flooding, wave overtopping, and stormwater flooding can combine to create a threat often described as compound flooding. Compound flooding occurs when multiple flooding sources, such as storm surge, high tides, heavy rainfall, or wave overtopping happen at the same time or in close succession, increasing flood severity and extent. This type of flooding can overwhelm drainage systems and reduce the effectiveness of typical flood mitigation strategies.

The study area is highly vulnerable to all sources of flooding. However, addressing flooding caused by wave overtopping at the seawall is not within the scope of this study, and it is important to understand the sources of flooding in isolation.



Sunny-day flooding near 24 Pearl Avenue – March 10, 2024
Source: Councillor McKenna

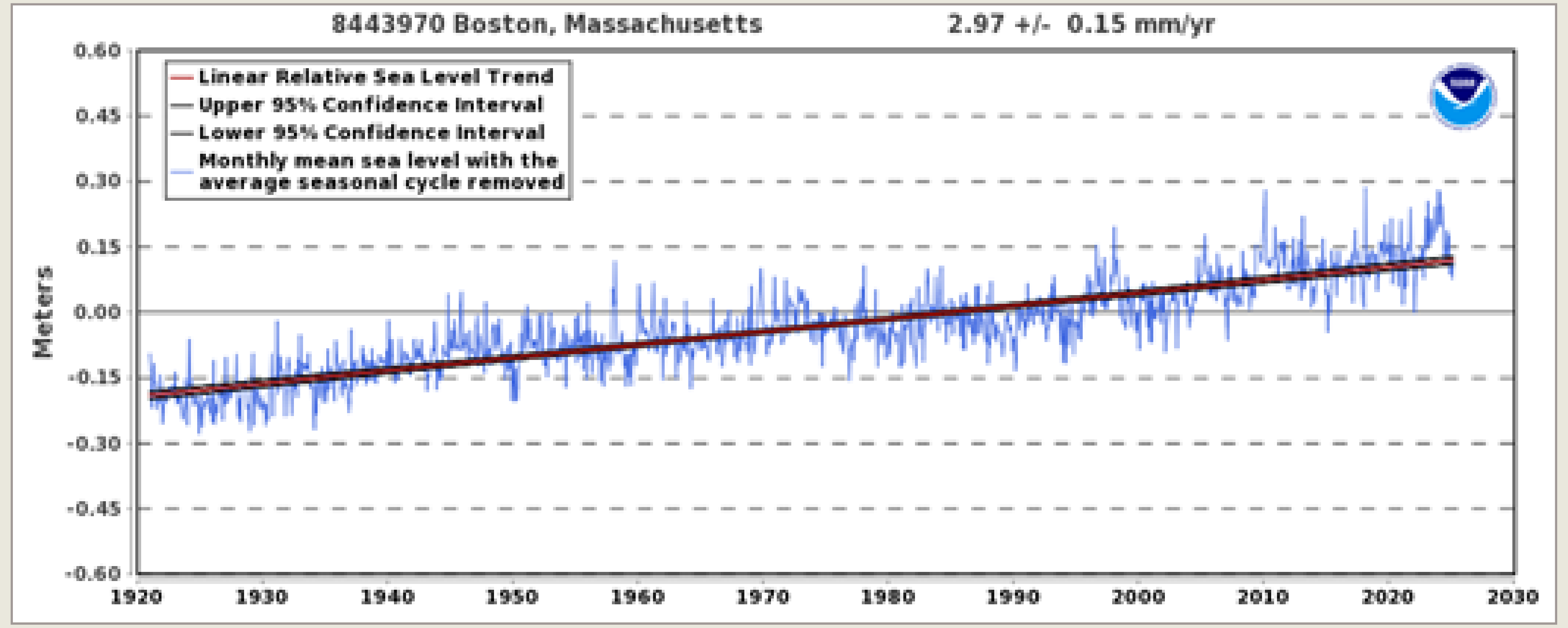
Flooding on Pearl Avenue – January 13, 2024
Source: CZM MyCoast

Sea Level Rise

The sea level is gradually rising along the Massachusetts coast. At the Boston Harbor tide gauge, the sea level, averaged over many years, has risen about 1 foot in the past century. The rate of sea level rise is also getting faster— it rose about 4 inches in 50 years from 1920 to 1970, and about 8 inches in 50 years from 1970 to 2020 (https://earth.gov/sealevel/). We can expect sea level to continue to rise in the future.

What's Not Included

The results of the Massachusetts Coast Flood Risk Model (MC-FRM) are an important source of information for understanding future flood risk on the Massachusetts coast. However, all models have limitations. MC-FRM takes into account waves, wind, storm surge, and the way water moves across different landscape types, but does not account for flooding from rising groundwater, flooding from rainfall, or changes in the land caused by erosion. This means that when stormwater systems don't function correctly or are overwhelmed, extra flooding not accounted for in the model can occur.



Relative Sea Level Trend from the Boston Harbor Tide Gauge (8443970) Boston, Massachusetts
Source: NOAA

Thanks to Beachmont's elevated topography, many homes are situated at high elevations and face a lower risk of coastal storm flooding. In addition, numerous waterfront properties are built on raised foundations, with front doors elevated several feet above ground level, further reducing flood vulnerability. However, some homes do lie within current and projected future flood zones, and even more basements fall below projected storm water surface elevations. These below-grade spaces are particularly vulnerable: floodwaters can enter through windows, doors, bulkhead entries, and compromised or porous foundations. To understand the role that flooding from Belle Isle Marsh and Broad Sound are playing in coastal flood vulnerability, an elevation-based flood pathways assessment was conducted for the study area. A flood pathway is the path that water takes on its way to impacted areas. This assessment predicts the behavior of flood water during coastal storms and high tides and does not include possible flood pathways that backflow through the existing stormwater system.

When water starts to rise in Belle Isle Marsh, it enters Beachmont through several pathways at the edge of the marsh. This is shown below. **Red arrows indicate primary flood pathways, where water first enters the neighborhood, and orange and yellow arrows indicate secondary flood pathways.**

Flood pathways near the study area

Rising waters in Belle Isle Marsh near Summer Street (October 29, 2019)
Source: CZM MyCoast

- At a water surface elevation of 6′ NAVD88, the lowest areas near the end of Summer Street begin to flood.
- When water surface elevations reach 7′ NAVD88, backyards fringing the marsh are inundated.
- At a water surface elevation of 8′ NAVD88, Pearl Ave is inundated, and access to many houses is impaired.
- The flooded area expands uniformly as water surface elevations continue to rise.
- Wave overtopping from Broad Sound contributes to flooding during storms. The degree of wave overtopping depends on a combination of wave height and water level, so it is difficult to associate this pathway with a specific water surface elevation.
- Once the water level in Broad Sound exceeds 12′ NAVD88, water flows over Winthrop Parkway even if there are no waves present. This elevation will serve as the maximum practical target for any physical interventions along the marsh's edge.
- Once water levels exceed 12′ NAVD88, Beachmont can expect to flood regardless of whether water can enter the neighborhood from Belle Isle Marsh.

What Areas are Most Affected?

One of the ***most significant flood pathways identified in this study is between 12 and 32 Pearl Avenue,*** where water from Belle Isle Marsh frequently flows into the neighborhood, causing street flooding, road closures, and vehicle damage. Additional flooding also occurs when waves overtop the seawall and Winthrop Parkway near Short Beach. However, Short Beach and Winthrop Parkway are outside the scope of this study, which is focused specifically on flooding caused by Belle Isle Marsh. Several secondary flood pathways are also present at low points near:

- **1107 Winthrop Avenue**
- **104 Summer Street to 98 Crystal Avenue**
- **126 Crystal Avenue to 139 Crystal Avenue**

Properties from 12 Pearl Street to 32 Pearl Street (January 17th, 2025)
Source: Woods Hole Group

Stories and Photos from Past Flood Events

Figure 7.—Rescue worker struggles to haul evacuation boat to the front door of this home in Revere, Mass. Note the excellent high-water mark just above the window sill level (photograph by Paul Benoit, Boston Herald American)

Coastal flooding – February 7, 1978
Source: U.S. Geological Survey

Historical photographs and local documentation of the Beachmont Neighborhood and nearby Winthrop **reveal how this community has weathered coastal hazards over the last century.**

Archival photographs from the Leslie Jones Collection at the Boston Public Library show flooded streets and storm impacts from the 1930s, including damage along Winthrop Shore Drive and the Roughans Point section of Beachmont. These photos highlight the longstanding vulnerability of these low-lying areas.

The **Blizzard of 1978** provides a more recent but equally sobering example of storm surge and flooding across Revere Beach and surrounding neighborhoods. Images of snow and ice-encased vehicles, submerged roads, and coastal erosion underscore how flooding has disrupted mobility, damaged homes, and endangered lives, challenges that persist today.

Stories and Photos from Past Flood Events

Winthrop Parkway in Winthrop, MA (1930)
Source: Boston Public Library – Leslie Jones Collection

Winthrop Parkway in Revere, MA (April 1940)
Source: Boston Public Library – Leslie Jones Collection

Storm damage in Beachmont, Revere, MA (January 29th, 1933)
Source: Boston Public Library – Leslie Jones Collection

Revere Beach after the Blizzard of 1978 (February 9, 1978)
Source: National Archives at Boston.

Winthrop Drive, in the Beachmont Section of Revere (February 7, 1978)
Source: U.S. Geological Survey.

How Bad is the Risk?

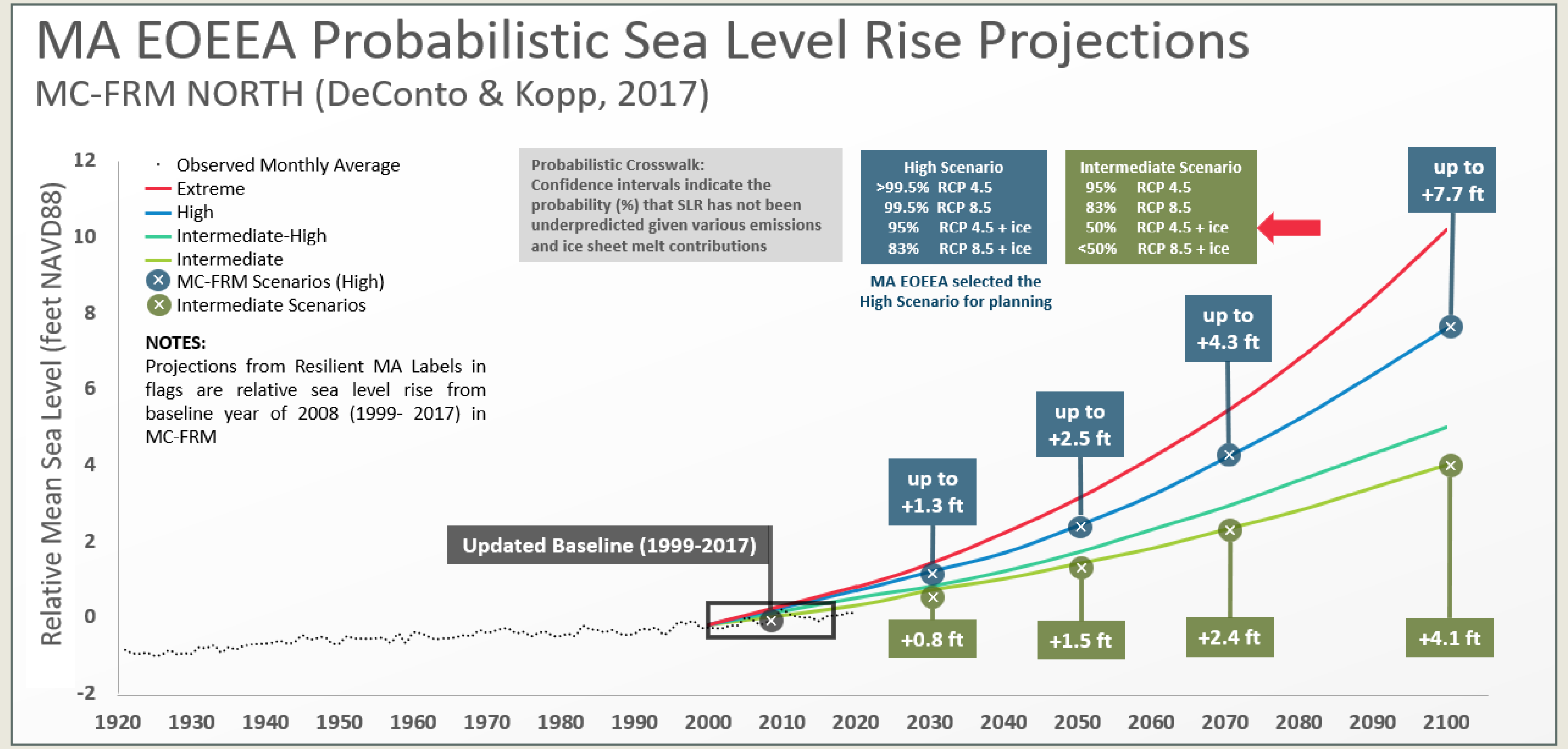
What the Data Tells Us About Future Flooding

Today vs. 2030, 2050, 2070 Flooding

Understanding Flooding: Community Realities and Clarifying Misconceptions

What the Data Tells Us About Future Flooding

Flooding in Beachmont is common during both storms and major high tides. ***Currently, it is common for low lying areas of Pearl Ave and Summer Street to flood, and less common for flood waters to enter buildings.*** This report includes a vulnerability assessment that shows the annual chance that buildings in the study area will flood in the future. This assessment utilizes data from the Massachusetts Coast Flood Risk Model, or MC-FRM, and official future Mean High Water (MHW) data that predicts how flooding could change in the future.



Sea level projections for the MC-FRM North Grid 2008 (1999-2017 epoch).

This assessment was conducted using official sea level rise and coastal flooding projections that are the state standard for climate change planning in Massachusetts. The sea level is rising, but experts use a range of projections to understand how quickly it will rise in the future. When these projections were developed several years ago, policy makers made the choice to assume that the sea level will rise very quickly in the future. They did this because it was very important to not underestimate sea level rise for large, long-term projects on critical infrastructure. We now have several more years of information about how fast sea level is rising, and can take new information into account when we interpret the data.

The blue line in the figure above shows the sea level rise projection used to develop the MC-FRM. The green lines show two other projections that seem to be closer to how things are playing out. This graph shows how the same amount of sea level rise is still expected to happen in these slower projections, but the year that it occurs changes. We use this logic to interpret the model results and plan most accurately for the future.

Today vs. 2030, 2050, 2070 Flooding

Throughout this report, you will see flooding and vulnerability results labeled “2030”, “2050”, and “2070”. Understanding that these year labels correspond to a high sea level rise scenario, we can instead read them as “as soon as 2030”, “as soon as 2050” and “as soon as 2070”. We can reasonably expect the conditions labeled 2030 to occur sometime in the years 2030-2050, the conditions labeled 2050 to occur sometime in the years 2050-2070, and the conditions labeled 2070 to occur sometime in the years 2070-2100. The way we interpret these results could continue to change as we get more updated information on how fast the sea level is rising. More details on the science and modeling used in this study are available in the Coastal Flood Risk Summary – Appendix B.

As sea levels continue to rise and coastal storms intensify, understanding how flood risk evolves is essential for long-term planning. This section compares present-day flood conditions with modeled projections for 2030, 2050, and 2070, using data from the Massachusetts Coast Flood Risk Model (MC-FRM). The data highlights how the section of the Beachmont neighborhood abutting Belle Isle Marsh is likely to become increasingly vulnerable to both storm surge and daily tidal flooding over time.

Flooding on Pearl Avenue (January 10th, 2024)
Source: NBC10 Boston

Flooding on Winthrop Parkway (Jan 10th, 2024)
Source: NBC10 Boston

Flooding on Pearl Avenue (January 10th, 2024)
Source: NBC10 Boston

Present-Day Flooding

Flooding today as mapped by FEMA places much of the study area within the “100-year storm” extent. The 100-year storm is the water level and flood extent that have a 1% chance of happening in a given year. Residential areas of Beachmont intersect with zone AE. The extents of the present-day 100-year storm area and projected flooding shown in the next section are very similar because of Beachmont’s steep hillsides as shown in the figure below. FEMA and MC-FRM modeling methods have different inputs and outputs, and this map should not be directly compared to the maps in the next section.

This May 4, 2023, virtual training, presented by the Massachusetts Office of Coastal Zone Management (CZM) and Woods Hole Group, provides an overview of the Massachusetts Coast Flood Risk Model (MC-FRM) “Level 2” or advanced model products. This training also covers comparison of the MC-FRM to other models and highlights how model products are used in the Climate Resilience Design Standards Tool.

This is the second in a series of three trainings: https://youtu.be/gjgzTHaGsKA?t=2819

FEMA Flood Insurance Rate Maps (Effective March 16, 2016)
Source: Federal Emergency Management Agency

MC-FRM Coastal Inundation Modeling

The Massachusetts Coast Flood Risk Model (MC-FRM) is a probabilistic hydrodynamic model that is used for coastal climate change planning in Massachusetts (MC-FRM FAQ, 2022). The MC-FRM considers a variety of factors such as sea level rise projections, historical and projected future hurricanes and nor'easters, elevation data, and land cover data to provide an accurate representation of future flood impacts along the state's coast.

The MC-FRM model describes coastal flooding for the years 2030, 2050, and 2070 across a range of Annual Exceedance Probabilities (AEPs). AEPs describe the chance that a certain water level will occur in any given year. For example, a 1% AEP means there's a 1 in 100 chance of that water level happening in any year, commonly referred to as the "100-year storm." Water levels with smaller AEPs are less likely to occur and correspond with more intense storms impacting wider areas, while water levels with larger AEPs are more likely to occur and correspond to more moderate storms.

The cumulative probability of a storm event occurring over a longer period is also important to consider, especially for assets intended to have long useful lifespans like buildings and roadways. As shown below, on average, over a 30-year period, which is a typical duration of a mortgage, the probability of a 1% AEP storm occurring is 26%.

Annual Chance Flood	Average Return Period	Cumulative Probability of Flooding		
		20-Year Period	30-Year Period	50-Year Period
1%	100	18.2%	26.0%	39.5%
5%	20	64.2%	79.0%	92.3%
10%	10	87.8%	96.0%	99.5%

Annual Exceedance Probability & Cumulative Probability for Coastal

Overwash Flooding on Winthrop Parkway (January 2024)
Source: CZM MyCoast

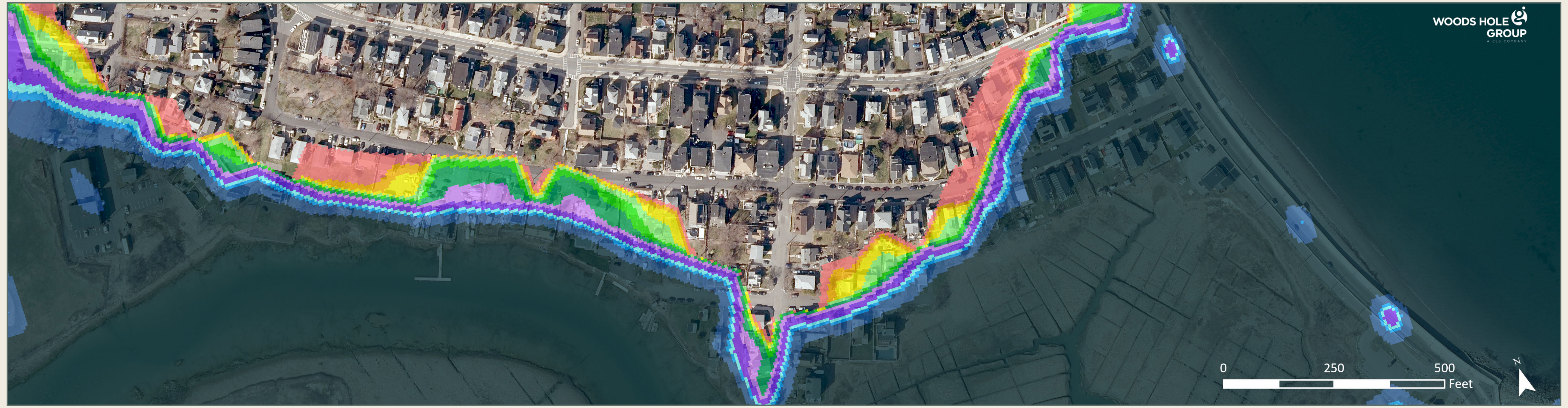
Today Vs. 2030, 2050, 2070 Flooding

It is important to note that these maps should not be used to assess the risk to individual buildings or properties. They are meant as a planning tool to identify areas that are vulnerable to flooding.

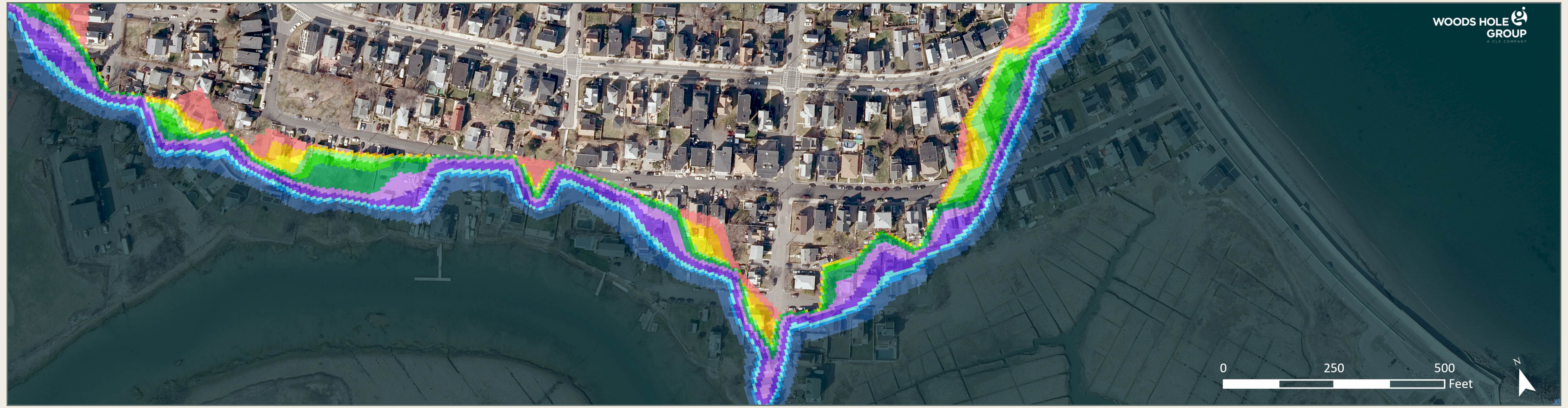
- Pink, orange, and yellow show low-probability but high-impact events, the 0.2% or 1% AEP (500-year or 100-year floods).
- Greens and purples show moderate probability events (5% to 20% AEP), which are less intense but more likely.
- Light blue and blue represent frequent flooding (25% to 50% AEP), including events that may happen every year.
- Dark blue indicates near-certain flooding (100% AEP)—areas expected to flood at least once per year under the projected sea level conditions. This includes areas that are flooded every day by high tide or all of the time.

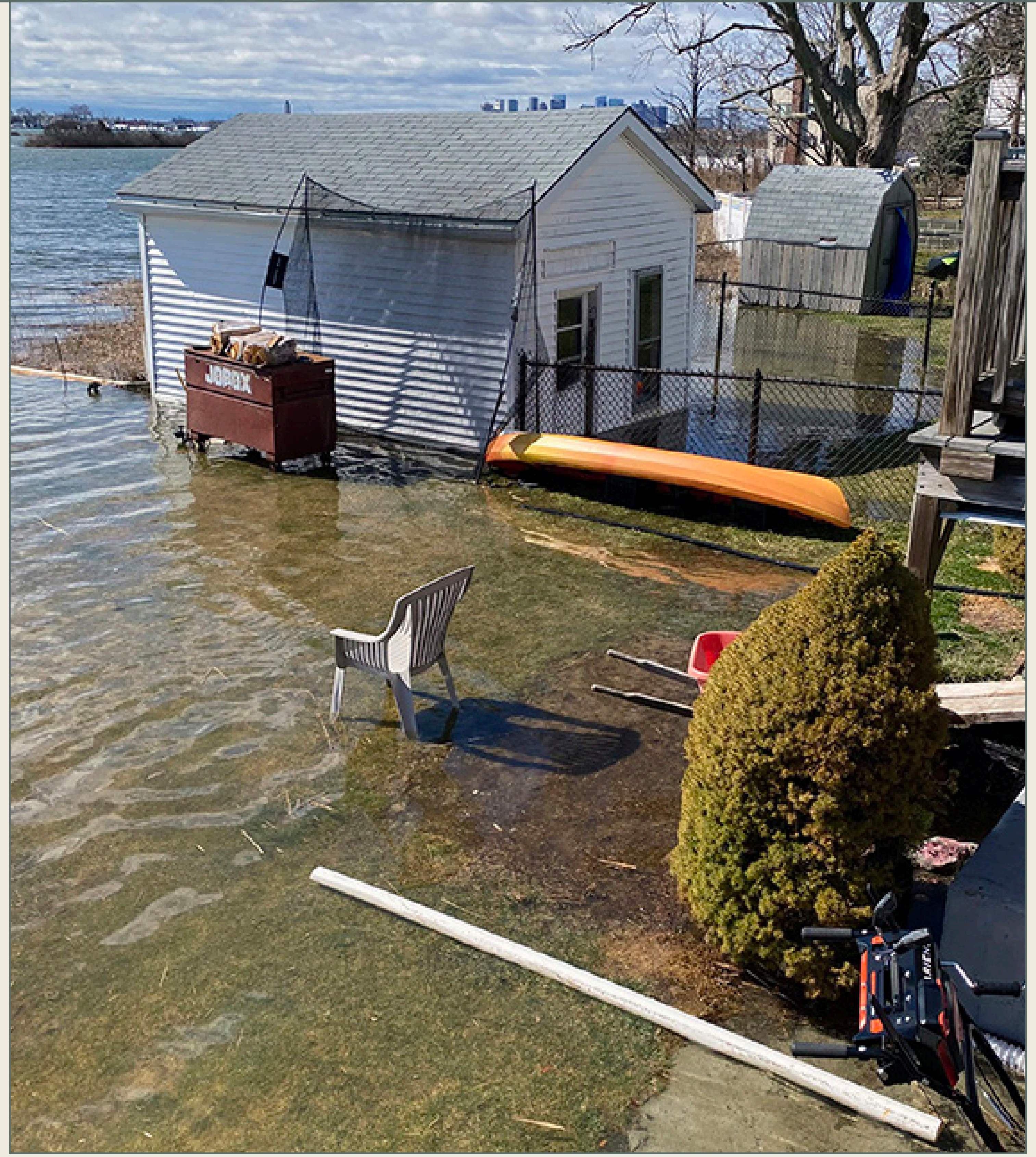
MC-FRM AEP as soon as 2030 ("High" Seal Level Rise Scenario)

MC-FRM AEP as soon as 2050 ("High" Seal Level Rise Scenario)



MC-FRM AEP as soon as 2070 ("High" Seal Level Rise Scenario)





Sunny-day flooding near 24 Pearl Avenue (March 10, 2024)
Source: Councillor McKenna

Daily Tidal Flooding

High tides occur twice each day and can pose a risk to low lying areas like Beachmont. As sea level rises, so too will the elevation of the high tides, becoming more of a nuisance to low lying areas and roadways. Flooded roads cannot provide reliable transportation corridors for residents or emergency responders, and cars parked in vulnerable areas can be damaged or destroyed. Beachmont residents are already impacted by "sunny day" flooding, so is crucial to evaluate how this threat is projected to evolve.

To determine the impact of future water levels at the project site, tidal benchmark elevations for Mean High Water (MHW) for the 2030, 2050, and 2070 planning horizons consistent with the sea level rise projections were utilized. MHW is the average of all high tides over a long period of time, and is a condition that can be expected to occur twice on most days. Based on the same sea level rise scenario used for MC-FRM modeling, the MHW elevation compared to a 2008 baseline could be:

- As much as 1.3 ft higher as soon as 2030
- As much as 2.5 ft higher as soon as 2050
- As much as 4.3 ft higher as soon as 2070

The shorelines are shown as a spectrum which helps visualize the area flooded daily for present day (2008) conditions and conditions expected as soon as 2030, 2050, and 2070. The figure on the right shows the projected MHW shorelines.

MHW shorelines for these tidal benchmark elevations were developed by Woods Hole Group and used to identify areas that may be vulnerable to daily inundation under non-storm ("sunny day") conditions for the 2030, 2050, and 2070 time horizons. These shorelines are currently in Draft form.

- ***The results show several properties fringing Belle Isle Marsh impacted by daily inundation as soon as 2050.***
- ***No basements are projected to experience MHW flooding in the 2050 time horizon due to water above ground flowing in through basement windows. However, current basement flooding related to groundwater seeping through basement walls is expected to continue and worsen. Properties at 8, 10, 12, 24, and 30 Pearl Ave could experience difficulties with access due to persistent inundation surrounding their homes as soon as 2050.***
- ***Properties at 1079 and 1089 Winthrop Ave and 126 and 129 Crystal Ave could also be difficult to access.***
- ***Foundation damage was not evaluated as part of this project, but is another possible impact of persistent inundation.***
- ***As soon as 2070, 11 properties are projected to have their lowest level (usually basement) below the MHW elevation, and a further 17 properties are projected to experience difficulties with access.***

Present Day 2030 2050 2070

Projected mean high water (MHW) shorelines for present day, as soon as 2030, 2050, and 2070 ("High" Sea Level Rise Scenario).

Understanding Flooding: Community Realities and Clarifying Misconceptions

Flooding can cause damage to homes and vehicles and disruption to routines. It can also disrupt the ability of first responders to provide lifesaving emergency services. In Beachmont, many residents have lost cars or experienced damage to their homes due to flooding during coastal storms. In some cases, cars have been totaled or rendered inoperable after being caught in rising water, leaving households without reliable transportation for work, school, or medical needs.

Many residents have also experienced less obvious but still disruptive impacts, such as managing logistics around moving cars during sunny day flooding, difficulty retaining tenants, and the long-term stress and mental health impacts of living in an area vulnerable to flooding. As flooding becomes more frequent over time, these impacts will worsen, and the neighborhood can be expected to change. When daily access to an area is cut off by rising tides, living there and maintaining services becomes very difficult.

Although most impacts of flooding have been negative, there have been some positive outcomes. ***Neighbors have already banded together to share information in group chats about when flooding is expected or beginning.*** This activity builds on Beachmont's history as a tight-knit community where many neighbors also share family ties. The challenges presented by frequent flooding have strengthened bonds between neighbors new and old. Residents have also engaged with the current study and advocated for themselves, helping to bring some relief to their community.

Flood risk is complex, and there is often no single solution that can eliminate the threat entirely. Still, the idea of a quick, one-size-fits-all fix is understandably appealing. Simple solutions feel more manageable in the face of uncertainty, disruption, and the urgency of repeated flooding. But while these so-called "silver bullets" may offer short-term reassurance, they rarely address the full scope of long-term impacts, trade-offs, or the evolving nature of coastal hazards.

As part of this planning process, community members shared a range of ideas, concerns, and questions—many of which reflect common misconceptions about how flooding works and what adaptation can realistically achieve. These reflections are entirely understandable, especially given the technical nature of resilience planning and the often complex roles of local, state, and federal agencies. The following section responds to some of these misconceptions and explains related concepts to offer greater clarity and support informed decision-making as Beachmont considers its path forward.

126 Crystal Avenue (2018)
Source: Julian

Belle Isle Marsh (January 17th, 2025)
Source: Woods Hole Group

"Dredging the marsh will reduce coastal storm flooding"

Some residents have observed sediment buildup in the Belle Isle Marsh channel near Pearl Avenue and expressed concerns that this accumulation may reduce the marsh's ability to store floodwater. However, dredging a marsh or tidal channel is not an effective solution for reducing coastal storm flooding. Coastal storm flooding, particularly during nor'easters, essentially forces the ocean to the doorstep of residents. The volume of storm surge during these events is immense and cannot be meaningfully controlled by increasing channel depth. This would be akin to asking to reduce the height of the tide by deepening a bay. In other words, dredging does not lower the height of the tide or storm surge.

It's important to distinguish between precipitation-based flooding, which results from rainfall overwhelming the drainage system, and coastal storm flooding, which originates from the ocean. The term flood storage generally applies to rainfall events, where water is retained in designated basins or detention areas. In those cases, restoring stormwater storage area may be appropriate as sediment buildup can impact drainage and reduce storage volume. However, in the case of storm surge or tidal flooding, the concept of flood storage is not applicable at a neighborhood scale. That said, the tidal creeks and channels in Belle Isle Marsh do play a critical role in moving water in and out of the area. Sedimentation may slightly reduce this conveyance during rain events, but it does not significantly hinder the marsh's ability to handle coastal storm surge.

Would a berm would prevent flooding for low-lying areas of Pearl Ave?"

A backyard berm is a vegetated earthen berm engineered to provide flood protection while maintaining open space and ecological habitat. Berms are typically gently sloped, which makes them preferable to hardened structures like seawalls or bulkheads for several reasons:

- They are better at dissipating wave energy rather than reflecting it;
- An earthen berm can support vegetation such as marsh grasses and transitional species;
- Earthen berms help to maintain habitat connectivity and visual open space.

To be effective, a berm must span the full length of a flood pathway and connect at both ends to the appropriate design flood elevation, otherwise, water may flank the barrier by flowing around it. Even a well-constructed berm will fail if there are gaps, low points, or unprotected edges in the system.

Projected mean high water (MHW) shoreline as soon as 2050

Beachmont's topography suggests that a berm could help reduce flooding along the primary flood pathway, but its potential is limited by several site-specific constraints. Currently, mean high water is projected to increasingly affect properties between 40 Pearl Ave and 1111 Winthrop Ave. By 2050, tidal flooding may regularly reach between 24 Pearl Ave and 30 Pearl Ave.

To provide maximum flood protection, a berm would need to stretch from 44 Pearl Ave to 1091 Winthrop Ave, tying into natural high points at approximately 9 feet NAVD88. This alignment would cross 12 private parcels and protect up to 16 residential structures from 10- to 50-year storm events and daily high tides through at least 2050.

Typical berm widths of 15 to 25 feet would significantly alter private yard space, limiting this option to property owners willing to accommodate such features entirely on their land.

Because the lowest point on Pearl Ave is about 7 feet NAVD88, any berm in this location could trap rainwater and floodwater from Short Beach behind it, rather than draining it away. This could result in localized flooding of yards, driveways, roads and basements. To avoid this outcome, a complex stormwater system would be required, potentially including:

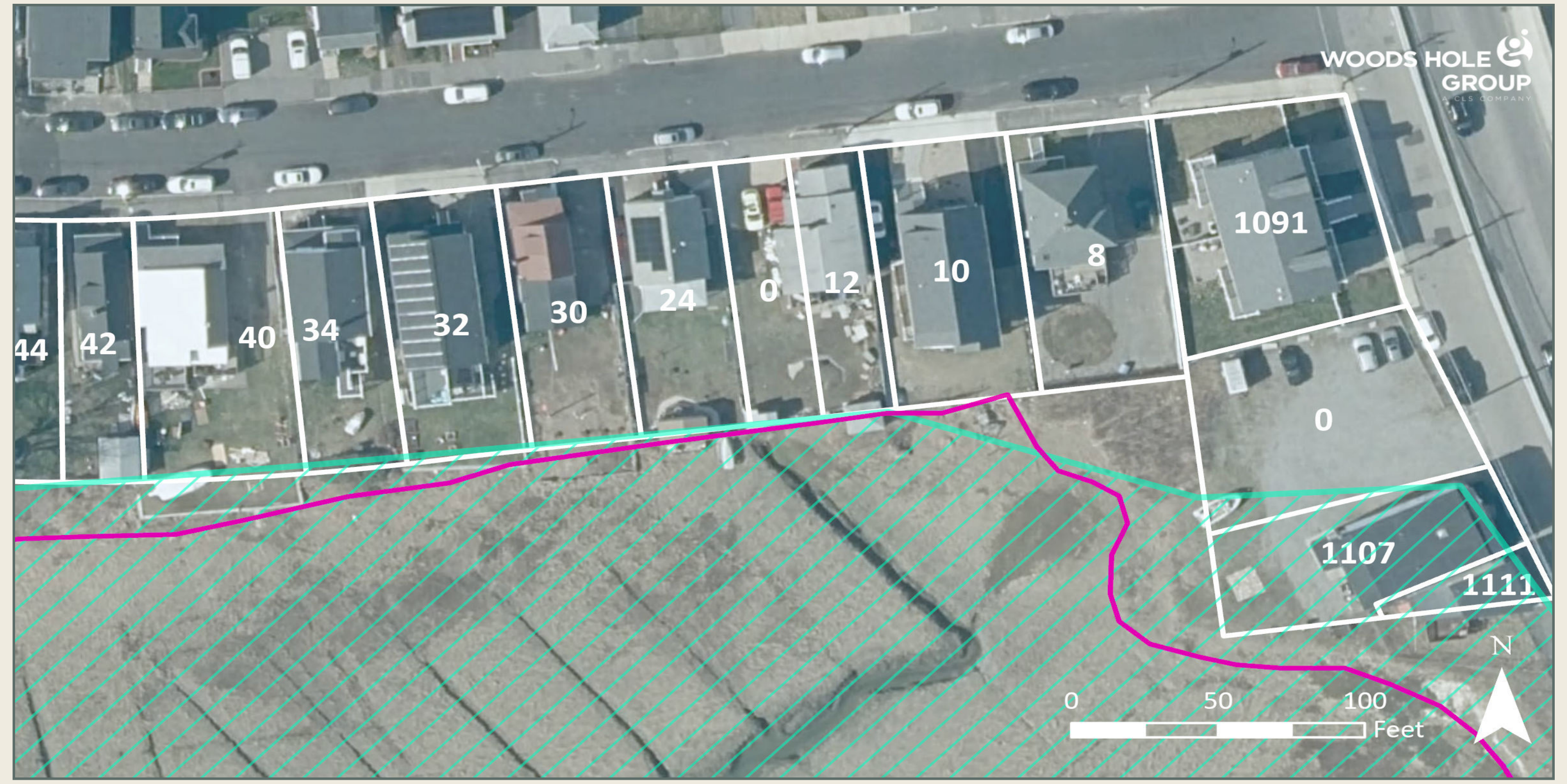
- *Underground storage tanks beneath higher ground on Pearl Ave;*
- *Discharge pipes;*
- *A pump system to move water into the nearby marsh system.*

Additionally, wave overtopping from Winthrop Parkway is another source of floodwater. Managing this would require substantial engineering solutions, such as raising or reinforcing the existing seawall—a task likely to require state or federal involvement.

An earthen berm built to 9 feet NAVD88 and extending approximately 460 linear feet is estimated to cost: $1,000 per linear foot, plus 40% contingency, for a total of $644,000 for the berm structure alone. However, if geotechnical or coastal studies require the addition of subsurface support structures, costs would increase. Assuming a stormwater storage chamber is necessary, the stormwater system (with contingency) is projected to cost between $2.8 million and $4.2 million. This brings the total estimated cost to about $4.7 million, excluding: engineering and design, permitting, mobilization and demobilization, and long-term maintenance.

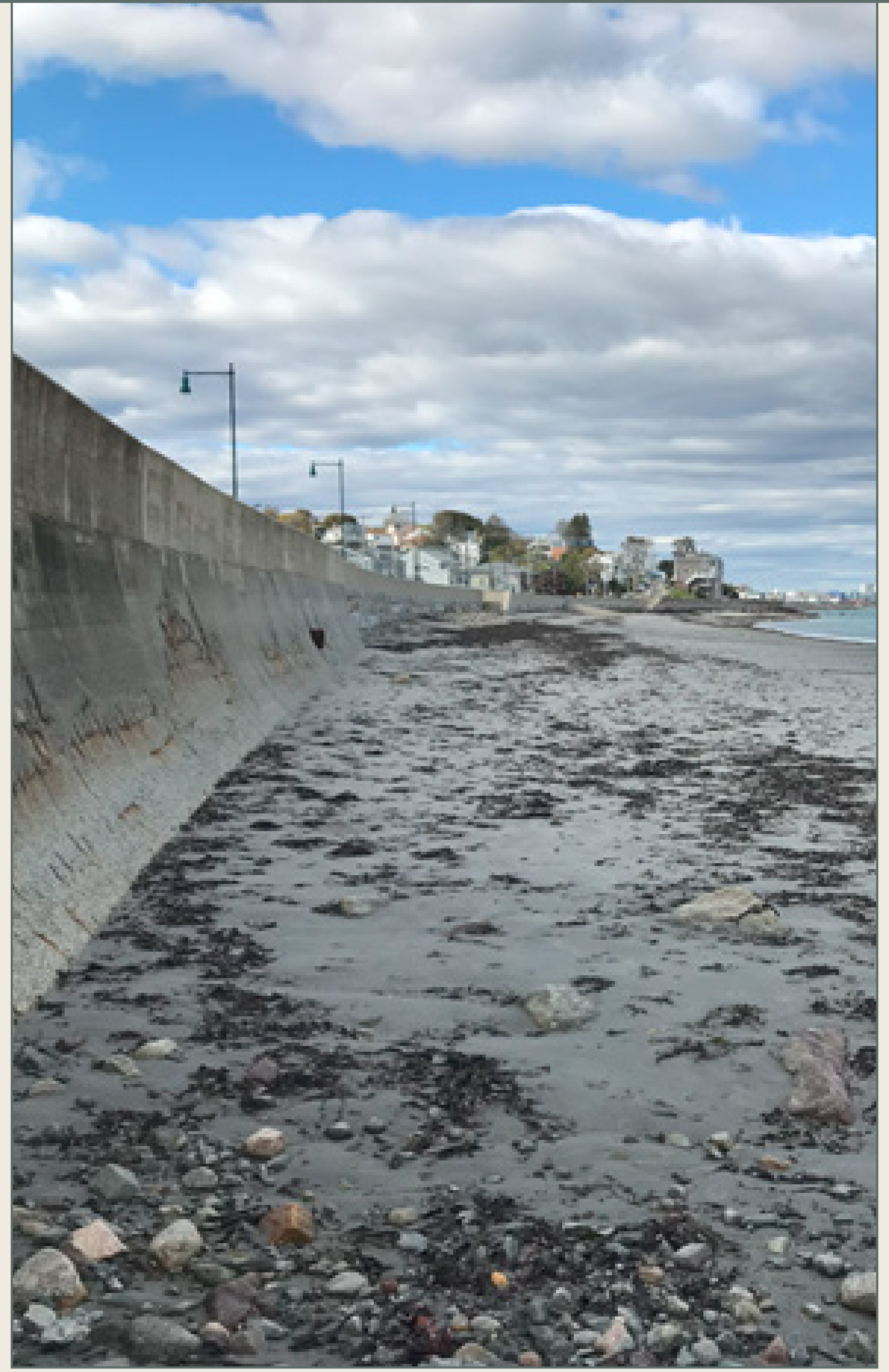
Since the project would primarily benefit private properties, it would likely require private funding. State funding for shoreline protection is typically directed toward projects that provide clear public benefits, such as protecting municipal infrastructure or public lands.

Lastly, while filling within Land Subject to Coastal Storm Flowage (LSCSF) also faces regulatory hurdles, the primary reason the berm concept was only explored within the boundaries of private parcels, in the backyards of marsh-adjacent homes, is that the land immediately seaward of these properties is protected salt marsh, making any encroachment into this area a non-starter. Filling salt marsh is prohibited because it degrades habitat and impairs critical ecosystem services. Belle Isle Marsh is designated as both an Outstanding Resource Water and an Area of Critical Environmental Concern (ACEC), imposing strict protections that make constructing flood barriers in the marsh effectively infeasible.



Area of Critical Environmental Concern (ACEC)

Outstanding Resource Water



Short Beach - Photo facing North

"Can a seawall can protect the Beachmont Neighborhood?"

Seawalls are a type of hard coastal engineering structure (usually concrete, stone, or steel) designed to hold back the ocean and protect the land behind them. Unlike "soft" solutions, such as dunes or vegetated earthen berms, which work in harmony with nature, hard engineering structures like seawalls are built to resist and block natural forces, including waves and tides. You'll see seawalls along places like Winthrop Parkway, which was built to prevent flooding and wave damage during coastal storms. Seawalls can be very effective in the short term. They create a physical wall that blocks waves from reaching roads, homes, and other infrastructure. During storms, they're designed to withstand the full force of crashing waves, sometimes referred to as wave loading, and keep the water out. For properties right behind a seawall, this can provide some peace of mind. However, since seawalls are rigid and reflective, they don't absorb wave energy, they bounce it back. This has serious side effects:

- When waves hit a seawall, the energy doesn't disappear, it bounces back. This bouncing motion pushes water downward and sideways, pulling sand away from the base of the wall. Imagine digging a hole at the edge of a sandbox, the more you push, the more the edges collapse. Over time, this process (called scour) eats away at the beach in front of the wall, making it lower and narrower.
- With less sand in front to break the waves. Waves then hit the wall with more force, and are more likely to splash or pour over the top. This "wave overtopping" can flood roads and yards behind the seawall, even if the wall itself isn't breached.
- Seawalls block water from the ocean, but they also trap water behind them. Rain, stormwater, or ocean water that overtops the wall can't easily drain back out. Without pumps or drainage systems, this water pools inland, causing flooding that the seawall was supposed to prevent.
- Seawalls protect the area directly behind them, but they can exacerbate issues in neighboring areas. The energy and water deflected by the wall can erode beaches.

A seawall is not an appropriate option for the coastline seaward of Pearl Avenue, as it would present significant regulatory challenges, disrupt natural coastal processes, and could lead to unintended consequences such as increased erosion on adjacent properties. In locations with high ecological value, softer, nature-based approaches are generally more appropriate.

"Would a flood barrier at Belle Isle Inlet help stop to flooding?"

As sea levels rise and flooding becomes more common, some have asked whether it would be possible to install a tide gate or storm surge barrier at the mouth of Belle Isle Inlet to block water from entering the marsh during storms. While this sounds like a straightforward solution, it's actually much more complicated and unlikely to be effective in the long run. Belle Isle Marsh is surrounded by water on nearly all sides. Even if a barrier blocked water from coming in through Boston Harbor, floodwater could still reach the marsh in several other ways:

- ***Over Winthrop Parkway*** – This is already happening today during storms
- ***Over south Revere Beach and Eliot Circle*** – Flooding could enter the marsh via old creek paths
- ***Through Suffolk Downs*** – Built on filled land, this area is low and at risk as sea levels rise

In the past, water from Chelsea Creek flowed through a channel (Sales Creek) into the marsh. That pathway still exists underground. As flooding increases, it's very likely that water will return to these old routes, bypassing any single barrier. Salt marshes like Belle Isle depend on the natural in-and-out flow of tides to stay healthy. Blocking that flow can: damage salt marsh plants and wildlife, harm fish and birds that rely on the marsh, cause fresh rainwater to get trapped and change the habitat, and reduce the marsh's ability to store stormwater. To avoid these problems, a barrier would need to be carefully designed to allow tides to flow in and out while draining rainwater yet still blocking storm surge. This would require a complex and expensive system with pumps, gates, and ongoing maintenance.

In the 1990s, the U.S. Army Corps of Engineers studied a similar barrier for the Saugus River inlet between Revere and Lynn. That project was estimated to cost $231 million in today's (2025) dollars and would have protected thousands of acres of development. In contrast, the Belle Isle Marsh area is much smaller, just a few hundred acres, and is still vulnerable to other flooding sources, even with a barrier. Despite a favorable cost-benefit estimate, the Saugus River project was ultimately stopped due to environmental concerns. A storm surge barrier at Belle Isle Marsh would be: ineffective unless all other flood pathways are also addressed, environmentally risky to the health of the salt marsh, and very expensive to design, build, and maintain.

Belle Isle Inlet and surrounding floodwater entry points

Ideas for Taking Action

What is Coastal Resilience?

As the Beachmont neighborhood faces increasing exposure to coastal flooding, storm surge, sea level rise, in addition to the on-going issues of stormwater and groundwater flooding. It is critical for the community to invest in strategies that build long-term coastal resilience. Coastal resilience can be framed as preparedness and risk reduction, and the National Oceanic and Atmospheric Administration (NOAA) defines resilience as:

"The ability to adapt to changing conditions and withstand—and rapidly recover from—disruption due to emergencies."

Resilience planning and adaptation involves considering the natural and built environment and often consists of a combination of infrastructure improvements, land use planning, ecosystem restoration, and community emergency response improvements to reduce vulnerability to coastal hazards.

Adaptation strategies can be used alone; in other situations, a combination of approaches may be most appropriate. Most adaptation strategies fall into one or more of the following categories, and these may evolve or shift over time as conditions, priorities, or resources change. The categories include avoid, accommodate, protect and retreat as shown on the figure on the right.

Coastal resilience adaptation strategies

What is Coastal Resilience?

Adaptation Strategy	Definition	Example
Avoid	Avoidance means **steering new development away** from areas that are, or will become, high risk for flooding due to sea level rise and storms. This includes zoning rules or planning decisions that prevent new buildings or roads in vulnerable areas.	The City of Revere could limit development near the edge of Belle Isle Marsh, an approach already supported by the City's Floodplain Overlay District, which guides land use and site planning in flood-prone areas by requiring flood-resistant construction standards, minimizing fill, and ensuring that projects do not increase flood risks elsewhere.
Accommodate	Accommodation means staying in areas that may flood but **making changes to reduce the impacts from flooding** when it happens. This could include raising roads, using flood-resistant building materials, or making sure people know how to respond during a storm.	For example, raising homes above flood level so water can pass underneath without damaging living spaces or elevating utilities such as electrical panels, hot water heaters, and HVAC systems to keep them safe from flooding.
Protect	**Protection is about creating barriers to shield** people and property from floods. However, in low-lying coastal neighborhoods like Beachmont, this strategy has limits, especially as sea levels rise and storms become more intense. Hardened physical defenses like seawalls can reduce flooding in the short term, but they may not fully prevent water from reaching homes during major events.	For example, the seawall along Short Beach provides some level of protection as helps buffer the neighborhood from storm surge, but water can still overtop Winthrop Parkway during storm events leading to interior flooding.
Retreat	Retreat means moving homes, roads, or other infrastructure **away from areas that flood too often** and can't be reliably protected. In places like Beachmont, it may not always be possible or affordable to keep building up defenses, especially as flooding worsens over time.	For example, voluntary buyout programs can help homeowners relocate from flood-prone properties, allowing the land to be turned into open space or wetlands that absorb water and reduce flooding.

This section outlines a range of potential adaptation strategies that the City of Revere and the Beachmont neighborhood may consider to reduce coastal flood risk and enhance long-term resilience. These strategies are conceptual and would require additional engineering, design, and community input prior to implementation. As climate conditions evolve and new data becomes available, it will be important for the City to regularly reassess flood risk, monitor the effectiveness of implemented measures, and adjust the approach accordingly to ensure that adaptation efforts remain effective.

Certain adaptation strategies were excluded from consideration in this study because they are not appropriate for the specific physical and environmental conditions in Beachmont. Additionally, although some adaptation strategies have been successfully implemented in other states or countries, they may not be permitted under current Massachusetts regulations and policies. As a result, the recommendations focus on strategies that are potentially, though not guaranteed to be, permittable and reasonably suited to the site's characteristics.

What Can Be Done Now (Near-Term Solutions)

While long-term planning for the study area is essential, there is an immediate need for actionable adaptation alternatives that can be deployed now to reduce flood impacts. The Beachmont neighborhood faces frequent flooding from high tides, rain events, and storm surge, which already disrupts daily life, damages infrastructure, and strains municipal services. ***Many residents are already experiencing the cumulative toll of repeated flooding, affecting property values, insurance costs, and their ability to access homes and roads safely.***

Near-term actions are essential for addressing existing vulnerabilities, building trust with the community, and making measurable improvements in the short term. These efforts will not eliminate flood risk entirely, and there is no single solution that will fully protect Beachmont. However, taking action now, through both municipal initiatives and individual homeowner actions, can reduce harm, improve preparedness, and support long-term resilience as state and local adaptation tools continue to develop.

Cost estimates for adaptation strategies were also developed as a part of this study. The cost estimates provided here are based on FEMA guidance, industry-standard assumptions, and professional judgment. These are intended as planning-level cost estimates to give a general sense of potential costs, not as detailed, site-specific engineering figures. Their primary purpose is to support comparison between different adaptation options rather than to define exact implementation costs.

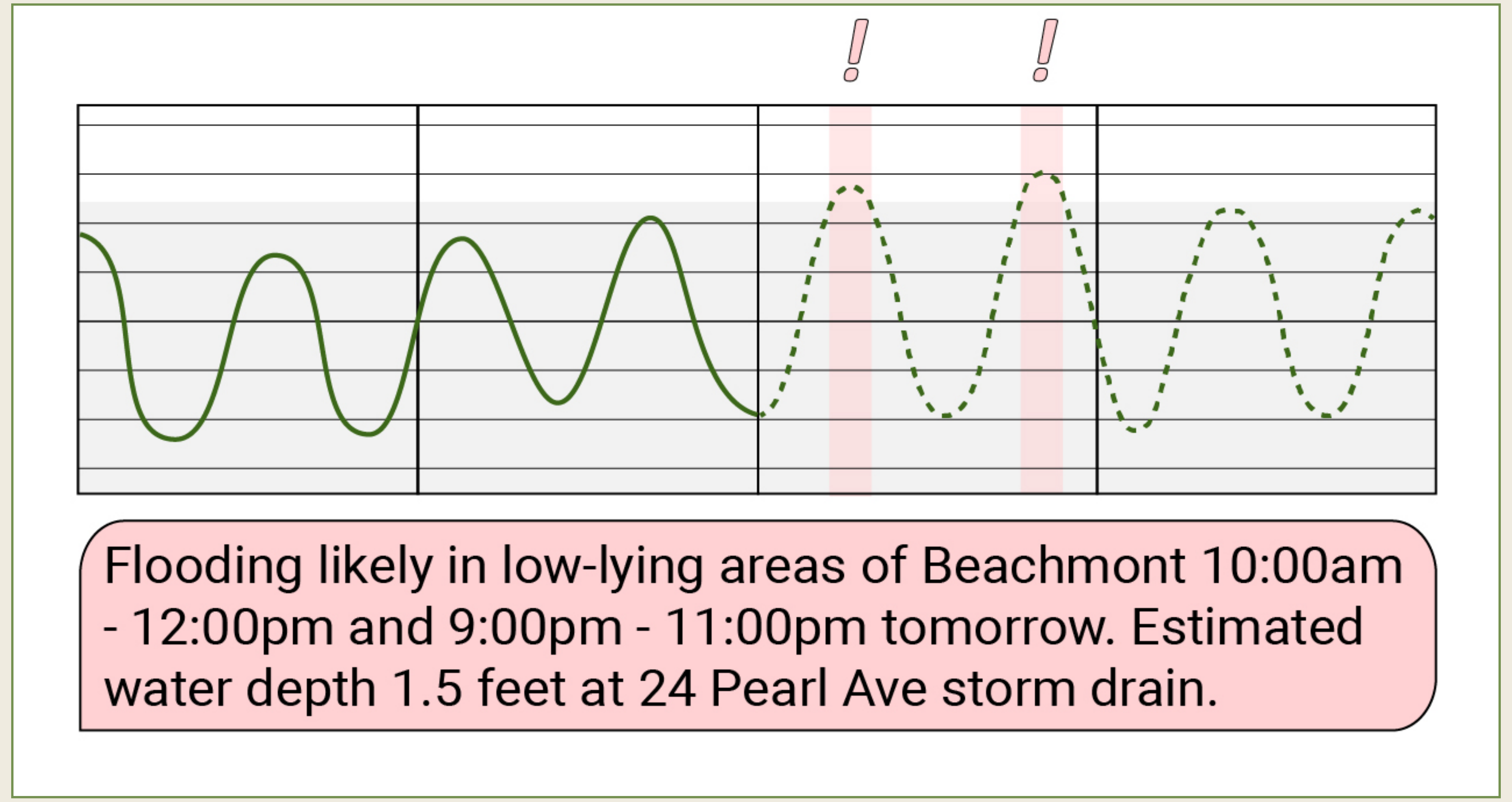
Potential Near-Term Municipal Actions

Belle Isle Marsh Flood Warning System

Purpose: Develop a community flood alert system for neighborhoods abutting Belle Isle Marsh, including Beachmont. This early warning tool would help residents respond to increasing sunny-day flooding, which can make roads impassable and damage parked vehicles. The system would use sensor data, predictive modeling, and outreach to inform residents, municipal staff, and emergency responders in real time. While this does not stop flooding, it improves preparedness and supports proactive decision-making—helping shift the community from reactive to informed and responsive flood risk management.

Details:

- Procure and install two Hohonu flood sensors in Belle Isle Marsh to collect real-time data on water levels and inundation.
- Develop a hindcast model using 20 years of tide data to support model calibration and identify flood patterns.
- Build a 48-hour operational flood forecasting tool based on locally defined elevation thresholds and inundation triggers.
- Integrate forecasting outputs into a user-friendly public web page displaying current conditions and warnings.
- Document sunny-day (nuisance) flooding events and correlate them with model predictions and sensor data.
- Conduct targeted stakeholder meetings with municipal departments and emergency responders to gather input on system needs and integration.
- Facilitate public engagement through community workshops to review flood risk, gather feedback on alert preferences, and explore future system applications.



Example of Early Flood warning output

Feasibility: High – the project involves proven technology, minimal infrastructure, and strong alignment with available funding and municipal capacity.

Estimated Cost: $75,000 – $150,000

Responsibility: City of Revere, North Suffolk Office of Resilience and Sustainability

Designate Full-Time Resident-Only Parking along the Streets in Study Area

Purpose: To provide safer, more reliable parking access for Beachmont residents, particularly those vulnerable to flooding, by reducing non-resident parking and reserving curb space along higher-elevation roadways. Streets located along the neighborhood's "high spine" (such as the western end of Crescent and Pearl Ave) offer critical refuge during tidal and storm-related flooding. Designating these streets as resident-only access will help ensure nearby households can park safely during flood conditions. This change will also support Department of Public Works' crews and the City's first responders, who are frequently called to assist with vehicle relocations and emergency evacuations during flood events. Reducing congestion and non-local vehicles in these areas improves operational efficiency and public safety response time.

Details:

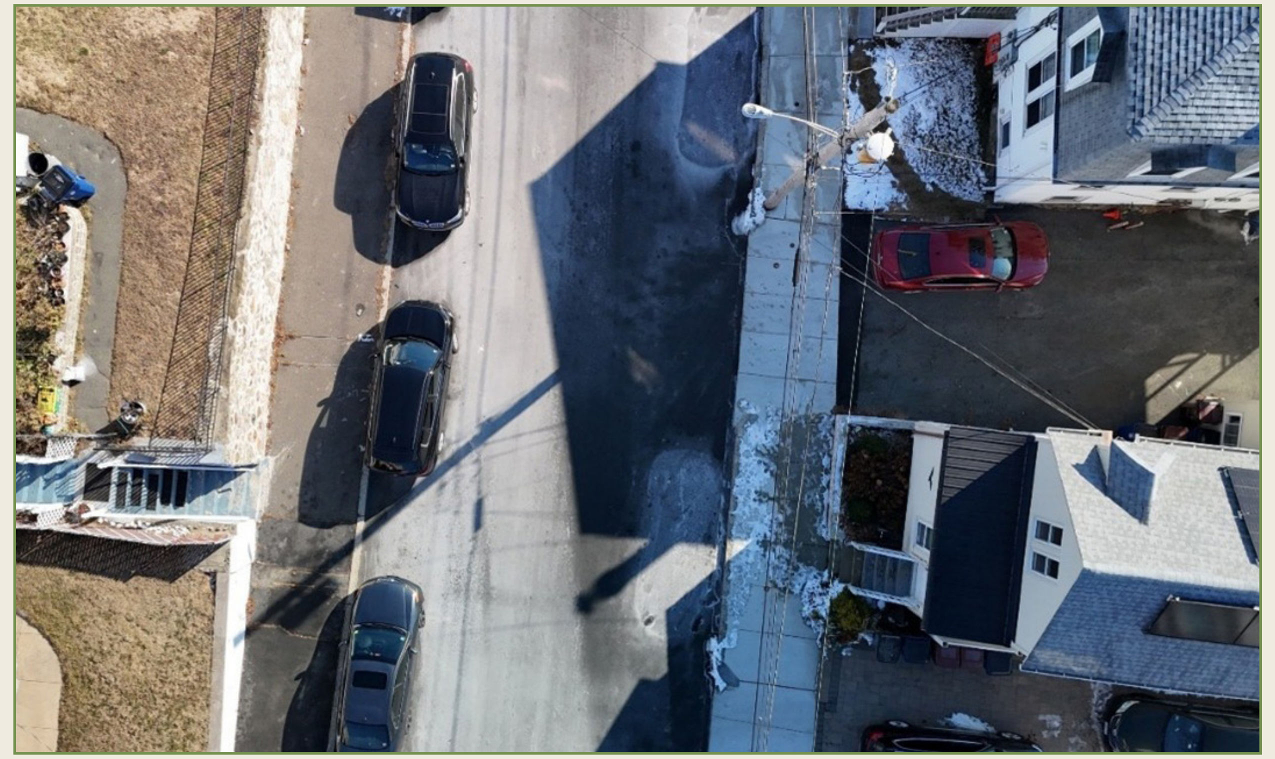
- Designate select streets in Beachmont—especially higher-elevation corridors like Crescent Ave, Pearl Ave, and Summer Street, as Resident-Only Access at all times to prioritize limit non-resident congestion.
- Align enforcement with current regulations (24-hour zones).
- Install permanent signage and street markings at neighborhood entry points to clearly communicate the resident-only policy.
- Coordinate with Revere Police and Parking Enforcement for routine monitoring and compliance through patrols and ticketing.
- Launch a community outreach campaign to inform residents of new parking access rules and gather input on street selection and signage placement.

Feasibility: High – This strategy builds on existing enforcement mechanisms (e.g., 24-hour resident zones), and requires minimal physical infrastructure. Key feasibility considerations include support from the community, clear communication, and consistent enforcement.

Estimated Cost: $1000 – $2,000 per street for parking signs; implementation depends on available staff time

Responsibility: City of Revere Parking Clerk, City of Revere Police Department

Potential Parking Only streets in the study area



Cars parked along the high spine of Pearl Avenue

Stormwater Infrastructure and Maintenance

Purpose: Stormwater is generally water that originates from precipitation and is conveyed across the ground surface in a variety of ways. Stormwater recharges groundwater (increasing the level) or can be stored in ponds or create surface flooding. In urban locations with plentiful impervious areas, stormwater is not able to absorb into the ground, and as such can contribute to surface runoff, flooding, and pollution hazards. To deal with stormwater runoff, communities adopt a variety of strategies including catch basins and piped infrastructure, detention ponds, outfalls to surrounding water bodies, etc. Discharge of stormwater is one concern, while backflow of tidal waters up and out of the stormwater system is another. Stormwater flooding is recognized as a significant issue for residents and drivers, particularly at the eastern end of Pearl Ave. Improvements to and maintenance of stormwater infrastructure are critical to reducing precipitation-based flooding.

Details:

- Existing catch basins should be maintained regularly. This entails clearing out sediment and debris which accumulate within the system on at least an annual basis.
- Stormwater discharge pipes can be retrofitted with check valves (e.g., duckbill check valves) which eliminate potential backflow when high tides or storm tides exceed the elevation of the inland catch basin, creating a negative pressure and flooding of a roadway through the piped connection. Slop on duckbill check valves are currently used in the Town of Winthrop along Shirley St, and can cost up to $1,000 per unit.
- The Revere Department of Public Works currently responds to the approximately 60,000 person city as best it can. However, the capacity for maintenance of every catch basin and emergency response to flooding which often coincide at multiple locations at once, is limited. Increasing the capacity and funds of Revere DPW with the intention of improving stormwater infrastructure installation and maintenance will improve conditions for Beachmont.
- A comprehensive understanding of stormwater flows, systems, and flooding in the neighborhood requires a complex analyses. DCR is currently developing a stormwater model of the neighborhood as a part of their Winthrop Parkway and Roughan's Point study, which may be leveraged to inform the abutter's of Belle Isle Marsh.

Feasibility: Moderate – Improving stormwater infrastructure is highly feasible from a technical standpoint but depends heavily on increasing staffing, funding, and equipment capacity within the City of Revere's Department of Public Works.

Estimated Cost: 165,000–$175,000 per year, includes catch basin cleaning and an added staff position excludes equipment purchases

Responsibility: Revere Department of Public Works

Raise Electrical System Components and Utilities Above Flood Level

Purpose: Raising your home's utilities, such as electrical panels, heating and cooling systems, fuel tanks, and major appliances, above the flood level helps reudce the potential for damage. Elevation reduces the risk of electrical fires, speeds up post-storm cleanup, and makes it safer and easier to return home after a flood. It can also reduce long-term repair costs, lower your flood insurance premiums, and decrease dependence on emergency electrical services after a major event.

Details:

- Work with a licensed electrician or contractor to elevate utilities above the Design Flood Elevation (DFE), which in Beachmont is the FEMA Base Flood Elevation plus two feet of freeboard.
- Plan for exterior platforms or utility racks to elevate equipment like air conditioning units, electrical panels, or hot water heaters.
  - If your home doesn't have enough space inside to move these utilities above flood level, installing them on exterior platforms can be a safe and effective solution.
  - These racks are typically built just above base flood elevation and anchored to the structure. This approach has been used successfully in densely built communities like Quincy, where space is limited but flood risk is high.
  - Be sure to work with a licensed contractor and confirm that the design meets local building codes and zoning requirements.
- Upgrade your systems through Mass Save. While Mass Save does not cover the cost of elevating utilities purely for flood mitigation it could cover this cost if combined with an energy efficiency upgrade.
- If you're replacing HVAC equipment, hot water heaters, or your electrical panel during an elevation, you may qualify for:
  - Rebates on high-efficiency systems
  - 0% interest HEAT Loans of up to $50,000 (May include electrical panel upgrades and HVAC replacements)
  - No-cost Home Energy Assessments to identify eligible upgrades and help you apply

Feasibility: Moderate – The main barriers are upfront cost, contractor availability, and physical space limitations, particularly for homes on small lots or with narrow side yards. However, homeowners may be able to request a setback exemption from the City to allow installation of elevated utility platforms in locations that would otherwise encroach on zoning setbacks.

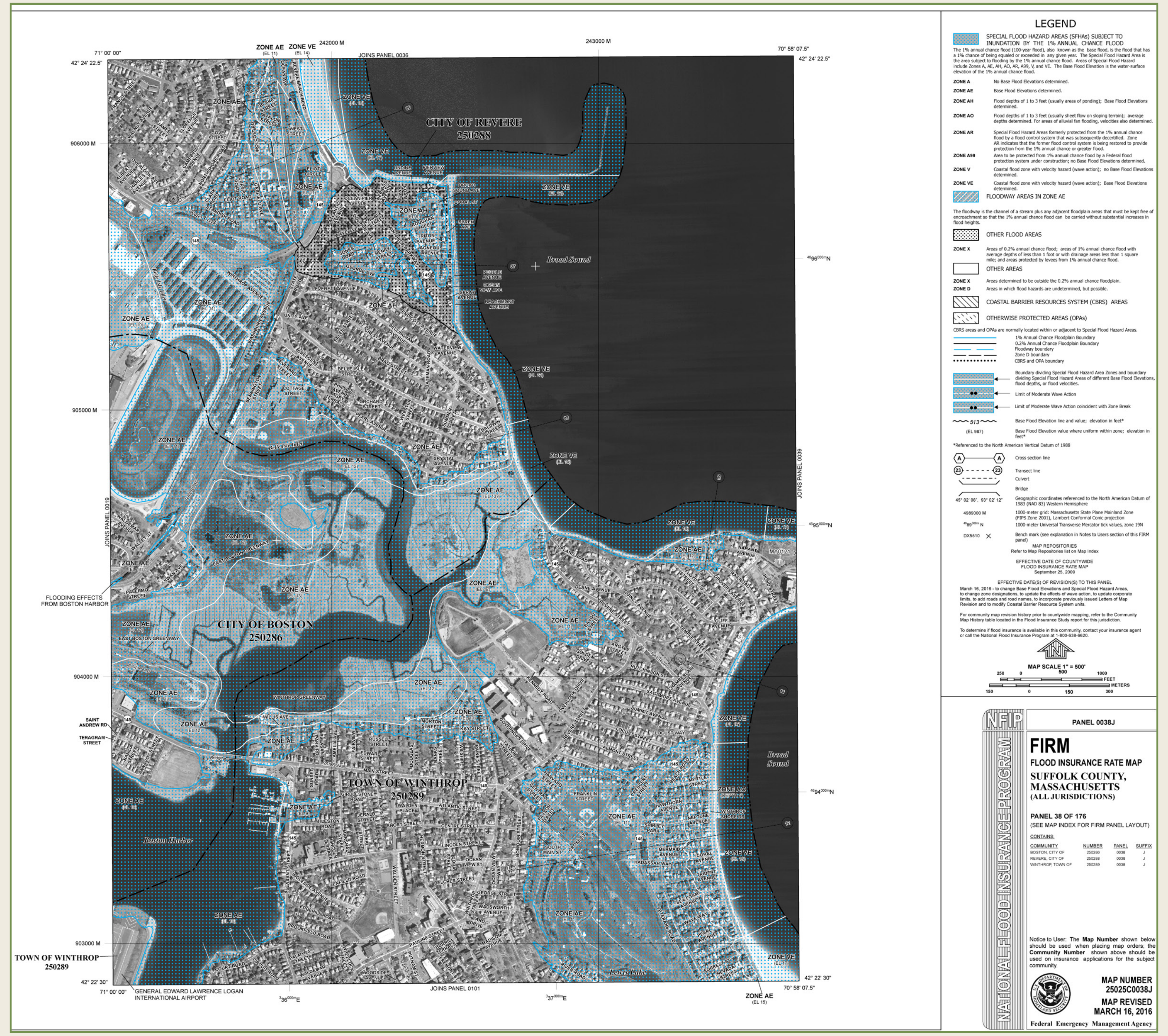
Estimated Cost: $3,000 - $10,000 per property

Responsibility: Homeowners are responsible for elevating utilities on their property. For questions about building code requirements or permitting, homeowners can contact the City of Revere Building Department, or the Conservation Commission for more information about permitting requirements.

Utility room constructed on an upper level
Source: City of Quincy Department of Planning & Community Development

Purchase Flood Insurance to Protect Your Property

Purpose: Buying flood insurance is one of the most important steps you can take to protect your home and its contents. Without flood insurance, you may be left to cover thousands of dollars in repairs on your own. Flood insurance helps ensure a faster recovery and greater financial security after a flood event.



FEMA FIRM panel
Source: FEMA

Details:

- Purchase a flood insurance policy through the National Flood Insurance Program (NFIP) or private insurance, even if you are not required to by your mortgage lender.
- Know your coverage options, policies are available for homeowners, renters, and condo owners. Renters can insure contents even if they don't own the building.
- Talk to a local insurance agent or visit https://www.floodsmart.gov/ to estimate your premium and learn what's covered.
- Understand that most homeowners insurance policies do not cover flood damage, you need a separate flood policy.

Feasibility: Moderate – Flood insurance is available to Beachmont homeowners and renters through the National Flood Insurance Program (NFIP). Many residents are unaware they're at risk, find premiums unaffordable, or assume disaster aid will cover all losses.

Estimated Cost: $1,000 - $2,000 per property

Responsibility: Homeowners, with technical support from the City of Revere or North Suffolk Office of Resilience and Sustainability (NSORS)

Wet Floodproofing – Installing Flood Vents

Purpose: To reduce structural damage during flooding by allowing water to safely flow in and out of enclosed areas like crawl spaces or basements. This technique, known as wet floodproofing, is often more appropriate for residential homes, especially older, wood-frame buildings, than dry floodproofing systems that rely on sealing out water. Flood vents help equalize water pressure during flooding and reduce the risk of structural collapse. Unlike dry floodproofing, buildings can be occupied, and vents remain in place permanently, requiring little to no deployment effort.

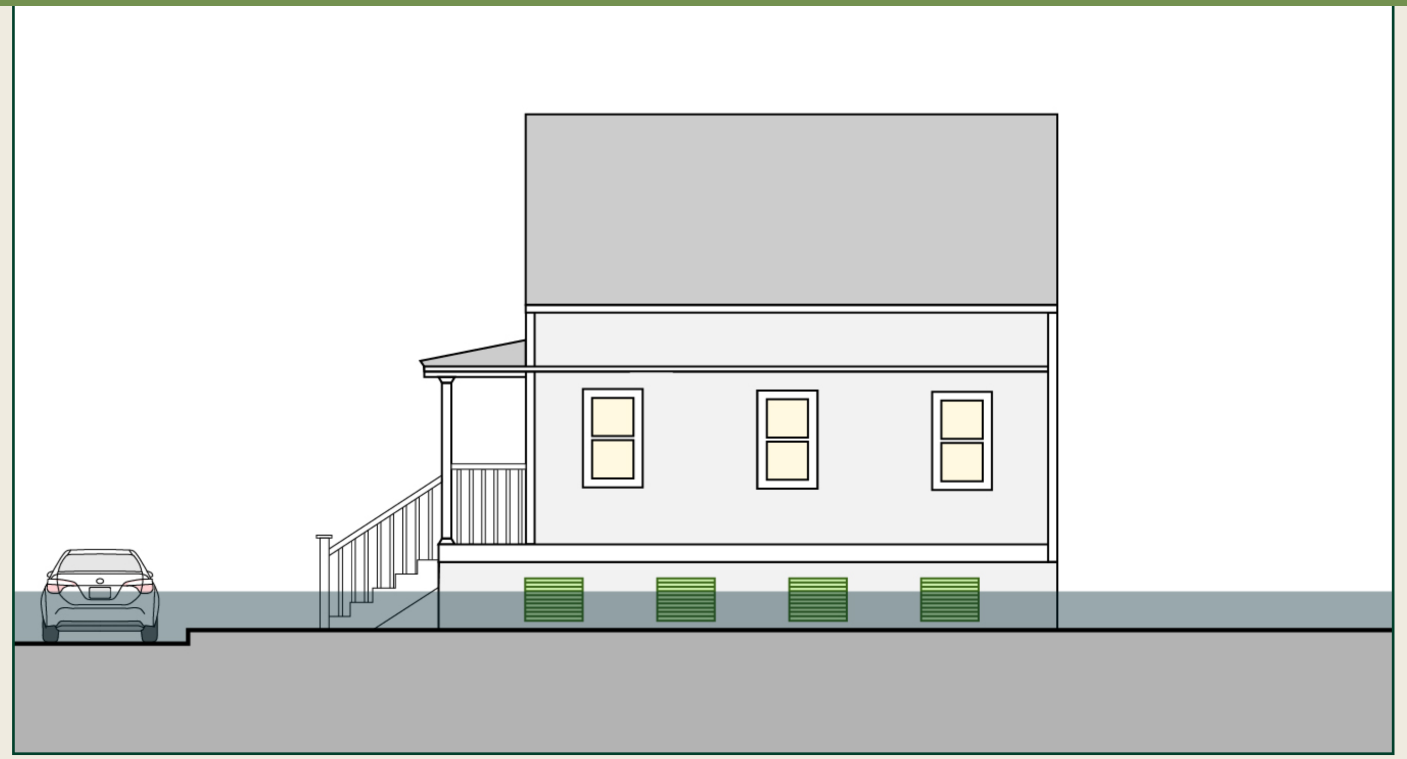
Details:

- Install permanent, FEMA-compliant flood vents below the base flood elevation to allow water to pass through safely during flooding.
- Incorporate flood vents into renovation or utility elevation projects to reduce long-term risk and possibly lower flood insurance premiums.

Feasibility: Moderate – Flood vents are widely available. Offers consistent flood risk reduction with little maintenance and there is no deployment necessary.

Estimated Cost: $1,000 – $5,000 per property, depending on number of vents, wall type, and installation needs.

Responsibility: Homeowners are responsible for installing flood vents. For questions about building code requirements, homeowners can contact the City of Revere Building Department



Side view of an example home with flood vents installed

Flood vent example
Source: Floodproofing.com, Inc.

Basement Infilling

Purpose: Basements are typically the first indoor area to flood residents in Beachmont. Water entering basements can come from many sources, including rainfall, groundwater, and coastal storm surge. The entry point of flooding is critical and may or may not be feasibly addressed at this point (i.e., doorway, window). If the source cannot be addressed effectively, basement flooding may be an reality on a regular or even permanent basis. As a result, abandonment of the basement through removing the basement may be preferable.

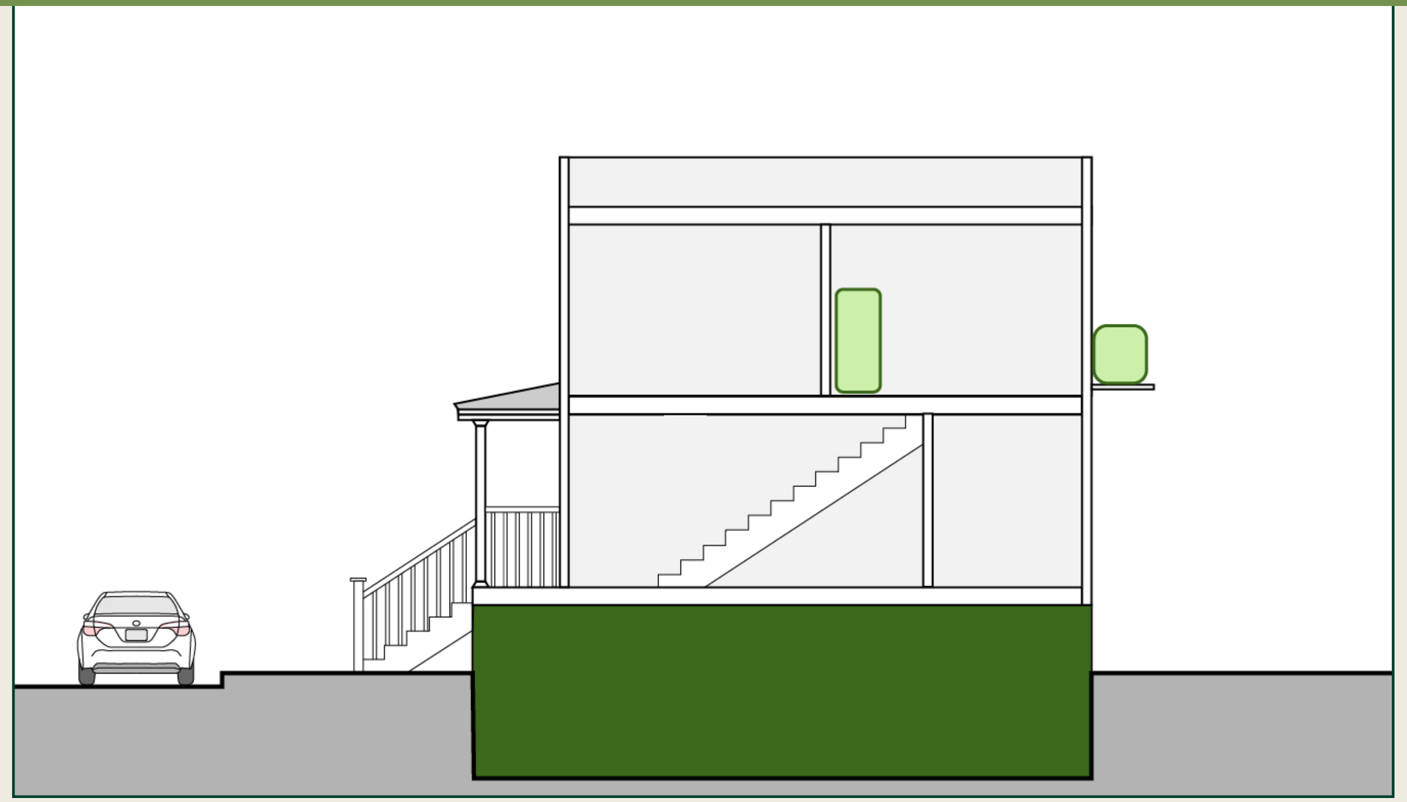
Details:

- This approach involves eliminating subgrade space by conveying gravel into the basement and/or crawl space.
- Basements must be abandoned, and all utilities, storage, and functional space relocated or removed.
- Walls which remain above infilled basements (such as a crawl space), should be retrofitted with flood openings that allow free flow of floodwaters to avoid damaging hydrostatic loads.
- Basement infilling can be expected to be effective for 30-50 years.
- Basement infilling has the potential to reduce annual flood insurance premiums.

Feasibility: Moderate – Basement infilling is a proven flood mitigation technique that significantly reduces damage to structures. Feasibility depends on the homeowner's ability to permanently abandon basement space and relocate utilities, an obstacle for many with limited above-grade square footage or income.

Estimated Cost: $70,000 – $110,000 per property

Responsibility: Homeowners are responsible for elevating utilities on their property. For questions about building code requirements or permitting, homeowners can contact the City of Revere Building Department, or the Conservation Commission for more information about permitting requirements.



Infilled basement with relocated/elevated utilities

Flooded basement at 8 Pearl Avenue (January 10th, 2024)
Source: Michael Chaplin

Raise Parking Spaces

Purpose: For residents living in the low-lying area of Beachmont, protecting their vehicle from flood damage is a top concern. One possible option is to build an elevated parking pad, a raised concrete platform that allows homeowners to park their cars above expected flood levels during coastal storms or heavy rain. This could include a small ramp and, if needed, stairs or a walkway connecting to their home. While this type of structure can be effective, it's important to work with a qualified contractor or engineer to make sure it's designed safely. If not done properly, elevated parking pads can cause water to flow around them more quickly, potentially leading to erosion or damage nearby. Homeowners will also need to get approval from the City of Revere Conservation Commission before starting construction.

Details:

- Approximately 10-12 residential driveways could be considered for raising.
- Each design would be unique to existing driveway layouts and proximity/elevation of the home to be accessed.
- To avoid the need for railings, a raised parking space should be less than 30 inches above ground surface.
- The slope up to the parking surface should not exceed 20% grade.

Feasibility: Moderate – While the concept is technically simple and construction costs are relatively low compared to structural home elevation, feasibility depends on property layout, stormwater impacts, and material availability. Sloped driveways, narrow lots, and proximity to neighboring structures may limit suitability. This might not be a viable option for all residents in the property area. Feasibility will depend on proximity to resource areas.

Estimated Cost: $5,000 – $10,000 per property

Responsibility: Homeowners are responsible for raising es on their property. For questions about building code requirements or permitting, homeowners can contact the City of Revere Building Department, or the Conservation Commission for more information about permitting requirements.

Elevated parking space example

Temporary Flood Barriers – Around Appliances

Purpose: While sealing off the entire structure may not be feasible, homeowners can take a more practical approach by installing temporary barriers around individual appliances, such as furnaces, hot water heaters, or washers/dryers, located in basements or ground floors. This is a form of interior dry floodproofing that reduces flood damage to essential equipment without requiring extensive modifications to the building. This solution can be particularly effective in homes where elevation is not feasible and full structural sealing is not advised (e.g., wood-framed homes).

Details:

- Install removable or deployable flood barriers (e.g., rigid shields, portable flood-walls, or water-resistant covers) around critical appliances located below base flood elevation.
- Use plastic sheeting and sandbags or stackable modular barriers to create a perimeter around appliances during flood warnings.

Feasibility: Moderate to High – This approach is low-cost, does not require structural retrofits, and is well-suited for Beachmont's older wood-frame homes. While it requires homeowner preparation and engagement, it can be implemented without permits and adapted to specific risk levels or appliance locations.

Estimated Cost: $200 – $2,000 per property, depending on type of barriers used, number of appliances protected, and installation method.

Responsibility: Homeowners are responsible for installing temporary flood barriers. For questions about building code requirements, homeowners can contact the City of Revere Building Department.

A product to protect water heaters from flood damage
Source: Floodproofing.Com, Inc.

Green Stormwater Programs for Homeowners

Purpose: Develop a coordinated program that helps Beachmont homeowners capture more rainwater on their property, before it flows downhill to the lower section of the neighborhood. By supporting up-gradient interventions like rain gardens, buffer plantings, and permeable surfaces, this program can reduce flooding in lower elevations.

Details:

- Homeowner grants or rebates for installing practices like rain gardens, rain barrels, permeable driveways, and vegetated swales, covering installation costs upfront.
- Workshops and outreach materials, based on CZM's Stormwater Solutions for Homeowners fact sheets (e.g., rain gardens, reducing impervious surfaces, vegetated buffers).
- Technical assistance through partnerships with CZM, the North Shore Clean Water Coalition, or UMass Extension—helping homeowners select, site, and build resilient green infrastructure.

Feasibility: Moderate – The program leverages proven designs from CZM's homeowner guides but requires funding mechanisms. Success depends on outreach, technical support, and public buy in.

Estimated Cost: $5,000–$15,000 per installed rain garden or swale, $500–$2,000 for permeable driveway or patio conversions, $20,000–$50,000 annually to fund incentives, workshops, and marketing

Responsibility: City of Revere Planning Department

Green stormwater example Watson Park - Braintree, MA

What Should Be Explored for the Future (Long-Term Solutions)

The following questions and answers explore long-term adaptation strategies that go beyond short-term fixes. These approaches, such as elevating homes, changing zoning regulations, and planning for voluntary buyouts, require more time, coordination, and investment but offer lasting solutions to reduce risk from coastal flooding. While some of these strategies involve higher costs or complex planning, they reflect the kind of actions that warrent further exploration to ensure the Beachmont neighborhood can adapt to rising seas and increasing storm impacts.

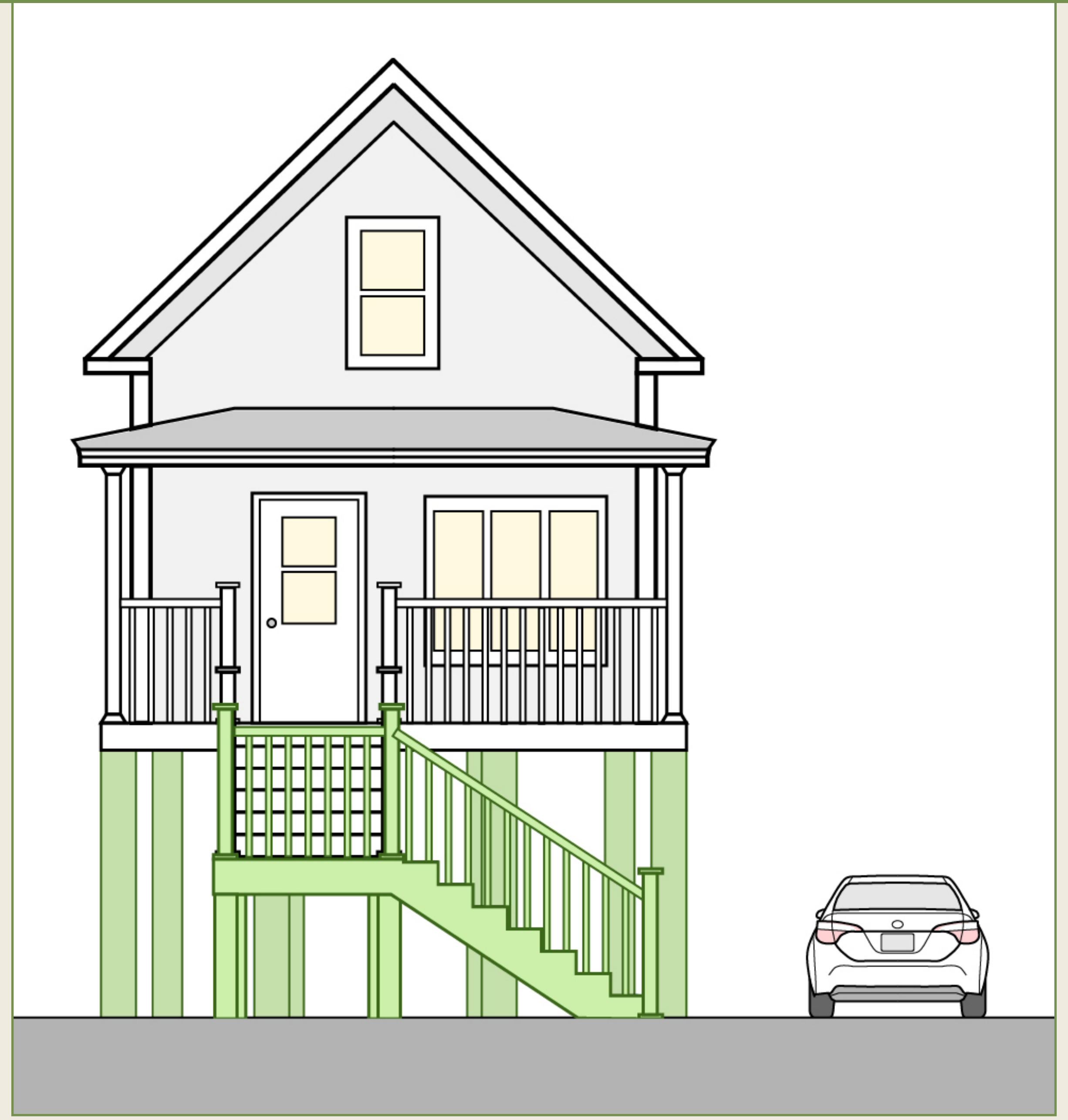
Should I elevate my home to protect against flooding?

Elevating residential structures is one way to reduce flood damage, lower insurance costs, and reduce vulnerability to future flooding, particularly for homes with high flood exposure but no foreseeable issues with daily access due to sea level rise.

Under the Massachusetts Building Code, elevation is required for residential buildings in FEMA's 100-year floodplain if they undergo significant improvements, new construction, or have sustained substantial damage. In these cases, the lowest floor must be raised to meet or exceed the applicable base flood elevation. FEMA recognizes elevation as a cost-effective long-term mitigation strategy for reducing flood risk. While costs can vary based on structure type, condition, and site constraints, elevation is often a significant investment. Because of this, it is most commonly pursued under two circumstances:

- *After a major storm damages a home, when insurance payouts can help fund the work; or*
- *When a vulnerable home is sold and rebuilt by an investor who can absorb the cost.*

Elevation is often reactive rather than proactive, triggered by damage or redevelopment rather than proactively planned. However, elevation remains one of the most effective ways to protect homes in vulnerable areas. The City of Revere could explore creating a local assistance program, either through grants, technical support, or partnerships, to help residents plan for and implement home elevation.



Example of an elevated home

This type of support has historically been offered through FEMA's Hazard Mitigation Assistance (HMA) programs. These programs have helped communities and homeowners fund elevation projects in the past. The Massachusetts Emergency Management Agency has information about Hazard Mitigation Assistance Grant Programs (https://www.mass.gov/info-details/hazard-mitigation-assistance-grant-programs-overview).

The Town of Hull offers a useful model, having established a Home Elevation Grant Program (https://www.town.hull.ma.us/climate-adaptation-conservation/pages/hull-home-elevation-grant-program) to support property owners in FEMA flood zones with the cost of elevating their homes. A similar program in Revere could improve access to funding, streamline the elevation process, and support equitable resilience planning in neighborhoods like Beachmont.

Can the City buy my home if it's at high risk of flooding?

In some cases, the City, working in partnership with state, federal, or nonprofit agencies, can apply for funding to offer voluntary property buyouts in high-risk flood areas. A critical component of this approach is that participation is entirely voluntary, and homeowners are never forced to sell. Voluntary buyouts specifically for flood risk reduction are done with the understanding that the structure will be removed and the land permanently preserved as open space or restored. Ownership of the land may be transferred to a public agency or a nonprofit land trust to ensure it remains undeveloped.

Unlike selling on the real estate market, which may become difficult in repeatedly flooded or high-risk areas, a buyout offers market-value compensation and a guaranteed sale, even if the home has experienced damage or is located in a zone that's projected to flood more frequently over time. A key benefit of a buyout is that the property is permanently removed from harm's way rather than transferring the risk to a future homeowner.

While this strategy can significantly reduce long-term flood risk and recovery costs, it is widely understood that voluntary buyouts can be a painful option, as the strategy may involve permanent relocation and the loss of community and/or generational homes.

Pearl Ave (January 17th, 2025)
Source: Woods Hole Group

Is there funding available to support voluntary buyouts in Beachmont?

Funding through FEMA's Hazard Mitigation Assistance (HMA) programs, including the Flood Mitigation Assistance (FMA) program, has historically supported pre-disaster mitigation efforts, such as the voluntary buyout of properties in flood-prone areas. ***These programs offer critical opportunities for communities like Beachmont to reduce long-term flood risk by enabling homeowners to relocate before experiencing catastrophic damage.*** FMA funds, in particular, may be used to purchase properties from willing sellers whose homes are insured through the National Flood Insurance Program (NFIP) and classified as repetitive loss or severe repetitive loss properties. In Massachusetts, the City (or other eligible community entity) must serve as the sub-applicant to the Massachusetts Emergency Management Agency (MEMA), which in turn applies to FEMA as the primary applicant. Individual homeowners cannot apply directly. Residents interested in exploring a buyout are encouraged to contact the City of Revere to express their interest and request information about future application cycles. For the most current program status and eligibility criteria, residents and municipal officials can visit ***MEMA's Hazard Mitigation Assistance Grant Programs*** Overview: https://www.mass.gov/info-details/hazard-mitigation-assistance-grant-programs-overview

In the absence of immediate state or federal funding, alternative pathways may still be available to support voluntary property acquisition. One such approach is the use of a land bank or a land trust. A land bank is a public or nonprofit entity established to acquire, hold, manage, and repurpose properties, such as those in flood-prone areas. Land banks are not financial institutions; instead, they are typically designed to address properties that may otherwise remain vacant, blighted, or vulnerable to recurring damage. In the context of adaptation, a land bank can serve as a tool to facilitate managed retreat by having funding to purchase properties from willing sellers. Once acquired, the land bank can hold these parcels in public trust and ensure that future development is prevented. Properties could then be converted into locations for marsh migration, open space, or a floodable park. Land banks can also support "undevelopment", the strategic removal of existing structures to restore natural floodplain functions. Property agreements can be structured so that current owners may continue to live on their property for as long as they choose, with the land bank holding a first right of refusal to purchase the property when the owner decides to sell. This provides a flexible, incremental approach to building long-term resilience.

- The Town of Plymouth, Massachusetts, for example, has recently established a municipal land bank. This initiative, aims to acquire and manage land for various community needs. The land bank is funded by a real estate transfer fee of 1% to 2%, paid by property buyers, with exemptions for affordable housing, first-time home buyers, and inter-family transfers. This model allows Plymouth to strategically acquire properties, particularly in flood-prone areas, and manage them in ways that enhance community resilience. More information can be found at https://www.plymouth-ma.gov/1344/Plymouth-Land-Bank-2024.
- Alternatively, the City of Revere could collaborate with an organization such as The Nature Conservancy (TNC), leveraging the organization's expertise as a land trust to facilitate voluntary buyout in Beachmont. TNC is a nonprofit dedicated to "conserving the lands and waters on which all life depends", with a strong presence in Massachusetts. Recently, TNC was a stakeholder in the environmental inventory of Belle Isle Marsh. Through a partnership with TNC, Revere could coordinate with willing sellers to acquire properties for permanent conservation and flood mitigation. TNC's capacity to hold land or conservation easements, restore natural floodplain functions, and access philanthropic or grant funding would complement the City's planning efforts.

What Should Be Explored for the Future (Long-Term Solutions)

What if I want to stay in Beachmont but leave the flood zone?

As part of a comprehensive approach to building long-term coastal resilience in the Beachmont neighborhood, the City of Revere could consider using a land swap strategy to support managed retreat. This approach would involve identifying higher-ground city-owned parcels, such as the Crescent Avenue Mini Park, located on elevated land above the flood-prone areas of Beachmont, as potential relocation sites for residents who voluntarily sell their homes in high-risk flood zones.

The City of Revere is exploring ways to help residents relocate out of high-risk flood zones without having to leave the Beachmont neighborhood. One option that the City could consider is a land swap strategy, which would allow homeowners in vulnerable coastal areas to voluntarily sell their property and move to safer, city-owned land on higher ground.

For example, the Crescent Avenue Mini Park, located uphill from the flood-prone areas, could be re-evaluated as a potential site for affordable, flood-resilient housing. Through a community planning process, this space could be redesigned to support new housing, while the vacated low-lying parcels could be restored as open space, wetlands, or a floodable coastal park.

This land swap model would enable the City to:

- Help residents stay close to neighbors, schools, and services;
- Restore natural flood buffers and reduce risk in vulnerable zones;
- Avoid the need to acquire new relocation land elsewhere;
- Use existing public land to support long-term climate adaptation.

By working with land trusts, housing authorities, and nonprofits, the City could also access funding, expertise, and long-term support to make this transition successful and equitable.

Crescent Avenue Mini Park in Revere, MA

Crystal Ave (January 17th, 2025)
Source: Woods Hole Group

What is a Coastal Floodplain Overlay Bylaw, and why would Revere adopt one?

A Coastal Floodplain Overlay Bylaw is a local zoning tool that establishes higher standards for development in flood-prone coastal areas, such as Beachmont. By adopting such a bylaw, the City of Revere could better manage future flood risks, reduce repetitive property damage, and promote safer, more resilient construction practices.

The bylaw would apply not only to areas already known to flood, such as those mapped by FEMA but also to places expected to be at risk in the future, based on models like the Massachusetts Coastal Flood Risk Model (MC-FRM). Key components could include:

- *Restricting new development in the most hazardous areas (known as "V Zones") while allowing only minor improvements like utility upgrades or floodproofing;*
- *Limiting fill or grading to preserve the land's natural ability to store and absorb floodwater;*
- *Requiring elevated construction using the higher of either the state building code or future flood projections to better prepare for sea level rise.*

This type of bylaw is a proactive strategy to reduce long-term flood risk. Raising standards for where and how buildings are constructed helps guide development away from areas likely to face repeated flooding, ultimately reducing the need for costly repairs, retrofits, or property buyouts. However, implementing a Coastal Floodplain Overlay Bylaw comes with challenges. Stricter development rules may be viewed as restrictive, particularly in neighborhoods with limited resources. Success will depend on clear communication, robust public engagement, and increased staff capacity to manage new permitting and enforcement processes.

The Cape Cod Commission, the regional planning agency for Barnstable County has developed a suite of model wetlands and zoning regulations that illustrate how Massachusetts municipalities are already using local policies to address coastal flood risks. These tools offer a helpful reference for communities like Revere that are exploring a Coastal Floodplain Overlay Bylaw and can be accessed here:
https://www.capecodcommission.org/our-work/regulatory-tools-for-coastal-floodplain-resiliency/

What’s Worth The Investment?

What Is a Benefit-Cost Analysis and Why Does It Matter?

While the last chapter outlines a broad range of resilience strategies for the Beachmont neighborhood, certain adaptation measures, particularly those that involve direct modifications to residential structures, require more investigation to understand their suitability. This section presents a preliminary Benefit-Cost Analysis (BCA) (using FEMA’s HAZUS software) focused on four building-level approaches: wet floodproofing, dry floodproofing, elevating homes, and voluntary property buyouts. The BCA examines how much damage each strategy could help prevent during future coastal flood events compared to how much it costs to implement.

A Benefit-Cost Analysis (BCA) is a tool used to compare the cost of a project with the financial benefits it provides over time. In the case of flood mitigation, this means comparing how much it would cost to take an action, like elevating a home, with how much cost from future flood damage it could help prevent. If the money saved by avoiding flood damage is greater than the cost of the project, the action is considered “cost-effective.”

Benefit-Cost Analysis is commonly used by state and federal agencies, such as FEMA when deciding whether to fund resilience projects. It helps ensure that public funding is used efficiently and that selected projects will provide long-term value to communities.

A Benefit-Cost Ratio (BCR) is calculated by dividing the total expected benefits by the total costs. For example, a BCR of 2.0 means that for every dollar spent, the project is expected to save two dollars in avoided damages. A BCR greater than 1.0 means the benefits outweigh the costs, while a BCR below 1.0 means the project may cost more than it saves.

While the BCR of an intervention is a helpful piece of information, it is not the only factor to consider. Some actions may not show a high benefit-cost ratio but still offer important social, health, or environmental benefits, such as peace of mind, preserving community character, or reducing disruption after a storm. That’s why this analysis is intended to support, not replace, conversations with residents and community-based decision-making.

Crumbling sidewalk at 9 Pearl Avenue (March 03, 2018)
Source: MyCoast

How Properties Were Categorized for the Benefit-Cost Analysis

To better understand how different types of flood mitigation strategies might perform across the Beachmont neighborhood, residential buildings were grouped based on their projected exposure to coastal flooding. This approach allows the Benefit-Cost Analysis to reflect the varying levels of risk faced by different properties. Grouping homes by vulnerability helps identify where specific interventions, such as elevation or floodproofing, are likely to be most cost effective. The figure below presents five vulnerability groups, ranging from homes at extremely high risk of regular flooding (group 1) to those with little or no expected exposure through 2070 (group 5). The groups in the figure below have the following characteristics:

Building Vulnerability Category

- Vulnerability Group 1
- Vulnerability Group 2
- Vulnerability Group 3
- Vulnerability Group 4
- Vulnerability Group 5

1. Buildings in **vulnerability group 1** are extremely vulnerable to coastal flooding. They can expect to experience loss of access due to daily mean high water flooding as soon as 2050, or they have basement entry point elevations lower than the projected mean high water elevation as soon as 2070.
2. Buildings in **vulnerability group 2** are highly vulnerable to coastal flooding. They can expect to experience loss of access due to daily mean high water flooding as soon as 2070, but are not vulnerable enough to meet the group 1 criteria.
3. Buildings in **vulnerability group 3** are moderately vulnerable to coastal flooding. They have at least a 1% annual chance of flooding as soon as 2050, but have no vulnerability to mean high water through the 2070 time horizon.
4. Buildings in **vulnerability group 4** are slightly vulnerable to coastal flooding. They have at least a 1% annual chance of flooding as soon as 2070, but less than a 1% annual chance of flooding as soon as 2050.
5. Buildings in **vulnerability group 5** have little to no vulnerability to coastal flooding. They have less than a 1% annual chance of flooding as soon as 2070.

In this analysis, buildings were grouped based on their flood risk, and the study examined how different flood protection actions might be performed for each group. This grouping helps identify which properties are most vulnerable and which types of actions may offer the greatest benefits.

A key metric used in the analysis is the Average Annualized Loss (AAL). AAL is the expected annual cost of damage to the structure, averaged over a long period of time. AAL provides a way to compare properties based on long-term risk rather than just what might happen in a single major storm.

- *For example, if a building has a 1% chance of experiencing $100,000 in damage from a 100-year storm, that risk would count as about $1,000 per year in expected damage.*

To calculate Average Annualized Loss, the study considered a wide range of possible storm scenarios and projected future water levels, including sea level rise. The calculation encompassed not only structural damage to buildings but also damage to vehicles, personal belongings, and indirect costs, such as lost rental income or business disruption. This broader approach helps paint a more complete picture of how flooding affects households and the neighborhood as a whole.

Flooded backyard at 24 Pearl Avenue (March 10, 2024)
Source: Councilor McKenna

How Properties Were Categorized for the Benefit-Cost Analysis

Flooded backyard at 8 Pearl Avenue (January 10th, 2024)
Source: Michael Chaplin

The tables show which actions are likely to be worth the cost; those are highlighted in maroon. Actions that aren't highlighted may cost more than they save or may not be practical for specific buildings. While the results are shown as averages for each group, every building is different. The green-highlighted actions are a starting point for deciding what might work best, but more detailed assessments would be needed for individual homes.

Vulnerability Group 1:

The total annualized loss averaged across group 1 is **$23,978 per year as soon as 2030, $34,749 per year as soon as 2050, and $51,005 per year as soon as 2070.** The average benefit cost ratios have been calculated for the following interventions on the 16 buildings in group 1 in the table below.

Average Benefit Cost Ratios (BCR) for Group 1

INTERVENTION	2030 BCR	2050 BCR	2070 BCR
Wet Floodproofing	9.36	*13.67**	*20.22**
Building Elevation	2.28	*3.23**	*4.46**
Voluntary Buyout	1.25	1.81	2.64

Group 1 can expect more benefits than costs from wet floodproofing, building elevation, and voluntary buyout in the near term. These actions were assigned high benefit-cost ratios because they successfully reduce damage from storm flooding; however, the methods used to calculate the ratios do not account for daily tidal flooding.

For Group 1, daily access disruptions from flooding are expected as soon as 2050, so actions other than voluntary buyouts are not considered viable starting in the 2050 time horizon despite their high benefit-cost ratios. **This is because even if a home is well-protected from flood damage, the streets around it may flood so frequently that daily life becomes difficult, making it hard to come and go, receive emergency services, or maintain utilities.*

Vulnerability Group 2:

The total annualized loss averaged across Group 2 is **$18,888 per year as soon as 2030, $25,964 per year as soon as 2050, and $31,804 per year as soon as 2070.** The following average benefit cost ratios have been calculated for the following interventions on the 11 buildings in group 2 in the table below.

Average Benefit Cost Ratios (BCR) for Group 2

INTERVENTION	2030 BCR	2050 BCR	2070 BCR
Wet Floodproofing	9.19	12.9	*17.48**
Building Elevation	2.14	2.93	*3.63**
Voluntary Buyout	0.95	1.34	1.79

Group 2 can expect more benefits than costs from wet floodproofing and building elevation in the near term. These actions were assigned high benefit-cost ratios because they successfully reduce damage from storm flooding; however, the methods used to calculate the ratios do not account for daily tidal flooding.

For Group 2, daily access disruptions from flooding are expected as soon as 2070, in this group (2) two homes are surrounded by water during normal high tides, so actions other than voluntary buyouts are not considered viable starting in the 2070 time horizon despite their high benefit-cost ratios. **This is because even if a home is well-protected from flood damage, the streets around it may flood so frequently that daily life becomes difficult, making it hard to come and go, receive emergency services, or maintain utilities.*

Vulnerability Group 3:

The total annualized loss averaged across group 3 is **$12,216 per year as soon as 2030, $18,903 per year as soon as 2050, and $30,005 per year as soon as 2070.** The following average benefit cost ratios have been calculated for the following interventions on the 6 buildings in group 3 in the table below.

Average Benefit Cost Ratios (BCR) for Group 3

INTERVENTION	2030 BCR	2050 BCR	2070 BCR
Wet Floodproofing	7.14	10.57	16.94
Building Elevation	1.71	2.55	4.03
Voluntary Buyout	0.7	1.07	1.7

Group 3 can expect more benefits than costs from wet floodproofing and building elevation in the near term. As soon as 2050, all three actions have more benefits on average than costs, and this remains true in the long term. It's important to note that even if actions were assigned high benefit-cost ratios in the near term this is because they successfully reduce damage from storm flooding; however, the methods used to calculate the ratios do not account for daily tidal flooding.

Despite their high benefit-cost ratios, even if a home is well-protected from flood damage, the streets in the area may flood so it important to understand how the broader area will be impacted.

Vulnerability Group 4:

The total annualized loss averaged across group 4 is **$3,397 per year as soon as 2030, $9,011 per year as soon as 2050, and $18,165 per year as soon as 2070.** The following average benefit cost ratios have been calculated for the following interventions on the 10 buildings in group 4 in the table below.

Average Benefit Cost Ratios (BCR) for Group 4

INTERVENTION	2030 BCR	2050 BCR	2070 BCR
Wet Floodproofing	1.18	4.05	8.31
Building Elevation	0.41	1.27	2.52
Voluntary Buyout	0.16	0.49	0.99

Group 4 can expect more benefits than costs from wet floodproofing in the near term. As sea levels rise, building elevation also becomes cost-effective, with both actions showing more benefits than costs by 2050. By 2070, all three adaptation actions, wet floodproofing, building elevation, and voluntary buyout, are projected to offer more benefits on average than costs. Unlike Groups 1-2 the homes in Group 4 are not expected to face daily tidal flooding or routine access disruptions within the planning horizon. As a result, Group 4 households have more flexibility to adapt in place over time, with the opportunity to choose strategies that align with their long-term needs and preferences.

Vulnerability Group 5:

The total annualized loss averaged across group 5 is **$210 per year as soon as 2030, $661 per year as soon as 2050, and $1,609 per year as soon as 2070.** The following average benefit cost ratios have been calculated for the following interventions on the 47 buildings in group 5 in the table below.

Average Benefit Cost Ratios (BCR) for Group 5

INTERVENTION	2030 BCR	2050 BCR	2070 BCR
Wet Floodproofing	0.08	0.25	0.86
Building Elevation	0.02	0.07	0.24
Voluntary Buyout	0.01	0.03	0.11

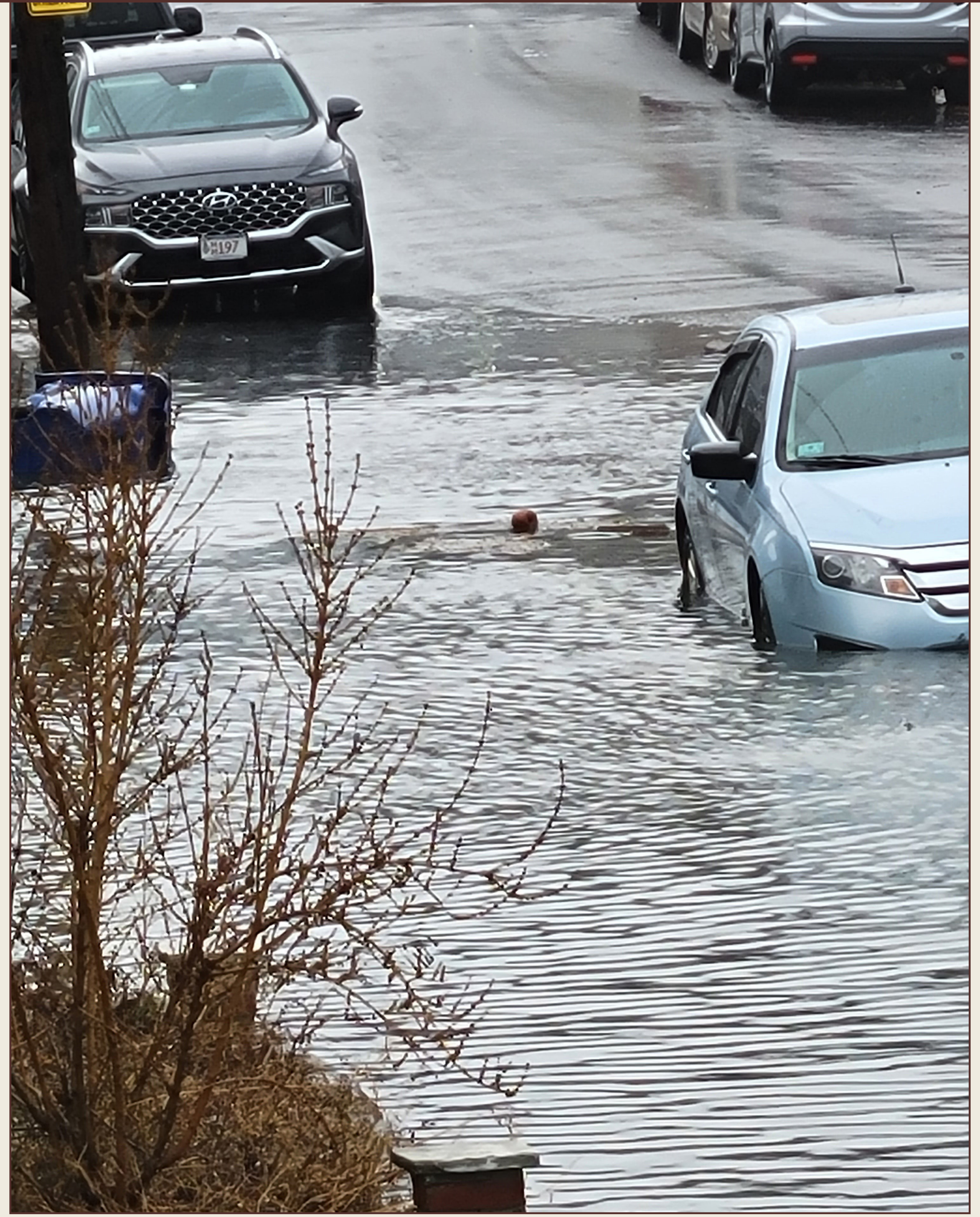
As might be expected for a group of houses with almost no flood vulnerability, none of the actions in the BCA have average benefits outweighing their average costs in any time horizon for group 5.

These results of the Benefit-Cost Analysis highlight a significant disparity in the financial burden of flooding among neighbors living on the same street. While some households face minimal costs over time, others, often just a few doors down, are at risk of recurring damage, costly repairs, and potential property devaluation. This variation highlights the uneven distribution of flood risk in the neighborhood and underscores the need for targeted, equitable support.

The analysis also demonstrates the potential value of adaptation measures such as wet floodproofing (allowing floodwater to pass through without causing major damage). These ***strategies can be highly beneficial for residents with high exposure in the short term***, reducing financial losses and extending the livability of vulnerable homes. However, they have clear limitations, especially for properties projected to lose daily access or become tidally isolated as early as 2050. In these cases, even well-executed adaptation measures may only provide temporary relief, as rising sea levels will eventually render properties uninhabitable or unsafe to inhabit.

Importantly, the decision to implement floodproofing or other resilience actions is influenced by more than just risk or cost-effectiveness. Personal preference, access to up-front capital, trust in programs or contractors, mobility or health limitations, and awareness of available resources all play key roles in shaping household decisions. For example, older residents may be less likely to pursue construction-based adaptations due to disruption, while renters may lack the authority to make improvements at all.

As a result, flood resilience cannot be approached with a one-size-fits-all solution. Tailored strategies, particularly those that account for social vulnerability and financial capacity, are critical to ensuring all residents, especially those in Group 1, are supported through near- and long-term adaptation planning.



Flooding along Pearl Avenue (January 10th, 2024)
Source: Michael Chaplin

Where Do We Go From Here?

What's Next for The City and The Community?

What's Next for The City and The Community?

This study identifies a range of near-term actions and long-term options that can help reduce flood risk, improve public safety, and strengthen the community's ability to recover from coastal storms and sea level rise. This study is not a final answer, but a starting point, a foundation for future decisions, funding, and action. The next steps involve continued collaboration between the City, community members, and partners to turn ideas into action and ensure all residents, especially those most at risk, are supported in adapting to a changing climate. The City of Revere will continue working with residents, regional partners, and state agencies to refine, fund, and implement key recommendations from this plan. Immediate next steps may include:

- Piloting projects with high feasibility and strong benefit-cost outcomes, such as the Belle Isle Marsh Flood Warning System.
- Seeking funding to launch a utility elevation assistance program.
- Working with regional stakeholders to ensure ongoing outreach, particularly to renters, seniors, and low-income households.

How Do I Stay Involved or Get Help?

Community members are central to Beachmont's resilience. Residents, property owners, and renters can stay involved in several ways:

- ***Attend events:*** Join community meetings or workshops focused on funding programs, flood insurance, or home retrofits.
- **Reach out:** Contact NSORS or City departments with questions about this report. For immediate help with flood insurance or building questions, residents can contact: City of Revere Building Department (781)286-8196, City of Revere Planning Department, North Suffolk Office of Resilience and Sustainability - for resilience and funding guidance (857)788-9582.
- **Connect with neighbors:** Share information, resources, and support within the Beachmont community to increase collective resilience.
- **Resources:**
  - Reduce Flood Risk Toolkit: The Association of State Floodplain Managers offers www.reducefloodrisk.org, a free online library of flood mitigation strategies tailored for property owners, renters, community groups, and municipalities.
  - FEMA Resources: FEMA offers several tools and publications to support affordable flood adaptation, including guidance on utility elevation, flood insurance, and flood-resistant materials. https://www.floodsmart.gov/get-flood-insurance has information about the National Flood Insurance Program. Materials included in Appendix D of this report include:

    Reducing Flood Risk for Residential Buildings That Cannot Be Elevated

    Flood Damage-Resistant Materials Requirements

    Protect Your Home From Flooding - Low-Cost Projects You Can Do Yourself

    Protecting Building Utility Systems From Flood Damage

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Appendix

Appendix A. Wetland Resource Delineation Memo

Appendix B. Coastal Flood Risk Summary

Appendix C. Public Meeting Materials

Appendix D. FEMA Flood Mitigation Resources