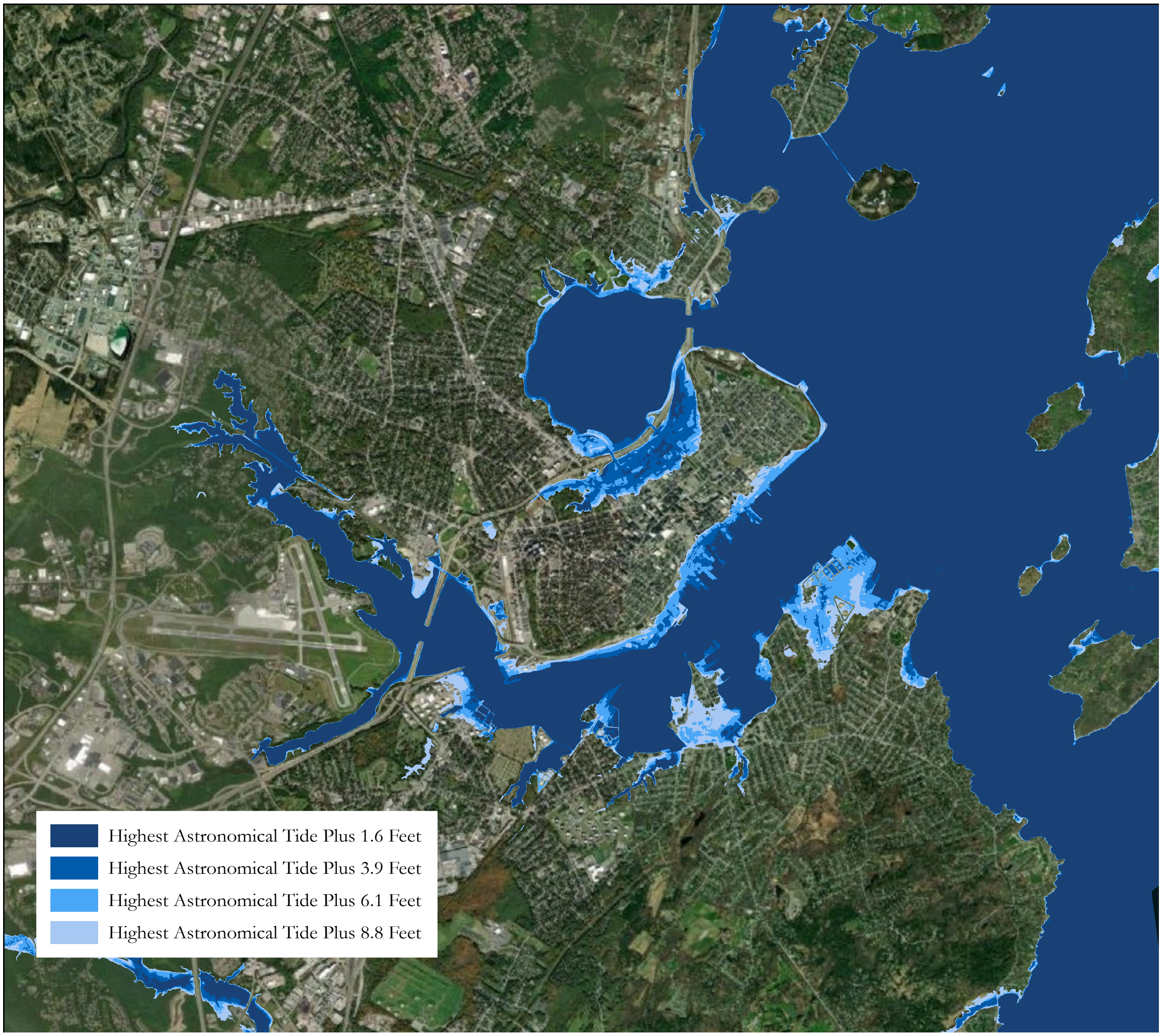
STAYING ABOVE WATER

Property Owner's Guide

Greater Portland Landmarks

Sea Level Rise and Storm Surge Scenarios in Greater Portland



The Scientific and Technical Subcommittee of the Maine Climate Council recommends committing to manage 1.5 feet of sea level rise (darkest blue) by 2050 and 3.9 feet by 2100. They recommend preparing to manage 3 feet of sea level rise by 2050 and 8.8 feet of sea level rise by 2100 (lightest blue).
(Scientific Assessment of Climate Change and its Effects in Maine, August 2020)

Sea Level Rise scenarios by P. A. Slovinsky, S, Rickerich, and C. H. Halsted of the Maine Geological Survey

Map Source: Esri, Maxar, GeoEye, Earthstar Geographcis, CNES/Airbus DS, USDA, AeroGRID, IGN, the GIS User Community

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This Property Owner's Guide was created with generous support from:

This material was produced with assistance from the New Century Community Program and the Maine Historic Preservation Commission. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the State of Maine.

Thank you to our Greater Portland Landmarks Preservation Partners and members!

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Photographs: Corey Templeton, Kate Burch, Julie Larry, Abigail Dolan, Leslie Moore, Sarah Payne, & Emma Survis

Introduction

Why is Greater Portland Landmarks concerned with the predicted effects of climate change?

Many of Greater Portland's most treasured prehistoric and historic sites sit along the coast and its intersecting rivers and streams—areas at high risk because of rising sea levels and extreme weather events. These sites include historic seaside communities, residential, commercial and industrial neighborhoods, wharves, forts, lighthouses, and 2,000 documented shell middens that contain valuable information and prehistoric cultural artifacts.

The 1927 Schlotterbeck & Foss Building is the only Art Deco commercial building designed by John Calvin Stevens and John Howard Stevens. This Bayside building, listed on the National Register of Historic Places in 2016, is an at-risk historic resource.

Already, coastal homes in places like Camp Ellis in Saco are being lost. Portland's Waterfront and Bayside neighborhoods experience recurrent flooding during extreme rain events and king tides. As the Gulf of Maine's water temperature rises faster than other oceans, predictions point to increased recurrent flooding in the near future. Communities such as Ferry Village, Higgins Beach, Pine Point, Prouts Neck, the Portland waterfront, and Portland's Bayside and Stroudwater neighborhoods are likely to be severely impacted by sea level rise and storm surges.

The damage and destruction of local historic landmarks and sites due to climate risks will be detrimental to Greater Portland's character and sense of collective history. If historic sites are lost, Greater Portland will face substantial revenue losses because our regional economy depends so heavily on historic districts, properties, and parks to attract tourism, new residents, and new businesses. The loss of archaeological sites will be both academically and culturally devastating. Information about Maine's prehistory and early colonialism could wash away, and Indigenous communities will lose evidence of thousands of years of their ancestors' lifeways. Planning for the future, preservationists need to make tough decisions about what will be lost, what can be saved, and how historic preservation can contribute to making our communities more resilient and sustainable.

What has Greater Portland Landmarks accomplished to date?

Landmarks has documented over 400 homes and commercial buildings in three neighborhoods prone to recurrent flooding and at risk from the impacts of sea level rise in Greater Portland: Bayside and the working waterfront in Portland and Ferry Village in South Portland. We've documented their historic characteristics, as well as the features that may make each building vulnerable to flooding or increased storm intensity to help us understand common risks for historic resources in these neighborhoods. You can view an online map of surveyed historic resources in Portland and South Portland and their vulnerability to sea level rise here.

What needs to be done?

Maine's historic resources are already being impacted by recurrent flooding and increased storm severity. We need to take immediate action to ensure the long-term preservation of our historic neighborhoods, buildings, and archaeological sites. Experts predict that in the coming century, many natural hazards that Greater Portland already faces – including flooding, extreme heat, and rising temperatures in the Gulf of Maine – will be exacerbated by climate change. There is a 27% risk of a flood event in Greater Portland over 5 feet by 2050. A flood event of that magnitude would impact historic and non-historic buildings valued at over $222 million. (The highest recorded flood event in Portland between 1912 and 2015 was 4.22 feet in 1978.)

No matter the budget, there are practical measures that can be taken to harden a historic building against disasters. Some projects are simple enough for a property owner to make them themselves, while others will require professionals to complete. Some work may need to be done over time depending on the financial and material resources available. Ultimately, building owners must decide which projects will work best for their situation and what will offer the greatest protection for their homes and families.

Flooding at Custom House Wharf during high tide, 2018 (Photo by Corey Templeton)

Who is this guide for?

This guide is intended for historic property owners, to illustrate possible strategies that can reduce the impact of climate change on their properties. Property owners should first identify the risks that challenge their property and neighborhood to understand the implementation strategies necessary to help reduce their risk. The case studies in this guide highlight possible mitigation, resilience, and adaptation strategies for several types of older properties in Greater Portland.

This guide provides strategies for mitigation, resilience, and adaptation.

Mitigation is defined by the National Oceanic and Atmospheric Administration (NOAA) as processes that can reduce the amount and speed of future climate change by reducing emissions of heat-trapping gases or removing them from the atmosphere. Greater Portland Landmarks recommends mitigation measures that create renewable energy on site or that save energy, without adversely impacting the character-defining features of a property. Preservation itself is a mitigation strategy - preserving a building saves energy that would be consumed during new construction from the production and transportation of new building materials. Plus, historic buildings are often naturally energy efficient because they were built before the prevalence of mechanical heating and cooling systems, so you can utilize your building's built-in passive strategies to reduce energy use.

Resilience is defined by NOAA as the ability to withstand, respond to, and recover from an adverse event like a flood or severe storm, or even a pandemic. Landmarks encourages owners to consider resilience strategies as one means of protecting historic properties, and to facilitate a quick recovery after a storm event. For example, by making site improvements to handle increased precipitation loads or regularly removing dead trees and branches, there is a reduced chance of damage to your property. Resilience strategies are complimentary to historic preservation as both focus on protecting the structure and materials of a building as well as improving the quality of life for the occupants.

Adaptation is defined by NOAA as the process of adjusting to new (climate) conditions in order to reduce risks to valued assets. Landmarks recommends adapting properties to reduce risk to flooding or storm damage while causing minimal impacts to the character-defining features of a property. In flood hazard zones, adaptation may involve elevating certain parts of a historic building above the Design Flood Elevation*. However, this practice may often compromise a buildings character defining features and is not recommended across the board. Owners of buildings with an official historic designation should consult local or state preservation offices to determine if the retrofits are appropriate. In Maine, owners of buildings listed on the National Register of Historic Places should contact the Maine Historic Preservation Commission for advice on specific treatments. Additional guidance can be found in the Secretary of the Interior's Standards for the Treatment of Historic Properties, which offers general guidelines and best practices for working on historic homes. Alterations to historic buildings may need to be reviewed and approved by a municipal board or commission with jurisdiction over historic properties to determine the appropriateness of the adaptation strategy.

**Design Flood Elevation is the elevation of the highest flood that a retrofitting method is designed to protect against, generally the Base Flood Elevation including an additional 1-3 feet.*

What should you consider when creating a plan to make your building more resilient?

- What type of disaster is likely to occur?
- What is the level of threat from these disasters?
- What is the level of damage from these threats?
- What impact will possible retrofits have on the historic character or features?
- Are there alternative options that protect the home from damage, but retain the historic character or features?

A water main break added to heavy rain that caused flooding along Somerset st. in Portland and stranded at least one motorist on his way to work Wednesday, December 19, 2012. (Photo by John Patriquin/Portland Press Herald)

Assessing Vulnerability

How can we prepare historic properties for the effects of climate change?

Preservationists across the country are addressing the need to plan for change and potential loss in historic resources vulnerable to the effects of climate change. Property owners can begin to plan for the impacts of sea level rise and increasing impacts from storm events on their properties, too. Online databases and maps can provide information for owners of property near rivers, streams, and the ocean about their risk for flooding from sea level rise or storm events – but all buildings have some level of vulnerability from intense rain or windstorms.

Flooding at Custom House Wharf during high tide, 2018 (Photo by Corey Templeton)

Assessing your historic property's vulnerability and taking preventative steps is easier and less expensive than repair after a storm or natural disaster event. The process to assess a property's vulnerabilities is similar to the maintenance practices that we encourage everyone to undertake seasonally or yearly. Take a walk around your property regularly, especially during or immediately after a storm to see how water is flowing off your building and across your lot. Water should not stand on horizontal surfaces or accumulate around a building's perimeter. Inspect your building for damage, loose materials, broken tree limbs, etc. after a storm and in the spring and fall. Take photos or videos - they may help if you need to talk with a contractor about the best way to fix any problems you identify or features on your home that might be vulnerable.

What should you look for? Here are some items to consider:

- Is there debris in your gutters and down spouts? Are the gutters properly secured to the building?
- Is water draining from your gutters back toward your foundation?
- Are any roofing shingles or flashing loose?
- Are there any loose bricks or stones in your chimney? What about in your foundation or stairs?
- Are there any cracks or openings that need to be sealed up in your foundation?
- Does rainwater on your patio, driveway, or path flow away from your house's foundation? Do you regularly have water in your basement during rainstorms?
- Do any of your basement windows have sills close to the soil or driveway where water could pool up and spill over into your basement?
- Are there any trees that are too close to your house or garage, leaving leaves on the roof or in the gutters? Are any tree limbs too close to electric overhead wires?
- Are your shrubs overgrown and growing too close to the house? Is the soil or mulch around your foundation higher than the top of your foundation?
- Don't forget to look at your fence, backyard, and outbuildings. Are there any loose features? Is your outdoor patio furniture or grill secured?

Potential Solutions

What are the best solutions to prevent or minimize damage to historic properties from the impacts of climate change?

There is rarely one single solution to protect a building. There are many factors that may determine which potential solutions should be implemented, such as aesthetics, cost, future risks, accessibility concerns, and code requirements. Some vulnerabilities have low costs to correct, while other solutions may be more expensive to implement. Create a budget and long-term plan to implement repairs as you can afford them. It is likely to be more cost effective to improve a building's climate resiliency while undertaking major home repairs.

The choice of materials for repairs and retrofits has a major influence on the strength, appearance, and durability of a house. A few extra dollars spent on quality materials pays off in the long run. According to the Secretary of the Interior's Standards, priority should be given to retaining historic materials during repairs and retrofits, and damaged materials should be repaired rather than replaced. When replacement is the only option, it should be done using in-kind materials that have the same characteristics and properties so they age and act similarly to the environment over time.

Historic buildings were designed and built so that all of the different parts of the building worked together to resist the elements and provide protection to their inhabitants. The potential solutions listed below are intended to work together as a system, too. For any measures that alter or change the structural system of a building, it is best to work with a professional engineer to ensure retrofits are structurally sound.

There is no retrofit, upgrade, or even new construction method that will prevent all damage during a natural disaster. However, by preparing a historic home to face the next storm, flood, or fire, we can minimize damage and ensure that older buildings will remain for future generations to enjoy.

What if I live in a historic district?

None of the suggestions or best practices in this document change if you live in a historic district, but some of your climate adaptation projects may require discussion with your local historic district commission. Some might require both a building permit and historic district commission approval. While there are a number of home renovation projects requiring review, the projects listed here are most likely to come up during an adaptation project.

Please contact your local historic district staff or commission if you are undertaking:

- Installation or replacement of gutter systems
- Installation of renewable energy systems and/or rooftop mechanicals
- Installation or alteration of exterior lighting
- Installation or alteration of awnings
- Re-grading and other non-vegetative alterations to the exterior

Possible solutions to consider that may make your building more resilient:*

**Listed in alphabetical order, not in any order of construction preference.*

Basement Cistern $$

A basement cistern acts as an underground well or reservoir and makes the basement unusable for anything else. Basement cisterns typically require stone walls.

Cool Roof $$$

A cool roof is one that has been designed to reflect more sunlight and absorb less heat than a standard roof. Cool roofs can be made of a highly reflective type of paint, a sheet covering, or highly reflective tiles or shingles. These highly reflective roofs can be visually different than traditional materials, which will impact the historic character of a building. They are best used on buildings where the roofing material is less visible, like a flat or low-pitched roof.

Dry Floodproofing $

Dry floodproofing allows a home to remain in its current location and elevation. However, dry floodproofing only recommended when the risk includes floodwaters moving at a low velocity, flooding is relatively low (2-3 feet above the ground), and occurs for a short duration. Feasibility and cost are site-specific.

Dry Well $$

Dry wells are pits in the ground lined with porous material. They capture stormwater and allow it to slowly infiltrate into the soil. Dry wells collect excess stormwater to mitigate flood damage to buildings and landscaping.

Elevate Home $$$$

A building can be elevated on its current site to become better protected from flooding. While elevating a building is expensive and a last resort, it may be a warranted solution where possible in order to create resiliency for a building, or historic neighborhood, to ensure its survival. Elevating a home typically involves raising the house and extending the foundation beneath it, using as much of the existing foundation as possible. Different elevation techniques are available for a variety of building materials and foundations. The visual character of a historic building is closely linked to its overall design, its height, massing, proportion and the overall scale of its architectural features. So, when the height of a structure is suddenly changed, it alters the overall proportions of the historic building and affects its integrity. Raising one historic building on a block can also skew that building's relationship to its neighbors and to a historic district or streetscape.

Flood Vents/Wet Floodproofing $

Wet floodproofing allows floodwater to enter a building and equalizes buoyancy pressures, reducing the floodwater's strain on buildings. This solution also allows the home to maintain its location and elevation. Furnaces and other appliances cannot be in a basement with wet floodproofing. Vents will require regular maintenance and the basement may need extensive cleanup following a flood event.

General Maintenance and Upkeep $ - $$

Dangers surrounding flooding and its effects on a building can be mitigated by general maintenance and consistent upkeep of a property. Porches and large trees that could cause damage to surrounding buildings should be monitored particularly closely. Consistent maintenance of a property will help property owners discover and repair potential problems before they are heightened by the effects of flooding or high winds.

Home Relocation $$$$
Home relocation is one of the most expensive solutions for mitigating flood damage. However, moving a home can significantly reduce the risk of damage from repeated flooding or storm damage. Relocation is most appropriate if a home is exposed to flood conditions with deep water, short warning time, high flow velocity, wave action, and significant quantity of debris in floodwaters (FEMA). Other costs to consider are the construction of a foundation, and the cost of land to which the house will be moved. When moving the structure from its original location it is important that it be placed in a similar context to maintain its historic integrity.

Native Plants/Rain Gardens $
There are many benefits to planting native vegetation. Since native plants are adapted to the local soil and climate conditions, the vegetation helps to reduce and redirect storm water runoff, reducing the extent of flooding and erosion. Native vegetation can be planted in garden beds, lawns, and green roofs or green walls.

Permeable Pavers $ - $$
The use of permeable pavers is an effective way to reduce and redirect water runoff into the soil. Rather than water collecting on impermeable surfaces and increasing the risk of flood damage, the permeability of a site allows water to return to the soil, reducing flooding and helping to maintain a supply of groundwater.

Rain Barrels $
Rain barrels are a quick and inexpensive solution for collecting rainwater. While not effective for flood events, they are useful in capturing rainwater on site and slowing down the amount of water that may enter overwhelmed storm drains, lessening localized flooding. Rain barrels can be as small as 50 gallons or as large as 330 gallons in volume and are available in a range of aesthetic options.

Raise First/Main Floor $$$$
If the existing floor-to-ceiling height allows, raising the first floor above the Base Flood Elevation (elevation of the 100-year flood, determined by statistical analysis) will help keep flood waters out of the first floor space. This may require the modification or adjustment of stairs, doors, or windows, which could have an adverse impact of the historic character of the building.

Reinforcement of Materials $ - $$
Porches, awnings, fire escapes, and unreinforced chimneys are all examples of structural features that may pose potential dangers in the event of high winds. Precautions must be taken to properly reinforce and stabilize the feature. Awnings can be retrofitted with a retractable mechanism that serves as an added safety measure, while maintaining the historic integrity of the structure. To mitigate damage to unreinforced chimneys, property owners have several options, ranging from reconstruction of the chimney to a full reconstruction of the chimney and firebox.

Service Equipment and Utility Elevation/Relocation $$$ - $$$$
If a utility is located close to ground level, it runs a higher risk of flood damage. Electrical outages, sewer backup, and internal damage to equipment can all be detrimental effects of flooding. Building owners should make sure that HVAC systems, fuel systems, electrical systems, sewage management systems, and potable water systems are at least one to two feet above the BFE as recommended by FEMA. Elevating or relocating this equipment is an efficient and generally long-term solution to issues caused by flooding. To relocate gas and electrical meters, contact your utility provider.

Slope Grade *$ - $$$*

Changing the angle of the land so that it slopes away from the building, and directs storm water away from the building. The cost depends on how much grade work will be required.

Solar Panels *$$ - $$$*

Solar panels improve energy resilience. When installed on a historic property in a location that cannot be seen from the ground, they will generally meet the Secretary of the Interior's Standards for Rehabilitation. Alternately, visible solar panels located on top of a compatible new addition should have relatively little impact on the historic character of a property.

Terraces and Retaining Walls *$$ - $$$*

Retaining walls offer another solution to redirect water runoff away from a house and prevent erosion that could cause further damage in the event of a flood. Costs will vary depending on the property layout and material used to construct the wall.

Wall/Perimeter Barrier *$$$$*

Erecting a perimeter barrier means that a home can stay in its current location and elevation. Cost varies depending on the height of the wall, which can be as short as three feet.

Bayside

Development History

Located on the Portland peninsula, Bayside has always been a mixed-use neighborhood; its earliest development patterns featured residential buildings adjacent to commercial and industrial ones. The neighborhood is largely built on fill: it was expanded by the infill of Back Cove several times in the past 200 years. Filling first began in 1840, when railroad executives urged infill so they could run tracks along the expanded coastline. Industrial development occupied much of this new coastal land by the mid-19th century, and by 1900 the shoreline extended to Marginal Way. During the 1950s, urban renewal drastically altered the landscape through large scale residential demolition and the construction of industrial buildings and new roads, including the Franklin Arterial, which divided the neighborhood in two.

This map from the 1871 Cumberland County Atlas shows Bayside after filling in 1840 to support the railroad tracks. The proposed Marginal Way is pictured across the water.

From its beginnings as a significant industrial warehouse area on the waterfront, in more recent years Bayside has been revitalized as a mix of commercial and residential buildings. Many lots are still underdeveloped, either vacant lots or parking lots, as a result of urban renewal clearances or later demolitions as industry in the area declined. Lancaster Street in West Bayside and Fox Street in East Bayside form a fairly strong separation between the residential and commercial areas, with the exception of Hammond Street in East Bayside.

Historic Significance

One of the oldest neighborhoods in Portland, Bayside is a mixed residential, commercial, and industrial district that has seen the evolution from a high-density neighborhood of working-class immigrants to its current diverse, mixed-income neighborhood.

Federal-style 235 Cumberland Ave. in Bayside

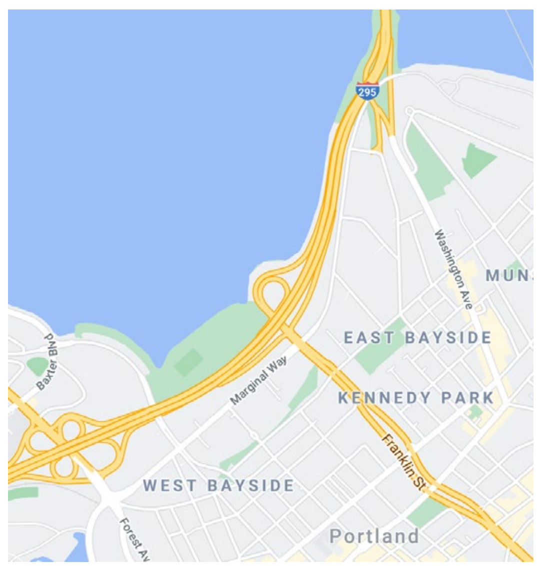
The neighborhood is known for its mix of architectural styles, illustrating ongoing evolution through different periods of development. The earliest known building in Bayside (235 Cumberland) was constructed in the Federal style, which remained popular throughout the 1820s and 30s. During the 1840s and 1850s, the Greek Revival style grew in popularity, and around half of Bayside's 126 surviving historic buildings were constructed in this style. After the Great Fire of 1866, new homes for individuals displaced by the disaster were constructed in Bayside in the Second Empire and Italianate styles. Three churches and eleven commercial buildings were constructed post-1866 as well.

As a result of additional filled land along Back Cove, industry in Bayside grew rapidly during the mid-20th century. Sanborn maps

Typical Bayside streetscape (Photo by Corey Templeton)

reveal that between the years of 1949 – 1958 the neighborhood saw the building of a motor freight station and warehouses for Sears-Roebuck Company, Westinghouse Electric Corporation, the Harcon Iron and Steel Company, the H.J Heinz Company, General Electric Supply Company, and many others. The majority of these warehouse buildings remain today, retaining a high degree of integrity and representing a cohesive picture of the economic importance of industry to Portland during this time.

Bayside remained a stable working-class neighborhood through the 1950s, though an influx of shipyard workers during World War II led to pockets of overcrowding and poverty. Faced with the effects of disinvestment from the Great Depression, federally-funded highways that allowed people to commute by car to downtown Portland from surrounding communities, and the rising popularity of suburban malls, local government worried about the economic viability of Portland's downtown and targeted the "slums" of Bayside for instigating commercial decline. On the peninsula, a series of arterials were planned to facilitate auto access to key downtown streets and offices. The construction of the Franklin Arterial split Bayside into two separate neighborhoods. From 1961 to 1972, the Slum Clearance and Redevelopment Authority (SCRAP) demolished more than 2,800 housing units in Portland, many of them in Bayside and home to immigrants and first-generation citizens. In their place, the city built public housing developments such as Kennedy Park (1964-1965) and the 16-story Franklin Tower (1969). Additionally, the state filled in even more of Back Cove in 1974 to build Interstate 295.

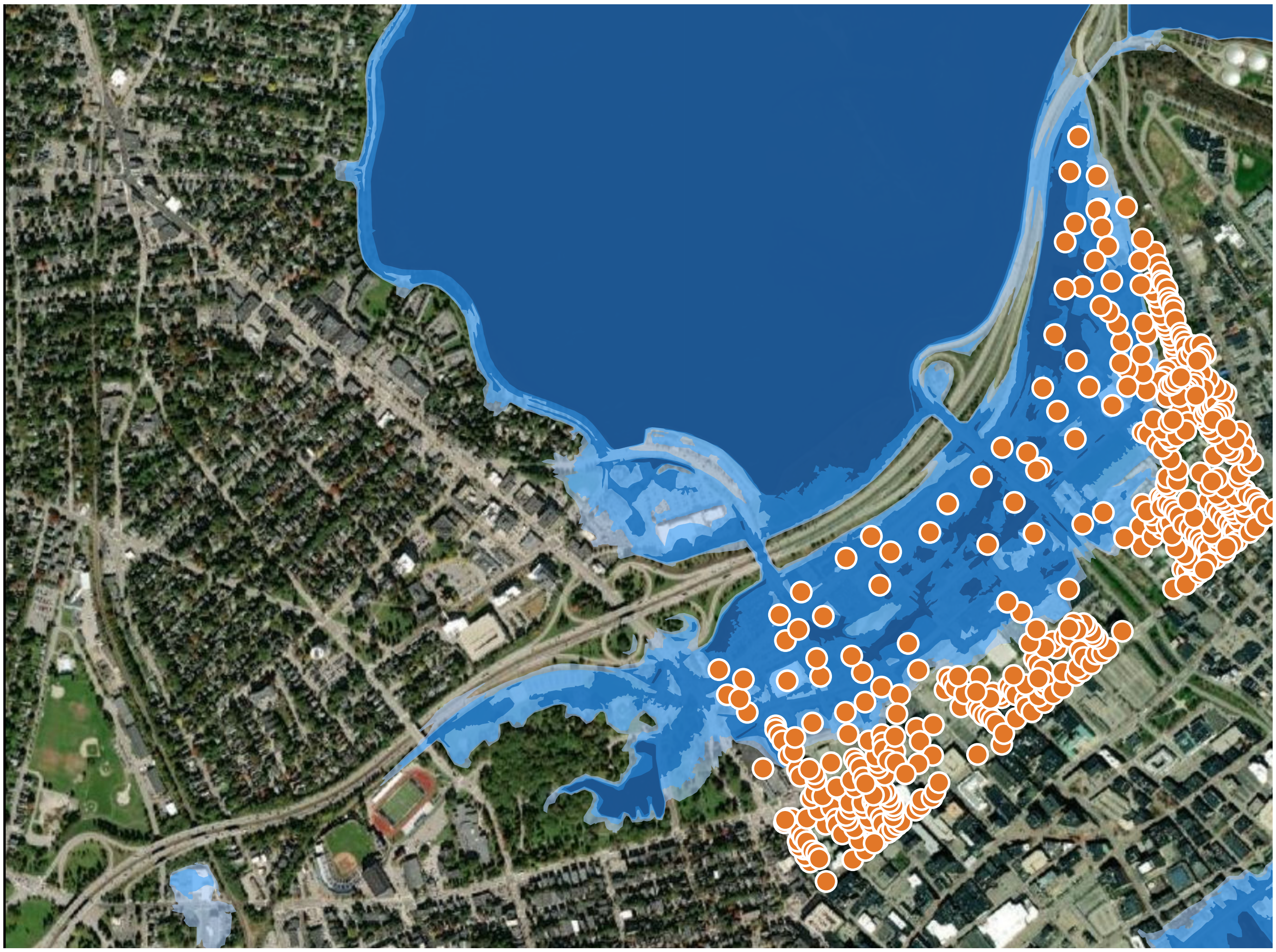


A current map of Portland shows the extent of fill in Bayside, and the neighborhood split in two by Franklin Street.

Despite the dramatic changes caused by Urban Renewal, road construction, and the decline of industrial activity, both East and West Bayside fundamentally retained their identity as working class neighborhoods that attracted new immigrants. In the last decades of the 20th century, refugees from Indonesia, Cambodia, Vietnam, Sudan, Somalia, and Iraq have made the neighborhood their home. Currently, new businesses such as Bayside Bowl, Tandem Coffee Roasters, and Rising Tide Brewery have revitalized industrial properties in northern East and West Bayside, attracting more upper middle-class residents to the neighborhood and raising concerns over gentrification.

Threat

As the population and economy of East and West Bayside continues to grow, so too does the threat of climate change. Flooding now occurs regularly during heavy rainfall and high tides along Marginal Way and Somerset Street, and is only projected to get worse. Most affected are the buildings constructed on land filled in during the 19th and 20th centuries. Due to sea level rise, Back Cove is slowly creeping back to reclaim those areas of the neighborhood that did not exist 225 years ago.



Each orange dot represents a surveyed historic resource in Bayside at risk due to increased flooding and sea level rise caused by climate change.

Case Studies: Adaptation and Mitigation Strategies

32 Anderson Street

c.1889, Italianate

Existing Conditions

This multi-family residence rests on a high foundation in an elevated area in Bayside. Although not identified as at risk to flooding from rain and storm surges, storm water runoff from uphill sites and parking lots to the rear of the dwelling could impact the masonry foundation and at-grade openings. There are few trees to shade the southwest-facing yard. The lot could be improved to encourage site drainage away from the building's foundation.

Strategies

- Install solar panels on the south slope of the roof, set back from the edge of the gable end
- Elevate critical mechanical systems on the interior
- Resize gutters to handle increasing precipitation loads and drain away from foundation.
- Install rain barrels or integrate gutter runoff into landscaping strategies
- Slope grade and landscaping away the foundation on the uphill side of the house to help drainage
- Install hardware around openings at grade level to accommodate retractable flood shields during storm events
- Reduce impermeable paving, particularly uphill of the dwelling

17 Brattle Street

c.1849, Greek Revival

Existing Conditions

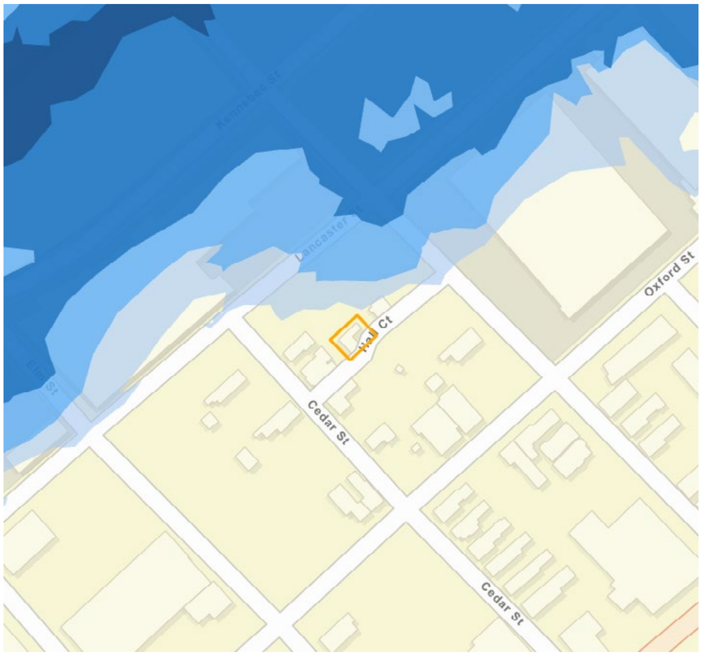
This single-family residence rests on a high foundation in an elevated area in Bayside. Although not identified as at risk to flooding from rain and storm surges, storm water runoff from nearby paved streets and parking lots uphill and across the street from the dwelling could impact the masonry foundation and at-grade openings. A large deciduous tree shades the south-facing side yard. The lot could be improved to encourage site drainage away from the building's foundation.

Strategies

- Install solar panels on the ell roof or main roof, set back from the edge of the gable end
- Elevate critical mechanical systems on the interior
- Integrate rainwater run off strategies into landscaping
- Maintain masonry, particularly chimneys to reduce damage from loose falling bricks and water infiltration
- Install hardware around openings at street level to accommodate retractable flood shields during storm events
- Slope grade and landscaping away from the foundation on the uphill side of the house to improve site drainage

3 Hall Court

c.1820, vernacular



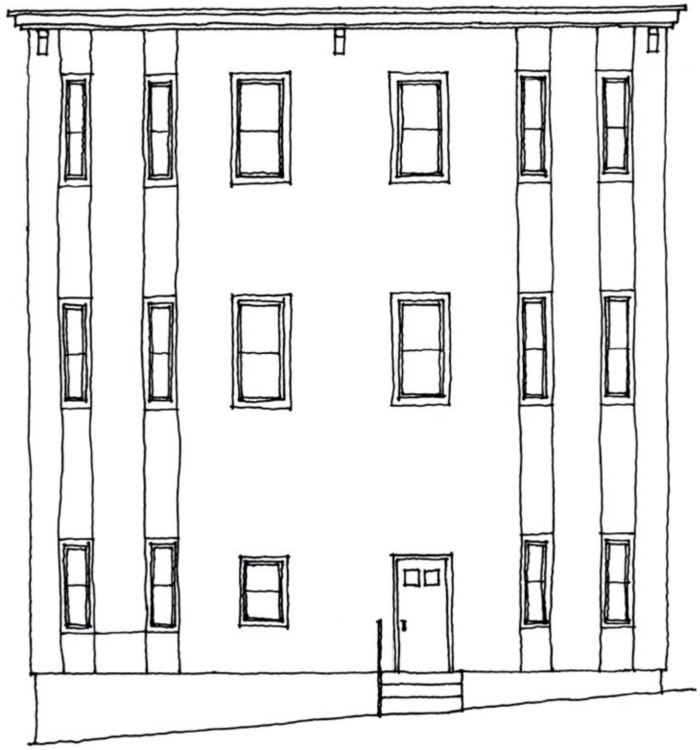
Existing Conditions

This historic single-family residence (c.1820) is built very close to grade and located at the edge of a low-lying area of Bayside identified as at risk to flooding from rain and storm surges. The area around the house features many paved surface parking lots where runoff during storm events negatively impacts adjacent properties and the city's storm water system. With the building sill located close to grade, even minimum levels of flooding or storm water runoff would submerge or wet the building's wood framing, siding, and trim. The front entrance is also very close to grade and susceptible to flood waters.

Strategies

- Resize gutters to handle increasing precipitation loads
- Install rain barrels or integrate rainwater run off strategies into landscaping
- Add trees where possible to help lower temperature by providing shade.
- Install solar panels on site or on the secondary elevation.
- Elevate critical mechanical systems on the interior

47-49 Boyd Street
c.1904, vernacular triple-decker



Existing Conditions

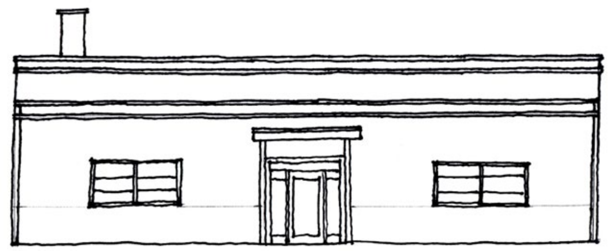
This multi-family residence rests on a foundation that reflects the topographical change on Boyd Street at the edge of a low-lying area identified as at risk to flooding from rain and storm surges. The area around the dwelling features many paved surface parking lots where runoff during storm events impacts adjacent properties and the city's storm water system. There are limited large trees to shade the yard or building. The relatively flat lot could be improved to encourage site drainage away from the building's foundation, particularly on the uphill side of the dwelling.

Strategies

- Install a cool roof on flat or low-slope roofs to reduce interior temperature and reduce heat island effects
- Elevate critical mechanical systems on the interior and exterior
- Install solar panels on the roof in consultation with a structural engineer or at the rear of the site
- Size gutters to handle increasing precipitation loads
- Install rain barrels or integrate rainwater run off strategies into landscaping
- Slope grade and landscaping away the foundation on the uphill side of the house to help drainage
- Add trees where possible to help lower temperature by providing shade.

66 Cove Street

c.1953, vernacular



Existing Conditions

This industrial brick building (c.1953) is typical of many of its small-scale neighbors, built in an section of Bayside that was once part of Back Cove until it was filled in the first half of the 20th century. The area currently experiences nuisance flooding during extreme storm and high tide events. The at-grade entrance is vulnerable to street flooding. Likewise, mechanicals systems on the exterior, and possibly the interior, are at risk from street flooding. Impermeable paving in the parking area surrounding the building does not allow storm water to penetrate into the ground and raises the temperature more than a vegetated surface would do.

Strategies

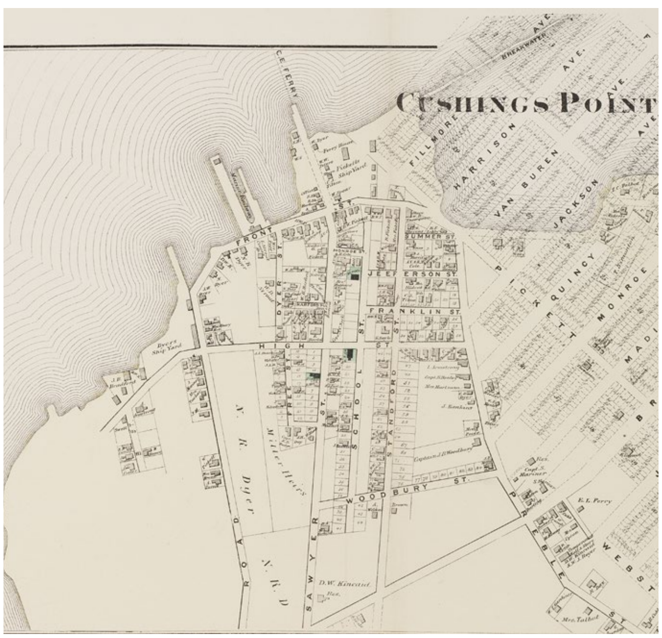
- Install a cool roof on flat or low-slope roofs to reduce interior temperature and reduce heat island effects
- Install solar panels on the roof in consultation with a structural engineer, or at the rear of the site
- Reduce impermeable paving in the parking area
- Add trees where possible to help lower temperature by providing shade
- Install temporary, deployable barrier at at-grade entrances during storm events
- Elevate critical mechanical systems on the exterior

Ferry Village

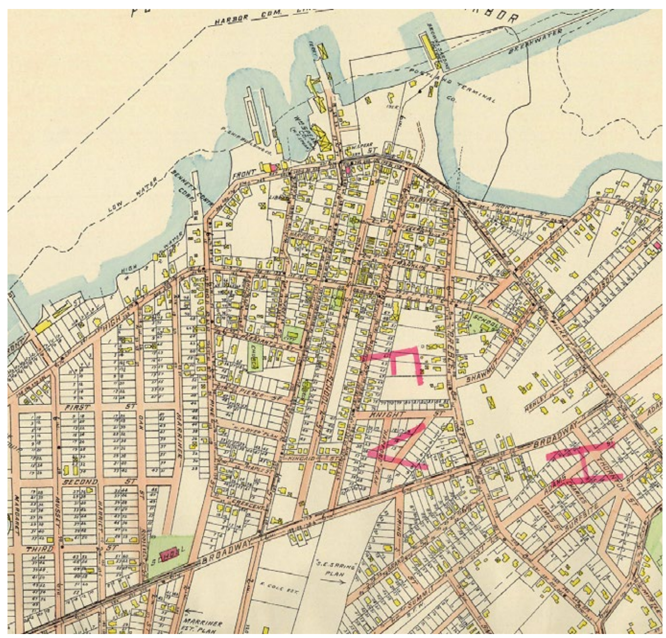
Development History

In 1850, George Turner and James Cahoon bought a large portion of land in the present-day Ferry Village and Knightville neighborhoods in South Portland. Their intention was to begin to subdivide the land and sell it at reasonable prices so that working-class individuals could afford to live there. Ferry Village began to take its modern shape during the 1870s as the neighborhood was subdivided and streetcars were introduced in the area, but this vision was only partially realized. In 1892, the western half of today's Ferry Village neighborhood was laid out in a subdivision of the former Mussey Farm with Harriet, Mussey, and Margaret Streets. A few years later, the area west of Pine Street, including Marriner Street, was subdivided from the estate of Joseph Marriner. Only 70 homes existed in the area by the time shipbuilding companies bought it in the 1940s.

In addition to shipbuilding, many other industries occupied the waterfront through mid-20th century, including a bicycle factory, sardine processing plant, and a plush factory that made fabric for automobiles. The waterfront land was expanded by filling parts of the harbor.



Early development in Ferry Village pictured in the 1871 Cumberland County Atlas.



The 1914 Richards Atlas shows additional fill and increased waterfront development in the area.

During World War II, some of the neighborhood's residences were removed for the construction of shipyards at Cushing Point, while unimproved lots on the west side of the neighborhood were developed with single family homes and apartment buildings to house shipyard workers. Since the demolition of the New England Shipbuilding Co. shipyards post-World War II, Ferry Village has returned to an almost entirely residential suburban neighborhood, with not even the main commercial street maintaining much of its pre-war character.

Historic Significance

Originally part of Cape Elizabeth, Ferry Village is significant for its long history in the shipbuilding industry, beginning in the early 1800s. In 1845, the ferry Elizabeth was constructed, connecting Ferry Village to Portland. Ferry Village was built up largely in the 19th century with later residential infill in the mid-20th century. The neighborhood consists of small-scale residential buildings in the Greek Revival, Italianate, Second Empire and Queen Anne styles. Ferry Village also features small-scale commercial, mixed-use, religious, and educational buildings from the 19th century.

Greek Revival 148-150 Sawyer Street in Ferry Village

On the eve of the United States' entrance into World War II, the Todd-Bath Iron Shipbuilding Corporation in South Portland opened a yard and was building ships for the British who were having a hard time keeping up production on their own, having lost so many vessels to German U-Boats. When the United States officially entered the war, the Maritime Commission called for the building of a second yard to handle the demands for new ships. The western yard was built on the eastern shore of Ferry Village after the property was seized by the government for the project, destroying many houses in the area. Soon the two shipyards were in full production, and by 1943 they joined together in order to form the New England Shipbuilding Co. Between 1942 and 1945 over 250 ships would be built and launched out of the combined yards.

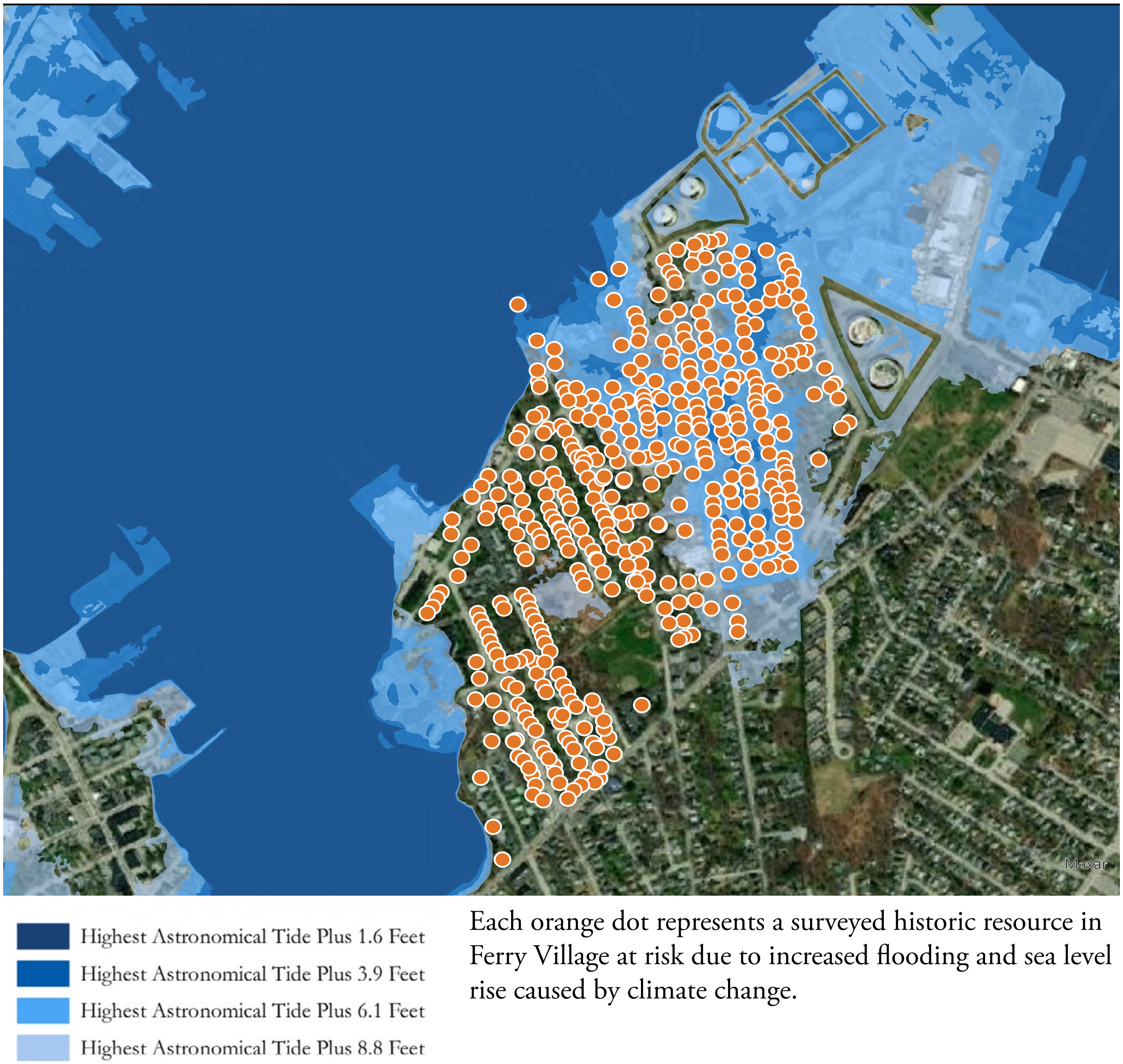
Italianate 179 High Street in Ferry Village

With the increase of naval presence in the area came a need for increased housing. In Ferry Village, small, single-family homes were constructed on undeveloped lots and a larger housing project, the Mill Cove Terrace apartments, was built. The Mill Cove Terrace apartment buildings are typical of units built in Greater Portland during this period. The development is laid out in a formal street plan comprised of simple, two-story rectangle apartment buildings that have two central doors with small porch hoods.

Typical Ferry Village streetscape

Threat

The low-lying character of the shoreline, as well as the fill and subsequent development in areas once part of the harbor, has left Ferry Village vulnerable to the effects of sea level rise. Further risk is posed by a stream that once bisected the neighborhood and is now buried, its former path apparent in flood maps that project flooding in properties far from the shoreline. Historic images depict flooding as far into the neighborhood as High Street, and anecdotal evidence of water in basements in the area of the former stream during extreme rain events corroborates the threat to properties deep into the Ferry Village neighborhood.

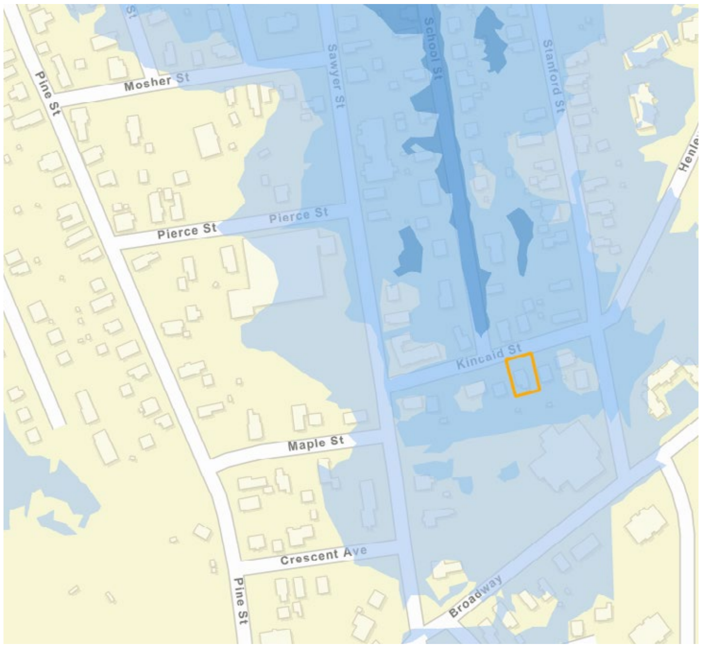


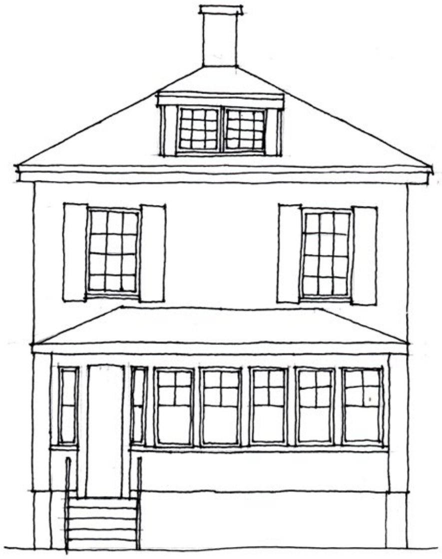
Each orange dot represents a surveyed historic resource in Ferry Village at risk due to increased flooding and sea level rise caused by climate change.

Case Studies: Adaptation and Mitigation Strategies

16 Kincaid Street

c.1900, Craftsman





Existing Conditions

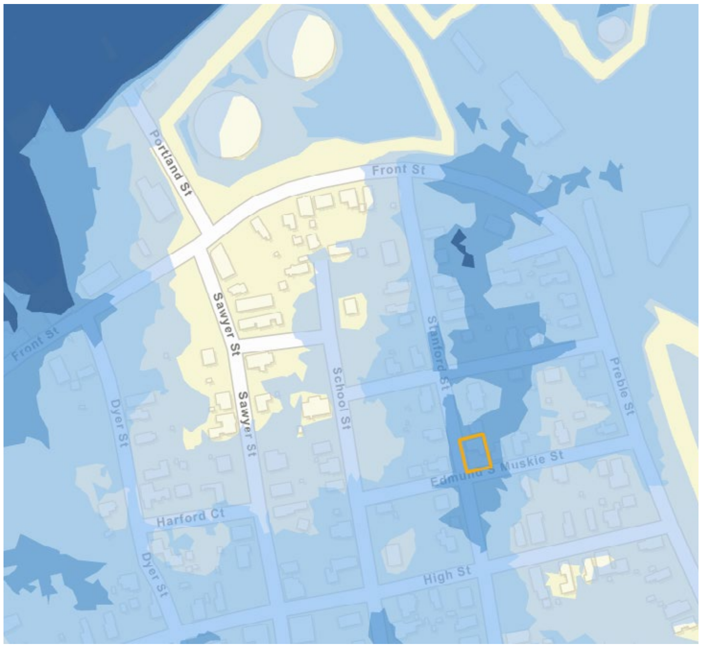
This single family residence rests on a high foundation at the edge of a low-lying area in Ferry Village identified as at risk to flooding from rain and storm surges. Buildings in this area were anecdotally noted during the study to have wet basements during some major rain events. Large trees shade the south-facing rear yard. The relatively flat lot could be improved to encourage site drainage away from the building's foundation.

Strategies

- Elevate critical mechanical systems on the interior
- Integrate rainwater run off strategies into landscaping
- Maintain masonry, particularly chimneys, to reduce damage from loose falling bricks and foundations to prevent water infiltration
- Slope grade and landscaping away the foundation to help drainage
- Reduce impermeable paving in the driveway
- Add trees where possible to help lower temperature by providing shade
- Install solar panels on the rear roof slope

27 Edmund S. Muskie Street

Benjamin W. Pickett House
c.1865, Italianate



Existing Conditions

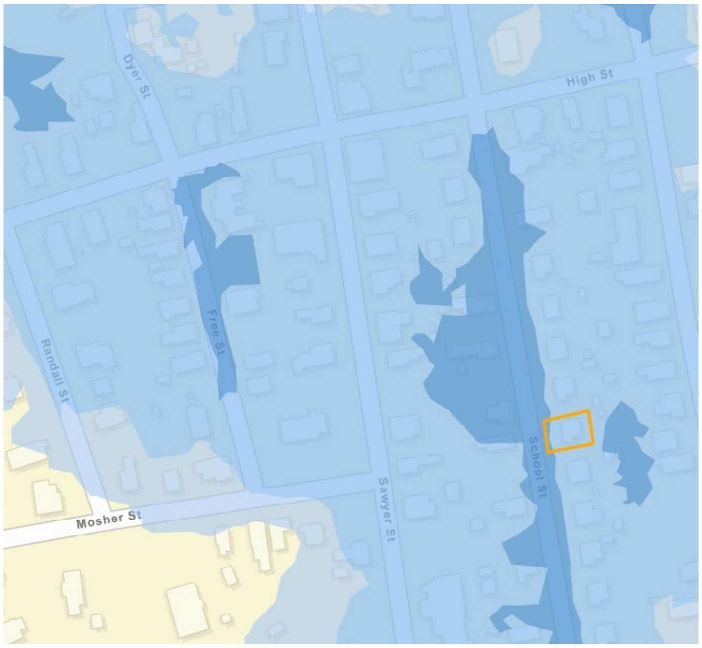
This historic single family residence (c.1865) is built very close to grade and located in a low-lying area of Ferry Village identified as at risk to flooding from rain and storm surges. With the building sill located close to grade, even minimum levels of flooding would submerge the building's wood framing, siding, and trim. The front entrance is also very close to grade and susceptible to damage from flood waters. Elevated levels of ground water could impact the basement, damaging critical mechanical systems.

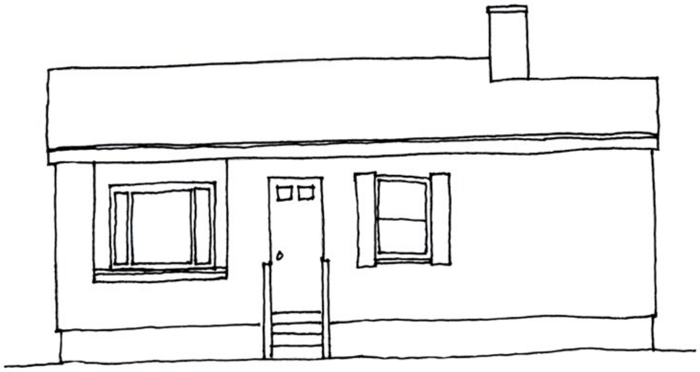
Strategies

- Elevate critical mechanical systems on the interior
- Size gutters to handle increasing precipitation loads
- Install rain barrels or integrate rainwater run off strategies into landscaping
- Slope grade and landscaping away the foundation to help drainage
- Install solar panels on the ell roof, garage, or at the rear of the site
- While a last resort, elevating the entire structure to raise the wood sills and entry above projected flood levels is an option. It would be prudent to raise the surrounding site where possible to mask the visual impact of the structure's elevation.

154 School Street

1962, Ranch





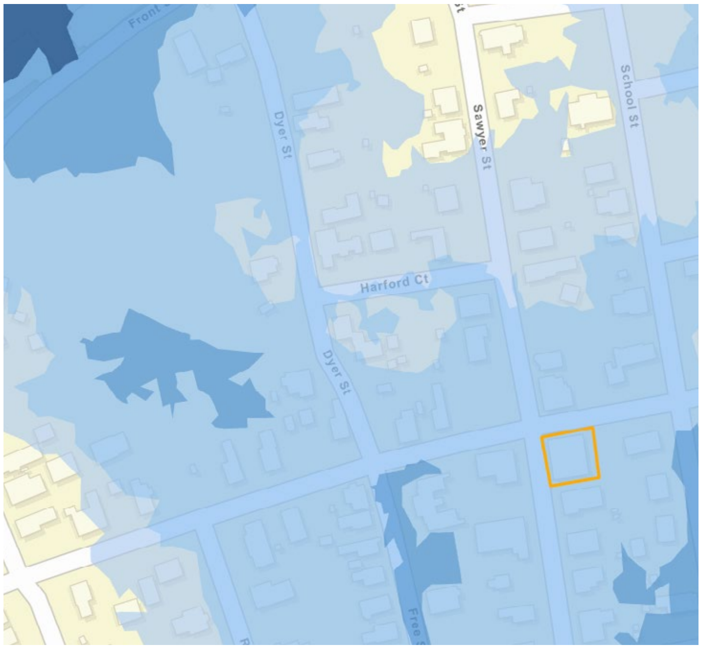
Existing Conditions

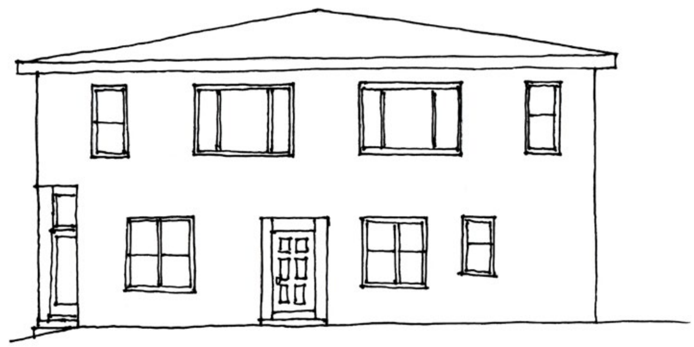
This single-family residence is slightly elevated above street level, in a low-lying area of Ferry Village identified as at risk to flooding from rain and storm surges. Buildings in this area were anecdotally noted during the study to have wet basements during some major rain events. Basement windows on the side elevations are at or near grade and are potentially vulnerable to flooding. Elevated levels of ground water could also impact the basement, damaging critical mechanical systems.

Strategies

- Install solar panels on the roof or site
- Elevate critical mechanical systems on the interior
- Integrate rainwater run off strategies into landscaping
- Maintain masonry, particularly chimneys to reduce damage from loose falling bricks
- Slope grade and landscaping away the foundation to help drainage
- Reduce impermeable paving in the driveway
- Add trees where possible to help lower temperature by providing shade
- Install hardware around basement windows to accommodate retractable flood shields during storm events

124 Sawyer Street
c.1900, vernacular





Existing Conditions

This mixed-use building at the corner of two major streets is located close to the sidewalk on two sides of the building and surrounded by paved parking on the two remaining sides. This low lying area of Ferry Village has flooded during historic storm events. Entries at or near grade are vulnerable to street flooding. Impermeable paving in the parking area does not allow storm water to penetrate into the ground and raises the temperature more than a vegetated surface would do.

Strategies

- Elevate critical mechanical systems on the interior and exterior
- Install temporary, deployable barriers at building entrances during storm events
- Install a cool roof on flat or low-slope roofs to reduce interior temperature and reduce heat island effects
- Install solar panels on the south slope of the roof
- Reduce impermeable paving in the parking area
- Integrate rainwater run off strategies into a new landscaping plan

Additional Resources

- **Boston Resilient, Historic Buildings Design Guide**
  https://www.boston.gov/sites/default/files/imce-uploads/2018-10/resilient_historic_design_guide_updated.pdf
- **City of Geelong: Site Permeability**
  http://bit.ly/siteperm
- **FEMA: Elevator Installation for Buildings in Special Flood Hazard Areas**
  https://www.fema.gov/media-library-data/1565284277165-49c1fcacd9c85fe504ad34438b0fbe4f/FEMA_TB4_FINAL_070219_508.pdf
- **FEMA: Foundation Requirements and Recommendations for Elevated Homes**
  https://www.fema.gov/media-library-data/1386073605870-56034eb27952e04bd44eb84b72032840/SandyFS2OpenFoundation_508post2.pdf
- **FEMA: Know Your Risk**
  https://www.fema.gov/flood-maps/products-tools/know-your-risk/homeowners-renters
- **FEMA: Protecting Building Utility Systems from Flood Damage**
  https://www.fema.gov/media-library-data/1489005878535-dcc4b360f5c7eb7285acb2e206792312/FEMA_P-348_508.pdf
- **FEMA: Protecting Service Equipment**
  https://www.fema.gov/media-library-data/1404150306122-7fa382623802512d66e4835281547fd0/FEMA_P312_Chap_9.pdf
- **FEMA: Retrofitting**
  https://www.fema.gov/pdf/fima/FEMA511-11-Chapter10.pdf
- **Maine's Climate Future: Coastal Vulnerability to Sea Level Rise**
  https://extension.umaine.edu/maineclimatenews/wp-content/uploads/sites/37/2011/06/MSG-E-10-04_SeaLevelRise.pdf
- **Maine Historic Preservation Commission: Climate Change and Historic Resources**
  https://www.maine.gov/mhpc/programs/protection-and-community-resources/climate-change
- **Maine Sea Grant: Building a Resilient Coast**
  https://seagrant.umaine.edu/wp-content/uploads/sites/467/2019/03/2009-sarp-comparative-analysis.pdf
- **National Park Service: Guidelines on Flood Adaptation for Rehabilitating Historic Buildings**
  https://www.nps.gov/tps/standards/rehabilitation/flood-adaptation.htm
- **National Park Service: The Secretary of the Interior's Standards for the Treatment of Historic Properties**
  https://www.nps.gov/tps/standards/treatment-guidelines-2017.pdf
- **University of Maine: Climate Change Institute**
  https://climatechange.umaine.edu/

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