

# Imagine a Bay State Without Beaches

## Strategies for balancing coastal defense and public access



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SAVE THE HARBOR //  
SAVE THE BAY

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# INTRODUCTION

## Boston's Public Beaches

Boston is a city that is intricately tied to the waterfront. The harbor serves as a place for ecological and recreational activity all while establishing productive economies. Although there is a hope that all facets of the harbor will thrive equally, climate change has placed unprecedented challenges upon the city to reevaluate a future Boston negotiating sea level rise and increased storm events.

Today and throughout history, communities around the harbor have experienced the impacts of flooding, erosion, and the damaging forces produced by coastal storms. Climate change will exacerbate these conditions, putting natural resources and the public realm of the harbor at risk. This document looks to understand the physical conditions of 14 public beaches in the Greater Boston area maintained by the Department of Conservation and Recreation. Looking to the future, the project will also begin to vision how these beach resources could potentially change over time as the city begins to develop new strategies to adapt and mitigate the impacts of new environmental challenges.

It is also important to emphasize that public beaches not only contribute to an ecologically rich harbor, but provide conditions to buffer coastal communities against the impacts of climate change while promoting public health through recreational opportunities. While this document focuses on the physical conditions of public beaches, it is necessary to further this work by centering the needs of populations who have been denied adequate infrastructural resources and focus on how investment in public spaces is equitably distributed to support historically marginalized people of color.



**HISTORY:**

**LANDMAKING  
AND SHORELINE  
TRANSFORMATION**

# WATERFRONT EVOLUTION

## PAST AND PRESENT SHORELINES

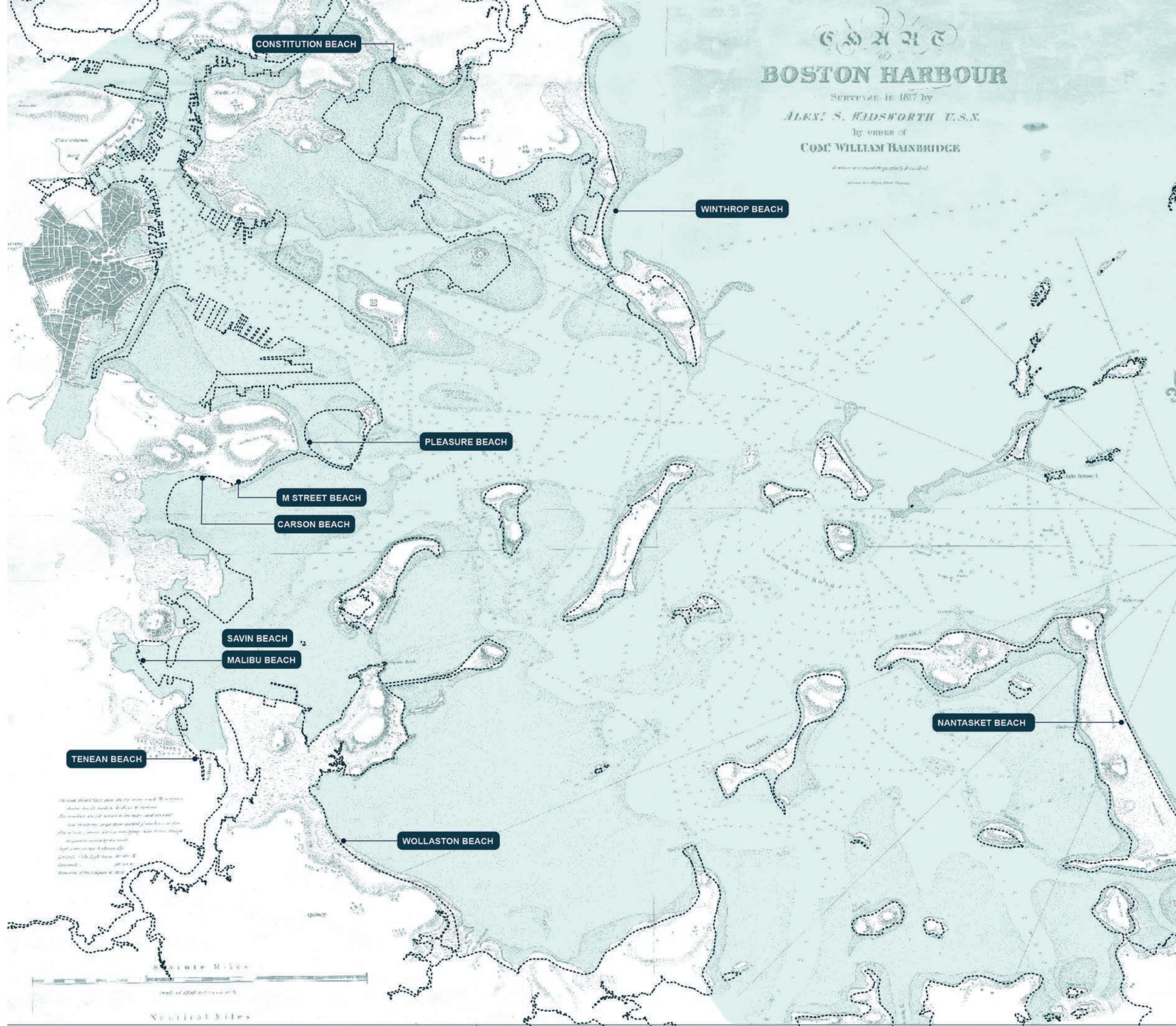
In order to understand the impact of climate change along Boston's public waterfront, past landfilling events are critical to acknowledge in influencing today's physical conditions. In the book, *Gaining Ground: A History of Landmaking in Boston*, author Nancy Seashoals documents projects driven by social, political, and economic influences that have resulted in the fabricated shoreline visible today.

In the adjacent map, an 1817 survey of the Boston Harbor is compared to the demarcated shoreline that exists today. In many cases historically low lying marshes and tidal mudflats were covered with various sediments to create new forms of elevated land to support the development of transportation, residential housing, and industry.

As marshes and tidal mudflats were transformed from a soft ecological buffer to a hard coastal edge, coastal processes occurring throughout the harbor shifted as well. Shoaling, erosion, and deposition are just some of the processes that have been greatly impacted and ultimately set the city of Boston on a trajectory of continuous maintenance of made land. Greater Boston's public beaches are no exception. The map identifies areas such as Carson Beach, Constitution Beach, and Malibu Beach that were completely fabricated land conditions to support recreational use.

### References:

1. [https://www.google.com/books/edition/Gaining\\_Ground/GAHS1C-9q1EsC?hl=en&gbpv=1&printsec=frontcover](https://www.google.com/books/edition/Gaining_Ground/GAHS1C-9q1EsC?hl=en&gbpv=1&printsec=frontcover)
2. <https://historyofmassachusetts.org/how-boston-lost-its-hills/>
3. Wadsworth, *Boston Harbor Survey, 1817*



# HISTORIC CHANGE AT BOSTON BEACHES

## CREATION OF PUBLIC RECREATION SPACES

The public beaches of Greater Boston's Metropolitan area represent diverse shoreline conditions and vary from man-made constructions to natural features. Both of these environments are continually shaped by interactions with coastal processes.

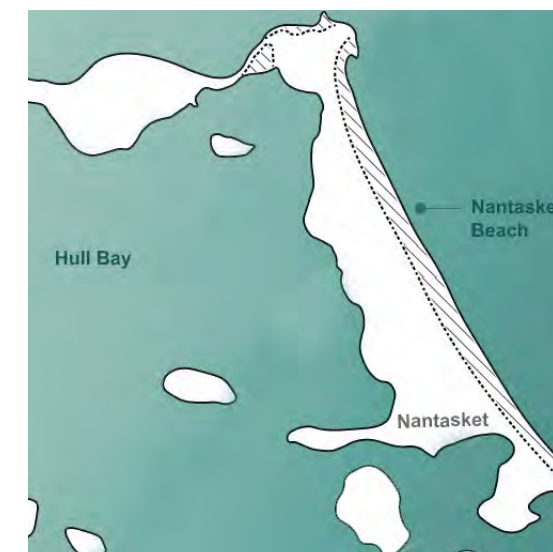
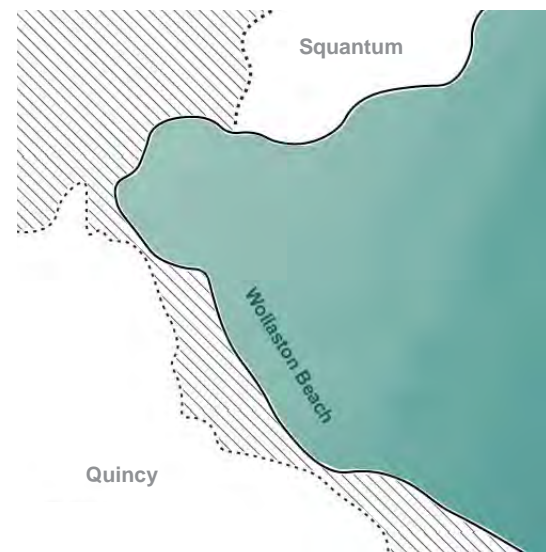
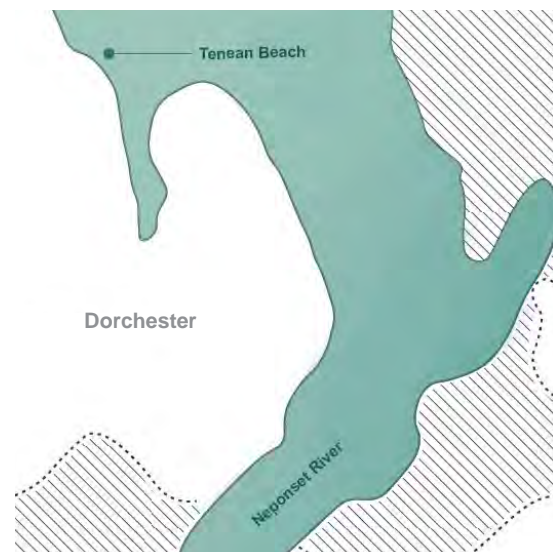
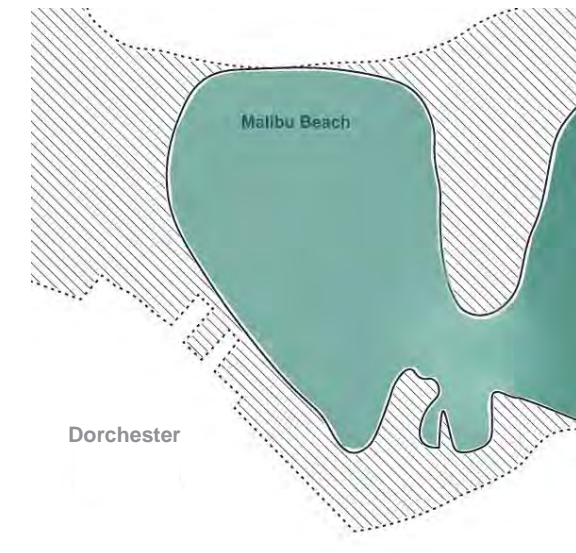
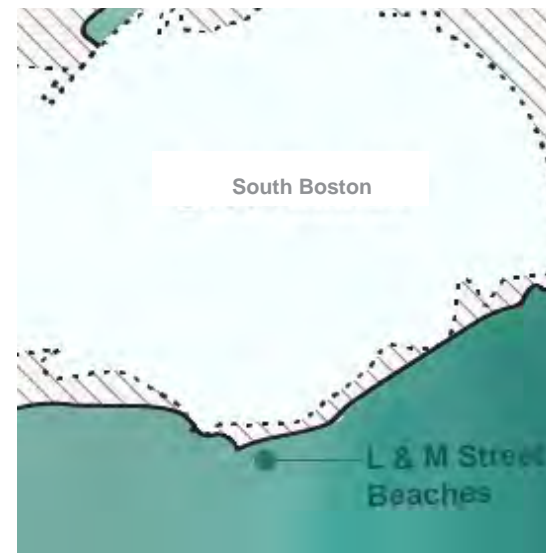
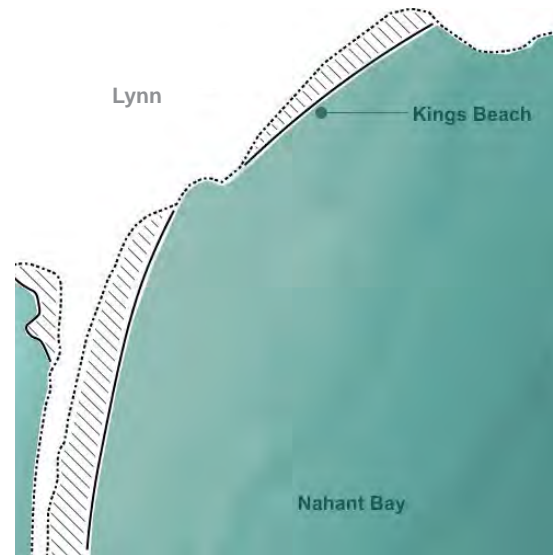
In many cases to create a sandy beach condition, marsh and tidal mudflats were filled with sandy material dredged from various offshore locations. Because some public beach conditions did not exist historically, maintenance and upkeep of sandy sediment is necessary.

Some public beaches, such as Winthrop and Wollaston, have historically existed along the coast but need to receive replenishments of sand through a process called beach nourishment. Inland development compounded by the hardening of coastal edges through man made seawalls, groins, breakwaters, and jetties have shifted sediment transport dynamics. As a result erosive forces have reduced the width of these beaches, increasing vulnerability for communities further inland.

Communities located on filled land also have an increased risk of inundation due to development on low elevational areas. As climate change brings intense coastal storms and increases sea levels, its critical to understand past conditions to understand the range of vulnerabilities impacting built form.

### References:

1. [https://www.google.com/books/edition/Gaining\\_Ground/GAHS1C-9q1EsC?hl=en&gbpv=1&printsec=frontcover](https://www.google.com/books/edition/Gaining_Ground/GAHS1C-9q1EsC?hl=en&gbpv=1&printsec=frontcover)
2. <https://historyofmassachusetts.org/how-boston-lost-its-hills/>
3. Wadsworth, *Boston Harbor Survey, 1817*



**MAPPING:**

**EXISTING CONDITIONS  
OF PUBLIC BEACHES**

# NAHANT BEACH

## Today's Coastal Infrastructure

Nahant Beach is located on an isthmus between Nahant and the mainland at Lynn. While there are no residential developments behind Nahant Beach, the causeway that connects Nahant to Lynn is a critical piece of infrastructure. The causeway was first developed in 1905 as part of a program to develop ocean parkways lead by the former Metropolitan Districts Commission.

Today the shores of Nahant Beach are a combination of man made and natural resources. Revetments and seawalls are the major types of infrastructure that reinforce the beach and prevent damage during coastal storm events.

### Seawall

The seawall along Nahant Road has been documented dating back to 1913. While the condition of this coastal edge is "fair" there are deteriorations along the structure. It is important to recognize that this structure plays a critical role in maintaining the land connection between Nahant and the mainland at Lynn.

### Private Coastal Structures

While many infrastructures along Nahant Road are maintained by the state, various parts of the shoreline are owned by private entities. Little Nahant Island is surrounded by private coastal structures and as a result, coordination for a comprehensive systemic approach to defend the shoreline can be difficult.

### Stone Revetments

A series of stone revetment are in place to dissipate wave energy from coastal storms and reduce the impact of flooding along the

Nahant Causeway. Similar to the seawall, these structures have been documented since 1913 and have been reported to be in "fair" condition. While this is the case, there is concern regarding the structures capability to defend the shoreline in the event of a major storm.

### Barrier Beaches

Before the creation of the Nahant Causeway, Long Beach was a land formation exposed at low tide which allowed for crossing into Nahant. This bar of sand has existed for generations and the beach acts as a buffer against tidal and wave energy coming from the ocean.

### References:

1. Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009
2. [https://en.wikipedia.org/wiki/Nahant\\_Beach\\_Boulevard#:~:text=Nahant%20Beach%20Boulevard%20was%20first,Olmsted%20Brothers%20landscape%20design%20firm](https://en.wikipedia.org/wiki/Nahant_Beach_Boulevard#:~:text=Nahant%20Beach%20Boulevard%20was%20first,Olmsted%20Brothers%20landscape%20design%20firm).
3. <https://nahanthistory.org/news/2019/4/4/the-local-history-of-fairy-land-nahant>





# NAHANT BEACH

## Coastal Storm Surge Inundation

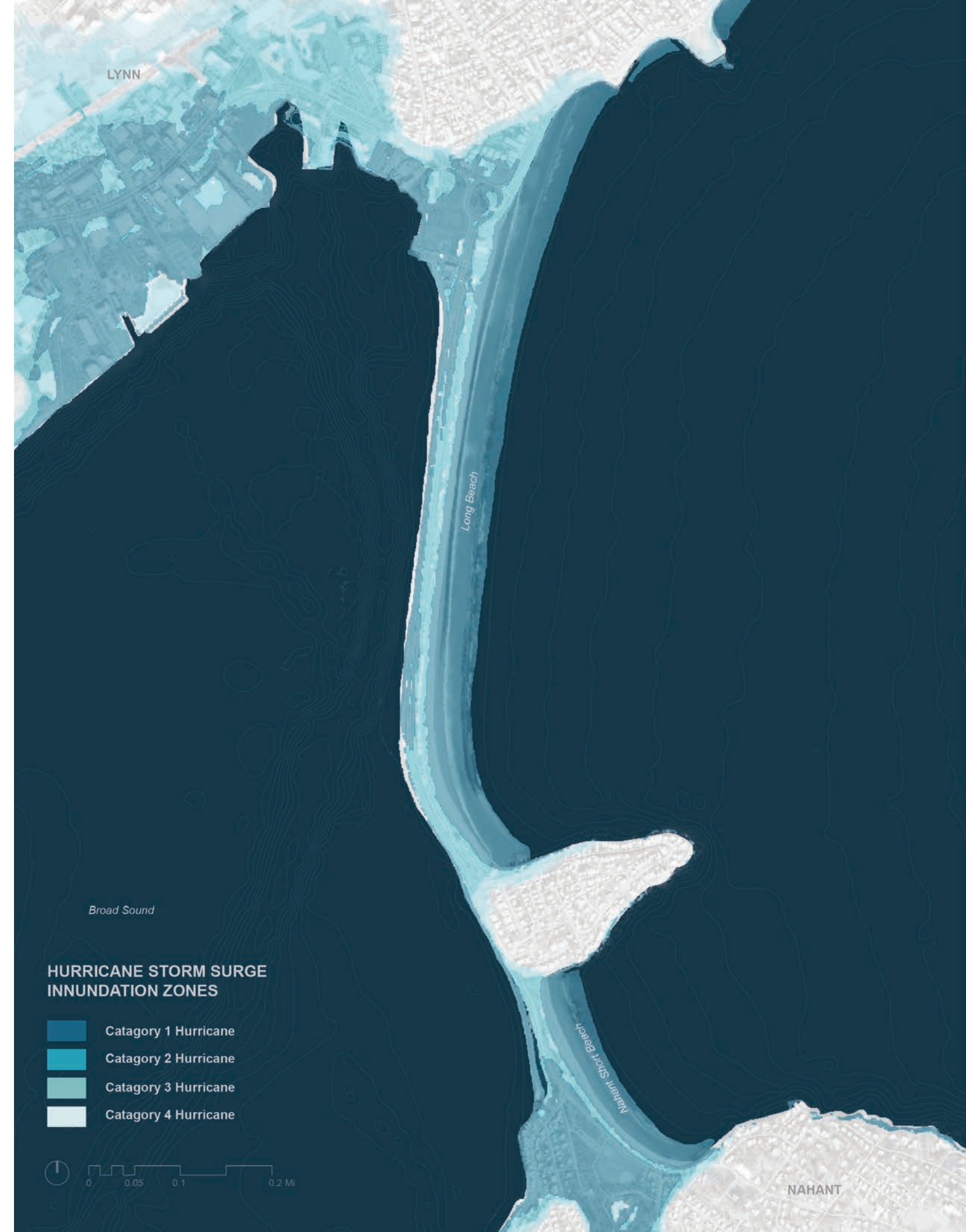
Heavy rainfall events have resulted in flash flood events for the Lynn and Nahant communities. These conditions block transportation routes and in their path leave various forms of destruction from totaled cars to damaged residential homes.

Coastal storm events have also pounded the shoreline causing an extensive volatile surf that puts many residential homes at risk. Wave energy from these storms have the power to wash ashore various debris and compromise infrastructures built to reduce the damaging effects of coastal forces.

Another critical issue facing the Nahant and Lynn communities is the lack of adequate drainage in response to flooding. Many reports document standing water days after floodwaters came ashore. This presents the inability for the built environment to use infrastructure to rebound after a flood.

*References:*

1. <http://www.msonewsports.com/nahant-weathering-storm-one-high-tide-books-photos-video/>
2. <https://www.boston25news.com/news/officials-struggle-to-pump-out-water-from-waterlogged-nahant/710918660/>



# KINGS BEACH

## Today's Coastal Infrastructure

Kings Beach is located in the city of Lynn along the North Shore of Greater Boston's metropolitan beaches. Land along this coastal edge was privately owned in the late 1800s, but community residents advocated for the shoreline to be allocated for public use. As a result, the Massachusetts Metropolitan Parks Commission acquired land parcels along the waterfront and set in motion the construction of Lynn Shore Drive. The result was an oceanside parkway supported by a structural seawall.

Today, Lynn Shore drive is adjacent to the Lynn Shore Reservation managed by Massachusetts Department of Recreation and Conservation. Through the Massachusetts Coastal Infrastructure Inventory and Assessment Project, the state identified coastal structures along the Kings Beach shoreline that mitigate the impacts of storm waves and coastal flooding. Both publicly owned and privately owned structures were documented to build a comprehensive dataset on the condition of our coastal shorelines.

In the adjacent map, these coastal infrastructures are identified alongside natural shoreline features to establish a comprehensive image of existing conditions along Kings Beach.

### Lynn Shore Drive Seawall

The first records of seawall construction along Kings Beach were established in 1905, and since that time other projects related to seawall maintenance and construction have been documented. The condition rating for the seawall varies along Kings Beach from "Good to Fair". While the seawall still functions in regard to mitigating the impacts of coastal conditions, deterioration has been identified and action will need to be taken to upgrade the seawall.

### Private Coastal Structures

In addition to publicly owned shoreline infrastructures, the state has mapped privately owned coastal infrastructures. These structures can range from bulkheads to seawalls to revetments and are maintained by individual landowners who used these shoreline defenses to reduce impacts from coastal storms and flooding.

### Coastal Beach

Using Massachusetts DEP wetlands data, coastal beaches were identified adjacent to hard shoreline infrastructures. According to the classification, coastal beaches are unconsolidated sediments that are influenced by tides and wave action. Coastal beaches have the potential to feed dune systems and support the attenuation of wave energy.

#### References:

1. City of Lynn Hazard Mitigation Plan, 2016
2. Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009
3. Report of the Board of Metropolitan Park Commissioners, 1901
4. Mapping and Analysis of Privately-Owned Coastal Structures Along the Massachusetts Shoreline, 2013
5. <https://docs.digital.mass.gov/dataset/massgis-data-massdep-wetlands-2005>
6. [https://en.wikipedia.org/wiki/Lynn\\_Shore\\_Drive#:~:text=The%20effort%20to%20create%20Lynn,along%20the%20Diamond%20District's%20oceanfront.](https://en.wikipedia.org/wiki/Lynn_Shore_Drive#:~:text=The%20effort%20to%20create%20Lynn,along%20the%20Diamond%20District's%20oceanfront.)
7. [https://en.wikipedia.org/wiki/Lynn,\\_Massachusetts](https://en.wikipedia.org/wiki/Lynn,_Massachusetts)



# KINGS BEACH

## Coastal Storm Surge Inundation

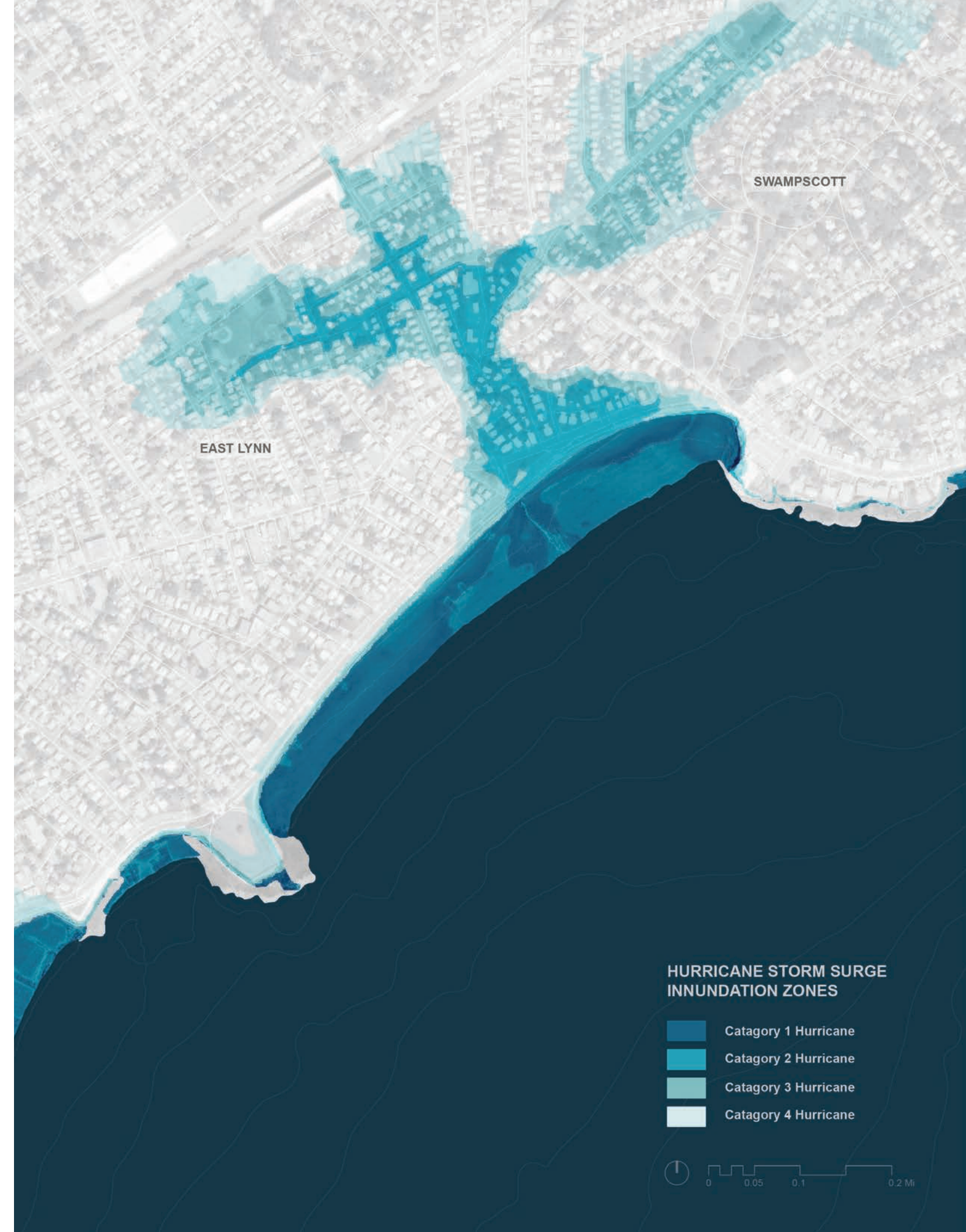
Along Kings Beach, a seawall is the primary defense against coastal flooding. The Nahant Causeway south of the Lynn shoreline also provides an additional buffer from damaging storm waves and flooding. While these physical conditions reduce risk, large storms still have the potential to impact the Lynn community.

According to the 2016 Hazard Mitigation Report, the City of Lynn experienced twenty two coastal flooding events from 1950- 2014. County flood data was used to establish this record, but community members have also documented

areas of observed flooding to produce a more comprehensive dataset. Using GIS data created by the US Army Corps of Engineers, the adjacent map begins to visualize potential extents of hurricane inundation zones dependent on storm severity.

References:

1. City of Lynn Hazard Mitigation Plan, 2016
2. <https://docs.digital.mass.gov/dataset/massgis-data-hurricane-storm-surge-inundation-zones>



# REVERE BEACH

## Today's Coastal Infrastructure

Since the mid 1800's development has occurred along the coast of Revere. The beach was a major attraction and from its inception was known as "the peoples beach" that supported a community of laborers and immigrants. Today, Revere Beach is celebrated as America's first public beach and it continues to be a resources to communities within the Greater Boston area.

Through the Coastal Management Zone's report on publicly owned coastal infrastructure, it was determined that fifteen structures contribute to mitigating the impact of coastal storm surge and flooding. In addition to man-made structures, natural coastal features such as barrier beaches and tidal marshes also work to absorb the impact of coastal storm events.

### Seawall

Along Revere Beach Boulevard, there are various seawall structures that reduce the risk of coastal flooding. The construction of seawall components have been started as early as 1836, but a significant portion of this coastal structure was rebuilt in the late 1980's due to significant storm damage as a result of a 1978 hurricane.

### Beach Nourishment

To maintain the heavily used Revere beach, Congress authorized the US Army Corps of Engineers to move forward with the placement of sand along the Revere Shoreline. Work started on this project in the mid 1950s but was stopped due to lack of funds. In 1991 the beach nourishment project at Revere was resumed and around 600,000 cubic yards of sand material was placed along the beach to reduce the impact of daily tides and annual storm waves.

### Breakwater

While the Coastal Zone Management report on coastal infrastructures does not have a construction date for the breakwater, a 1934 House document describes the approval of a breakwater off Roughan's Point for "the protection of property along the waterfront." While the rating of this coastal infrastructure is "fair" concerns regarding the ability to mitigate the impacts from a larger coastal storm event have been noted.

### Stone Revetment

This waterfront edge is a rocky sloped structure intended to absorb the impact of storm waves. The condition of this infrastructure has obtained a "good" rating from the state and notes that the revetment provides adequate protection to inland properties.

### Tidal Marshes

Rumney Marsh Reservation contains a tidal marsh system that provides a natural buffer along the shores of developed land. The area has significant marine habitat value and the marsh system provides opportunities for water absorption and wave attenuation.

#### References:

1. *Next Stop Revere, Draft Master Plan, 2020*
2. *Open Space and Recreation Plan, 2017*
3. *Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009*
4. *Revere Coastal Flood Protection Study, USACE, 1982*
5. *Mapping and Analysis of Privately-Owned Coastal Structures Along the Massachusetts Shoreline, 2013*
6. <https://archives.lib.state.ma.us/bitstream/handle/2452/412369/ocm39986872-1935-HB-0299.pdf?sequence=1&isAllowed=y>
7. <https://docs.digital.mass.gov/dataset/massgis-data-massdep-wetlands-2005>
8. [https://www.nae.usace.army.mil/Missions/Civil-Works/Shore-Bank-Protection/Massachusetts/Revere/https://en.wikipedia.org/wiki/Lynn,\\_Massachusetts](https://www.nae.usace.army.mil/Missions/Civil-Works/Shore-Bank-Protection/Massachusetts/Revere/https://en.wikipedia.org/wiki/Lynn,_Massachusetts)



# REVERE BEACH

## Coastal Storm Surge Inundation

The Great Blizzard of 1978 was a turning point for Revere Beach. An already declining coastal condition was exacerbated by flooding, storm waves, and aggressive precipitation in the form of snow. Images from the event show the road and seawall along Revere Beach completely destroyed along with various businesses and residential homes.

The damage from this coastal winter storm set development plans in motion that built back the lost economy along the shoreline while reconstructing man made coastal structures and

artificially replenishing the beach to defend future inland properties from storm events.

Even with an updated shoreline in place, large extents of the Revere community are at risk of inundation in various coastal storm events as seen in the adjacent map. New research on sea level rise has projected not only will the City of Revere suffer during storm events, but chronic flooding will impact various parts of the community.

*References:*

1. *Open Space and Recreation Plan, 2017*
2. <https://www.wbur.org/news/2018/06/18/sea-level-rise-massachusetts-homes>



Surf Crashing into a Seawall at Revere Beach

*Credit: Leslie Jones and Boston Public Library, 1917-1934*



# SHORT BEACH

## Today's Coastal Infrastructure

Short Beach is located at the city line between Revere and Winthrop. During high tide, the water reaches the base of the seawall along Winthrop Parkway. As the tide recedes a stretch of sand emerges at low tide. The sandy stretch is bounded by rocky intertidal zones to the north and the south.

### Seawall

The Beachmont community in Revere is dependent on the seawall that runs along Short Beach to reduce the risk of coastal flooding and storm wave damage. According to the Coastal Zone Management Inventory of coastal structures, the seawall was first documented in 1955 and is in “fair” condition. The report also states that this infrastructure may not be capable of adequately defending the shoreline in a major coastal storm event.

In 2018, the Winthrop Massachusetts Newspaper reported that \$4 million dollars will be allocated to the repair of the “failing” seawall on Winthrop Parkway.

### Stone Revetment

This coastal structure along Seawall Ave has records dating back to 1922 and consists primarily of a stone material. The infrastructure has been documented to be in “good” condition and has been evaluated to provide an adequate defense against a major coastal storm.

### Coastal Beach, Rocky Intertidal Shore, and Tidal Flats

While the width of Short Beach is smaller than adjacent beaches at Revere and Winthrop, there

is a diverse range of natural resources along this waterfront edge. Not only do these elements contribute to marine habitat diversity, they layer up various buffers against sea level rise and storm surge.

### Belle Isle Marsh

From the late 1800's transpiration lines separated natural resource connectivity between Short Beach and Belle Isle Marsh. While marshes at Belle Isle have the capacity to store water and buffer against tides and wave energy, this area is also a pathway for floodwaters to impact developed communities along its edges.

#### References:

1. Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009
2. <https://winthroptranscript.com/2018/08/03/winthrop-projects-earmarked-in-2-4b-state-budget-bond-bill/>
3. <https://winthropmemorials.org/civic/pages/history-of-winthrop-clark.html>
4. <https://beachfinderne.com/index.php/short-beach>
5. <https://ngmdb.usgs.gov/topoview/viewer/#12/42.4289/-71.1724>



# SHORT BEACH

## Coastal Storm Surge Inundation

While the seawall along Winthrop Parkway and Short Beach work together to buffer the shoreline from coastal storm events, recent floods have impacted many residents of Revere and Winthrop.

In the winter of 2018, footage of flooded streets adjacent to Short Beach showed the extent of damage that is possible when water over tops the seawall. People within the community reported five to six feet of standing water in basements and documented totaled cars in streets overwhelmed by floodwaters. Transportation

routes along Winthrop Parkway were also closed down due to impassable floodwaters.

As seen in the adjacent inundation map, storm events pose great risk to Beachmont and Winthrop communities adjacent to Bel Isle Marsh and the coastal beaches.

*References:*

1. <https://www.wbur.org/news/2017/03/14/photos-march-snowstorm>
2. <https://www.itemlive.com/2018/03/02/photos-noreaster-crashes-north-shore/>



**A Rocky Short Beach before Seawall Construction**

*Credit: Historic New England, General Photographic Collection, 1916*



# WINTHROP BEACH

## Today's Coastal Infrastructure

Winthrop Beach directly faces the ocean which exposes the shoreline to various coastal processes. As a result shoreline erosion has greatly impacted the extents of Winthrop Beach and has spurred many coastal infrastructure projects to accumulate lost sediments.

The Great 1938 Hurricane had devastating impacts along the Winthrop Shore causing severe erosion and flooding along with infrastructural destruction.

### Breakwaters "The Five Sisters"

In the mid 1930s the State of Massachusetts built offshore breakwaters along the coast of Winthrop Beach to reduce the energy of waves reaching the shore. While the breakwaters have been successful in accumulating sediments, the shift in transport patterns have resulted in other parts of the beach to erode.

### Stone Jetties

There is little documentation on the construction of the five stone jetties located along the shoreline, but the earliest available records for the structures were from the 1950's. These structures protrude into the water, perpendicular to the shoreline. With these structures, the goal is to influence the beach currents and tide to prevent beach erosion.

### Beach Nourishment

Beaches provide natural buffers against the erosive forces of wave action. Once beaches significantly erode, developed infrastructures that sit along the coast are subject to more risk from

coastal storms and flooding. Winthrop Beach has had a long legacy of beach nourishment documented over time.

In 1959 the Winthrop Beach Shore and Bank Protection Project was completed by the US Army Corps of Engineers. A key component of the project was the placement of 245,000 cubic yards of sand between the beach groins.

Significant erosion along the Winthrop Shoreline persisted even after the beach replenishment. As a result the Department of Conservation and recreation kicked off a 17 million dollar project to further improve upon the resiliency of Winthrop Beach. Approximately 450,000 cubic yards of sediment will be dredged from of behind the breakwaters and portions of Rumney Marsh.

The project also focused on other infrastructural repairs to the seawall and groins.

### References:

1. Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009
2. [https://www.jstor-org.ezp-prod1.hul.harvard.edu/stable/44560127?seq=4#metadata\\_info\\_tab\\_contents](https://www.jstor-org.ezp-prod1.hul.harvard.edu/stable/44560127?seq=4#metadata_info_tab_contents)
3. <https://www.newenglandhistoricalsociety.com/great-1938-hurricane/>
4. <https://www.nae.usace.army.mil/Missions/Civil-Works/Shore-Bank-Protection/Massachusetts/Winthrop/>
5. <https://www.boston.com/news/local-news/2012/11/07/long-awaited-winthrop-beach-restoration-underway>
6. <https://www.town.winthrop.ma.us/home/news/state-local-officials-celebrate-completion-winthrop-shore-drive-improvements>





# WINTHROP BEACH

## Coastal Storm Surge Inundation

The Winthrop Shoreline has experienced damaging impacts from hurricane events. In the Great 1938 Hurricane, the shoreline was ravaged by erosive forces and storm waves, leaving behind a damaged waterfront. Government officials realized the importance of a robust beach to alleviate the impacts of storm events and responded with various infrastructures supported by a nourished Winthrop Beach.

Recent storm events have shown that even the defenses in place still struggle to prevent destruction from flooding and wave action. Most

recently in 2018, winter storm events swept through the North Shore of Boston's Metropolitan Region and caused flood damage to a range of homes within the Winthrop Community.

References:

1. <https://winthroptranscript.com/2018/03/10/the-lion-roared-in-winthrop-town-hit-by-second-severe-flood-in-two-months/>
2. <https://www.newenglandhistoricalsociety.com/great-1938-hurricane/>



# CONSTITUTION BEACH

## Today's Coastal Infrastructure

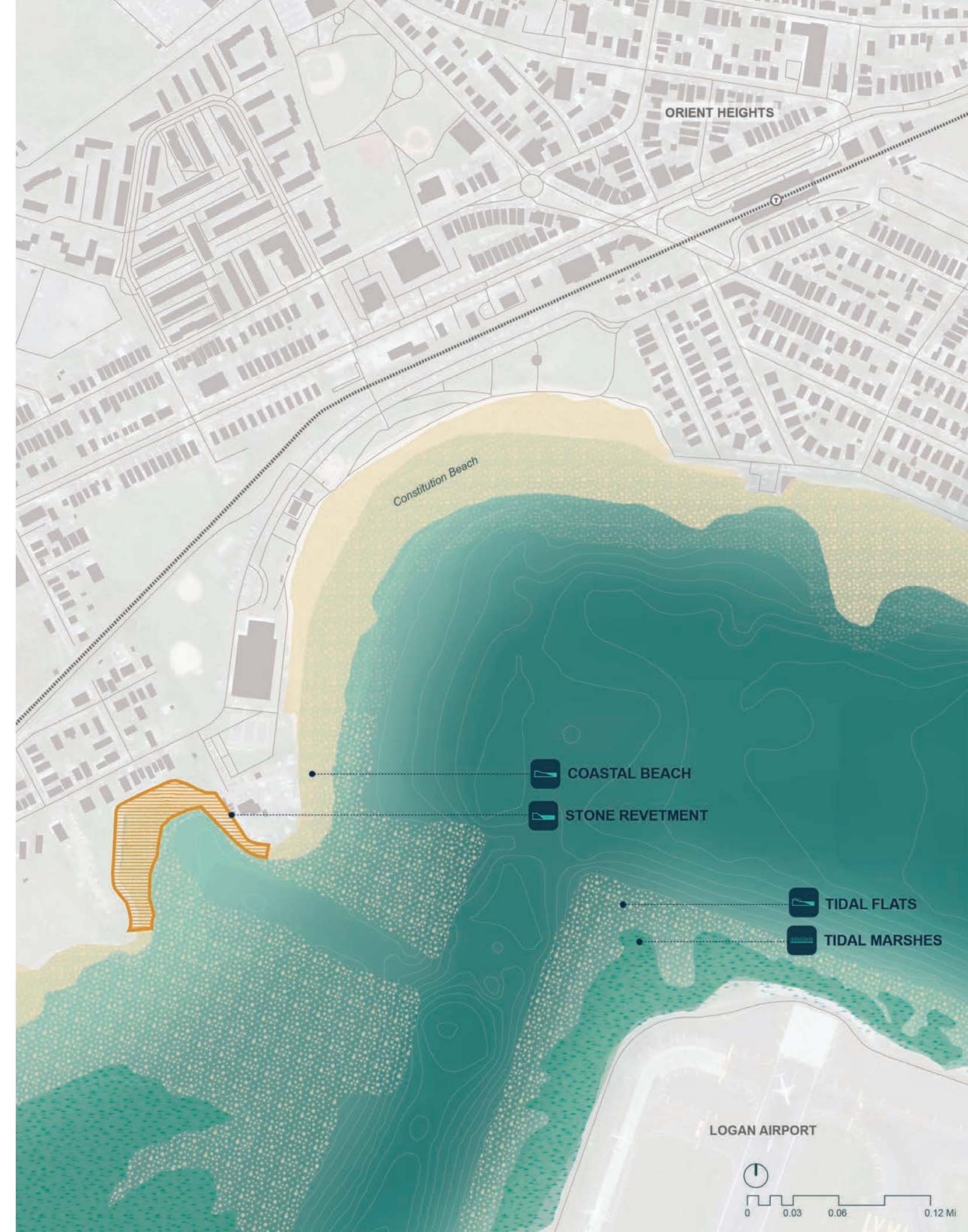
Before the 1950's, Wood Island Park was a major recreational space in the East Boston Community. To make way for Logan Airport this land was reallocated for establishing the new transportation hub. To make up for the lost public amenity Constitution Beach was constructed.

The project resulted in large dredging operations in the late 1940s to supply the base sediment used to create a sandy beach landscape for public use.

Belle Isle Inlet shelters Constitution Beach from receiving waves from open ocean but connectivity to tidal action still makes this natural resource susceptible to flooding. Storm surge also has the ability to bring floodwaters into developed communities. The shoreline lacks hardened infrastructures such as seawalls and supports a man made condition of marshes and tidal flats.

### References:

1. Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009 [https://www.mass.gov/files/documents/2016/08/sb/boston\\_78352\\_541.pdf](https://www.mass.gov/files/documents/2016/08/sb/boston_78352_541.pdf)
2. [https://www.google.com/books/edition/Gaining\\_Ground/GAHs1C-9q1EsC?hl=en&gbpv=1&bsq=orient](https://www.google.com/books/edition/Gaining_Ground/GAHs1C-9q1EsC?hl=en&gbpv=1&bsq=orient)
3. <http://eastietimes.com/2018/03/10/another-storm-and-more-flooding/>
4. <https://www.bostonpreservation.org/sites/default/files/2018-05/EAST-BOSTONFINALNPPREPORT%20%281%29.pdf>
5. <https://onthegrid.city/boston/east-boston/belle-isle-seafood>



# CONSTITUTION BEACH

## Coastal Storm Surge Inundation

The legacy of landmaking in Boston Harbor has left many portions of the city at low lying elevations more vulnerable to flooding and the impacts of large storm events.

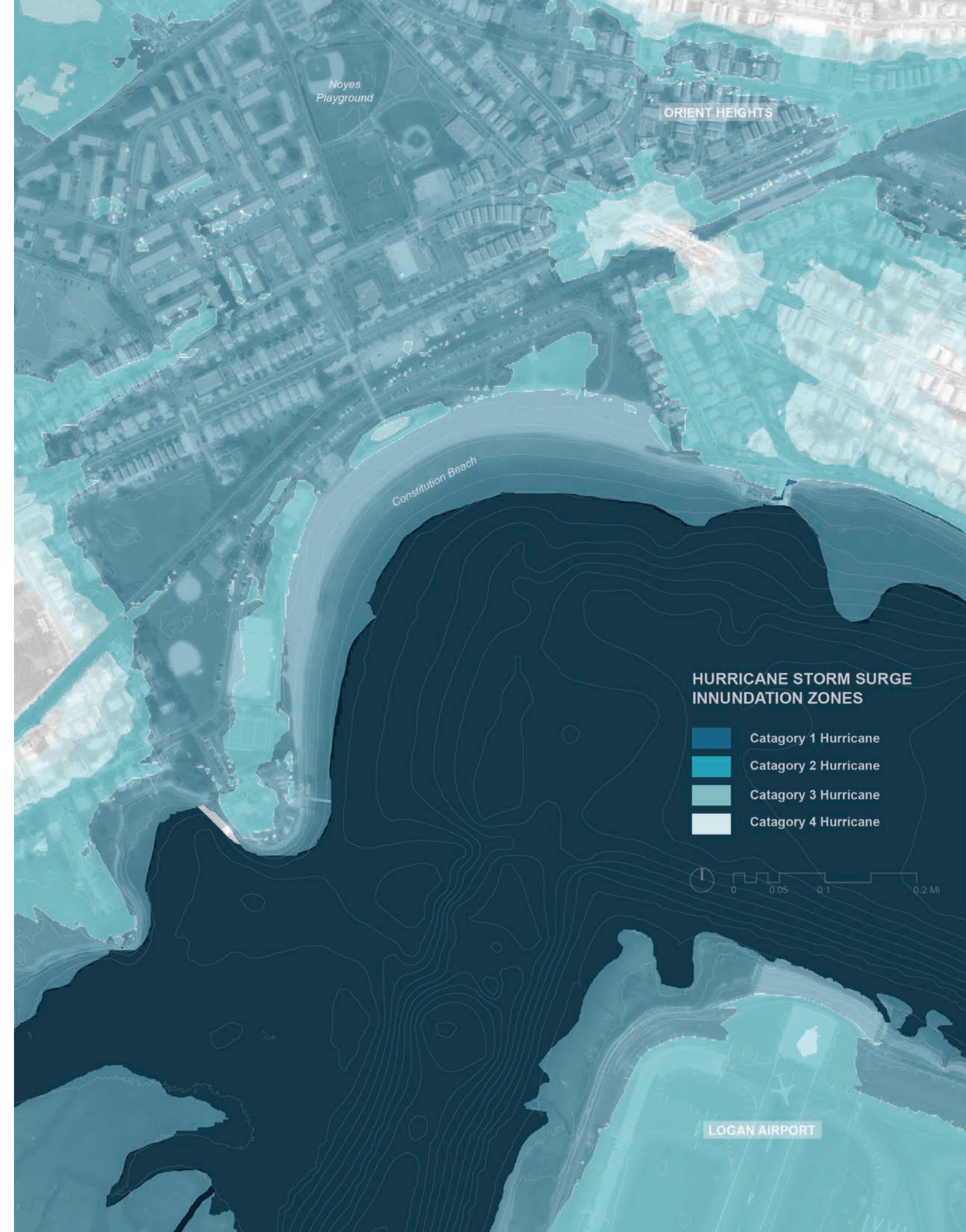
Historic surveys of the harbor show that the location of Constitution Beach used to be a tidal channel. The adjacent inundation map shows a pattern of flooding that aligns with locations that were previously aqueous marshes and tidal flats.

While Constitution Beach provides some topographical buffer from floodwaters, the

landform alone will not be able to prevent water from entering more developed portions of East Boston. This is particularly concerning not only for residential communities, but for the MTBA transportation system. Orient Heights T Station and associated tracks have been identified as a location exposed to the impacts of climate change.

References:

1. <http://easttimes.com/2018/03/10/another-storm-and-more-flooding/>
2. <https://willbrownsberger.com/mbta-behind-on-climate-adaptation/>



# PLEASURE BAY

## Today's Coastal Infrastructure

Fort Independence on Castle Island was established in the 1600s. During that time Castle Island was in fact an island surrounded by water. From the late 1800's to the early 1900's land reclamation in South Boston facilitated the filling of marshes and tidal mudflats to ultimately connect the island with the South Boston Mainland.

The Head Island Causeway was then built to expand the recreational activities along the waterfront. In short, this beach and associated bay is a completely constructed environmental condition.

### Coastal Beach

Pleasure Beach is documented to be in a "good" condition with minor erosion. In the event of a major storm, an evaluation within the CMZ Coastal Structure Inventory indicated the landform would be able to handle a major storm with minimal damage.

### Stone Revetment

The earliest structural records on file for the Head Island Causeway were documented in 1950. Today the condition of the revetment remains good with minor areas of erosion. A walking path is atop of the revetment which creates a recreational asset that connects one from the beach to Castle Island. Two tide gates allow for waters to pass through the revetment to create opportunities for tidal exchange within the bay.

### Seawalls

A series of seawalls are situated along the shoreline of Castle Island. These structures

provide additional reinforcement of man made beach features and reduce the risk of inundation for communities located further inland from Pleasure Beach.

#### References:

1. Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009
2. [https://en.wikipedia.org/wiki/Nahant\\_Beach\\_Boulevard#:~:text=Nahant%20Beach%20Boulevard%20was%20first,Olmsted%20Brothers%20landscape%20design%20firm](https://en.wikipedia.org/wiki/Nahant_Beach_Boulevard#:~:text=Nahant%20Beach%20Boulevard%20was%20first,Olmsted%20Brothers%20landscape%20design%20firm).
3. <https://nahanthistory.org/news/2019/4/4/the-local-history-of-fairy-land-nahant>



# PLEASURE BAY

## Coastal Storm Surge Inundation

Pleasure Beach is a constructed landform at low elevations and as a result is susceptible to coastal flooding. Conley Terminal which is located behind Pleasure Beach is a significant economic driver in the City of Boston, but was also established on low lying fill. Although land making ultimately connected Castle Island to mainland South Boston, these areas are particularly vulnerable to inundation.

While the City Point neighborhood will be more significantly impacted by stronger coastal storms, the recreational and economic resources that

create the unique landscape of South Boston will be challenged more regularly by rising sea levels and seasonal storm events.

References:

1. [www.universalhub.com](http://www.universalhub.com)



**Flooding at Head Island along the Causeway**

*Credit: Adam Gaffin, Universal Hub, 2018*



# M STREET BEACH

## Today's Coastal Infrastructure

M Street Beach is a popular South Boston location for waterfront recreation. It is located along Day Boulevard which connects Carson Beach to Pleasure Beach and out to Castle Island. To support public use of the beach a bathhouse has been built along with wooden privacy fences to section off different parts of shoreline.

### Seawalls

The seawalls located along M Street Beach are part of the larger structural system along Day Boulevard. According to the Coastal Zone Management report on coastal structures, these built edges are in good condition and should be able to adequately defend against damaging storm conditions.

### Coastal Beach

Sandy edges of the shoreline have been regularly maintained to support recreational access to the water. While minor erosion has been documented, the coastal beach landform has been evaluated to be in good condition.

### Wood Jetty

These structures have been noted in the CMZ report to be privacy fences along M Street Beach. While this is the case, these structures still act as hardened conditions that have manipulated sediment processes along the shoreline.

### References:

1. Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009 [https://www.mass.gov/files/documents/2016/08/sb/boston\\_78352\\_541.pdf](https://www.mass.gov/files/documents/2016/08/sb/boston_78352_541.pdf)
2. [https://en.wikipedia.org/wiki/Day\\_Boulevard](https://en.wikipedia.org/wiki/Day_Boulevard)



# M STREET BEACH

## Coastal Storm Surge Inundation

While flooding has not significantly impacted the shoreline along M Street Beach, climate change and sea level rise bring new challenges to the waterfront. In a category one hurricane Day Boulevard and the majority of the coastal beaches along the shoreline are susceptible to inundation.

In more significant storm events, developed communities of South Boston are within inundation zones. Conversations on how to adapt structures along the waterfront are now continually at play. Recently, community

discussions were underway to consider strategies that would be effective in supporting the Curly Community Center and adjacent bathhouse. These are vulnerable community resources along the waterfront and must consider a multitude of approaches that will effectively engage with dynamic shoreline conditions in the future.

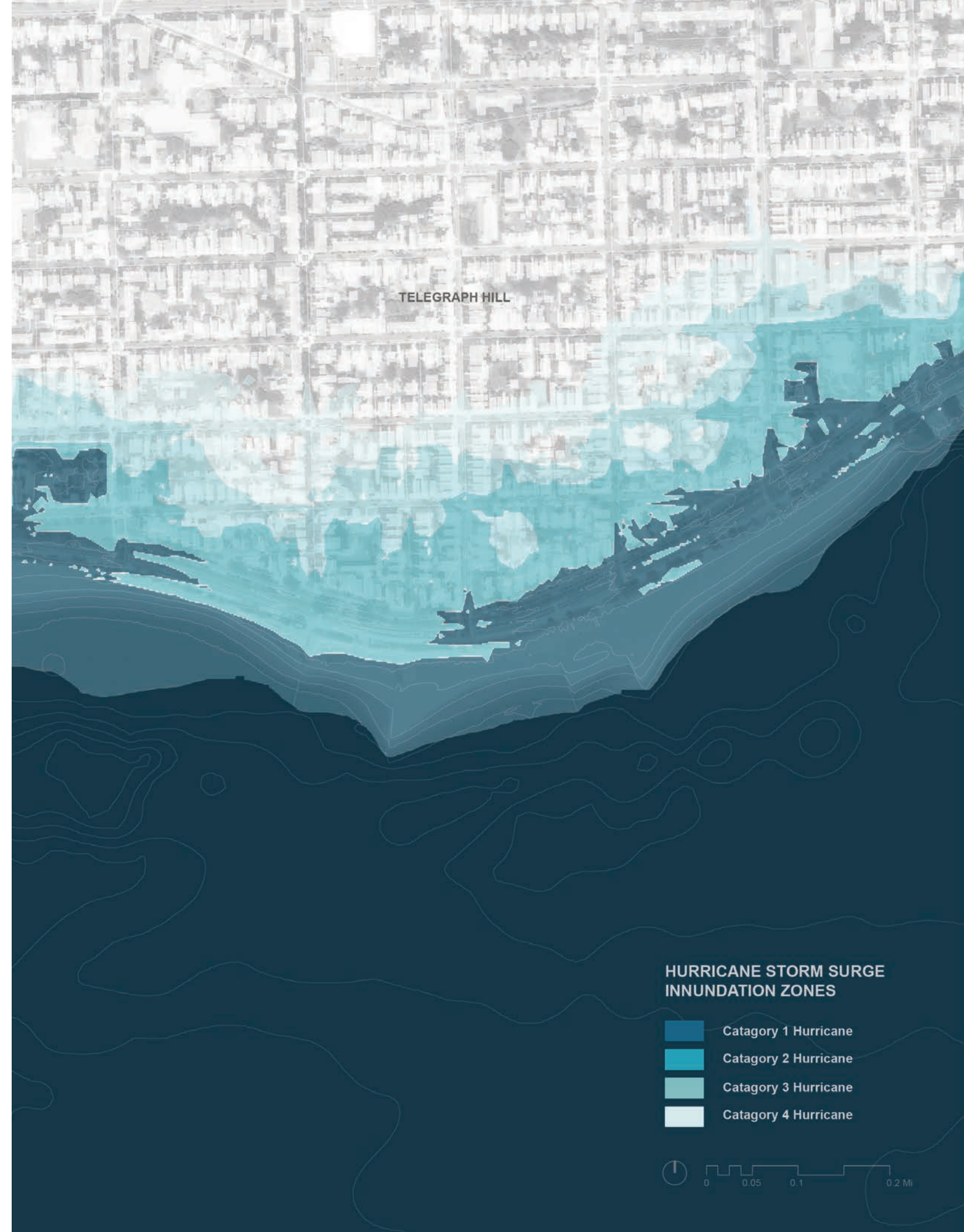
*References:*

1. <https://www.dotnews.com/2019/chance-public-talk-about-15m-rehab-l-street-center>



**Flooding along Day Boulevard**

*Credit: Universal Hub*



# CARSON BEACH

## Today's Coastal Infrastructure

Carson Beach is a waterfront that serves many communities in South Boston. The beach landform itself provides a buffer against damaging storm conditions so various stretches of the shoreline do not contain structurally hardened edges.

Moakley Park provides an additional open space buffer behind Carson Beach to establish more distance between the waterfront and built urban fabrics. To the north and south of Carson Beach, developments are closer to the shoreline and have hard structures to provide further defenses against damaging coastal conditions.

### Beach Dunes

While this feature of the shoreline is small, it provides an added layer of habitat and landform to buffer high energy coastal processes during storm events.

### Coastal Beach

Carson Beach was a fabricated landform to promote recreational access along the waterfront. As a result, fine grained sand was placed to form the beach condition seen today. The landform acts as a softened edge that can absorb the impact of damaging storm waves.

### Seawall

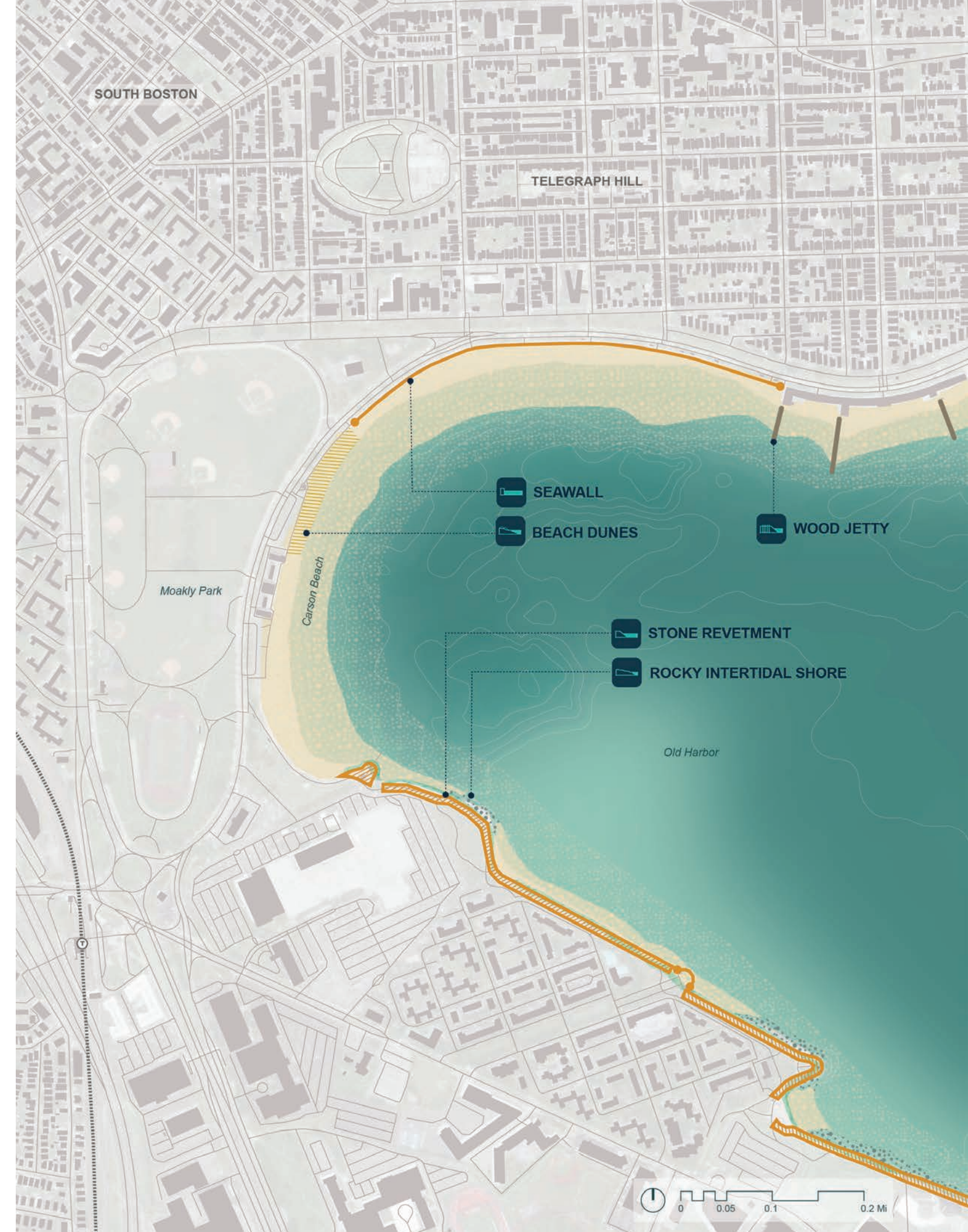
Extending to M Street Beach along Day Boulevard this coastal structure is rated to be in good condition. According to the Coastal Zone Management report, the structure is evaluated to perform well during a major storm event to reduce damages within developed areas.

### Stone Revetment

Extending from Carson Beach into Dorchester Shores Reservation, the stone revetment is documented to be in extremely good condition. As a result, the Coastal Zone Management report evaluated that this shoreline would be able to withstand the impact of damaging storm events to reduce the impact on the high density development directly behind.

### References:

1. Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009 [https://www.mass.gov/files/documents/2016/08/sb/boston\\_78352\\_541.pdf](https://www.mass.gov/files/documents/2016/08/sb/boston_78352_541.pdf)
2. [https://en.wikipedia.org/wiki/Carson\\_Beach,\\_South\\_Boston](https://en.wikipedia.org/wiki/Carson_Beach,_South_Boston)





# CARSON BEACH

## Coastal Storm Surge Inundation

The elevation of Carson Beach allows this public recreational space to serve as a buffer against coastal flooding for adjacent communities along the water. Today a key concern regarding inundation is related to stormwater flooding. Site conditions show that this portion of the waterfront is less developed, but contains extensive flat ground.

Due to the physically flat nature of the site, Carson Beach and Moakley Park become a pathway for coastal floodwater in the event that a storm event is significant enough. In the adjacent

map a highpoint can be observed along the back end of Carson Beach, but there are lower elevations which create pathways for floodwaters to pass through and enter communities along the waterfront and behind Moakley Park.

References:

1. <https://www.wbur.org/earthwhile/2019/05/02/moakley-park-east-boston-climate-resiliency>



# SAVIN HILL AND MALIBU BEACH

## Today's Coastal Infrastructure

Savin Hill and Malibu Beach are constructed recreational resources within the Dorchester Bay Basin. Located at the mouth of the Neponset River, these beaches are sheltered by land supporting Morrissey Boulevard. As a result, there is an additional layer of defense between these beaches and open ocean coastal processes.

The beaches are located at the edge of urban developments but have minimal hardened structures on the north end of the shoreline. Stone Revetments and seawalls are predominately located in the southern portion of Dorchester Bay Basin and do not extend into the beaches.

### Tidal Marshes

Along Malibu Beach there is a strong presence of coastal marshes. While at times this condition can prevent direct access to the water, these habitats contribute to the overall health of the harbor and support a multitude of aquatic species.

### Tidal Flats

While there is limited vegetation within this aquatic environment, it contributes to the success of the tidal marshes along the shore. Although shallow and muddy at low tide, the condition provides an extra buffer against wave energy along the shore.

### Coastal Beach

The sandy condition along this edge is a constructed landform to support recreation. While the beach is smaller than most beaches in the

Greater Boston area it supports a shore condition that can absorb the impacts of storm events.

### Stone Revetment

Along the Southeast Expressway a stone revetment is in place to defend the shoreline along this critical infrastructure. While the structure is rated to be in good condition, there is a necessity to maintain this structural edge in order to prevent risking public health and safety.

#### References:

1. Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009 [https://www.mass.gov/files/documents/2016/08/sb/boston\\_78352\\_541.pdf](https://www.mass.gov/files/documents/2016/08/sb/boston_78352_541.pdf)



# SAVIN HILL AND MALIBU BEACH

## Coastal Storm Surge Inundation

While Savin Hill Beach and Malibu Beach are coastal conditions sheltered from open ocean wave energy. Currently the low lying condition of the beach puts this public resource at risk of flooding.

As seen in the adjacent inundation map, a category one hurricane can produce significant flooding along critical infrastructure such as Morrissey Boulevard while also compromising recreational resources and park space. While a significant portion of the Savin Hill community sits on elevated land, developments on the fringe are

at risk to the impacts of coastal storms. Interstate 93 which is also a significant infrastructure has the potential to be impacted by floodwaters.

References:

1. <https://www.bostonharbornow.org/wp-content/uploads/2017/02/Preparing-for-the-Rising-Tide-FINAL.pdf>



Credit: Boston Harbor Now, Science News, 2016



# TENEAN BEACH

## Today's Coastal Infrastructure

Tucked behind the Southeast Expressway is Tenean Beach. While this beach is small in relation to the other public beaches in the Greater Boston Harbor area, it is apart of a larger Dorchester Shores Reservation and supports a range of recreational activities for adjacent communities. Tenean beach also sits further up the Neponset River so it is sheltered from open ocean waters.

Along the beach itself there are no hardened coastal structures, but to the north of the site there is a stone revetment.

### Coastal Beach

Tenean Beach is a product of landmaking along the shoreline. While that is the case, this recreational asset is well maintained and acts as a buffer to coastal waters during storm events. The landform is rated to be in good condition with sand and gravel composing the majority of the shoreline.

### Tidal Marshes

Along the tidal channel adjacent to Tenean Beach, marsh vegetation has been established which contributes to the overall ecological diversity of the site.

### Tidal Flat

Extending out into the Neponset River, tidal flats shallow out parts of the harbor and help in reducing wave energy that reaches the shore.

#### References:

1. Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009 [https://www.mass.gov/files/documents/2016/08/sb/boston\\_78352\\_541.pdf](https://www.mass.gov/files/documents/2016/08/sb/boston_78352_541.pdf)



# TENEAN BEACH

## Coastal Storm Surge Inundation

Various images of coastal flooding at Tenean Beach have been collected by community members and local newspapers. The content included extreme high tide events that flood park and beach infrastructure. In addition to the beach flooding, recreational assets such as the playground have faced closure to evaluate the potential for structural damage.

While there has not been significant documentation of storm wave damage, hurricane conditions still have the ability to put the entirety of the public resource at risk and

extend into neighboring communities behind Morrissey Boulevard. In the adjacent map, the developments within Neponset have the potential to be significantly impacted by inundation.

*References:*

1. <https://caughtindot.com/cid-photo-of-the-week-high-tide-at-tenean-beach/>
2. <https://www.universalhub.com/2016/storm-takes-out-tenean-beach>



High Tide Flooding along Walkway

*Credit: Maria Lyons, 2019*



# WOLLASTON BEACH

## Today's Coastal Infrastructure

Wollaston Beach is the largest public beach in the Greater Boston metropolitan area. Quincy Shore Reservation was established in 1899 and secured a public resource for the many communities that are near Quincy Bay.

Quincy Shore Drive was built in 1908 and established a promenade that complimented the beach to further recreational opportunities in the area, while also hardening the shoreline in ways that began to impact coastal processes.

### Beach Nourishment

Known as the Quincy Beach Shore and Bank Stabilization Project, this effort set out to mitigate the impacts of coastal erosion by the placement of sand material along the coast. With this added material in place there would be more sediment in the system to maintain the width of the beach for public access.

### Seawall

A key part of the bank stabilization project included a seawall that runs along the back edge of the beach. Although the project was completed in 1959, the structure is still in excellent condition and would be able to withstand the impacts of a major coastal storm according to the Coastal Zone Management Coastal Structures Inventory.

### Concrete Jetty

While there is limited availability of information regarding the history of these structures, their placement along the shore impacts the flow of sediment along Wollaston Beach. In aerial imagery one can observe the accumulation and erosion of sediment around the structures.

### Tidal Marsh

Tidal marshes bookend Wollaston Beach and further add to the diversity of the shoreline. While these conditions are ecological assets, these areas also exist at low elevations and can be viewed as inundation pathways for floodwaters into developed communities adjacent to the shore.

### References:

1. Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009 <https://www.mass.gov/files/documents/2016/08/re/quincy-weymouth.pdf>
2. <https://www.nae.usace.army.mil/Missions/Civil-Works/Shore-Bank-Protection/Massachusetts/Quincy-Shore/>
3. [https://en.wikipedia.org/wiki/Wollaston\\_Beach](https://en.wikipedia.org/wiki/Wollaston_Beach)
4. <https://www.patriotledger.com/article/20140603/NEWS/140609361/12662/NEWS>



# WOLLASTON BEACH

## Coastal Storm Surge Inundation

In the Wollaston and Quincy communities a range of flood events have impacted the coastal edge. While the Blizzard of '78 presented damaging effects of storm surge and coastal flooding, other events since then have produced dangerous conditions for city residents. While seawall infrastructure is in place along the coast, over topping of this infrastructure has the potential to lead to inland flooding in developed areas.

In the adjacent map, the dark blue regions delineate areas that are subjected to inundation

during a category one hurricane. The extensive reach of this condition create potentially dangerous environments for residents and begin to identify the potential extents of those at risk during major storm events.

References:

1. <https://patch.com/massachusetts/quincy/quincy-shore-drive-closed>
2. <https://www.southcoasttoday.com/news/20180104/storm-batters-south-shore-with-widespread-coastal-flooding>



Coastal Flooding Along Quincy Shore Drive

Credit: Scott Eisen, Getty Images



# NANTASKET BEACH

## Today's Coastal Infrastructure

Nantasket Beach is an area that has historically experienced many damaging storm events and flooding events. On the coastal edge that faces Massachusetts Bay, Nantasket Beach serves as a wide barrier to mitigate the impacts of storm events. Along the majority of the beach there is an elevated dune like landform that further enhances the natural systems that buffer the shoreline.

The Nantasket Beach Community is developed with various structures adjacent to the water. As a result many parts of this community are vulnerable to inundation and flooding events.

### Barrier Beach

On the ocean facing portion of Nantasket Beach, a large swath of sand acts as a barrier beach to absorb the impact of oncoming waves. While the natural landform is relatively stable, development on certain parts of the shoreline have resulted in erosion which can become more problematic in the future.

### Seawalls

There are a series of seawalls along Nantasket Beach. On the ocean facing side, a seawall along the southern portion of the beach is of structural concern and various evaluations by the US Army Corps of Engineers have established alternatives to adapt the infrastructure in a way that works in alignment with coastal processes. The seawalls facing Hull Bay range in condition from poor to excellent so it is important to note that the infrastructural system is not coordinated along the shoreline. In order to accommodate the risks associated with climate change and sea level rise, it is important to consider how the shoreline

will work as a single system to adapt to the range of conditions that are predicted for the future. Piecemeal placement of various infrastructural types have the potential to add more weak points to an already vulnerable environment.

### Revetments

Similar to the seawalls, the revetments range in condition. While they have the ability to mitigate the impacts from storm events, evaluations of future performance with climate change and sea level rise need to be considered.

### Private Coastal Structures

There are many private coastal structures that dot the coast along Nantasket Beach. It is likely that these structures are owned by individual property owners and they are responsible for maintenance and upkeep. Through the sporadic placement of these structures it can be difficult to form one unified system to alleviate the damages projected to incur with sea level rise and climate change.

#### References:

1. Coastal Zone Management, Coastal Infrastructure Inventory and Assessment, 2009 <https://www.mass.gov/files/documents/2016/08/wd/hull.pdf>
2. <https://www.nae.usace.army.mil/Portals/74/docs/topics/NantasketBeach/NantasketBeach-AppendixF.pdf>





# NANTASKET BEACH

## Coastal Storm Surge Inundation

Nantasket Beach and the town of Hull have experienced a range of flooding events that have incurred significant damages. In a 2013 study produced by the US Army Corps of Engineers it has been documented that the area has experienced “17 additional natural hazards which have triggered federal or state disaster declarations” since 1991. These events incur huge financial cost and reduce the integrity of coastal structures that have been built along the shoreline.

These coastal events also impacts the natural

resources along Nantasket as well. Severe wave energy promotes erosion of barrier beaches and reduces the potential for these natural systems to buffer against the impacts of dynamic forces. Emergency responses have been developed to support the integrity of coastal structures, but the system needs to be evaluated in a way that promotes a systemic and sustainable approach to the shoreline.

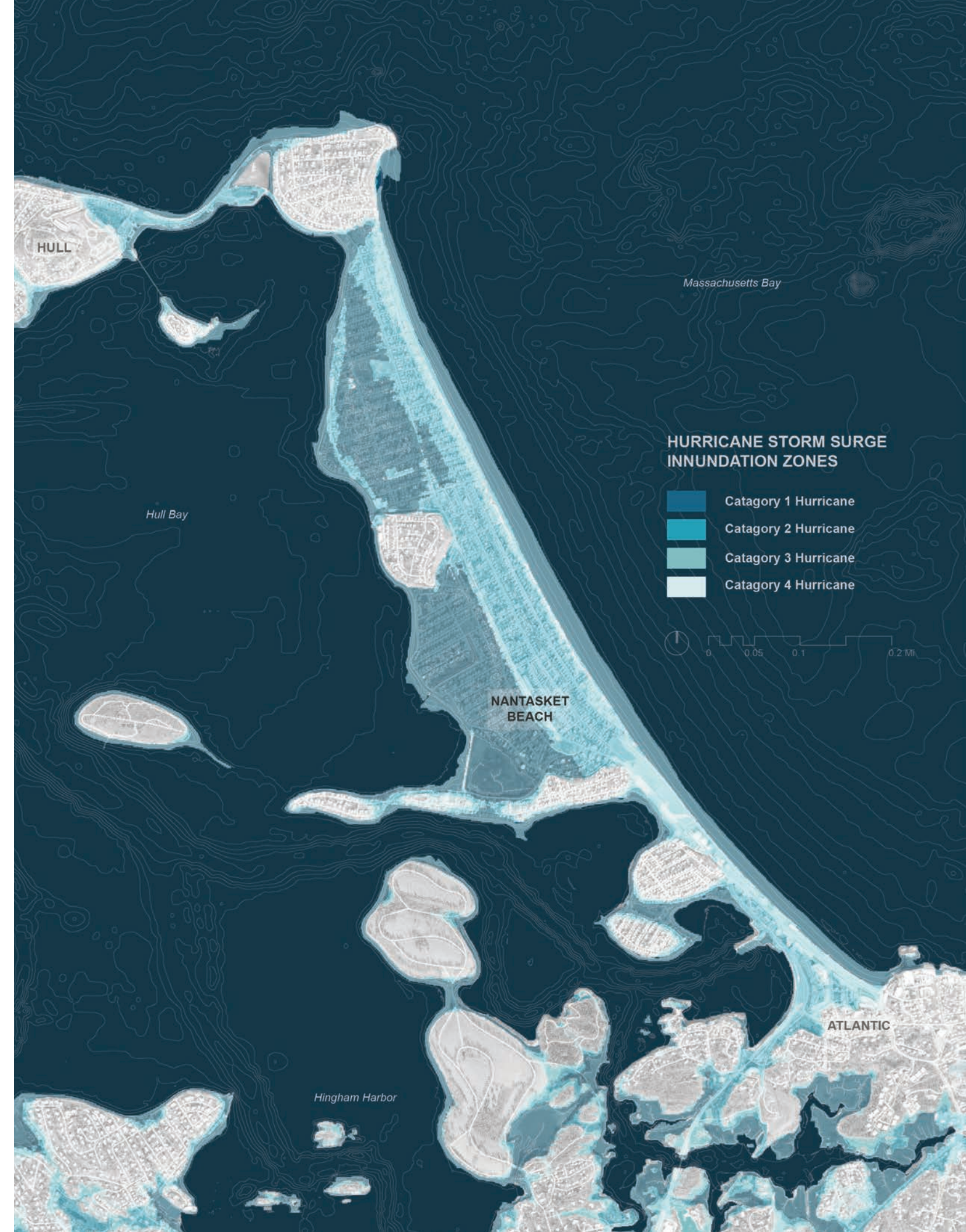
References:

1. <https://www.nae.usace.army.mil/Portals/74/docs/topics/NantasketBeach/NantasketBeach-AppendixF.pdf>



Coastal Flooding In Hull

Credit: Gary Higgins, The Patriot Ledger, 2018



**DESIGN  
STRATEGIES:**

**TYPES OF  
PROPOSED COASTAL  
INFRASTRUCTURES**

# DESIGN STRATEGIES

## Hard Coastal Structures

Due to the constructed nature of the Boston waterfront, design strategies to mitigate climate change have been developed to address urban conditions with limited space. It is important to recognize that these approaches rely heavily on engineered structures and contain little flexibility in their interaction with the natural environment. Many of these approaches have been covered in the work of Climate Ready Boston which focuses on the development of resources and planning tools to mitigate the impacts of climate change and sea level rise.

### Elevated Street

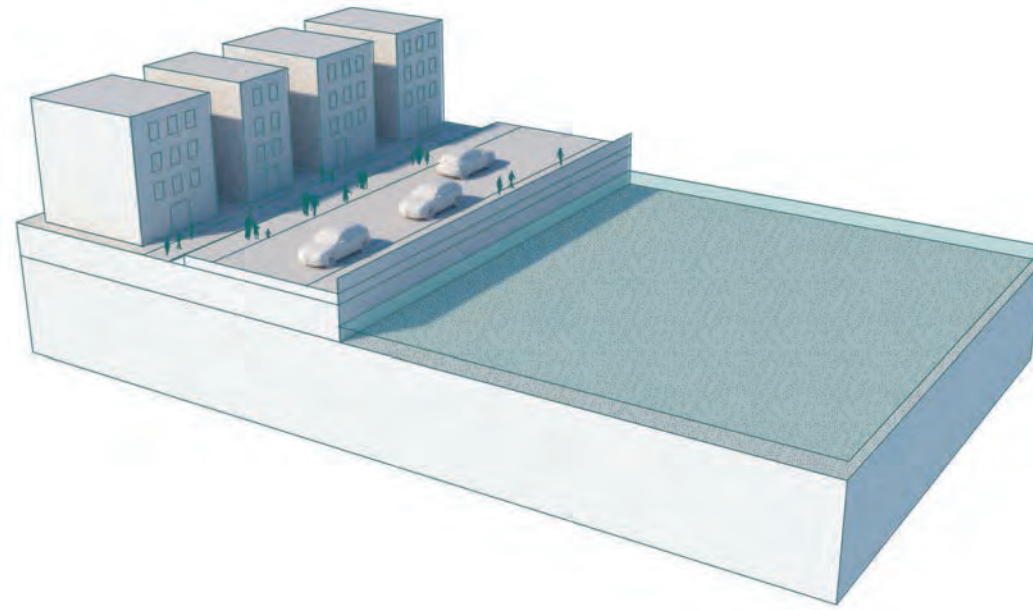
In this condition, roadways would be lifted to a base flood elevation to prevent the influx of floodwaters and absorb the impact of storm wave energy. While this condition can establish a strong defense, there is a lack of connectivity to the waterfront and the establishment of new physical conditions that could be problematic in facilitating adequate drainage.

### Seawall

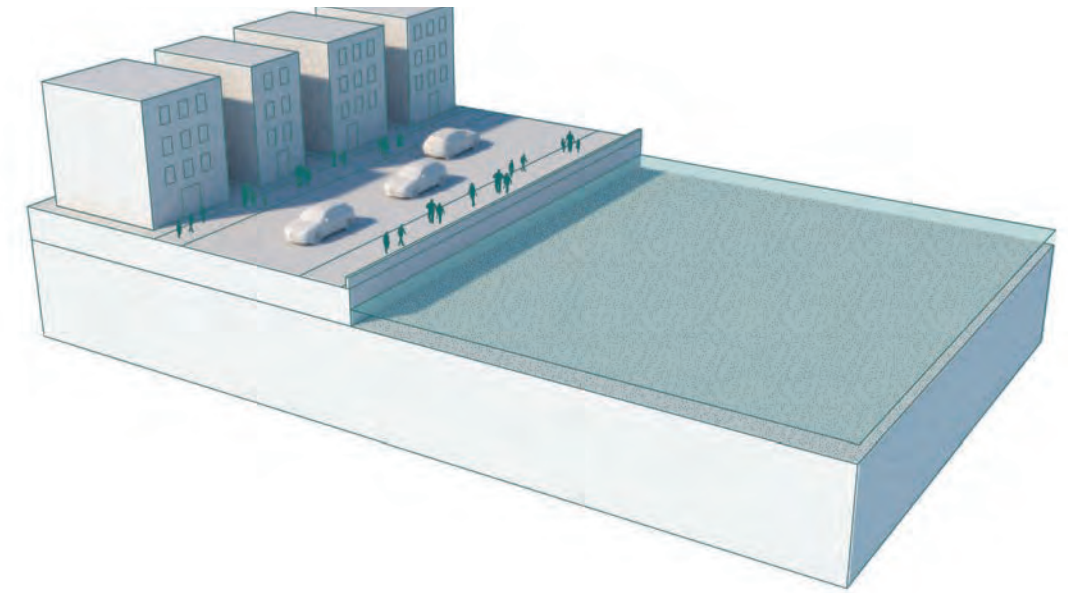
This condition elevates coastal edges to a base flood elevation to prevent floodwaters from entering developed areas. While this requires limited space, accessibility to the waterfront also comes into question due to the need for a comprehensive connected system of elevations.

### Harborwalk

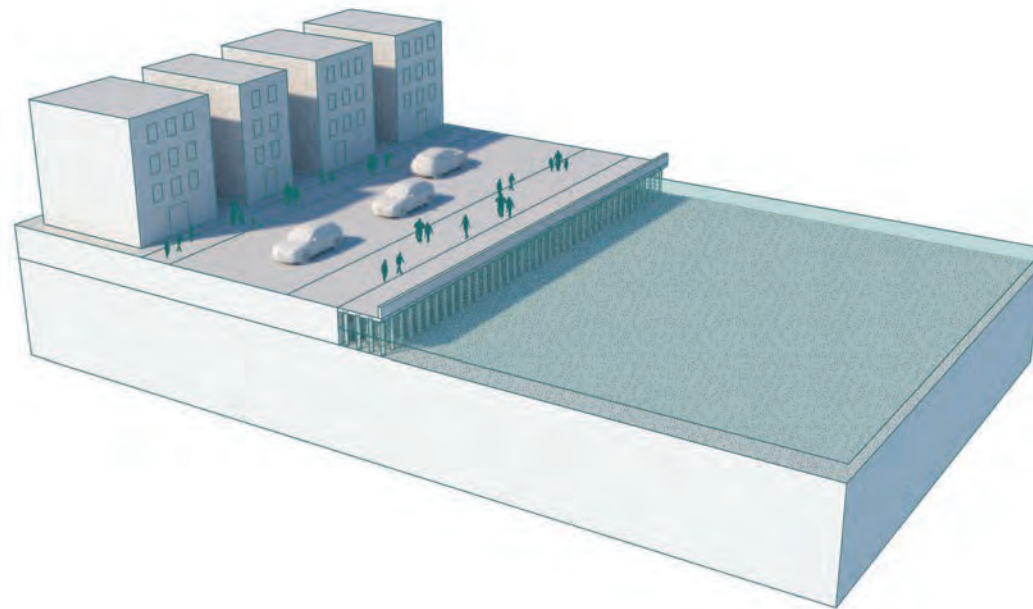
The Harborwalk presents opportunities to extend into the harbor and develop a new comprehensive system that incorporates flood mitigation infrastructure. An expanded Harborwalk could introduce new public space while bolstering coastal defenses.



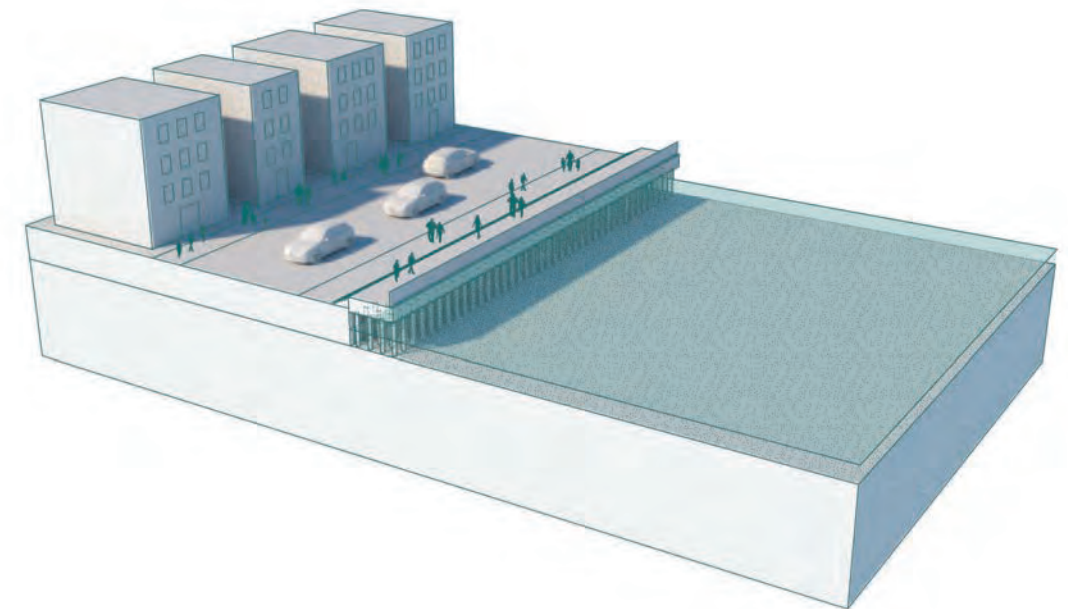
**Elevated Street**



**Seawall**



**Extended Harborwalk with Seawall**



**Extended and Elevated Harborwalk**

# DESIGN STRATEGIES

## Hybrid Coastal Structures

Infrastructures explored within this section require more expansive public land conditions to allow for a designed condition that focuses equally on engineering and ecological integration. Instead of solely relying on a built physical condition, marsh restorations, dune restoration, and other habitat approaches become more dynamic assets of the infrastructure while contributing to the health of the harbor. Once again, these strategies have been adopted from the work of Climate Ready Boston to generate a conversation around the physical condition of the shoreline.

### Levees and Berms

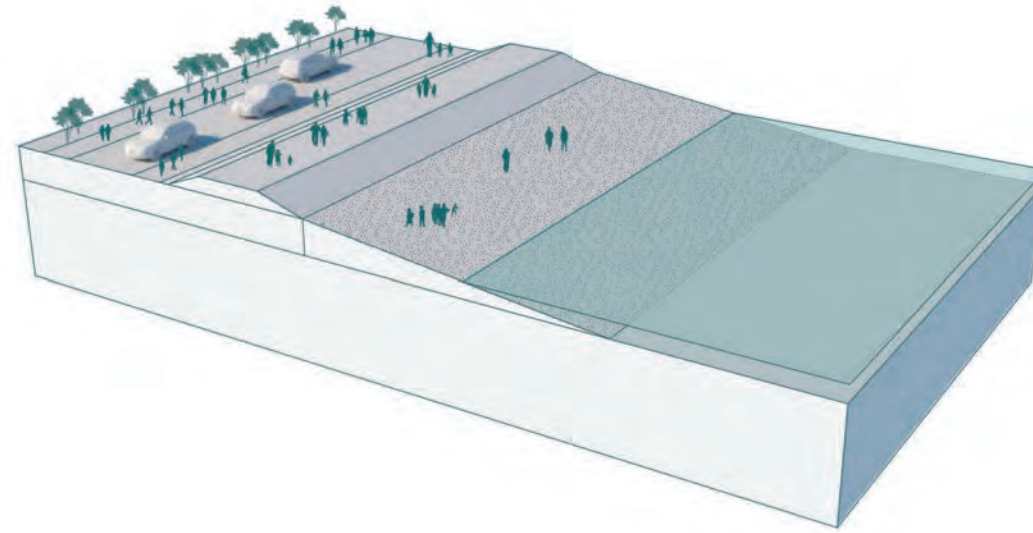
In this engineered condition an elevated landform along the coast is developed to mitigate the impact of floodwaters and storm waves. The materiality of this condition can range from stone rip rap to soil to a sand capped berm with a clay core. While these infrastructure will need to be built at a base flood elevation, there is an expanded opportunity for these infrastructure to also become ecologically and socially rich assets.

### Living Revetment

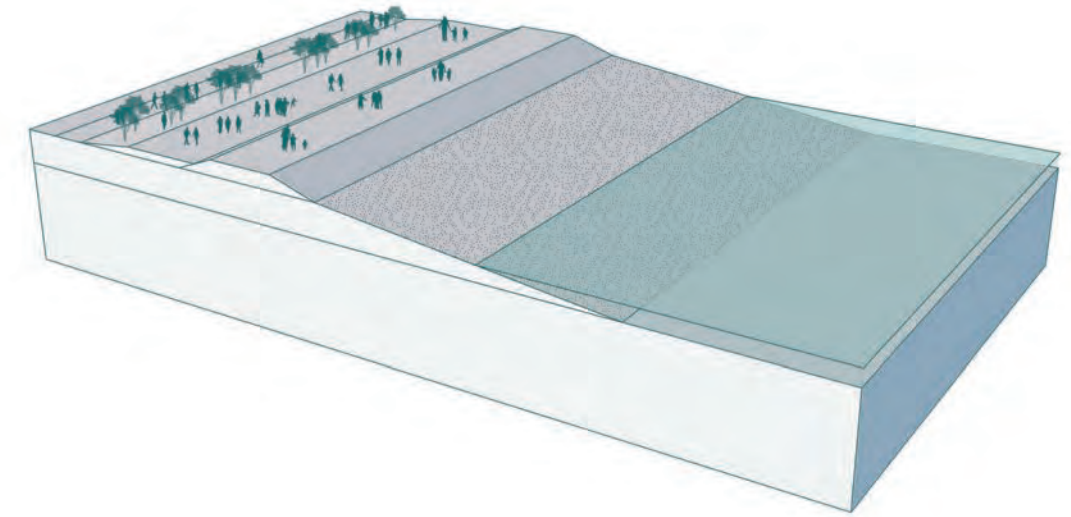
In this condition a traditional rip rap edge will be developed to also support a more ecologically rich condition along the waterfront and inland. Incorporation of ecological features has the potential to reduce the wear on physically built structures while also establishing a more dynamic relationship between natural resources of the harbor.

### Barrier Breakwater

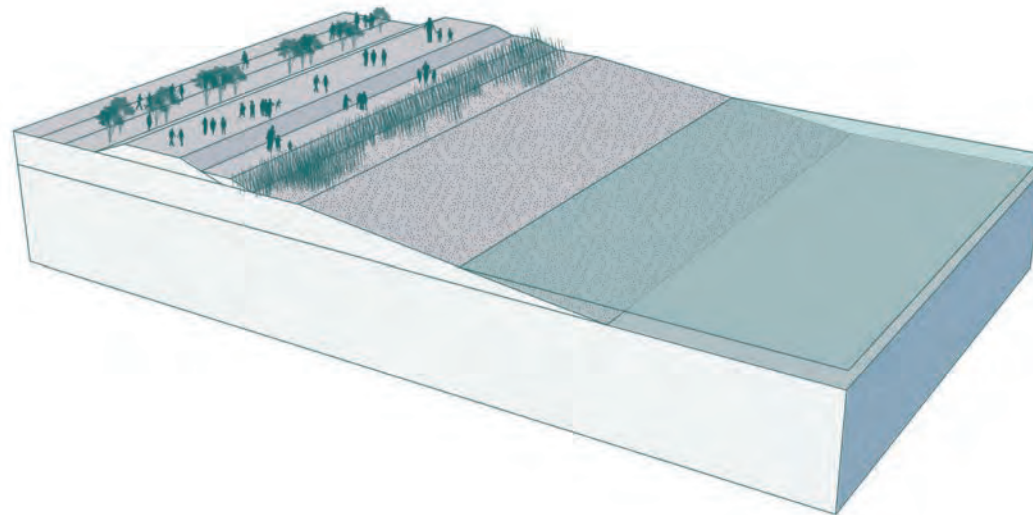
A barrier island condition composed of rip rap material is an infrastructure that can absorb the impact of damaging waves. With this condition, beaches will be sheltered and reduce destruction on developed inland areas.



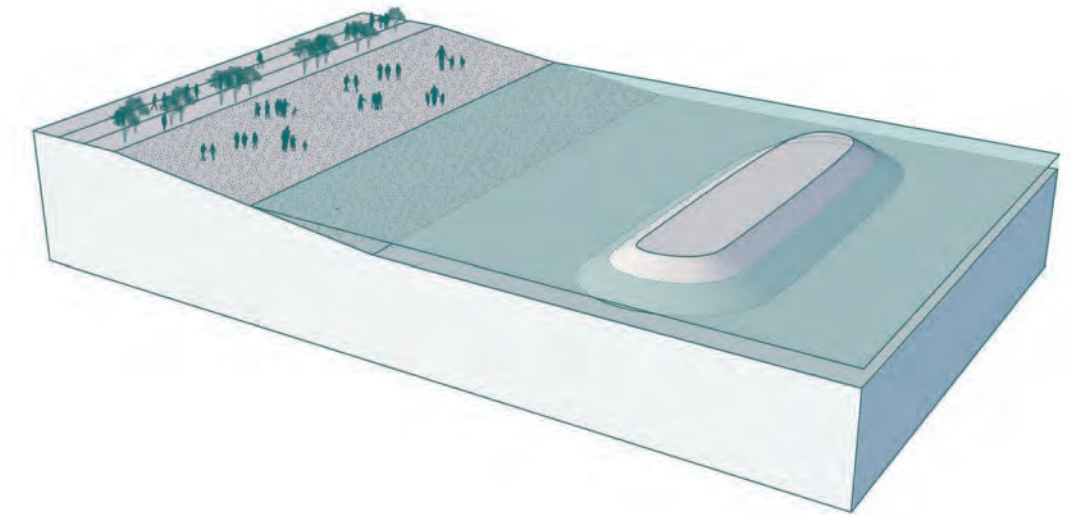
**Levee/ Berm**



**Expanded Berm**



**Living Revetment**



**Barrier Breakwater**

# DESIGN STRATEGIES

## Soft Coastal Structures

Soft coastal infrastructures would be designed as restorations of natural beach systems. While these assets would be engineered and fabricated, the focus would be to develop an edge condition that is flexible and adaptable to changing conditions. It is important to note that while these features have the capacity to absorb more water and reduce the impact of storm waves, there is no guarantee to keep floodwaters out under these conditions. Flooding is also part of a natural beach system, but cities have developed shorelines in ways that allow for valuable assets to exist within the floodplain.

### Beach Nourishment

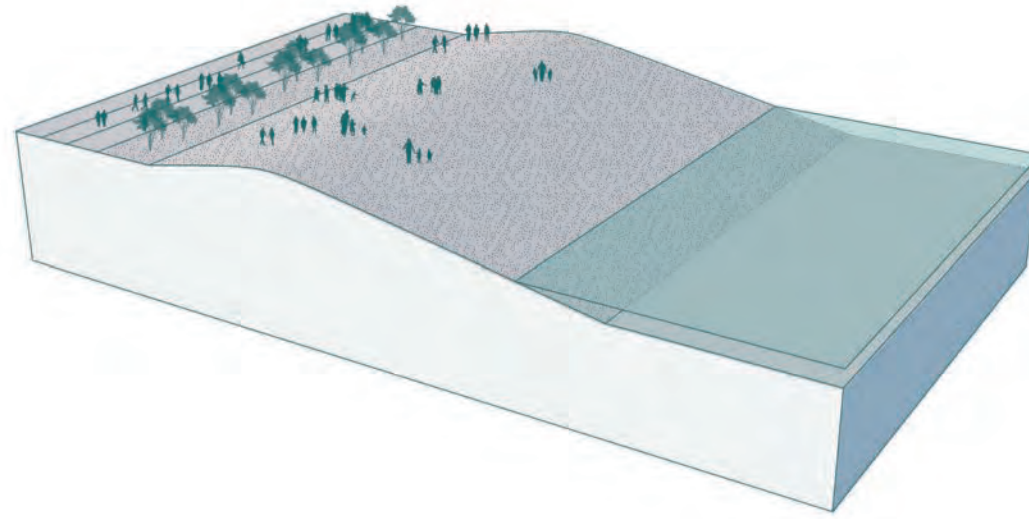
Historically this strategy has been used across the Boston Harbor. Sediment is dredged offshore and material is then placed along the coast to bolster the edge condition. This expanded beach mitigates the impact of damaging storm waves and adds an elevational landform.

### Terraced Marsh and Terraced Reefs

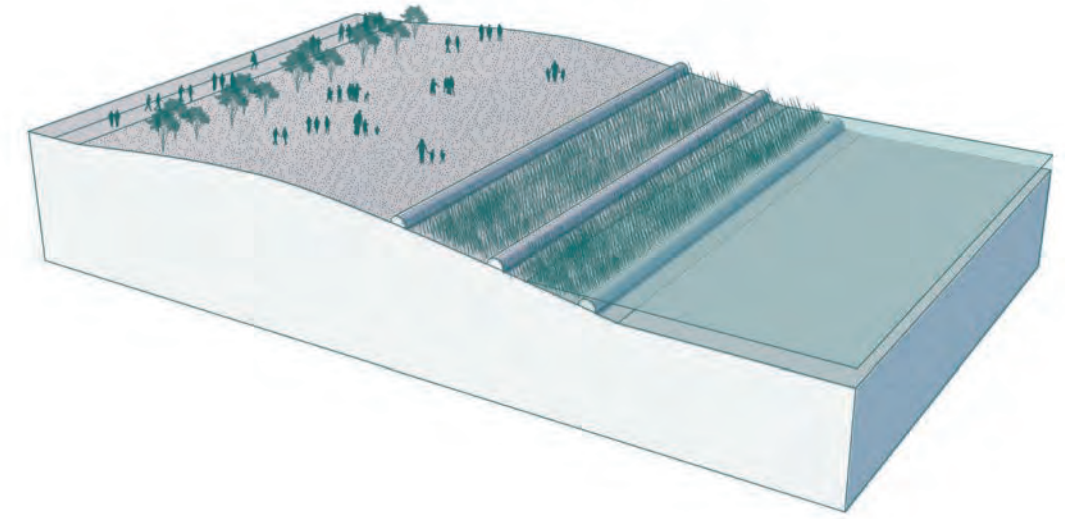
To support the growth of marsh conditions along the shoreline, stepped edges can be deployed to slow wave energy coming into the shore and provide a suitable foundation for the aquatic vegetation. In shallow conditions of water, micro breakwaters can be developed to establish strips of reef for the attenuation of waves before reaching shore.

### Layered Dunes

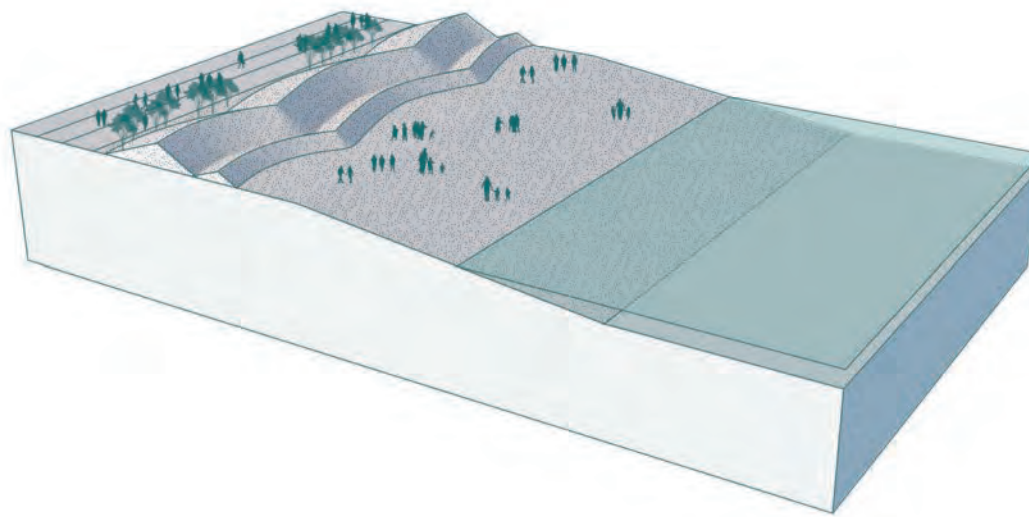
Here sand would be used to construct a dune landscape to provide additional buffers to developed shoreline edges. This condition would also support robust habitat conditions.



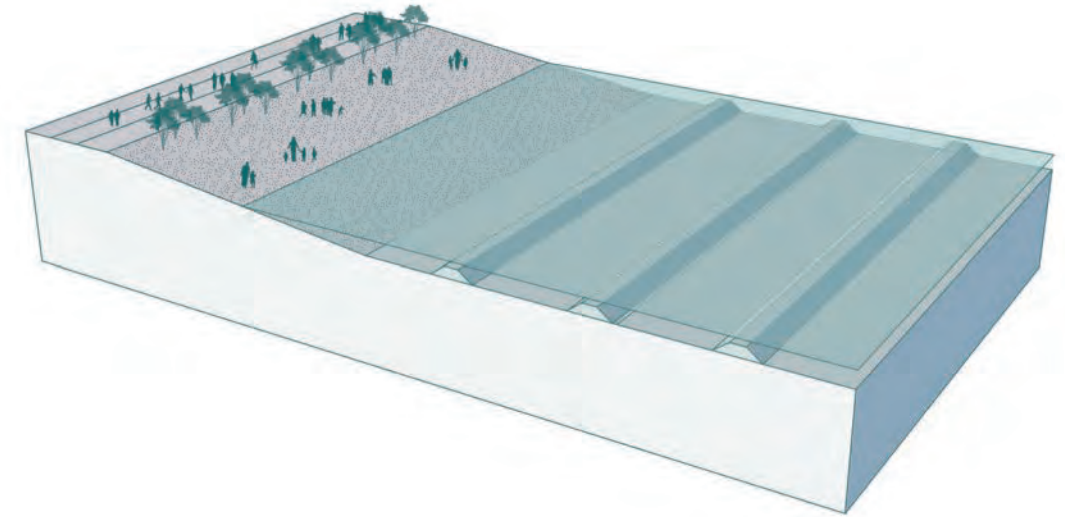
**Beach Nourishment**



**Terraced Marsh**



**Layered Dunes**



**Terraced Reefs**

**VISUALIZATION:**

**TOOLS TO IMAGINE  
THE FUTURE**

# NANTASKET BEACH

## CONCEPTUAL DUNE AND REVETMENT

The seawall at the south end of Nantasket Beach has become damaged over time as it has absorbed impact from an array of storm events. While the hardened edge has mitigated some of the impacts of storm surge and high wave energy, it has created issues regarding beach erosion and ultimately structural integrity.

In a US Army Corps of Engineers document, the viability of maintaining a seawall in this location along Nantasket Beach could potentially result in compromising the shoreline. In the adjacent image, a rendering is used as a tool to begin to imagine the potential infrastructural futures of this section of the beach. Instead of a vertical edge, an inland parking lot area is converted into a revetment supported by a dune system.

Before Condition:



