



Town of Marblehead



COMMUNITY RESILIENCE BUILDING WORKSHOPS SUMMARY OF FINDINGS

June 30, 2018

Town of Marblehead

Community Resilience Building Workshops

Summary of Findings



Overview

Marblehead is a coastal community of 19,808 residents (2010 U.S. Census) located in Essex County, approximately 18 miles north of Boston, situated on the North Shore of Massachusetts between Massachusetts Bay and Salem Harbor. The town has a total area of 19.6 square miles, of which 4.4 square miles is land and 15.2 square miles water. With 77.61% of Marblehead ocean, its long nautical, seafaring history and the importance of its thriving boating community make perfect sense. Marblehead's deep, sheltered harbor is home to six yacht clubs, 1800 moorings, nine public dock facilities, a large commercial fishing fleet, 35 private docks and boat operations. The Causeway is the only road access to the Neck where 3000 people live.

The Town of Marblehead is governed by a Board of Selectmen with a Town Administrator and operates under the open town meeting format - <https://www.marblehead.org>. The majority of the town is zoned as a single residence district with the small business districts and small industrial park zoned as "unrestricted." The town's five shoreline zoning districts have increased sideline requirements, a waterfront setback requirement, and a lower maximum height restriction designed to protect the views from and towards the shoreline. The harbor front district is designed to maintain, promote, and secure current and future water-dependent development, particularly marine services.

Marblehead is no stranger to the fierceness of the ocean, destructive storms and coastal erosion along its 14.2 miles of coastline, but there is a growing awareness that climate change will be the driver of a new future and that the time to plan and begin implementing adaptation measures for climate change resiliency is now. For this reason, the Board of Selectmen voted to make climate change one of the three priorities in Marblehead's Community Compact with the State.

The Workshop's central objectives were to:

- Define top local natural and climate-related hazards of concern
- Identify existing and future strengths and vulnerabilities
- Develop prioritized actions for the Community
- Identify immediate opportunities to collaboratively advance actions to increase resilience.

Through the Municipal Vulnerability Preparedness (MVP) process, Marblehead has demonstrated its commitment to understanding the potential impacts of climate change on the town's infrastructural, societal and environmental assets and how its residents, businesses and town services may be impacted.

Community Resilience Building Workshop

Marblehead's Core Team, made up of from the relevant town department heads, decided a one-day Community Resilience Building (CRB) Workshop would be best for their community and invited Town staff, Commission and Board members plus representatives from key community groups: League of Women Voters, Marblehead Conservancy, yacht clubs, Marblehead Chamber of Commerce, nursing homes, residents, and Sustainable Marblehead.

The workshop was held at the Boston Yacht Club on Wednesday May 16 and was attended by 36 participants. Lively engaged discussions ensued throughout the day. The MVP Provider, Salem Sound Coastwatch's Executive Director, Barbara Warren, facilitated the Core Team meetings, CRB Workshop and assisted with Marblehead's Public Listening Session on June 14.

The following Summary of Findings provides an overview of the top hazards, current concerns and challenges, current strengths and actions to improve the Town of Marblehead's resilience in the light of climate-related hazards today and for the future.



Summary of Findings

During the May 2018 CRB Workshop, participants were presented with the latest climate projections developed for Massachusetts by the Northeast Climate Science Center at UMass-Amherst (resilientma.org) and then asked to identify the top four natural hazards for Marblehead that will be driven by climate change. Having just experienced the 2018 winter with freezing temperatures and four nor'easters that left businesses and roadways flooded, seawalls in shambles, trees uprooted and power outages, participants easily reached agreement that coastal flooding from intense storms and the resulting storm surge, especially those coinciding with astronomically high tides, was the greatest hazard. Whatever has been experienced to date only becomes worse if the climate projections of a sea level rise by mid-century range of 1.1 feet to 2.7 feet and a worse case for 2100 of 9.7 feet of sea level rise become reality. Inland flooding while localized is significant because this flooding affects transportation routes in and out of Marblehead. With a warming world comes an increase in the frequency and intensity of storms and precipitation since “with every 1C° of warming, the air can hold 7% more moisture.”¹ Storm generated high winds and coastal erosion were also selected as hazards of concern. The Marblehead FEMA Hazard Mitigation Plan 2015 documented 32 high wind related events range from \$25,000 to \$1.1 million in damage between 2004 and 2013.

Top Hazards and Vulnerable Areas - Marblehead

Top Hazards

1. Coastal Flooding from Storm Surge and Sea Level Rise
2. Inland Flooding due to Intense Precipitation
3. High Winds
4. Coastal Erosion

While there is overlap with the hazards identified in the Town's 2015 approved FEMA Hazard Mitigation Plan (See Table Pg. 3), the CRB workshop participants sought to look at the climate change driven hazards slightly differently and included coastal erosion as its own separate hazard.

¹ Peter Stott, U.K. Met Office's Hadley Center for Climate Change

Table 2-2. Vulnerability Matrix 2015 Update
(Marblehead FEMA Hazard Mitigation Plan Pg. 39)

Hazard Future Occurrence	Potential	Damage
Flood-Related Hazards	High	Extensive
Winter-Related Hazards	Medium	Minor/Serious
Wind-Related Hazards	High	Extensive
Urban Fire-Related Hazards	Low	Minor/Serious
Geologic-Related Hazards ²	Low	Catastrophic

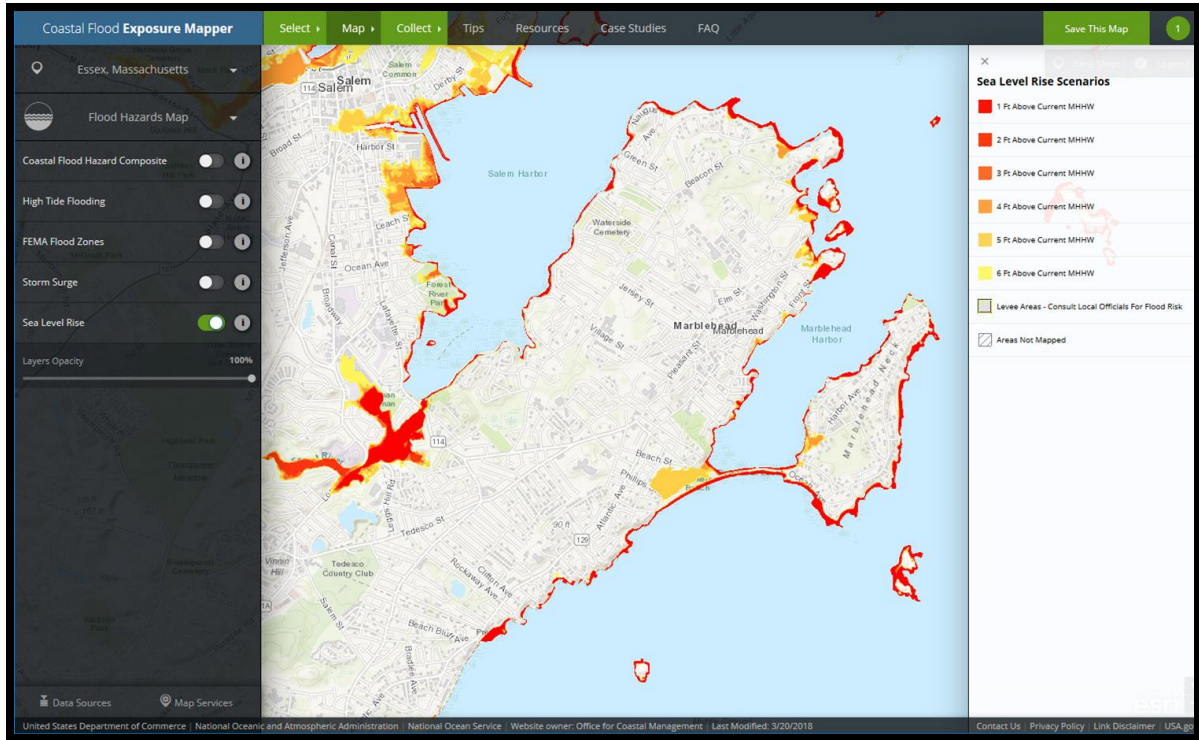
The four hazards are all driven by severe storms, which may take the form of nor'easters, blizzards, hurricanes, thunderstorms and tornadoes. It was recognized that climate change projections indicate that these weather events may intensify and/or be more frequent, which may lead to even greater damages being sustained by the community.

While sea level rise is mainly confined to the coastal edges of Marblehead, it will worsen Marblehead's already flooded evacuation routes. Storm surge has much more potential to cause extensive damage.

Workshop participants were shown the following two maps during the presentation. The Projected Sea Level Rise map shows the National Oceanic and Atmospheric Administration (NOAA) modeling of coastal flooding above Mean Higher High Water (average height of daily highest tide) with six increasing levels of sea level rise (1-foot increments up to six feet). This map does not account for storm surge, waves, erosion, and other dynamic factors. The Storm Surge Map shows the current hurricane surge inundation zones.

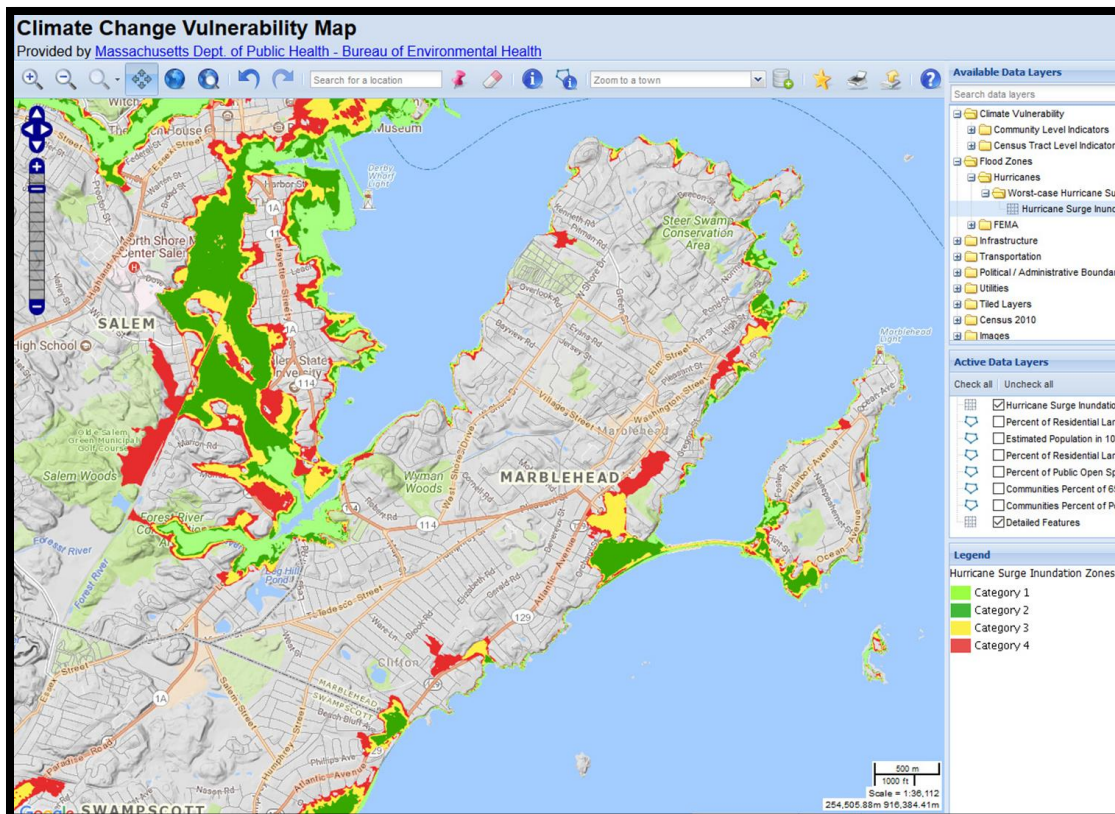
² "A major fault, long since inactive, separates the two rocky terrains and is responsible for the submerged trough that forms Marblehead Harbor. This fault line is located nearly mid-harbor and is approximately 170' wide and of undetermined length. These large faults are not recent, but most likely formed when the great supercontinent, Pangea, rifted apart and the Atlantic Ocean started to open." Marblehead Open Space and Recreation Plan. 2012. Pg. 19

Projected Sea Level Rise Map



The next map shows the current hurricane surge inundation zones.

Storm Surge Mapping



Areas of Concern – Vulnerable Areas

Neighborhoods: Atlantic Avenue at Preston Beach, Goldthwait, Ocean Avenue to Shipyard (Commercial Street), The Causeway to Neck (Ocean Avenue - Sargent Road, Harbor Avenue - Flint Street and Sean Way), Marblehead Harbor (Walnut, Gregory, Front Street District to Fort Sewall), Little Harbor to Doliber's Cove, Wymans Woods (West Shore Drive)

Ecosystems: Marblehead Harbor and west side of Salem Harbor; beaches - Fort, Tucker, Gas House, Grace Oliver, and barrier beaches - Devereux, Riverhead, Preston; salt marshes at Forest River Conservation Area and Golthwait Reservation, Dolibers Cove, Little Harbor, Brown's and Gerry Islands, intertidal marine resources – eelgrass and shellfish.

Transportation: Lafayette Street (Rt. 114) and Loring Ave on Salem/Marblehead line, Front Street, Atlantic Avenue (Rt. 129-Preston Beach area) on Swampscott/Marblehead line, The Causeway, low-lying areas of West Shore Drive.

Infrastructure: All assets built around Marblehead Harbor which includes six yacht clubs, boat yards, public docks, landings and seawalls, Historic and Business Districts, Fort Sewall which is on the National Registry of Historic Places, Marblehead Municipal Light Department – electric power distribution system and substations, and Marblehead Water and Sewer Department stormwater and sewer infrastructure.

Ecosystems: Marblehead Harbor and west side of Salem Harbor; beaches – Fort, Tucker, Gas House, Doliber Cove, Grace Oliver, and barrier beaches - Devereux, Riverhead, Preston, salt marshes at Forest River Conservation Area and Golthwait Reservation, Brown's and Gerry Islands, intertidal marine resources – eelgrass and shellfish

Current Concerns and Challenges Presented by Hazards

- Integrity and Aesthetics of Marblehead's Scenic Shoreline
- Thriving Boating Community – recreational and commercial
- Historical and Cultural Significance of Town Center

These are some of Marblehead's unique community characteristics that residents value and seek to maintain. Marblehead is no stranger to the fierceness of the ocean, destructive storms and coastal erosion along its 14.2 miles of coastline and has recovered in the past. Nor'easters and hurricanes generally subject the Town's infrastructure, private yacht clubs, commercial developments, homes, and natural resources in the flood-prone coastal areas to the most severe damage. There is a growing awareness, however, that climate change will be the driver of a new future and that the time to plan and begin implementing adaptation measures for climate change resiliency is now. While there are many actions that are in progress or are ongoing, workshop participants understood the significance of reexamining actions with longer-term climate resilience criteria of at a minimum mid-century.

Historic Flooding Events - Massachusetts		
Date	Type of Event	Local Impacts
September 21, 1938	The Great New England Hurricane - Cat 3	10-17 inches of rainfall and up to 20-foot storm surge.
September 15, 1944	The Great Atlantic Hurricane - Cat 1	11 inches of rain and up to 70-foot waves.
September 1950	Nor'easter	
August 31, 1954	Hurricane Carol - Cat 2, followed by Edna	2 hurricanes struck within 12 days with 7 inches of rain causing stream flooding and streets washed out.
September 12, 1960	Hurricane Donna - Cat 2	10-20 inches of rain and 5-10-foot storm surge. Wettest tropical cyclone to impact New England.
September 1962	Nor'easter	
May 1967	Nor'easter	
March 1972	Severe Storms and Flooding	No information available.
February 1978	The Blizzard of '78 Most devastating Nor'easter in Massachusetts history.	Set all-time high water mark of 15.25 feet above Mean. 30 inches snowfall, with 20-foot drifts.
September 27, 1985	Hurricane Gloria - Cat 3	Arrival at low tide resulted in moderate storm surge.
March 31-April 7, 1987	Severe Storms and Flooding	Spring storms added 7 inches to already high river conditions to produce major flooding.
1988	Nor'easter	
August 19-21, 1991	Hurricane Bob - Cat 3	4-7 inches of rain and storm surge impacts.
October 15-18, 1991	"The No-Name Storm" or "Perfect Storm" Nor'easter	25-foot waves on top of 4-foot high tide. Many coastal roads washed out.
December 11-13, 1992	Nor'easter	Highest water levels 1-foot below record of 1978 (25 ft. dunes wiped out in Ipswich) and 6 inches of rain.
October 20-21, 1996	Severe storms and flooding	13 inches of rainfall in Essex County (7.89 in Boston).
June 13-18, 1998	Heavy rain and flooding	Flash flooding from June 12-14 > 8 inches in < 12 hours.
March 21-22, 2001	Nor'easter	High tides ran 2-3 feet above normal along east facing coastline.
February 2003	Presidents Day Storm	Astronomical high tide coincided with 15-foot seas to cause flooding along most of eastern Massachusetts coastline. 27.5 inches of snow recorded at Logan Airport.
March 31-April 2, 2004	Flooding	6 inches fell over several days. Floodwaters caused many roads close.
May 9-16, 2006	"Mother's Day Flood"	Extreme rainfall >12 inches.
April 15-20, 2007	"Patriot's Day Storm" Nor'easter	Worst coastal flooding coincided with evening high tide on April 17 (3.6 inches recorded at Logan Airport).
December 11-12, 2008	Severe winter storm	8-12 inches of snow accompanied by 30-40 mph winds resulting in coastal flooding and structural damage.
March 12-16, 2010	Nor'easter	Record-breaking rainfall (7.06 inches at Logan Airport) coastal flooding and 70 mph winds.
January 11-12, 2011	Nor'easter	Snow, high winds, and coastal flooding.
October 29-30, 2012	Nor'easter	Rare October snowstorm, icing, high winds.

Historic Flooding Events - Massachusetts		
Date	Type of Event	Local Impacts
February 8-10, 2013	Winter Storm Nemo - Nor'easter	24.9 inches of snow in Boston, hurricane-force winds, and 4.2 feet of storm surge.
January 26-28, 2015	Winter Storm Juno	24 inches of snow fell in Boston with 4-feet of storm surge and high winds.
January 4, 2018	Winter Storm Grayson	5-foot storm surge on top of extreme high tide of 11.6' at 12:36pm
March 1-3, 6-8, 12- 14 2018	3 - Nor'easters - Riley, Quinn, Skyla	Hurricane-force wind, unusually high tides and storm surges along the coast, destructive winds wind and downed trees, heavy snow and severe coastal flooding; blizzard conditions

Specific Categories of Concerns and Challenges

Critical Infrastructure Limitations

Marblehead Water and Sewer Department maintains over one hundred miles of sewer mains, over 3,000 structures, and 28 pump stations, servicing approximately 7,900 buildings. Sewage is pumped from the Beach Street pumping station to the South Essex Sewerage District (SESD) treatment plant in Salem where it receives secondary treatment before being discharged into Salem Sound.

Thirteen of the 28 Sewer Pump Stations are at risk: Atlantic Ave/Preston (Seaview), Goldthwait Road (Phillips), Beach Street (SESD), Front Street (Fort Beach), Norman Street, Crowninshield Road, Corn Point Road, Mooring Road, Cloutman's Lane (Edgemere), Naugus Avenue, Green Street, Liberty (Liberty Road), Lafayette Street, on the Neck: lower Harbor Avenue, Sargent Road, Nahant Street. These sewer pump stations need to be evaluated for storm surge elevations, watertight access, alternate power sources, seawater infiltration. The only information available is a 1990 sewer pump station evaluation and working knowledge of present and past employees.

Currently, eight stations (Shorewood, SESD, Phillips, May, Sunset, Fort Beach, Naugus, Clifton), are continuously monitored by SCADA. Five stations have back-up generators onsite (Shorewood, Green, Norman, Sargent, Fort Beach). The sewer department has six portable generators for the remaining 23 stations. All stations have some level of alarm and lights, but it is critical that neighbors alert the Water & Sewer Department when they hear alarms or see lights since these indicate that a station has a power loss, high wet well level or station flooding. Ongoing education is a necessary component of being resilient. There is a need for more SCADA monitored stations, and more portable or onsite generators and sump pumps. As the Town prepares for higher sea level and storm surges, protection measures such as floodgate barriers, watertight wet well covers, and raised elevations need to be investigated and considered.

One NPDES permit (a 2-mile outfall pipe off Sargent Road) remains, activation is initiated only in extreme flooding events when SESD cannot take any more sewerage.

Coastal and inland flooding can be exacerbated by inadequate stormwater infrastructure. An inventory of the stormwater infrastructure in particular the ocean stormwater outfalls that experience backflow at current high tides is necessary to understand where to build resilience.

Marblehead's Open Space and Recreation Plan 2012 noted, "Since there is a very large amount of impervious surface in the very dense town, the ability of these open spaces to take up water during heavy rainfalls has become extremely important to prevent local flooding of some neighborhoods."³ A study of the Town's imperviousness and flooding would help to evaluate ways to reduce stormwater impacts, incorporate green infrastructure and protect critical open space.



Marblehead Municipal Electric Light Department

(MMLD), founded in 1894, provides the Town with safe, reliable electricity and value-added electric service at competitive rates. All of Marblehead's electricity is supplied from a Salem substation off Jefferson Ave., near the Salem Police station. Two high voltage feeder lines run underground near Canal Street and continue underground the length of the Marblehead Rail Trail in Salem, including sections that run through Salem State University. The supply lines continue underground to Lafayette Street in Salem and continue underground, under the Lead Mills Rail Trail. The supply lines, run within the underside of the wet bridge structure, then within the underside of the dry bridge structure (where the Marblehead town line with Salem is located) and continue underground until about 700 feet past the dry bridge. From there the supply lines rise to a utility pole and continue along the rail trail above ground on utility poles, through Wyman Woods and on to the substation located just before the intersection of the rail trail with Village Street.

MMLD has four substation locations in town, the Village Street station (adjacent to the rail trail), the Clifton Street station (on Atlantic Ave.), the Beacon Street station (located at Woodfin Terrace, within the Dept. of Health's Landfill area), and 80 Commercial Street. Marblehead's underground supply line from Salem is the Electric Light Department's only connection to the ISO-NE Grid. Only one substation, the 80 Commercial Street substation, is believed to be in an area potentially threatened by coastal flooding.

Aerial photos taken on May 14, 2018 documented that the ocean-side (Salem Harbor) of the trail embankment had eroded approximately 45%, as measured from the trail center line to the base of the embankment, to within 12 feet of the underground supply high voltage lines. When compared to 2009-2017 aerial photography that showed no erosion, it became clear that the erosion was attributable to the March 2018 storms. This erosion is a serious threat to Marblehead's power supply and presents a severe town-wide safety and health hazard if further erosion is allowed to take place.

³ Marblehead Open Space and Recreation Plan. 2012

Workshop participants were receptive to MMLD taking steps to reinforce its limited in-town electric power generating capacity (diesel) by developing renewable energy sources such as solar power, coupled with battery storage systems. If the ISO-NE supply was unavailable, MMLD could not meet Marblehead's current electrical demand. A detailed plan for how to ration and distribute in-town power production under emergency conditions does not exist today.

The MMLD main office is a critical community asset, located at 80 Commercial Street, and directly on the harbor at Hammond Park. Its 124 year-old office has recently been renovated. However, several resiliency projects remain, including repairing visible damage at Hammond Park (east side of the building), seawall erosion and tidal damage from the March 2018 storms (north side of the building), evaluating the risk of flooding from underground water pipes that once pumped cold ocean water to the main building basement to cool diesel engines, and preventing ocean wave backflow in the on-site storm drains that empty directly into the harbor.

Utilities and Public Safety from Fallen Trees and Limbs

This past winter of 2018, communities across the North Shore experienced power outages, property and personal damage from uprooted trees and falling limbs. Recognizing the extensive damage and the high potential for strong winds, participants are concerned about the Town's aging infrastructure, road closures and power disruptions. The Town may be able to manage their tree maintenance better, but because many of the trees are on private property, public outreach and education need to take place.

Vulnerability of Road Network

Two peninsulas jutting into Massachusetts Bay, Marblehead is at the end of the line for transportation and utilities. As a peninsula, access to the town is limited. State Route 114 and Route 129 end at the intersection of Atlantic and Ocean Avenues. Route 114 heads west into Salem, while Route 129 heads south along Atlantic Avenue into Swampscott. Transportation access is dependent on the roads in the neighboring towns of Salem and Swampscott as are the MBTA Commuter Rail Newburyport/Rockport Line stations and the four Marblehead to Boston MBTA Bus routes. Route 114 and Route 129 both have current day flooding problems at the Town boundaries.

One participant voiced the current transportation reality, "If one of the major routes close down for any reason, it can take 4-5 hours to get out of Marblehead." In a storm emergency, there may be no way to get in or out of Marblehead.

The Causeway, the only road access to the Neck, is built on a sand bar (tombolo⁴), which requires fortification. The flood hazard on the Causeway is clearly a significant natural

⁴ "Tombolos are formed where offshore islands divide the current so it meets again on the landward side and drops sand and gravel. Examples are the connection between the Neck and the mainland and the one between Gerry Island and Gas House Beach." Marblehead Open Space and Recreation Plan. 2012 Pg. 23

hazard risk and frequently affects the approximately 3,000 residents of the Neck. Rebuilt in 2009 for \$9 million, it remains a public safety hazard during storms, wind driven waves and extreme high tides and was closed seven times in the last year. Being a long sandbar, coastal erosion is an ongoing problem as well.

Seven neighborhoods experience storm-related flooding and could benefit from an analysis of flooded roads to determine short and long-term solutions. All roadways have electric, gas, sewer and stormwater infrastructure that may be impacted from flooding. In some cases, Town utilities and pumping stations are on private roads and behind private seawalls.



Fort Beach, King Tide November 2016



Fort Beach, After Nor'easters 2018

Coastal Storm Damage and Coastal Reinforcements

For hundreds of years, people have been building on Marblehead Harbor and reinforcing the water's edge. At the end of the harbor is Fort Sewall, an earthen fort on National Registry of Historic Places and across the harbor, Chandler Hovey Park and Marblehead Light. The Historic District, which is much of the B1 business district, houses the Marblehead Municipal Light Department on Commercial Street, the Harbormaster's office off Ferry Lane, State Street and Commercial Public Landings where many of the 30 commercial fishing boats bring in their catch. Six yacht clubs ring the harbor.

Approximately 247 residential structures and 26 commercial properties are within the coastal and inland flood hazard areas (Marblehead FEMA HMP 2015). Many of these structures are there because of seawalls (35 in the Harbor, 37 town owned revetments). Some are town owned; some are private. For example, the Corinthian Yacht Club alone has 90 feet of seawall. In 1966, Marblehead explored with the Army Corps of Engineers the building of a breakwater at the entrance of the harbor at Lighthouse Point on the Neck, but the breakwater proposal failed to gain support at two different town meetings.

Participants voiced the opinion that currently coastal reinforcements are responded to with “band-aid” treatments and that a study is needed to assess current conditions, ownership, and potential impacts of failure. Community water’s edge treatment standards need to be developed to be able to work with private and public property owners to make the entire area more resilient. Many questions will need to be addressed such as the nature of this private/public partnership, government regulations, and the interaction of public safety, property protection, and property rights. Accommodating and adapting to the risks of climate change may require local and state policy changes and greater flexibility. The interconnectedness of the harbor reinforcements requires a careful holistic study of private and public property along the water's edge to develop a resilient, cohesive response that will work at private, town, state and federal levels.

Communications

Marblehead’s communication network is vulnerable to interrupted service and potentially inadequate response coverage during storm events. Landlines are vulnerable to ice, wind and snow events as are cell towers and antennas. Microwave transmission between towers and repeaters need to remain operable. Having watched other communities struggle with cascading communication failures, participants were aware of the challenge and importance of maintaining communications during emergencies, especially with aging trees and utility poles. Participants felt that greater sharing of communication resources while creating redundancies would be make the Town more resilient and better prepared for emergencies.

Emergency Management

For most people, emergency preparedness is out sight, out of mind until the emergency is a reality. When emergencies are imminent, people need to know how to safely protect and, if necessary, evacuate their homes. Evacuation routes need to be identified and local shelters available if evacuation off Marblehead is impossible. People need to know flood hazard precautions, such as not driving on flooded roads.

When roads are flooded or there are life-threatening waves crashing over the Causeway, a fire truck and ambulance are positioned on the Neck side. Police are needed on the road to prevent people from trying to cross. This requires using personnel that may be needed elsewhere. Workshop participants understood the importance of continued public education about the dangers inherent in these hazards and the need to continually seek new and nontraditional ways to provide the public with this essential information. At a listening session with the Neck Association, concern for more emergency planning specifically for the Neck when the Causeway is impassable was voiced. Ideas included a Neck-side emergency shelter, heliport and an urgent care practice.

A Marblehead Emergency Preparedness Plan needs to be easily located on the Town website and regularly shared within the Town Departments and with vulnerable neighborhoods. After the winter storms of 2018, the need for emergency preparedness staging area and a post-emergency debris management plan became apparent.

Another aspect of emergency management is the removal of boats before a disaster. For the commercial fishing boats, it is also very important to be able to get back into the water in a timely manner after the storm. Currently, there are two tidal boat ramps: Riverhead and Little Harbor and four cranes for hauling boats: Beacon, Front Street, Cliff Street and Parker's boat yard.

Coastal Erosion

Wind and wave action provides enormous energy that weathers, erodes, and changes unprotected intertidal zones: rocky outcrops, sandy beaches, sheltered coves, and salt marshes. Waterfront open spaces and parks areas, such as Beach Bluff Park, Seaside Park, Crocker Park, Chandler Hovey Park, and Fort Sewall and the two largest beaches in town, Preston Beach and Devereux Beach, receive the brunt of ocean storms and tidal action. Preston Beach, a sandy barrier beach, is armored by seawalls and spans the border between Marblehead and Swampscott. Devereux Beach, a sandy to cobble beach, is armored at one end by the wall supporting the Causeway. Forest River Conservation Area and the Goldthwait Reservation contain salt marshes. Within the town's boundary, there are two small islands, Brown's Island and Gerry Island, both under the jurisdiction of the Trustees of Reservations.

The erosion rates per year of 6 to 17 inches have been documented at Fort Sewall, 9 to 10 inches at The Causeway and 6 to 10 inches at Devereux Beach. Participants recognized that with the rising sea level and increasing intensity and frequency of storms, greater rates of erosion will take place. Given the higher elevations landward of the salt marshes and beaches, landward retreat by these valued natural assets will be difficult or impossible. If there is nowhere to retreat, they will disappear with sea level rise.

Current Strengths and Assets:

The Town's elected and appointed officials and staff are committed to maintaining and improving emergency preparedness and the community's resilience. The participation in the CRB workshop by community organizations and public listening sessions demonstrates the residents desire to be involved and informed. Coordination amongst the Town's departments is a community strength. Police, Fire, EMS, Harbormaster, and Water & Sewer personnel are well acquainted with the natural hazards and are generally equipped to respond. Ongoing collaboration and support amongst leadership and staff will help to advance comprehensive, cost-effective approaches to resilience as identified in this Summary of Findings.

Infrastructural Asset Strengths:

- Most of the Town's critical emergency response assets are on high ground: the Police, Fire and Transfer Stations and the Tower Way Garage where the DPW fuel pumps are located; as are the Town administrative buildings, Abbot Hall and Mary Alley Municipal Building.

- The Town has its own electrical department, MMLD.
- The two heliports are in resilient areas at the Bell School and Transfer Station.
- The Town's drinking water comes from the Massachusetts Water Resources Authority (MWRA), actually at the "end of the MWRA gravity fed line."
- South Essex Sewer District (SESD) in Salem handles Marblehead's sewerage.

Societal Asset Strengths:

- The Marblehead Community Center, Council on Aging, Housing Authority, and many faith-based organizations provide important supportive services.
- Schools, nursing homes and elderly housing are on higher ground.
- The Veterans Middle School and the Marblehead Community Center are available as emergency shelters.

Environmental Asset Strengths:

Its geology, a complex of ancient igneous rock, is definitely one of Marblehead's key environmental resiliency strengths. Many of its critical infrastructure are located on the high elevations, away from the coast and waterfront. The coast is armored in some areas by this high rocky coastline.

- On the west side of town, the elevation reaches 105 to 108 feet at Beacon Street and Wyman Woods, while the highest points on the east side along Marblehead Harbor reach 70 feet: Gilbert Heights, Roundy's Hill, the training field at Abbot Hall, and the cliffs rising between Goldthwait Reservation and Greystone Beach.
- Marblehead Harbor is 27 feet deep at its greatest depth during low tide and approximately ½ mile wide and 1¾ miles long.
- Densely populated at near full buildout, Marblehead has 25 parcels protected as parks, conservation lands or land via conservation restrictions or trusts for over 257 acres.
- Seven ponds and four major wetland areas make up 69 acres, 2.4% of the town's total area, and have a network of trails around these inland water resources.⁵

⁵ Marblehead Open Space and Recreation Plan. 2012 Pg. 27



Top Recommendations to Improve Resilience:

Marblehead Harbor is a critical societal, environmental and infrastructural asset that focuses the Town's identity and its economy. It is a "harbor town" with a very long history and thus consists of a myriad of businesses and residents, public and private properties, commercial and recreational boating – most of it protected by an aging infrastructure of seawalls. The integrity of Marblehead's coastal infrastructure failed in many locations during the past winter, raising many concerns about the best ways to move forward on improving Marblehead's infrastructural assets to achieve greater resiliency for the long-term. This MVP Plan seeks to develop a more resilient, cohesive response to protecting coastal assets in Marblehead, while addressing some very real and immediate threats that these hazards have already wrought on the community, such as, the coastal erosion at the Lead Mills that increased the risk of exposing the two high voltage feeder lines that deliver Marblehead its electricity. Ongoing public outreach and communication with the community are necessary and vital for the success of the following action priorities.

Highest Priority

- Address immediate need to protect the two 23-kilovolt feeder lines underground in the Lead Mills area of the Rail Trail.
- Evaluate current flooding and future risks at thirteen sewer pump stations and then protect from flooding; Upgrade alarms to SCADA; Educate public on alarm and sump pumps; Replace sewer lines that are at risk of seawater flooding as indicated from current investigation.
- Inventory stormwater infrastructure and ocean backflow; Begin resiliency improvements at flood priority areas; Conduct a study of imperviousness, evaluating options to reduce hardening, increase flood storage and/or incorporate green infrastructure; Continue public education.

- Develop a detailed plan for power distribution under emergency conditions; Investigate risk from harbor pipes to MMLD office building; Evaluate power substations near the water; Design deployment of town renewable energy sources; Consider alternative electrical power supply. Conduct town-wide utility pole assessment and replace as needed. Evaluate and repair visible seawall erosion at rear of building site adjacent to Hammond Park.
- Assess reasons for the Causeway closures in order to reevaluate solutions, particularly where it currently breaches; Install warning lights and gates; Educate coastal residents and others about emergencies and risks; Make sure there are shelters on both sides of the Neck.
- Permit and reconstruct or repair public seawalls that are in immediate need from the winter 2018 storms.
- Develop a resilient, cohesive response to protect assets in Marblehead Harbor that addresses the mix of private and town properties, state and federal regulations; Restart conversation about constructing a breakwater to protect the harbor assets, which will require a cost/benefit analysis; Update the CZM private/public seawall inventory that includes climate change risk projections.
- Conduct flooded road analysis to determine short and long-term solutions. Conduct appropriate tree maintenance near assets to protect power distribution and prevent road closures.
- Assess feasibility of using Reynolds Park for temporary underground stormwater storage.
- Continue to protect the environmental quality of the harbors through sewer and stormwater improvements, boat pump outs, and residential and boater awareness.
- Conduct tree inventory/survey to evaluate needs with goal of maintaining a healthy tree canopy, while removing threats to utilities and roadways during high wind / storm events / coastal erosion.
- Monitor condition and maintain barrier beaches; Determine is something can be done with the water that overtops the barrier; Develop a post storm operations and management plan.

Moderate Priority

- Improve communications redundancy for emergency services.
- Complete Emergency Preparedness Plan Update; Conduct public education in advance of a disaster: how to prepare, shut down power, evacuate.

- Evaluate adequacy of existing resources for boat removal during emergencies and determine possible new access points.
- Educate and encourage retrofitting that include flood-wise actions (e.g. blow out panels, raising utilities); Maintain and repair Fort Sewall earthen fort using resilient solutions.
- Implement flood proofing and flood storage that would prevent the Abbot Library from future flooding.
- Maintain parks and conservation areas; if resiliency actions are needed to protect infrastructural assets, conduct in the most practically sound environmental manner.
- Maintain access on the Rail Trail for non-vehicular transportation; Improve drainage, elevate areas that flood or construct alternative passage.

Lowest Priority

- Monitor erosion at Chandler Hovey Park; Assure functionality of Marblehead Light.
- Monitor shoreline for erosion at the Waterside Cemetery.
- Evaluate beach and salt marsh systems vulnerability to inform long-term policy, which includes understanding beach erosion and habitat retreat.
- Protect and maintain Brown and Gerry Islands, while understanding the natural changes that will occur due to sea level rise.
- Stay informed of the climate change research on eelgrass and shellfish, and implement if possible.



Next Steps

Marblehead will begin incorporating the MVP Report findings into its ongoing and new planning efforts. The town will use this document and the actions identified to seek funding sources to implement the various recommendations and projects. The town will continue to educate and increase education efforts on climate change and hazard mitigation and adaptation.

CRB May 2018 Workshop Participants:

COMMUNITY RESILIENCE WORKSHOP MAY 16, 2018

	YES	AFFILIATION	Signature
1	Ken Lord	Schools Department	
2	Judy Jacobi	Board of Selectmen	Judy Jacobi
3	Debby Larkin	Housing Authority	Debby Larkin
4	Lisa Hooper	Council on Aging	Lisa Hooper
5	George Barbuzzi	Chamber & Nursing Homes	George Barbuzzi
6	John McGinn	Town Administrator	John McGinn
7	Rebecca Cutting	Town Planner	Rebecca Cutting
8	Charlie Quigley	Town Engineer	Charlie Quigley
9	Fred Madio	Marblehead Conservancy	F.R. Madio
10	Don Morgan	Marblehead Conservancy	
11	Andrew Petty	Health Department	
12	Amy McHugh	Water & Sewer Department	Amy McHugh
13	Carl Siegel	Water & Sewer Commission	Carl Siegel
14	Jan Smith	Resident/ex CZM & Concom	Jan Smith
15	Jason Gilliland	Fire Chief	Jason Gilliland
16	Robert Picariello	Police Chief	Robert Picariello
17	Mike Michaud	BYC	Mike Michaud
18	Mark Sousa	Harbormaster	Mark Sousa
19	Peter James	Rec and Park Department	Peter James
20	Jamie Bloch	Rec and Park Department	Jamie Bloch
21	David Kucharsky	Sustainable Marblehead	David Kucharsky
22	Ashley Nye	Selectmen Office	Ashley Nye
23	Chuck Cerrutti	Fire - emergency	Chuck Cerrutti
24	Polly Whitmore	LWV	P. Whitmore
25	Steve Leverone	Planning Board	Steve Leverone
26	Alison Nieto	Finance Director	Alison Nieto
27	Rich Baldacci	Building Commissioner	Rich Baldacci
28	Andrew Christensen	Planning Board	Andrew Christensen
29	Brian LeClair	Conservation Commission	Brian LeClair
30	Bill Conly	Historic Commission	Bill Conly
31	Arthur Graves	DPW	Arthur Graves
32	Patricia Sullivan	Sustainable Marblehead	Patricia Sullivan
33	Kurt James	Sustainable Marblehead	Kurt James
34	Andrew Oliver	Real estate	Andrew Oliver
35	Joe Kowalski	Electric light company	Joe Kowalski
36	Betsy Cruger	Animal control officer	Betsy Cruger
37	Kyle Pettinelli	Fireman MFD	Kyle Pettinelli
38	Linda Price Collins	Rec and Park	Linda Price Collins

Report Citation:

Warren B. and R. Curran Cutting (2018) Town of Marblehead Community Resilience Building Workshop Summary of Findings. Town of Marblehead, Salem Sound Coastwatch. Marblehead, Massachusetts.

CRB Workshop Project Team: Organization, Name, Role:

Town of Marblehead – Rebecca Curran Cutting, Project Coordinator, Core Team Member.

Salem Sound Coastwatch – Barbara Warren, MVP Provider and Lead Facilitator

Marblehead Core Team Members –

John McGinn (Town Administrator), Rebecca Curran Cutting (Town Planner), Chuck Cerrutti (Emergency Management Coordinator), Charlie Quigley (Town Engineer & Conservation Commission Representative), Bob Picariello (Police Chief), Jason Gilliland (Fire Chief,) Rich Baldacci (Building Commissioner), Amy McHugh (Superintendent Water/Sewer Dept.), Mark Souza (Harbormaster), Peter James (Superintendent of Park & Rec), Andrew Petty (Health Director)

Breakout Facilitators and Scribes: Rebecca Curran Cutting and Salem Sound Coastwatch staff: Jack Nessen, Megan Podeszwa and Alex Lacy,

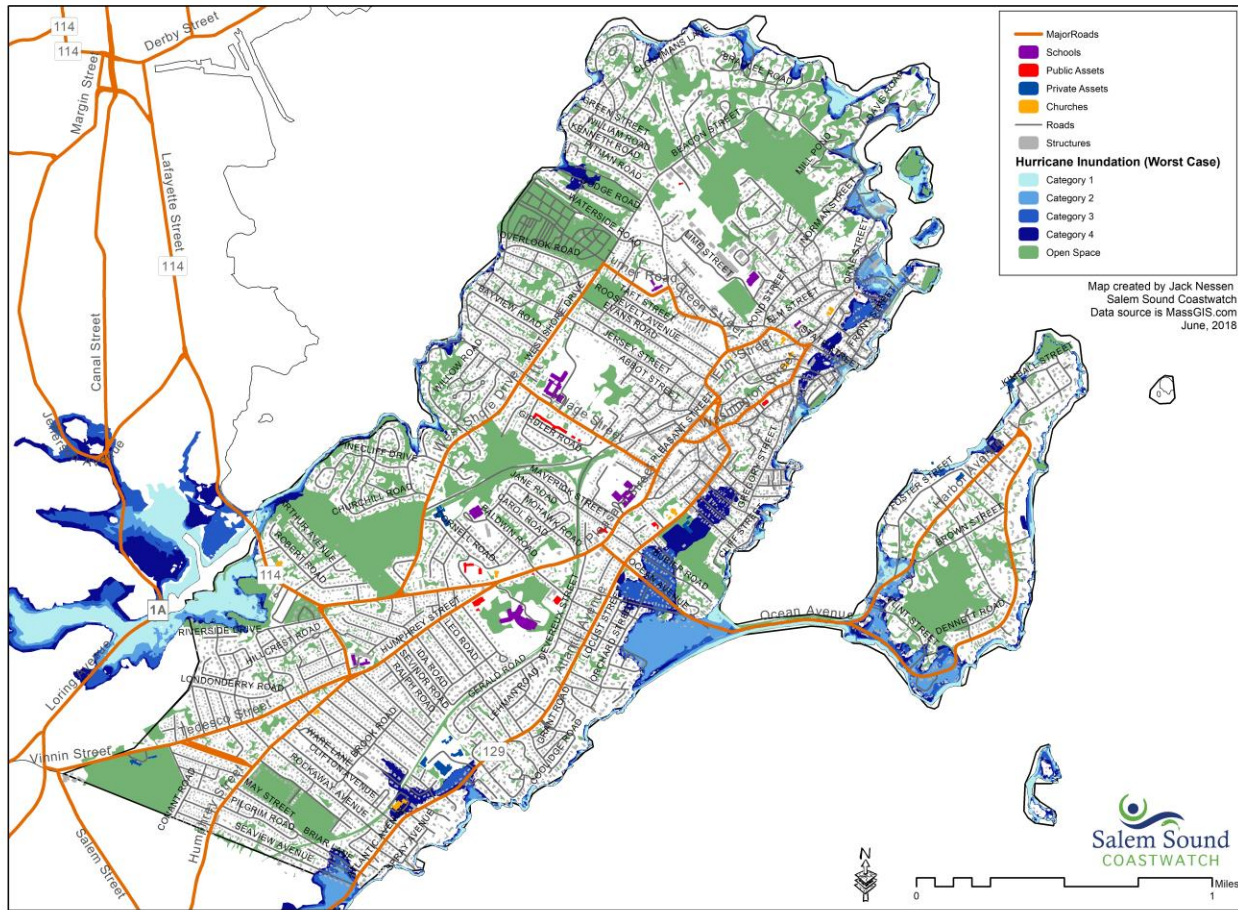
Acknowledgements:

Special thanks to the Boston Yacht Club for providing a wonderful on the harbor location for the CRB Workshop, the Town of Marblehead Core Team, William Conly of the Historical Commission, Joe Kowalik –MMLD General Manager and CRB Workshop participants, including members of the following organizations: League of Women Voters, Marblehead Conservancy, Boston Yacht Club, Marblehead Chamber of Commerce, and Sustainable Marblehead. Thanks also to the Marblehead Community Access and Media, Inc. for the coverage of the public listening session.

This effort was made possible by Massachusetts Executive Office of Energy and Environmental Affairs.

Appendix:

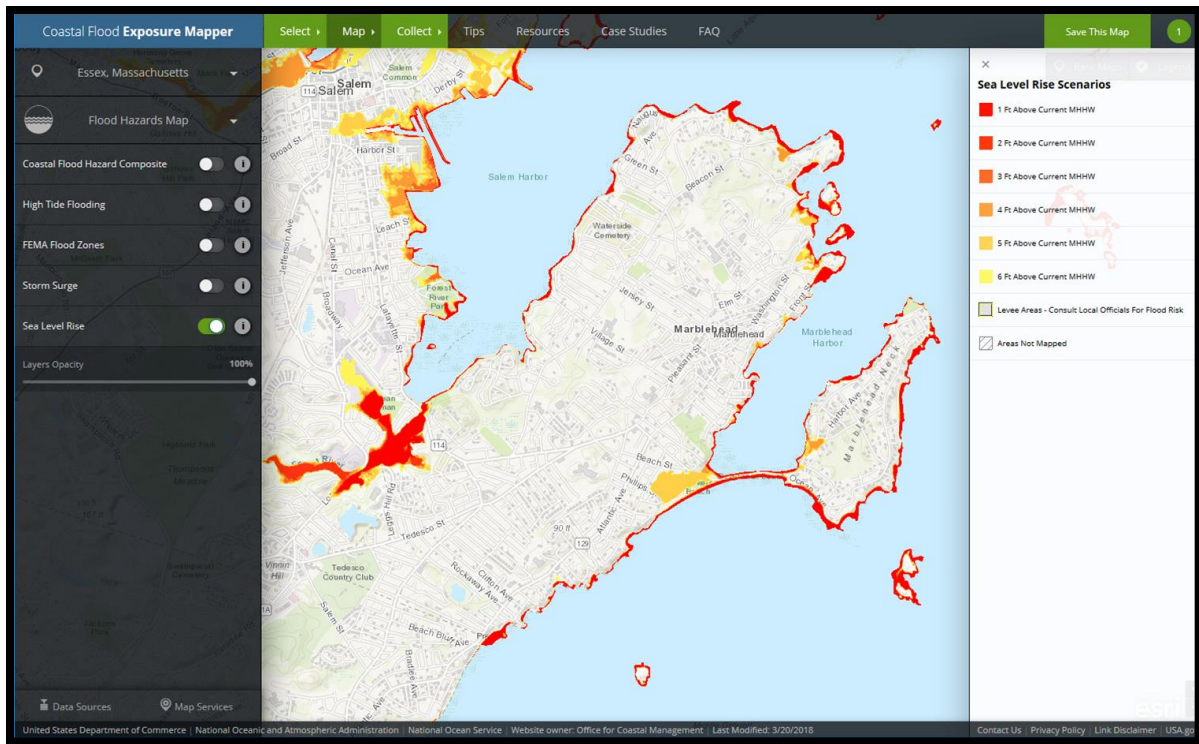
Base Map of Marblehead Used During the Workshop



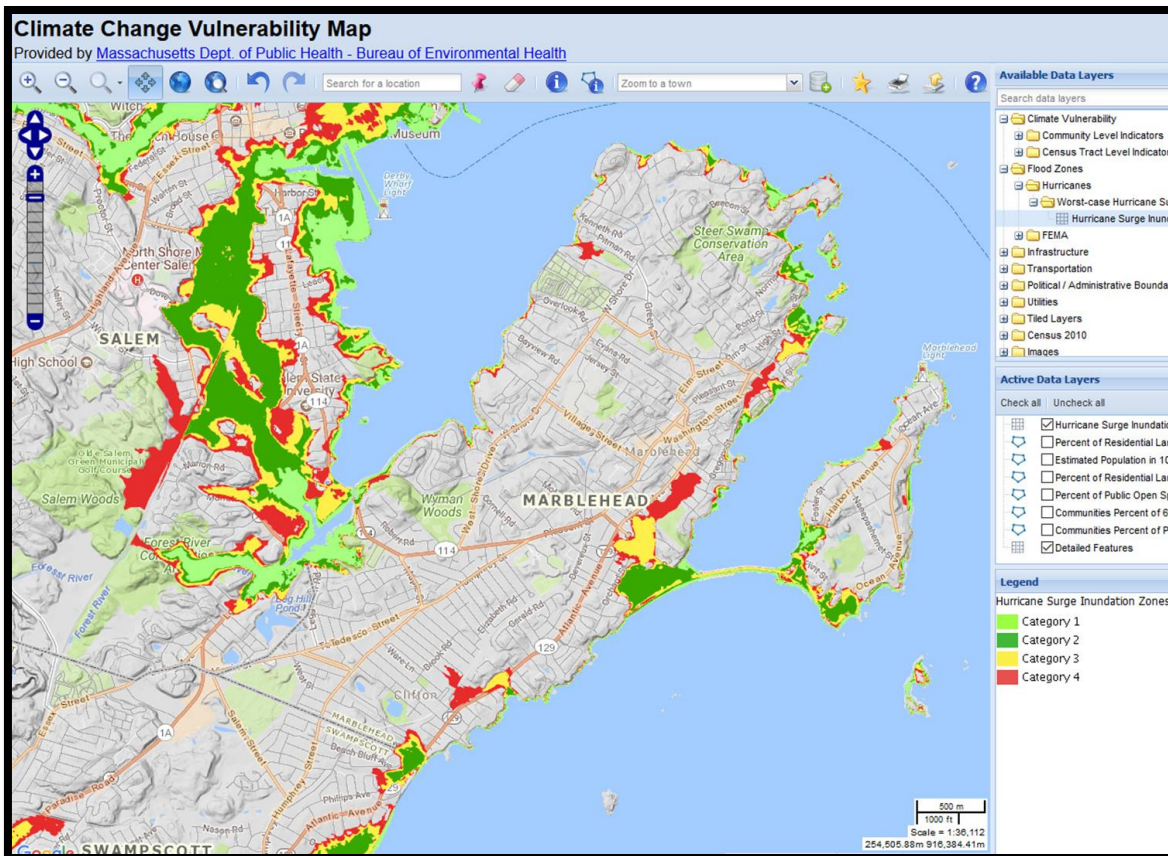
Town of Marblehead, MA - Massachusetts Vulnerability Preparedness

Projected Sea Level Rise Map NOAA Digital Coast Sea Level Rise Viewer

<https://coast.noaa.gov/digitalcoast/tools/slr>

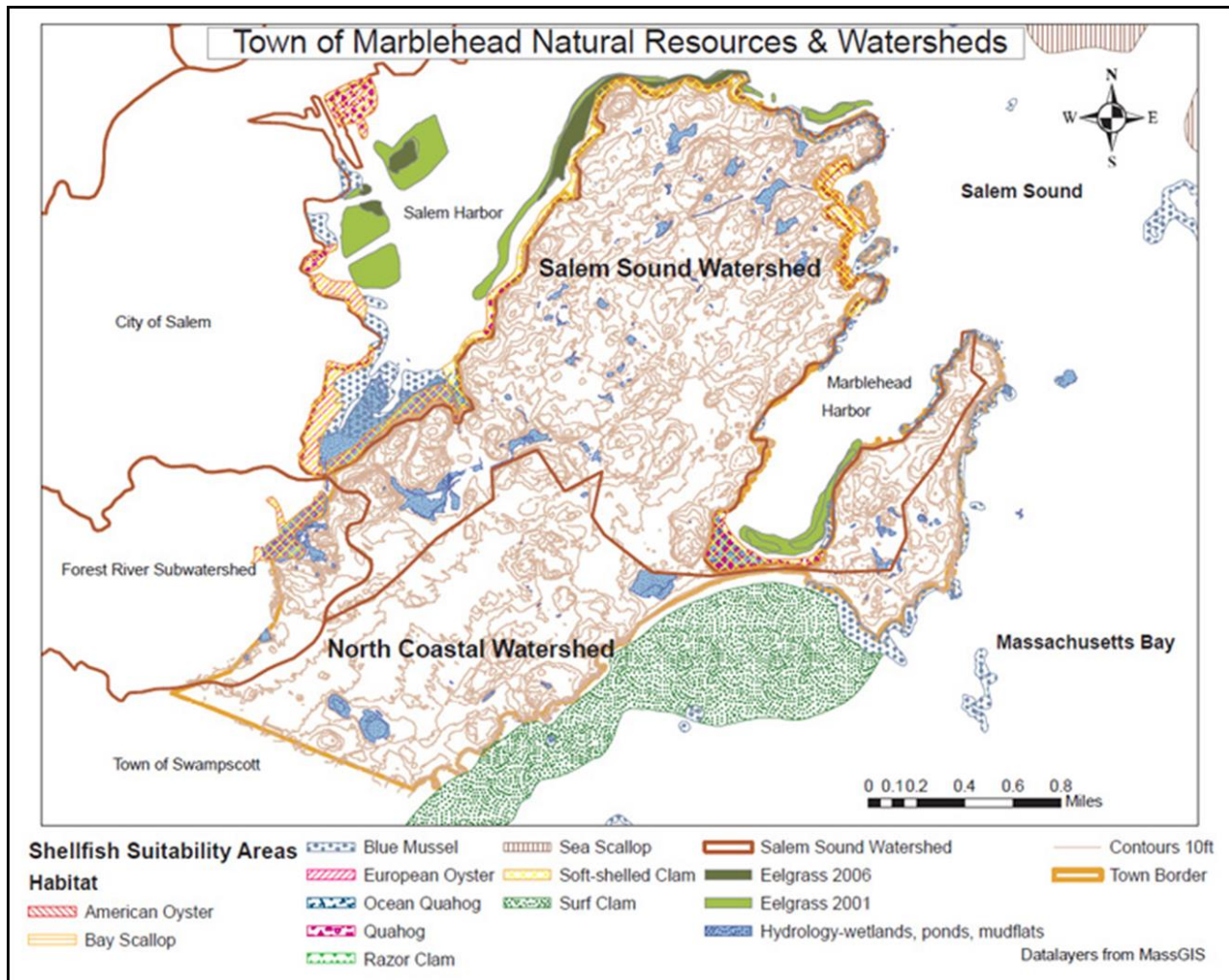


Current Hurricane Surge Inundation Zones: Resilient MA. <http://resilientma.org/map/>



Marblehead Natural Resource and Wetlands Map

Created by Salem Sound Coastwatch



<http://marblehead.wickedlocal.com/news/20180622/marblehead-proactively-tackles-climate-change-with-mvp-plan>

Marblehead proactively tackles climate change with MVP plan By Greg Phipps

Posted Jun 22, 2018 at 12:54 PM Updated Jun 22, 2018 at 12:54 PM

Municipal Vulnerability Preparedness plan looks at future climate risks

Significant climate changes are predicted to have a major impact on area cities and towns, particularly coastal communities, over the next 50 years. Marblehead is looking to be proactive in addressing the problem.

On Thursday, June 14, town officials and members of the community met at Abbot Hall to discuss a drafted Municipal Vulnerability Preparedness (MVP) plan. The town has received an MVP grant from the state to assist in preparing for future climate risks and effectively responding to hazards caused by storms, flooding, and erosion.

Back in May, the town held a workshop where approximately 40 stakeholders teamed up to identify and prioritize local climate risks. The major hazards cited for Marblehead were coastal and inland flooding, high winds, and coastal erosion. The MVP plan prioritizes protecting the areas of infrastructure, social assets, and the environment.

Barbara Warren, executive director at Salem Sound Coastwatch, was hired to assist the town in developing the plan. At Thursday's meeting, she discussed the project and what areas (or actions) Marblehead needed to prioritize. She said a finalized plan is due by June 30 and added that the state will call for proposals to fund MVP actions - where a specific area of concern is addressed.

"The state expects towns and cities to update their MVP plans as needed, this could be every year. And [the state] expects the town will take actions every year, or it could lose its MVP designation," she explained.

Warren pointed out that 14.2 miles of Marblehead is coastline area. Statistics from the Massachusetts Climate Change Clearinghouse and the Northeast Climate Science Center showed that sea levels are projected to experience a 2.7-foot rise by 2050, to go along with an increased frequency of storms such as nor'easters, blizzards, and hurricanes. Annual precipitation could also increase by 53 inches by mid-century.

According to the information provided, high wind events over the period from 2004-2013 caused up to \$1.1 million in damage to Marblehead.

"It's very important that coastal communities understand the potential impacts of climate change on the town's infrastructure, societal and environmental assets, and how its residents and businesses may be impacted," said Warren. "With a prioritized plan of actions, [the town] can identify immediate and long-term opportunities to advance the community's resilience."

The top priority area identified in the current plan was to protect two 23-kilovolt underground feeder lines at the Lead Mills Rail Trail. Erosion caused by last winter's storms has begun to effect the power lines. As a result, it was cited as an immediate need in the MVP plan and should be taken care of before the end of the year, one town official said Thursday.

Warren said the plan seeks to “develop a more resilient, cohesive response to protecting coastal assets while addressing some very real and immediate threats that these hazards have already wrought” on the community.

“The coastal erosion at Lead Mills increased the risk of exposing the two high-voltage feeder lines that deliver Marblehead’s electricity,” she said. “Of course all this will require ongoing public outreach and communication. Without this kind of planning and thinking, projects may be undertaken that create a temporary fix but do nothing for longer term resilience.”

Other areas were designated as high priority in the plan. Warning lights and gates could be installed on the Causeway, which would include placing shelters on both sides of the Neck. As well, finding both short and long-term solutions to road flooding was noted. Marblehead would work with neighboring towns on this issue.

The repair of public seawalls was also listed as a planned priority, as were both the storm water and sewer infrastructures. This includes evaluating current and future risks at 13 sewer pump stations in town. Maintaining barrier beaches such as Devereux, Riverhead and Preston was noted.

Also included in the plan were efforts to devise a resilient and cohesive response to protect Marblehead Harbor, one that addresses the mix of private and town properties and state and federal regulations. It also calls for reconsidering the construction of a breakwater structure to protect the harbor.

The breakwater subject was brought up at Thursday’s meeting. It was pointed out that the idea was seriously contemplated as far back as the 1960s but was never approved. It was said that the proposed MVP plan was “only a bandage” and that “the [flooding and erosion] problems are going to keep happening” unless a barrier is built.

The topic of public safety was raised. One resident said it didn’t seem to be addressed that clearly in the plan. Another person emphasized the importance of the urgency behind the preparedness plan.

“We all know climate change is real. How much time do we have to act?” she said. “These things we’re talking about here are serious.”

Moderate to low priority sites were also identified in the plan draft. They included Fort Sewall, Chandler Hovey Park, and Waterside Cemetery.

Community Resilience Building Risk Matrix
Marblehead June 2018



Municipal Vulnerability Preparedness (MVP)
www.CommunityResilienceBuilding.org

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

				Top Priority Hazards				Priority	Time
				Coastal Flooding - Sea Level Rise & Storm Surge	Inland Flooding - Intense Precipitation	High Wind	Coastal Erosion	H - M - L	Short Long Ongoing
Features	Location	Ownership	V / S						
Infrastructural									
Lead Mills: Electrical Feeder Line		Town	V	Address immediate need to protect the two 23-kilovolt feeder lines underground in the Lead Mills rail trail.				H	S
Sewer Infrastructure: Sewer Lines and Pump Stations		Town	V	Evaluate current flooding and future risks at 13 sewer pump stations and then protect from flooding; Upgrade alarms to SCADA; Educate public on alarm and sump pumps; Replace sewer lines that are at risk of seawater flooding as indicated from current investigation.				H	S/S /O/ O
Stormwater Infrastructure		Town	V	Inventory stormwater infrastructure and ocean backflow; Begin resiliency improvements at flood priority areas; Conduct a study of imperviousness, evaluating options to reduce hardening, increase flood storage and/or incorporate green infrastructure; Continue public education.				H	S/O/O
Marblehead Municipal Electric Light Department	80 Commercial St. + 4 substations, power lines	Town	V/S	Develop a detailed plan for power distribution under emergency conditions; Investigate risk from harbor pipes to MMLD office building; Evaluate power substations near the water; Design deployment of town renewable energy sources; Consider alternative electrical power supply.	Conduct town-wide utility pole assessment and replace as needed.		Evaluate and repair visible seawall erosion at rear of building site adjacent to Hammond Park.	H	S/O/L
The Causeway		Town	V	Assess reasons for closures in order to reevaluate solutions, particularly where it currently breaches; Install warning lights and gates; Educate coastal residents and others about emergencies and risks; Make sure there are shelters on both sides of the Neck.				H	O
Seawalls		Town	V	Permit and reconstruct or repair public seawalls that are in immediate need from the winter 2018 storms.				H	S
Marblehead Harbor: MMLD, harbormaster's, yacht clubs, boat yards, public docks, landings, seawalls, Front Street		Private, Town	V	Develop a resilient, cohesive response to protect assets in Marblehead Harbor that addresses the mix of private and town properties, state and federal regulations; Restart conversation about constructing a breakwater to protect the harbor assets, which will require a cost/benefits analysis; Update the CZM private/public seawall inventory that includes climate change risk projections.				H	L/L/S
Roads		Town, State	V	Conduct flooded road analysis to determine short and long-term solutions; Work with neighboring towns to find solutions to flooding and resiliency.	Conduct appropriate tree maintenance near assets to protect power distribution and prevent road closures.			H	O
Communication Utilities		Town	V	Improve communications redundancy for emergency services.				M	O
Emergency Preparedness		Town	S/V	Complete Emergency Preparedness Plan Update; Conduct public education in advance of a disaster: how to prepare, shut down power, evacuate.				M	S
Chandler Hovey Park with Marblehead Light		Town, Federal	S/V			Assure functionality	Monitor for erosion.	L	L

Societal								
Marblehead Harbor		Town, Private	V	Evaluate adequacy of existing resources for boat removal during emergencies and determine possible new access points.			M	O
Historic District		Town, Private	V	Educate and encourage retrofitting that include flood-wise actions (e.g. blow out panels, raising utilities).		Maintain and repair Fort Sewall earthen fort using resilient solutions.	M	O
Reynolds Park		Town	V/S	Assess feasibility of using as temporary underground stormwater storage.			H	S
Abbot Library		Town	V/S	Implement flood proofing and flood storage to prevent the Library from future flooding.			M	O
Waterside Cemetery		Town	S/V			Monitor shoreline for erosion.	L	L
Environmental								
Marblehead Harbor and West Side of Salem Harbor		Town/ Salem/ Private	V/S	Continue to protect the environmental quality of the harbors through sewer and stormwater improvements, boat pump outs, and residential and boater awareness.			H	O
Parks and Conservation Areas: V - Lead Mills, Fort Sewall, Chandler Hovey		Town	V/S	Maintain condition; if resiliency actions are needed to protect infrastructural assets, conduct in the most practically sound environmental manner.			M	O
Town Trees		Town	V/S	Conduct tree inventory/survey to evaluate needs with goal of maintaining a healthy tree canopy, while removing threats to utilities and roadways during high wind/ storm events / coastal erosion.			H	S/O
Barrier Beaches: Devereux, Riverhead, Preston		Town	V/S	Monitor condition and maintain barrier beaches; Determine is something can be done with the water that overtops the barrier; Develop a post storm operations and management plan.			H	O/L
Beaches: Fort, Tucker, Gas House, Grace Oliver Salt Marshes: Goldthwait, Forest River Conservation Area		Town/ Goldthwait Trustees	V V/S	Evaluate beach and salt marsh systems vulnerability to inform long-term policy, which includes understanding beach erosion and habitat retreat.			L	L
Brown and Gerry Islands		Trustees of Reservation	V	Protect and maintain Brown and Gerry Islands, while understanding the natural changes that will occur due to sea level rise.			L	O/L
Rail Trail		Town	V	Maintain access for non-vehicular transportation; Improve drainage, elevate areas that flood or construct alternative passage.			M	O/L
Coastal Marine Habitats: Eelgrass Beds, Shellfish		Private/Town/ State	V	Stay informed of the climate change research on eelgrass and shellfish, and implement if possible.			L	L