

Marion Multi-Hazard Mitigation Plan



September 2021

PREPARED FOR:
Town of Marion
2 Spring Street
Marion, MA 02738

PREPARED BY:
Woods Hole Group, Inc.
A CLS Company
107 Waterhouse Road
Bourne, MA 02532 USA

CERTIFICATE OF ADOPTION
Selectboard

TOWN OF MARION, MASSACHUSETTS

A RESOLUTION ADOPTING THE
TOWN OF MARION MULTI-HAZARD MITIGATION PLAN (2021)

WHEREAS, the Town of Marion recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the Town of Marion established a Local Planning Team to prepare the Town of Marion Multi-Hazard Mitigation Plan (2021); and

WHEREAS, the Town of Marion Multi-Hazard Mitigation Plan (2021) contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Marion, and

WHEREAS, duly-noticed public meetings were held by the Local Planning Team on July 27, 2021 and September 9, 2021, and

WHEREAS, the Town of Marion authorizes responsible departments and/or agencies to execute their responsibilities demonstrated in the plan, and

NOW, THEREFORE BE IT RESOLVED that the Town of Marion SELECTBOARD adopts the Town of Marion Multi-Hazard Mitigation Plan (2021), in accordance with M.G.L. 40 §4 or the charter and bylaws of the Town of Marion.

ADOPTED AND SIGNED this Date: January 4, 2022

Norman A. Hills
Norman A. Hills, Chair

J.P.A.M.
John P. Waterman, Vice-Chair

Randy L. Parker
Randy L. Parker, Clerk



Marion Multi-Hazard Mitigation Plan

December 2021

Prepared for:
Town of Marion
2 Spring Street
Marion, MA 02738

Prepared by:
Woods Hole Group
A CLS Company
107 Waterhouse Road
Bourne, MA 02532 USA
(508) 540-8080



Table of Contents

CHAPTER 1 – INTRODUCTION	1-1
1.1 PURPOSE OF PLAN	1-2
1.2 THE PLANNING PROCESS	1-2
1.3 PLAN DESCRIPTION	1-6
1.4 PREVIOUS FEDERAL/STATE DISASTERS	1-6
1.5 CLIMATE CHANGE.....	1-6
CHAPTER 2 – LOCAL PROFILE	2-1
2.1 OVERVIEW	2-2
2.2 GEOGRAPHY	2-2
2.3 CLIMATE	2-2
2.4 NATURAL ENVIRONMENT.....	2-2
2.5 LAND USE.....	2-3
2.6 TRANSPORTATION	2-4
2.7 CRITICAL FACILITIES.....	2-5
2.8 HISTORICAL PROPERTIES	2-6
2.9 SEWER SYSTEM	2-6
2.10 REPETITIVE LOSS PROPERTIES.....	2-7
CHAPTER 3 – HAZARD IDENTIFICATION.....	3-1
3.1 FLOODING (COASTAL & INLAND)	3-3
3.2 COASTAL EROSION	3-14
3.3 HURRICANES & TROPICAL STORMS	3-18
3.4 SEVERE WINTER WEATHER (SNOW/BLIZZARD/ICE STORM/NOR’EASTER).....	3-26
3.5 WILDFIRE	3-31
3.6 TORNADO	3-35
3.7 DROUGHT	3-38
3.8 EXTREME TEMPERATURE	3-42
3.9 EARTHQUAKE.....	3-45



3.10	INVASIVE SPECIES	3-48
3.11	OTHER SEVERE WEATHER.....	3-50
3.12	LANDSLIDE.....	3-58
3.13	TSUNAMI.....	3-67
3.14	DAM AND CULVERT FAILURE.....	3-64
3.15	SUMMARY OF HAZARDS	3-68
CHAPTER 4 – VULNERABILITY ASSESSMENT.....		4-1
4.1	METHODOLOGY.....	4-2
4.2	RESULTS.....	4-4
4.3	VULNERABLE PROPERTIES AND CRITICAL FACILITIES.....	4-15
4.4	VULNERABLE POPULATIONS.....	4-17
CHAPTER 5 – MITIGATION MEASURES.....		5-1
5.1	MITIGATION GOALS AND OBJECTIVES	5-2
5.2	EXISTING CAPABILITES	5-2
	<i>Town Plans and Policies.....</i>	<i>5-3</i>
	<i>Town Staff.....</i>	<i>5-3</i>
	<i>Financial Capabilities</i>	<i>5-3</i>
	<i>Existing Mitigation Measures</i>	<i>5-4</i>
	<i>Participation in the National Flood Insurance Program (NFIP)</i>	<i>5-5</i>
5.3	PROGRESS ON MITIGATION ACTIONS SINCE 2004.....	5-6
5.4	PROPOSED MITIGATION.....	5-10
	<i>Planning Process</i>	<i>5-10</i>
	<i>Proposed Mitigation Actions.....</i>	<i>5-10</i>
CHAPTER 6 – PLAN MAINTENANCE PROCESS.....		6-1
6.1	PLAN MONITORING, EVALUATION AND UPDATES	6-2
6.2	INCORPORATION OF MITIGATION STRATEGIES.....	6-2
6.3	CONTINUED PUBLIC INVOLVEMENT.....	6-3
6.4	PLAN ADOPTION	6-3
REFERENCES		R-1



Acronym List

BFE	Base Flood Elevation
CERT	Community Emergency Response Team
CFR	Code of Federal Regulations
CPA	Community Preservation Act
DCR	Department of Conservation and Recreation
EF-Scale	Enhanced Fujita Scale
EOEEA	Executive Office of Energy and Environmental Affairs
FEMA	Federal Emergency Management Agency
FHBM	Flood Hazard Boundary Map
FIRM	Flood Insurance Rate Map
LiMWA	Limit of Moderate Wave Action
LPT	Local Planning Team
MassCZM	Massachusetts Office of Coastal Zone Management
MassDOT	Massachusetts Department of Transportation
MC-FRM	Massachusetts Coast Flood Risk Model
MEMA	Massachusetts Emergency Management Agency
MHMP	Multi-Hazard Mitigation Plan
MIPAG	Massachusetts Invasive Plant Advisory Group
MRC	Medical Reserve Corps
MSL	Mean Sea Level
MVP	Municipal Vulnerability Preparedness
NESIS	Northeast Snowfall Impact Scale
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
SFHA	Special Flood Hazard Areas
SHMCAP	State Hazard Mitigation and Climate Adaptation Plan
SHMO	State Hazard Mitigation Officer
SLOSH	Sea, Lake and Overland Surge from Hurricanes
SLR	Sea-Level Rise
SRL	Severe Repetitive Loss
SRPEDD	Southeastern Regional Planning and Economic Development District
USACE	US Army Corps of Engineers
USGS	US Geological Survey



Virtually every type of weather has been and will be experienced within a coastal Massachusetts town. From freezing temperatures and blizzard conditions in the winter to heat and humidity in the summer, Marion must plan for the worst. The old adage of “if you don’t like the weather, wait a minute” certainly applies.

In addition to potentially severe weather, Marion’s unique peninsular geography and its position at the upper extent of Buzzards Bay exposes the Town to potential wave energy and storm surges capable of causing coastal erosion, flooding, and property damage to multiple sections of Town. In total, Marion has approximately 33 miles of marine shoreline.

Natural hazards of all kinds can result in injury, loss of life, and damage to buildings and infrastructure, which can have significant adverse impacts on the Town’s economic, social, and environmental resources. Through the development and implementation of this Multi-Hazard Mitigation Plan, the Town of Marion is proactively trying to prepare for and mitigate potential impacts from the various natural hazards.



1.1 PURPOSE OF PLAN

To facilitate review of this plan against FEMA's Local Mitigation Review Guide, when the text addresses an element of the Guide, it is identified in a colored bullet in the margin.

The Federal Emergency Management Agency (FEMA) defines hazard mitigation as “any sustained action taken to reduce or eliminate the long-term risk to human life and property from (natural) hazards”, such as floods, hurricanes, winter storms, tornadoes, earthquakes, etc. Hazard mitigation may include both structural measures, such as flood control structures, and nonstructural measures, such as regulations and bylaws, to prevent flooding. Local planning and mitigation efforts allow communities to reduce or eliminate the loss of life and property damage resulting from natural hazards. The Town of Marion produced this Multi-Hazard Mitigation Plan for the entire Town with the goal of providing sustained actions to reduce or eliminate risk to human life and property damage from a natural hazard event. Objectives of this plan are as follows:

- Describe the planning process;
- Identify relevant background information about the Town, including geography, climate, land use, and infrastructure;
- Identify natural hazard risks and areas in town most likely to be impacted;
- Complete a risk assessment to profile hazard events, inventory assets, and estimate potential losses;
- Identify existing disaster mitigation measures already in place;
- Develop proposed mitigation measures and a mitigation strategy based on the risk assessment; and
- Design a mechanism to keep the plan updated to reflect current conditions and establish a schedule for monitoring, evaluating, and updating the plan.

What is a Hazard Mitigation Plan?

Natural hazard mitigation planning is the process of reducing or eliminating the loss of life and property damage resulting from natural hazards such as floods, earthquakes, and hurricanes through long-term strategies, including planning, policy changes, programs, projects, and other activities.

Preparation of this Multi-Hazard Mitigation Plan Update before a major disaster occurs will help the community prevent property damage and loss of life associated with natural hazards, save money by instituting mitigation measures to protect against natural hazards, allow funding through FEMA for pre-disaster remediation, and expedite disaster recovery. The Plan will also help to reduce or eliminate repetitive flood losses.



A1.a
A1.e

1.2 THE PLANNING PROCESS

Public participation is a central component of this planning process, providing critical information about the local occurrence of hazards while also serving as a means to build a base of support for hazard mitigation activities. Additionally, the most successful mitigation plans are developed after participation by a wide range of stakeholders who play a role in identifying and



implementing mitigation actions. During preparation of this Multi-Hazard Mitigation Plan, the planning process included the following:

- A public online survey to assess the community's experience with local natural hazards and its perception of the Town's risk to natural hazards;
- An opportunity for the public to comment on the plan during draft stages and prior to final approval;
- An opportunity for local and regional agencies and organizations, neighboring communities and private industries to be involved in the planning process; and
- A review and incorporation of existing plans, studies, reports, and data.

A1.b

This Multi-Hazard Mitigation Plan (MHMP) is the first of its kind for the Town of Marion. It was developed through substantial input from the Local Planning Team (LPT), which consisted of various Town officials and was able to provide critical local knowledge about the community to facilitate the development of this Plan.

A1.a
A1.c
A1.d

The LPT was formed by the Town Planner, and included the Town Administrator, Chiefs of the Police and Fire Departments, the Harbormaster, and department heads/representatives for the Planning Board, Department of Public Works, Building Department, and Conservation Commission. For a full list of LPT members and their departmental affiliations, see Appendix B. The LPT met for 5 working meetings during the Plan development process; agendas for each are provided in Appendix B. The 2021 MHMP was largely funded through FEMA's Pre-Disaster Mitigation Program. In addition to the LPT input, public participation in the hazard mitigation planning process is also important, both for plan development and for implementation of the plan. Residents, business owners, and other community members are an excellent source for information on the historic and potential impacts of natural hazard events and particular vulnerabilities the community may face from these hazards. Their participation in this planning process also builds understanding about the hazard mitigation process and potentially creates support for future mitigation actions. Although typically, public meetings would be hosted in person to gather this information and educate residents on hazard mitigation, due to the ongoing COVID-19 pandemic during critical development stages of this report, the Town opted to host online presentations instead. The presentations were hosted live on July 27 and September 9 of 2021, and recordings were made available for residents to view when they were able.

A1.c
A2.a-c
A3.a-b

Copies of the announcements for the public presentations, as well as a master list of LPT members, are provided in Appendix B. These materials provide a foundation for understanding the planning process and major decisions made along the way and can help provide crucial background information the next time the LPT meets to review and update the MHMP.

A public online survey was also administered to assess the community's experience with local natural hazards and their perception of the risk, and to reach a wider demographic that may not be available to attend public meetings in person. The results of this online public survey are included in Appendix B. Results from this survey were used by the LPT to update the list of critical facilities and to guide the mitigation action development process.



The following steps were taken during the planning process:

- 1) Develop an LPT responsible for updating this Plan;
- 2) Define the potential natural hazards that could affect Marion;
- 3) Determine hazard locations and critical infrastructure potentially affected;
- 4) Conduct a vulnerability assessment of buildings and infrastructure;
- 5) Outline existing hazard mitigation measures and document progress on the 2004 Plan's actions;
- 6) Determine gaps in hazard mitigation preparedness;
- 7) Define proposed hazard mitigation measures to fill these gaps; and
- 8) Evaluate the feasibility of and prioritize mitigation measures.

The above steps will allow implementation of proposed mitigation measures with a goal of reducing damage and improving public safety during a natural disaster. To solicit public comment, the draft Plan was posted on the Town of Marion's website, with a notification on the Town's Facebook page, a direct link to the plan, and directions for how to submit questions or comments. A screenshot documenting the website posting is provided in Appendix B. The draft Plan was also presented on September 9, 2021 at a public hearing to gather additional public input. Comments received during the meeting are included in Appendix B. Advertising for the public hearing included posting an announcement on the Town website and in the local paper, copies of which are included in Appendix B. The draft plan was posted on the website for 2 weeks prior to finalization. Comments and responses are provided in the comment response document in Appendix B.

A2.a
A2.b

The draft Plan was also sent to Town Planners in Mattapoisett, Rochester, and Wareham, as well as the Southeastern Regional Planning and Economic Development District (SRPEDD) for review and comment. A copy of the email sent to these neighboring towns and regional planning body soliciting their feedback on the Plan is also provided in Appendix B.

A4.a
A4.b

During the preparation of this Plan, several existing studies and documents related to Marion and the surrounding area were reviewed. Preparation of this Plan borrowed from the following plans and documents where appropriate:

- Massachusetts State Hazard Mitigation and Climate Adaptation Plan (2018);
- Marion Community Preservation Plan (2021);
- Marion Comprehensive Emergency Management Plan (2020);
- Marion Master Plan (2017);
- Municipal Vulnerability Preparedness (MVP) Workshop Summary of Findings (2018); and
- Local bylaws and regulations.

The 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) was developed through a collaborative process that involved numerous state agencies, a large cross-section of stakeholders, members of the public, working groups, and a consulting team. This was the SHMCAP's eighth revision from its initial preparation in 1986, but this version is unique in



that it is the first-of-its-kind statewide plan that fully integrates a traditional hazard mitigation plan with a climate change adaptation plan.

The Marion Community Preservation Plan was created in 2021 to outline community preservation goals, which include acquisition and preservation of open space and land for recreational use, creating and preserving community housing, and protecting historical buildings and landscapes. In addition, the document also details requirements given in the Community Preservation Act (CPA) Massachusetts Law (Chapter 44B) and guidelines for project submission.

The Marion Comprehensive Emergency Management Plan from 2020 provides a framework for effective preparedness, mitigation, response, and recovery to preserve public welfare and safety. The plan lists responsibilities of each department in an emergency scenario, the most likely threats and hazards facing the Town, and protocols for regional and state communication during and after a disaster.

The Marion Master Plan was developed in 2017 to compile general mission statements, goals, and recommendations that will ultimately be used to guide the development of a future vision for the Town of Marion. The Master Plan document covers land use, economic development, services and facilities, transportation, housing, open space and recreation, and natural and cultural resources. A unique aspect of the Master Plan is the chapter on climate change resilience.

The Municipal Vulnerability Preparedness (MVP) Workshop Summary of Findings document (workshop conducted in June of 2018) provides an overview of the MVP workshop process including participation of attendees, top hazards identified, vulnerable areas of the town discussed, and natural hazard planning. In addition, participants developed recommendations to improve community resilience within small discussion groups.

A2

Various town departments and boards have implemented and updated bylaws and regulations as necessary to control development and ensure safe construction methods that adhere to current best management practices. The Marion Planning Board, Conservation Commission, and Building Department are the primary town agencies responsible for regulating development in the town. More specifically, these boards regulate development through the Zoning Bylaw and the Marion Wetlands Protection Bylaw. Feedback to these boards was ensured through the participation of their Town staff liaisons (i.e., Town Planner, Conservation Commission chair, etc.) on the LPT. In addition, SRPEDD, the regional planning agency for Marion, works with all agencies that regulate development in its region, including the municipal entities and state agencies, such as Department of Conservation and Recreation and MassDOT. This regular involvement ensured that during the development of the Marion Multi-Hazard Mitigation Plan, the operational policies and any mitigation strategies or identified hazards from these entities were incorporated.

Technical information from the plans, regulations, and bylaws described above was incorporated into this Marion Multi-Hazard Mitigation Plan in a number of ways, including by:

- 1) Guiding the planning process;
- 2) Helping develop mitigation actions;



- 3) Providing recent data on various hazards and their impacts; and
- 4) Ensuring that mitigation actions in this plan were consistent with current state and local activities and plans.

1.3 PLAN DESCRIPTION

A1.d

FEMA developed a “Local Mitigation Review Guide” (Guide) to ensure Local Hazard Mitigation Plans meet the requirements of the Stafford Act and Title 44 Code of Federal Regulations (CFR) 201.6. This Guide was used as a tool in developing this Plan. For ease of assessment, when the text addresses an element of the Guide, it is identified in a colored bullet in the margin.

1.4 PREVIOUS FEDERAL/STATE DISASTERS

The Town of Marion has experienced 5 natural hazards that triggered federal or state disaster declarations since 2010 (FEMA 2021a). These are listed in Table 1-1 below. The vast majority of these events involved flooding.

Table 1-1. Disaster declarations for the Town of Marion since 2011.

Disaster Name	Type of Assistance	Declared Areas
Tropical Storm Irene (August 27-29, 2011)	FEMA Public Assistance and Hazard Mitigation Grant Program	Counties of Plymouth, Barnstable, Berkshire, Bristol, Dukes, Franklin, Hampden, Hampshire, & Norfolk
Hurricane Sandy (Oct 27 – Nov 8, 2012)	FEMA Public Assistance and Hazard Mitigation Grant Program	Counties of Plymouth, Barnstable, Bristol, Dukes, Nantucket, & Suffolk
Severe Winter Storm (February 8-10, 2013)	FEMA Public Assistance and Hazard Mitigation Grant Program	All 14 MA Counties
Severe Winter Storm (January 26-28, 2015)	FEMA Public Assistance and Hazard Mitigation Grant Program	Counties of Plymouth, Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Suffolk & Worcester
Severe Winter Storm (March 2-3, 2018)	FEMA Public & Individual Assistance	Counties of Plymouth, Barnstable, Bristol, Nantucket, Norfolk & Essex

1.5 CLIMATE CHANGE

Although this plan is focused on specific natural hazards (e.g., flooding, hurricanes, wind, extreme precipitation, etc.), it is important to consider how each of these hazards will be affected by climate change in the future, and how, in some cases, the effects of climate change are already being felt. Climate change is already intensifying natural hazards, resulting in changes to precipitation patterns, sea level rise, increased temperatures, and more extreme weather. Climate change will continue to alter these natural hazards, in most cases increasing their severity, duration, or frequency. In the face of climate change, it is critical for the Town to build long-term resilience by leveraging historical risk data, integrating data on project future climate conditions, and developing and implementing actions that will reduce the Town’s overall risk.



One of the first steps in hazard mitigation planning is to identify and define the Town's assets. Without a detailed and accurate understanding of the infrastructural, societal, and environmental resources present within the Town, it is impossible to develop a plan to protect them. The goal of this chapter is to provide a local profile, detailing the community's assets, the Town's geography and climate, an overview of the Town's environmental resources, the Town's land use and demographic patterns, the locations of major infrastructure and critical facilities, and historical locations throughout Town.

Although all community assets may be affected by natural hazards at times, some assets and infrastructure are more vulnerable because of their physical characteristics, location, or socioeconomic uses. This asset inventory will help support the vulnerability analysis conducted in Chapter 4, which will identify specific vulnerable assets within the Town of Marion.



B1.b

2.1 OVERVIEW

The Town of Marion is a coastal community located in Plymouth County, Massachusetts. It was incorporated in 1852. As of the 2020 census, the population of Marion was 5,347. This number moderately increases during the summer months with seasonal residents and visitors. The Town has a traditional New England government structure with a three-member Selectboard, a Town Administrator, and an open Town Meeting. Among the basic services provided to the residents are public safety, schools, water, sewer, garbage collection, recreational facilities, and a public library.

Drinking water is supplied to Marion residents from wells in Marion and Rochester. Marion operates its own Wastewater Treatment Plant, which provides sewage treatment services for the Town. Fire protection is provided exclusively by the Marion Fire Department, led by a Fire Chief. The Fire Chief is typically included on municipal projects and matters that have a water element, which is the majority of them.

The Town maintains a website at: <https://www.marionma.gov/>

2.2 GEOGRAPHY

Marion is located in southeastern Massachusetts on Buzzards Bay. Sippican Harbor is in the middle of the Town, which separates Converse Point to the west and Sippican Neck to the east. Northeast of the Town runs the Weweantic River, which forms the border of Wareham. With numerous estuaries and coves, waterways are one of the Town's greatest assets, which not only spurred early maritime industries, but provides multiple coastal outlets and harbors protecting commercial and recreational boaters and beaches to draw summer vacationers.

Marion is approximately 26 square miles in area. The Town is located approximately 12 miles east of New Bedford and 50 miles south of Boston. Marion is bordered by Mattapoisett, Rochester, and Wareham (from west to east in a clockwise direction).

2.3 CLIMATE

Marion averages 51 inches of rain per year, with an additional average annual snowfall of 35 inches. Average temperatures range from highs in the low 80's (Fahrenheit) during the summer months to lows in the low 20's during winter months. Marion's location along Buzzards Bay generally keeps temperatures cooler in the summer and warmer in the winter relative to other nearby inland communities at the same latitude.

2.4 NATURAL ENVIRONMENT

Marion's natural environment and natural resources are important to the Town's identity and quality of life. In fact, one of the most important factors in why people move to and visit Marion is its natural environment and coastal features. The Town has a varied landscape, with large stretches of open space, forested land, and upland, as well as coastal salt marshes, sandy beaches, and protected harbors. These natural resources support the economy through tourism



and recreation, in addition to a variety of other ecosystem services, such as clean air and water. The natural environment also increases resiliency and reduces hazard impacts, through flood attenuation as wetland areas absorb flood waters, through stormwater management as rainwater drains through the soil, and through erosion control as vegetation secures soil along coastal banks and dunes. Salt marshes are an important first line of defense against storms and provide invaluable ecosystem services to the Town. However, the long-term health of salt marshes is threatened by sea level rise. Without suitable landward areas (e.g., of an appropriate slope and elevation, undeveloped, etc.) for salt marshes to migrate into, there will likely be an overall reduction in total salt marsh area over time. The Town supports efforts to promote or enhance the health of existing salt marshes and recognizes the long-term challenge of sea level rise's impact on salt marsh habitat.

D1.a

2.5 LAND USE

During the colonial period, Marion relied upon agricultural and maritime industries to support the local economy. Farming typically included growing corn, wheat, or rye and raising animals such as cows, pigs, and sheep. Like many coastal Massachusetts towns, Marion also relied on marine industries such as commercial fishing, the coastal trade, whaling, salt production, and building ships. In its early history, settlers of Marion also manufactured tar from the nearby forests. Today, the Town of Marion still depends on maritime industries, as well as summer tourism as the many beaches provide recreational opportunities.

Figure 2-1 depicts the 2021 assessor's parcel dataset categorized by land use. The largest category by area is residential land use (including single-family homes, multi-unit properties, condos, etc.) for a total of 40% of Marion's total area. The next largest categories by area are tax exempt, Chapter 61, commercial, and industrial, comprising 33%, 23%, 3% and 1% of Marion's area, respectively. This categorization reflects the classifications used in the 2017 Marion Master Plan. There has not been any major development or land use changes since the 2004 SPREDD Regional Natural Hazard Disaster Mitigation Plan or the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan that impacts risk level or vulnerability to hazards. In addition, there is no planned development in Marion that would affect the Town's vulnerability.

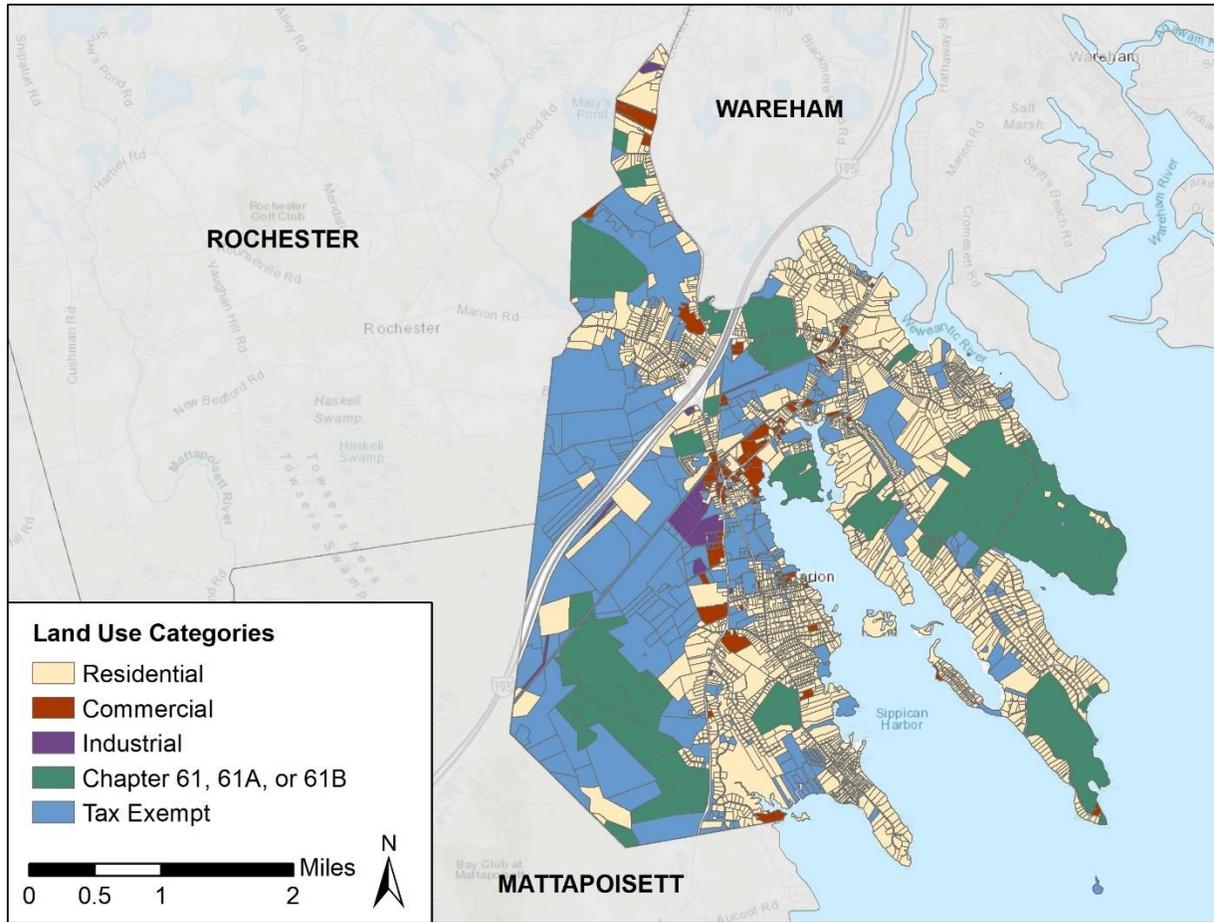


Figure 2-1. Town of Marion land use categories (2021).

Table 2-1. Number of Parcels in Each Land Use Classification.

Land Use Type	Number of Parcels
Residential	2,899
Commercial	123
Industrial	21
Chapter 61, 61A, or 61B	54
Tax Exempt	378
Total	3,475

2.6 TRANSPORTATION

The Town of Marion includes a number of major transportation corridors, including Routes 6, 105, and 195. There are no public rail or bus services offered in Marion; the nearest regional bus service is in new Bedford and the nearest regional rail service is in Middleborough.



2.7 CRITICAL FACILITIES

Critical facilities are those that are essential to the health and welfare of the Town and those that are especially important for response and recovery following hazard events. Critical facilities include buildings and infrastructure such as emergency operations centers, critical municipal buildings, water and wastewater facilities, schools, churches, marinas, etc. The LPT developed a list of critical facilities, which is provided in Appendix C. The critical facilities in Marion are shown in Figure 2-2; the numbers correspond to the list in Appendix C. A portion of these critical facilities are located within high hazard areas, such as floodplains. However, due to the importance of these facilities, special care must be taken to ensure continued operation even during disaster events.

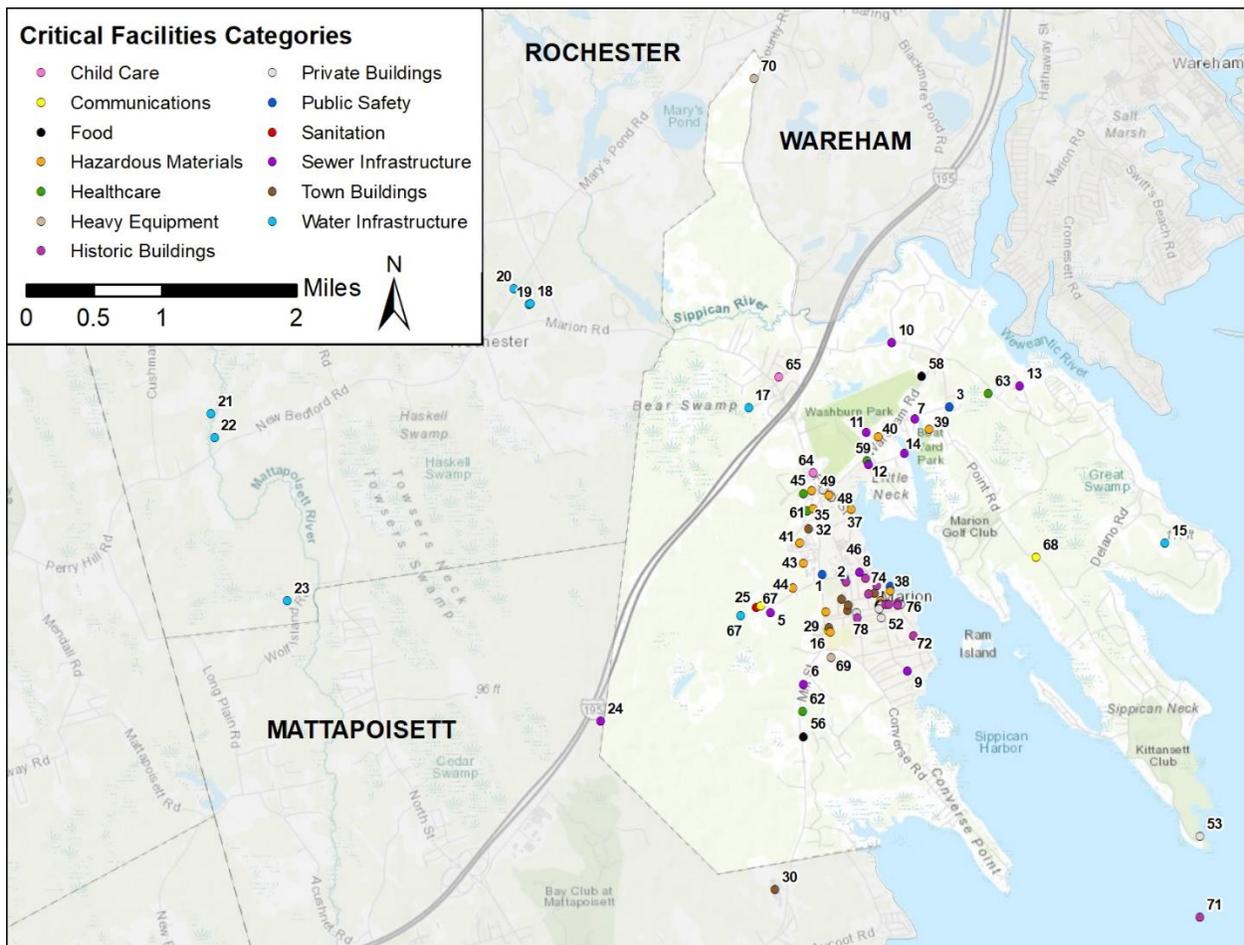


Figure 2-2. Marion critical facilities map.



2.8 HISTORICAL PROPERTIES

The Town of Marion identified 11 important historical structures. The buildings are located in Marion's historic center and include extensive information about the Town's past and some of its most noteworthy citizens.

- 1) **Bird Island Light (Sippican Harbor)** – Constructed in 1819, this lighthouse is located on a small island in outer Marion Harbor. The light served as a vital navigational aid for ships coming into Marion and other surrounding coastal towns.
- 2) **H.R. Reed House (46 Water Street)** – Built in 1893, this historical home was designed by James Templeton Kelley and owned by Henry Ransford Reed. Older parts of the home date back to the 1840s and were inhabited for a summer by President Cleveland and Mrs. Grover Cleveland, earning this structure a spot on the National Register of Historic Places.
- 3) **H.H. Richardson House (aka Percy Browne House; 192 Front Street)** – This house was designed by Henry Hobson Richardson and built from 1881 to 1882. The structure has great architectural significance and has many distinctive design elements.
- 4) **Ryder House (21 Main Street)** – Built in 1691 for the Ryder family, this is the oldest surviving house in Marion.
- 5) **Historical house located at 15 Main Street** – Built in the early 1800s, this house contains a brick passageway that may have been part of the Underground Railroad.
- 6) **Historical house located at 3 Main Street** – This dual-purpose structure was built in 1806 and served as both a post office and as a store that outfitted ships.
- 7) **Two Captains House (2 Main Street)** – Built in 1813, this house was owned by Captains Elisha E. Luce and Noble E. Bates, who often voyaged to southeastern Asia.
- 8) **Old Schoolhouse (72 Pleasant Street)** – Built in 1814, this was one of the first schoolhouses in Marion.
- 9) **Tabor Hall (13 Cottage Street)** – Built in 1880, this structure was the original Tabor Academy founded by Elizabeth Taber, serving as the dining hall, dormitory, and classrooms.
- 10) **The Old Stone Studio (46 Spring Street)** – Built in 1885, this structure was used as a storage facility before being purchased by the Gilder family and becoming a salon for artists. Well-known visitors included Ralph Waldo Emerson, Mark Twain, and Walt Whitman.
- 11) **Historical house located at 173 Front Street** – This house, c. 1800, was a stop on the Underground Railroad.

2.9 SEWER SYSTEM

Portions of the Town are serviced by a municipal sewer system, comprised of eight pumping stations, three grinder pump neighborhoods, and a wastewater treatment plant. The pumping stations and wastewater treatment plant are included as specific features in the critical facilities list (see Section 2.7 and Appendix C). There are also three areas of Town, (1) Berry Area, (2) Dexter Beach, and (3) Converse Road, where grinder pumps are utilized to convey private residential wastewater to the public sewer main. The grinder pumps were not included specifically as critical facilities, but they do comprise important components of the sewer system.

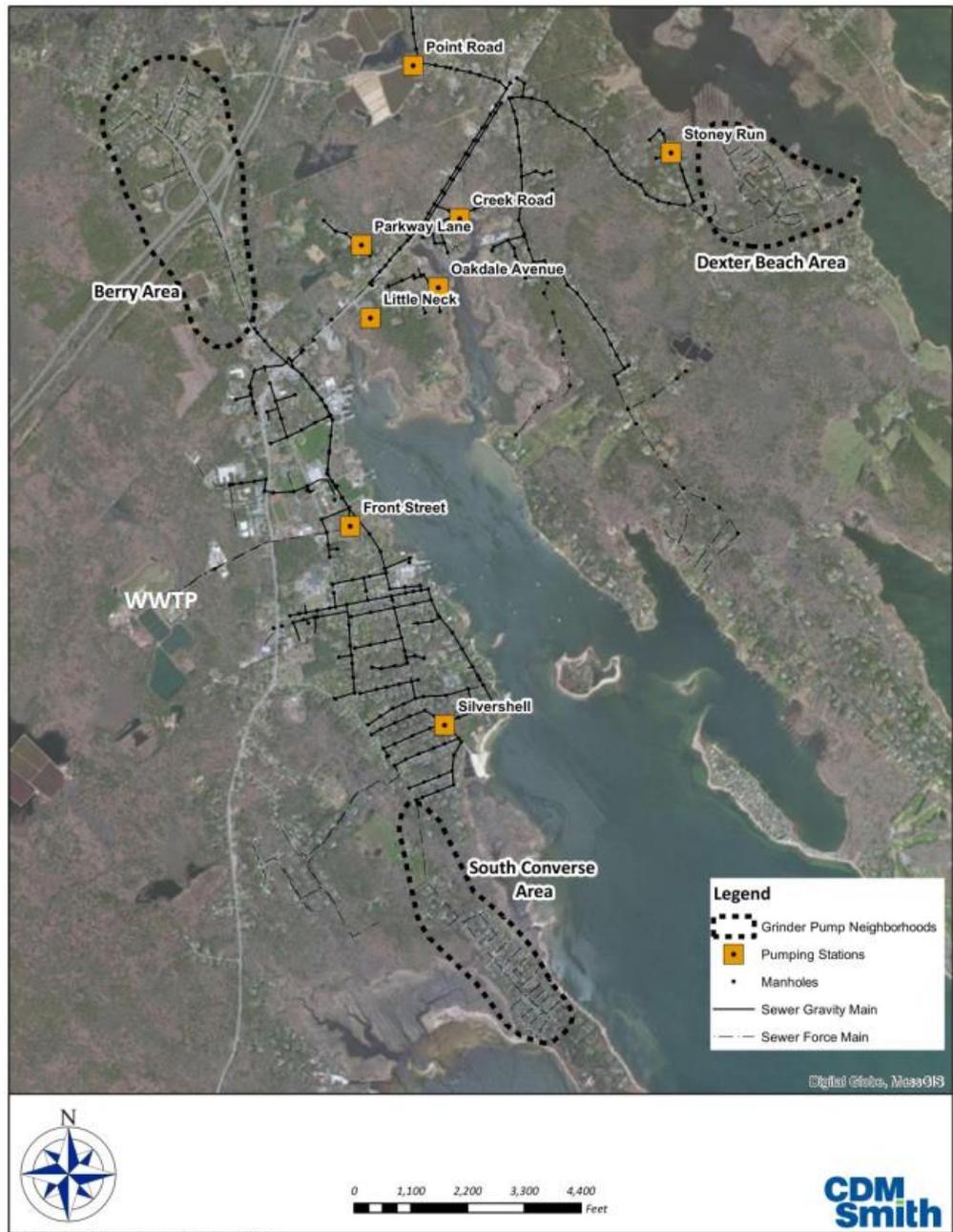


Figure 2-3. Pumping station and grinder pump neighborhood location map (CDM Smith, 2019).

B4.a

2.10 REPETITIVE LOSS PROPERTIES

Repetitive Loss Properties are those for which two or more losses of at least \$1,000 each have been paid under the National Flood Insurance Program (NFIP) within any ten-year period since 1978. As of 2021, the Town of Marion has 7 Repetitive Loss Properties, none of which are Severe Repetitive Loss (SRL) properties. Four (4) are single-family residential, one (1) is residential other, while the remaining two (2) are non-residential properties.



Marion is vulnerable to a wide range of natural hazards that can threaten the people, economy, infrastructure, and natural resources of the Town. As suggested under FEMA planning guidance, the Town of Marion reviewed the full range of natural hazards identified in the most recent Massachusetts State Hazard Mitigation and Climate Adaptation Plan (2018), which included:

- | | |
|--|--|
| 1) Inland Flooding | 8) Drought |
| 2) Coastal Flooding | 9) Extreme Temperature |
| 3) Coastal Erosion | 10) Earthquake |
| 4) Hurricanes and Tropical Storms | 11) Invasive Species |
| 5) Severe Winter Storms (snow, blizzards, ice storms, Nor'easters) | 12) Other Severe Weather (heavy precipitation, high wind, thunder/lightning) |
| 6) Wildfire | 13) Landslide |
| 7) Tornadoes | 14) Tsunami |

In addition to the hazards above, the Town of Marion also included Dam/Culvert Failure as an additional hazard. This chapter provides a description of each hazard, the location(s) within Marion that are impacted by each hazard, previous occurrences of each hazard, the possible magnitude of each hazard, the probability of each hazard occurring in a given year, and some of the impacts that can happen in the event that hazard occurs.



B1.a

FEMA defines a hazard as an act or phenomenon that has the potential to produce harm or other undesirable consequences to a person or thing. All natural disasters pose hazards to property, loss of human life, and have the ability to limit access to power, communication services, water, wastewater collection/treatment, and transportation. Downed trees and limbs also limit emergency access and complicate cleanup efforts. Through the development of this Plan, Marion is taking steps to protect its infrastructure from natural disasters as much as possible, such that essential utilities and services continue when most needed. Hazards associated with natural disasters typically encountered in Marion include winter weather, high winds, and coastal flooding. Natural disasters occurring less frequently, such as tornadoes, earthquakes, or landslides, pose less frequent but unique challenges.

The 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan identifies 14 natural hazards that could have an impact on communities in the Commonwealth of Massachusetts. These hazards are:

- | | |
|-----------------------------------|--------------------------|
| 1) Inland Flooding | 8) Drought |
| 2) Coastal Flooding | 9) Extreme Temperature |
| 3) Coastal Erosion | 10) Earthquake |
| 4) Hurricanes and Tropical Storms | 11) Invasive Species |
| 5) Severe Winter Storms | 12) Other Severe Weather |
| 6) Wildfire | 13) Landslide |
| 7) Tornadoes | 14) Tsunami |

B1.b

As suggested under FEMA planning guidance (FEMA, 2011), the Town of Marion reviewed the full range of natural hazards identified in the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan. Also, given some particularly problematic culverts in the Town, and the potential risk associated with their failure, culvert failure was also evaluated along with dam failure. The full list of hazards addressed in this plan is provided in the call out box below. In addition to the 2018 State Plan, other resources consulted during the drafting of this plan included news articles and other media sources, and local knowledge from LPT members. All resources are referenced in the text of each hazard profile.

Hazards Addressed in Detail in the Marion Multi-Hazard Mitigation Plan

- | | | |
|---|-------------------------------|---------------------------------|
| 1. Flooding (Coastal & Inland) | 6. Tornado | 11. Other Severe Weather |
| 2. Coastal Erosion | 7. Drought | 12. Landslide |
| 3. Hurricane/Tropical Storm | 8. Extreme Temperature | 13. Tsunami |
| 4. Severe Winter Weather | 9. Earthquake | 14. Dam/Culvert Failure |
| 5. Wildfire | 10. Invasive Species | |



3.1 FLOODING (COASTAL & INLAND)

Overview

Flooding was identified as one of the top hazards in Marion according to the LPT and the MVP Workshop. Flooding can be caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms. Sea-level rise also has the potential to exacerbate these flooding issues in the future.

The Town of Marion is subject to two kinds of flooding: coastal flooding where wind, tides, waves, and storm surge lead to flooding low lying coastal areas, and inland flooding where heavy precipitation overwhelms the capacity of natural and structured drainage systems to convey water away from roads and other areas of concern, causing it to overflow the system. Although the Town of Marion experiences the majority of its flooding from coastal storm events, these two types of flooding are often related as inland flooding is prevented from draining by wind and tide driven coastal water. Both types of flooding can be caused by major storms, such as nor'easters and hurricanes. Nor'easters can occur at any time of the year, but they are most common in winter. Hurricanes are most common in the summer and early fall. Due to Marion's geographic position along Buzzards Bay, the Town is somewhat protected from significant flooding impacts due to nor'easters but is extremely vulnerable to the high storm surges that would result if a hurricane were to track up Buzzards Bay. Despite some geographical protection from nor'easters, these storms tend to cover a larger area than hurricanes and tend to last longer, resulting in storm conditions coinciding with at least one high tide – a combination that results in the most severe flooding. Large rainstorms or snowfalls can also lead to inland flooding. See later sections for more specific details on those natural hazards.

Most of the Town's rivers and waterways remain tidally influenced for their entire length such that inland flooding is closely tied to coastal flooding conditions. Much of this type of flooding is contained within existing wetland areas, reinforcing the need to protect and maintain these areas as a mitigation measure. High tides and coastal flooding can prevent water from draining out of the streams and stormwater conveyance systems. This can result in flooding that occurs well away from coastal areas.

Flooding due to storm run-off that overwhelms the carrying capacity of storm water infrastructure can be exacerbated by poor design or poor maintenance. Flooding from blocked drainage occurs in flat or depressional areas where runoff or rain collects but cannot drain out. Drainage systems are made up of ditches, storm drains, retention ponds, and other infrastructure designed to transport storm water away from roadways and parking lots, to receiving streams, bays, and/or the ocean. Large storms can overwhelm these systems and blocked or clogged drainage ditches and culverts can inhibit the flow of water, resulting in back-ups and ponding. Water will remain in an area until it infiltrates into the soil, evaporates, the blockage is cleared, or the water is actively pumped out.

Coastal flooding results from storm surge, which occurs when water is pushed onshore during powerful storms, such as hurricanes and nor'easters, and can raise the water level by several



feet. Storm surges are easily capable of inundating low-lying areas, and waves associated with coastal storms can be highly destructive as they move inland, battering buildings, structures, and infrastructure in their path. However, the magnitude of flooding is strongly influenced by the tides; storm surge that occurs during a high tide will inundate a larger area than if the same surge occurs at low tide. A storm surge coinciding with a high tide event can devastate coastal features such as piers, floats, docks, and boats.



Figure 3-1. Inland flooding during a heavy precipitation event in Marion (photo provided by an online public survey participant). As noted by the resident that provide the photo, this level of flooding occurs frequently – 3 times in July and August 2021 alone.

Hazard Location

B1.c
B2.a

Figure 3-2 shows the Effective 2021 FEMA Flood Insurance Rate Map (FIRM) for Marion. These areas represent the risk of flooding from a 100-year storm. This map depicts the areas of Marion in A, AE, AO, and VE zones and within the 0.2% flood area (an area expected to be inundated during a 500-year storm event). The different FEMA flood zones are defined as follows:



- A Zones are subject to inundation by the 1% annual chance flood event but were determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no BFEs or flood depths are shown.
- AE Zones, also within the 100-year flood limits, are defined with BFEs that reflect the combined influence of stillwater flood elevations and wave effects less than 3 feet.
- AO Zones, representing coastal hazard areas that are mapped with flood depths instead of base flood elevations. Depths are mapped from 1 to 3 feet, in whole-foot increments. These areas are generally located in areas of sheet flow and runoff from coastal flooding where a BFE cannot be established.
- VE Zones, also known as the coastal high hazard areas, are defined by the 1% annual chance flood limits and wave effects 3 feet or greater. The hazard zone is mapped with base flood elevations (BFEs) that reflect the combined influence of stillwater flood elevations, primary frontal dunes, and wave effects 3 feet or greater.

However, recent post-storm field visits and laboratory tests throughout coastal flood hazard areas have consistently confirmed that wave heights as low as 1.5 feet can cause significant damage to structures that are constructed without considering coastal hazards. While not formally defined in the National Flood Insurance Program (NFIP) regulation, any area of an AE zone of a FEMA generated line showing the Limit of Moderate Wave Action, or LiMWA, which is the inland limit of the area expected to receive 1.5-foot or greater breaking waves during the 1-percent-annual-chance flood event, has been classified as a Coastal A Zone. This area is subject to flood hazards associated with floating debris and high-velocity flow associated with waves and debris that can erode and scour building foundations and, in extreme cases, cause foundation failure. The LiMWA is shown in Figure 3-2.

According to the 2016 Federal Emergency Management Agency (FEMA) Flood Insurance Study for Plymouth County, flooding in the Town of Marion generally occurs along the Buzzards Bay coastline, usually as a result of the high tides and wave action associated with hurricanes and major storms. Flooding can also originate from Aucoot Creek, Benson Brook, the Sippican River, and other coastal tributaries. Approximately 36 percent of the Town's land area is located in FEMA Special Flood Hazard Areas (SFHA).

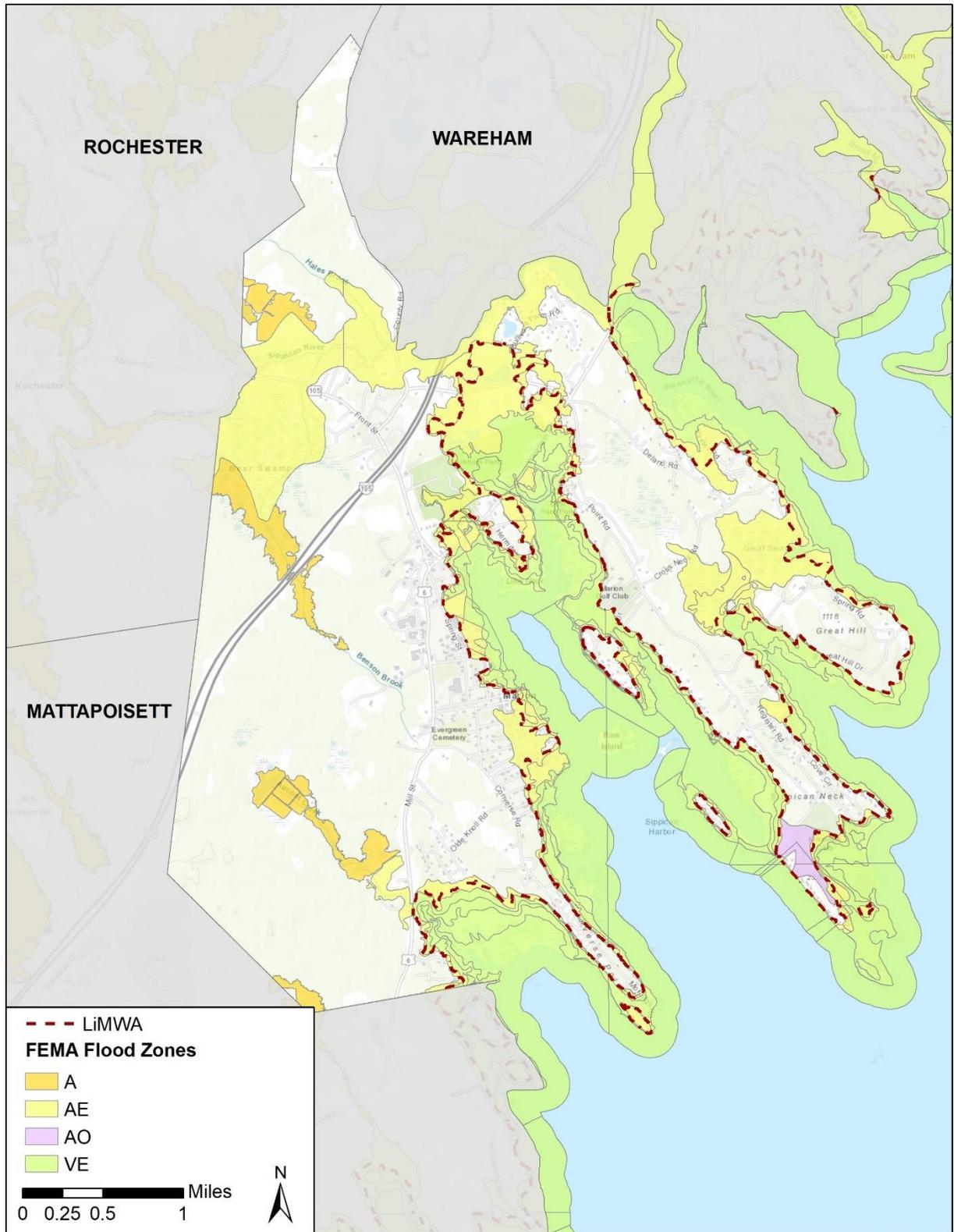


Figure 3-2. FEMA Special Flood Hazard Areas in Marion (Effective 2021).



Previous Occurrences & Extent

B1.c
B2.a,c

Below is a list of major flooding events that have occurred in Marion from between 2011 and 2021, from NOAA's NCEI Storm Events Database (NOAA, 2021), which lists a number of specific flooding incidents for Marion:

May 11, 2013: A widespread rainstorm passed over Southern New England, leading to heavy precipitation and flooding in low-lying areas with poor drainage. Flooding along Spring Street near the Taber Library resulted in almost impassable conditions.

June 7, 2013: Heavy rain impacted the Town as the remnants of Tropical Storm Andrea passed through southeast Massachusetts. Record high rainfall was recorded for the month of June. Spring Street was inundated with over a foot of water from the fire station to Sippican School.

September 3, 2013: A cold front moved across the New England area, resulting in heavy showers, thunderstorms, and severe winds in some areas. The westbound lanes of Route 6 were impassable due to flooding near Converse Road.

November 17, 2014: Heavy rain, damaging winds, and thunderstorms within the region lead to impassable flooding conditions on Route 6 heading west near Barnabas Road.

September 10, 2015: Showers and thunderstorms developed along the south coast of Massachusetts. Heavy rain caused closures of Route 6 and Spring Street due to flooding.

July 22, 2019: Severe rain showers and thunderstorms lead to flooding and wind damage in southeast Massachusetts. In the Town of Marion, flooding led to impassable conditions on County Road.

Due to the unique geography and cultural/agricultural history of Marion, there are many cranberry bogs, both active and abandoned. These, along with upstream bogs in neighboring towns, have the potential to cause flooding to surrounding properties and infrastructures during heavy rain events. For example, historically there has been some flooding in extreme rain events at Grassi Bog.

The extent of flooding in the future, however, will impact a larger area of Marion. Sea-level rise refers to the increase in mean sea level over time. Global mean sea level (MSL) has been rising since the end of the last ice age approximately 11,000 years ago. Recently, sea-level rise (SLR) rates have accelerated, with unprecedented rates along the northeastern U.S. since the late 19th century (Kemp et al., 2011). Global sea-level rise is driven by several factors, including thermal expansion of ocean water and freshwater inputs from melting glaciers. Because sea level sets a baseline for storm surge, sea-level rise will exacerbate already existing coastal flood issues. As local sea level rises, it allows coastal storm surge to extend farther inland. With the higher sea levels predicted in 2030, 2050 and 2070, areas much farther inland will be at risk of being flooded. Although sea-level rise plays a substantial role, local flooding also depends on tides, natural and artificial barriers, and the contours of the land along the coast (Figure 3-3).

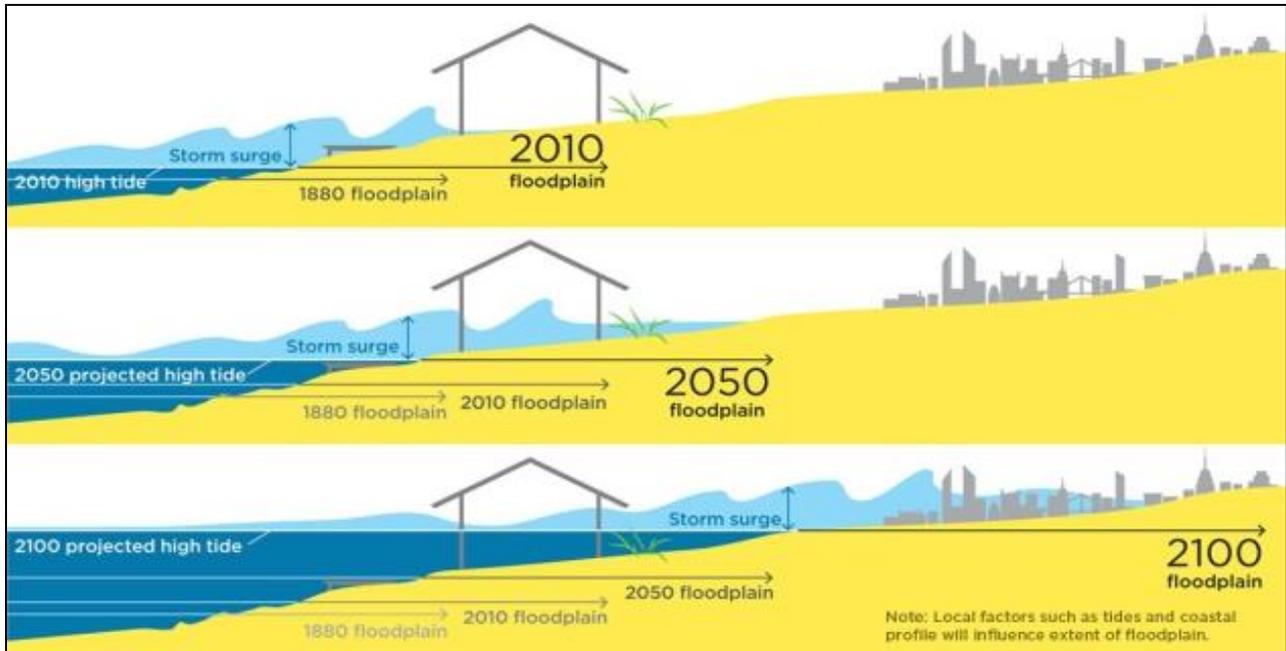


Figure 3-3. Sea-level rise magnifies the risks of storm surge and high tides (UCS, 2015).

The National Oceanic and Atmospheric Administration’s (NOAA) Center for Operational Oceanographic Products and Services maintains a series of tide gages along the coast of Massachusetts. Records from NOAA’s Woods Hole tide gage (station ID 8447930), indicate that our relative sea level has risen at a rate of 2.92 mm (+/- 0.17 mm) annually based on the monthly mean sea level between 1932 and 2019, resulting in a change of 0.96 feet (11.5 inches) in 87 years (Figure 3-4).

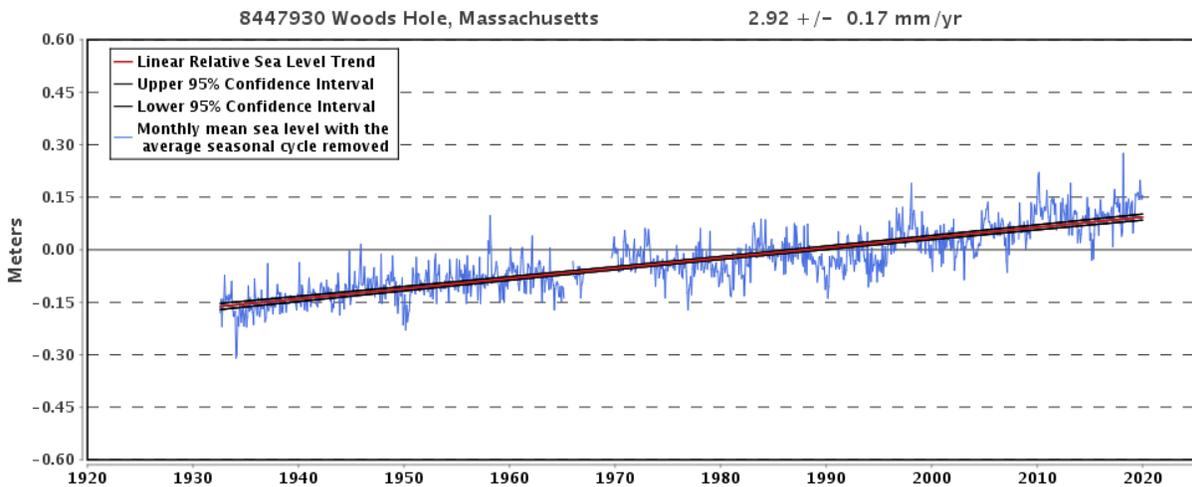


Figure 3-4. Sea-level rise trend from Woods Hole, Massachusetts (NOAA, 2020a).



Although the historical sea-level rise trend presented in Figure 3-4 is linear, this is not expected to continue. Global sea-level rise projections range from an additional 4.3 ft (under an intermediate sea level rise scenario) to 10.5 ft (under an extreme sea level rise scenario) by 2100.

The probability of inundation in present day, as well as in future out years, along the entire Massachusetts coastline has been calculated through the Massachusetts Coast Flood Risk Model (MC-FRM), which was developed for the Massachusetts Department of Transportation (MassDOT) (Bosma et al., 2019). The MC-FRM incorporates a full suite of processes that affect coastal water levels, including tides, waves, winds, storm surge, sea level rise, and wave set-up at a fine enough resolution to identify site-specific locations that may require adaptation alternatives. The MC-FRM provides fine-resolution data and is also superior to a more rudimentary “bathtub” approach, since the latter does not account for critical physical processes that occur during a storm event, including waves and winds, nor can it determine the limited volume of water that may be able to enter certain areas, particularly those with narrow entry points.

The mean sea level in Marion in the year 2000 was at an elevation of -0.30 feet (NAVD88). This starting elevation from 2000 can then be used to compare to projected relative mean sea-level elevations at future years under various scenarios. The data in Table 3-1 summarize the expected relative mean sea level elevations (relative to NAVD88) for various out-years under various sea-level rise scenarios. MassDOT chose to utilize the high sea level rise values as inputs to the MC-FRM; these values also correspond with the Massachusetts EEA recommendations for assessing sea-level rise (EEA, 2018). Note that the values in Table 3-1 are *elevations* of the projected mean sea level at various times relative to a vertical datum of NAVD88, not the *magnitude of change* in elevation. For comparison, the baseline (i.e., year 2000) mean sea level elevation, is -0.30 feet (NAVD88).

Table 3-1. Relative mean sea level (feet, NAVD88).

	2030	2050	2070	2100
Intermediate	0.7	1.4	2.3	4.0
Intermediate-High	0.8	1.7	2.9	5.0
High	1.2	2.5	4.3	7.8
Extreme	1.4	3.1	5.4	10.2

Probabilistic flood risk maps for 2030, 2050, and 2070 are presented in Figures 3-5 through 3-7. The color-coded results represent the percent chance of flooding in any given year due to the combined impact of sea-level rise and storm surge. For example, areas shaded light purple have a 5-10% chance of flooding. In other words, these areas will flood in a 10 to 20-year storm event. Similarly, areas shaded in yellow have a 0.2-0.5% chance of flooding (i.e., will flood in a 200 to 500-year storm event).

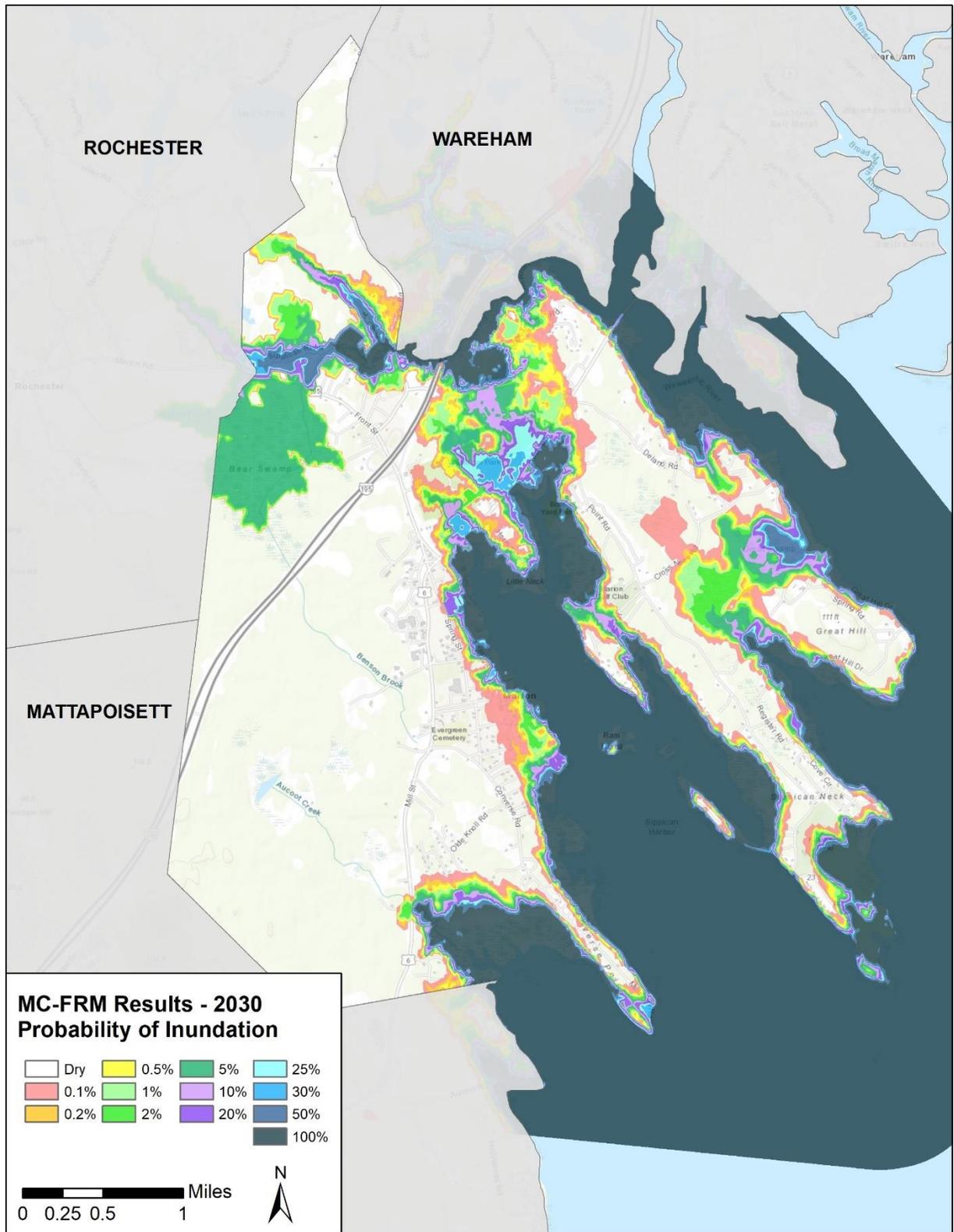


Figure 3-5. Probability of inundation in 2030 given assuming a high sea-level rise scenario (data from MC-FRM).

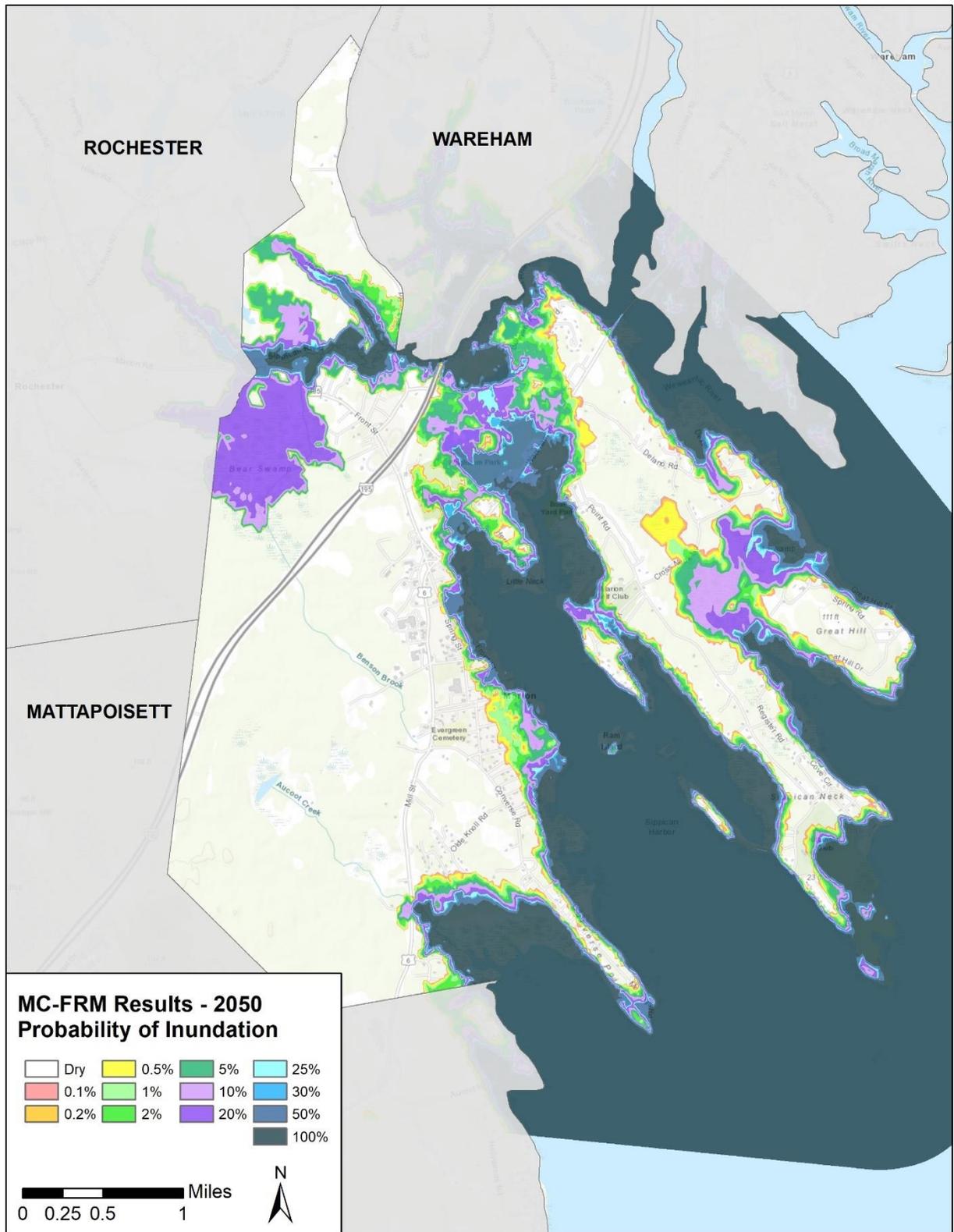


Figure 3-6. Probability of inundation in 2050 given assuming a high sea-level rise scenario (data from MC-FRM).

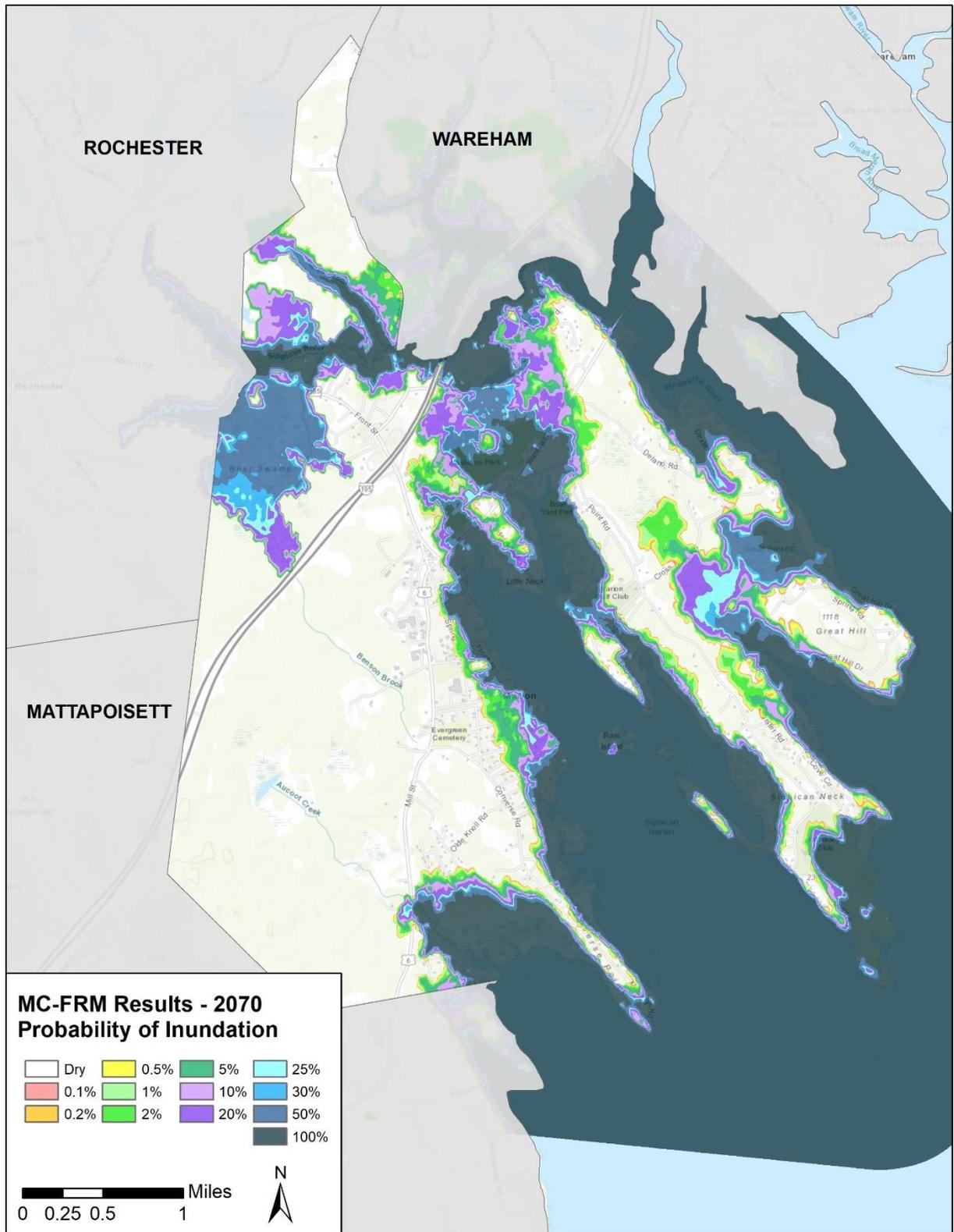


Figure 3-7. Probability of inundation in 2070 given assuming a high sea-level rise scenario (data from MC-FRM).



B2.b

Probability

Based on the frequency of past flooding occurrences described above, it is likely (between 10 and 100% probability in the next year) that flooding of some type will occur in Marion. However, climate change is projected to increase the frequency and intensity of severe weather events that can lead to major flooding events, such as heavy precipitation events, thunderstorms, or hurricanes. Considering projections of increased storm intensity as well as sea level rise, it is likely that in the future Marion will experience more severe and/or more frequent flooding.

B3.a

Impact

Below is a list of possible impacts for a flooding event in Marion:

- **People:** People can be knocked down or washed off their feet while walking in floodwaters. Injury or death can result from people being trapped in their vehicles during a flood event. People can be displaced from their homes due to post-flood safety and health hazards. Also, intrusion of water into households can lead to health and respiratory issues caused by the development of mold and mildew.
- **Emergency Response:** Flooded roadways can inhibit response access and emergency evacuation.
- **Infrastructure:** Flooding causes debris and sediment deposits on Town infrastructure and roads. Storm surges and associated waves can damage utility poles, roadways, water mains, sewer pipes and other Town infrastructure. Potential loss of potable drinking water in flooded areas due to the need to shut valves to protect the Town's drinking water supply.
- **Buildings:** Moving water associated with floods can damage buildings and other structures. Building foundations on or near the beach can be undermined by the velocity of floodwaters. Debris carried by flood waters can act as battering rams and damage buildings. Buildings can float off their foundations if not anchored properly. Basements can flood or can collapse due to external water pressure.
- **Economy:** Communication and infrastructure systems damaged during floods can disrupt economic activities and close businesses. Roadway disruptions due to flooding can reduce customer base. There can be economic losses associated with reduced value on coastal properties damaged by flooding.
- **Natural Systems:** Floods can deposit sediment and debris onto parks, beaches, marshes, and estuaries.
- **Transportation:** Floods can wash out bridges and culverts. Debris lodged in culverts can inhibit flow, causing additional flooding on the upstream side. There can be major disruptions to transit services.



3.2 COASTAL EROSION

Overview

Coastal shorelines—especially beaches, dunes, and banks—change constantly in response to winds, waves, tides, and other factors including seasonal variations, sea level rise and human alterations to the shoreline system. Every day, winds, waves, and currents move sand, pebbles and other materials along the shore or out to sea. This dynamic and continuous process of erosion, sediment transport, and accretion shapes the coastal shoreline. Shorelines change seasonally, tending to accrete gradually during the summer months when sediments are deposited by relatively low energy waves, and erode dramatically during the winter when sediments are moved offshore by high energy storm waves and currents, such as those generated by nor'easters.

B1.c
B2.a

Hazard Location

The Massachusetts Office of Coastal Zone Management (CZM) has documented the rate of change of all ocean-facing shorelines of Massachusetts through their Shoreline Change Project (Thieler et al., 2013). Shorelines were delineated and evaluated to demonstrate trends from the mid-1800s to 2009. These data were then incorporated into MORIS, the Massachusetts Ocean Resource Information System, to provide better access to the shoreline change data and to allow the public to view the data using the online tool.

Figure 3-8 displays the long-term shoreline change data in Marion from CZM's Shoreline Change Project. Long-term data ranges from 1895 to 2013 in Marion. Rates shown in Figure 3-8 are in feet per year, where negative values indicate erosion and positive values indicate accretion. From these data, approximately 21% of the Town's coastline (where data is available) is either stable or accreting over the long-term (1895 to 2013). Areas of more significant long-term erosion include northeast Aucoot Cove, areas around Stewarts Island, and isolated areas within Sedge Cove and Wings Cove. Accretional trends in the long term are also present along the shoreline, such as Charles Neck Point, east Sippican Harbor near West Drive, and north of Great Hill Point and Warren Point. In this area, erosion is often episodic, as a result of significant storm flooding and wave impacts, rather than continuous erosion.

The more recent rates of shoreline change, between 1978 and 2013, are shown in Figure 3-9 and indicate approximately 59% of the Town's coastline (where data is available) is either stable or accreting. Compared to the long-term erosion rates, in the short term, erosion around Aucoot Cove has decreased in severity. In contrast, the erosional areas around Great Hill Point and Warren Point have increased in severity.

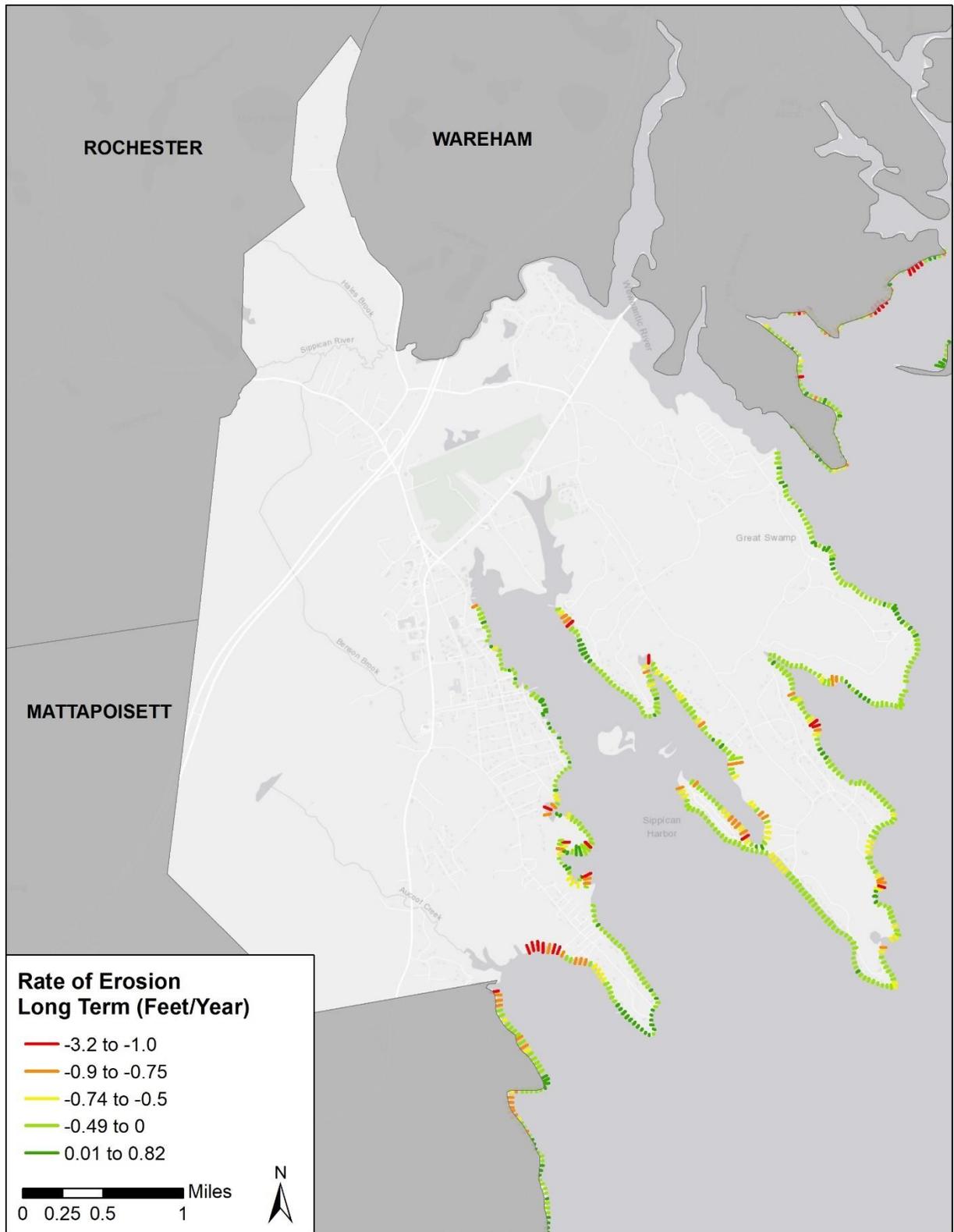


Figure 3-8. Long-term (1895 to 2013) rates of shoreline change (feet/year).

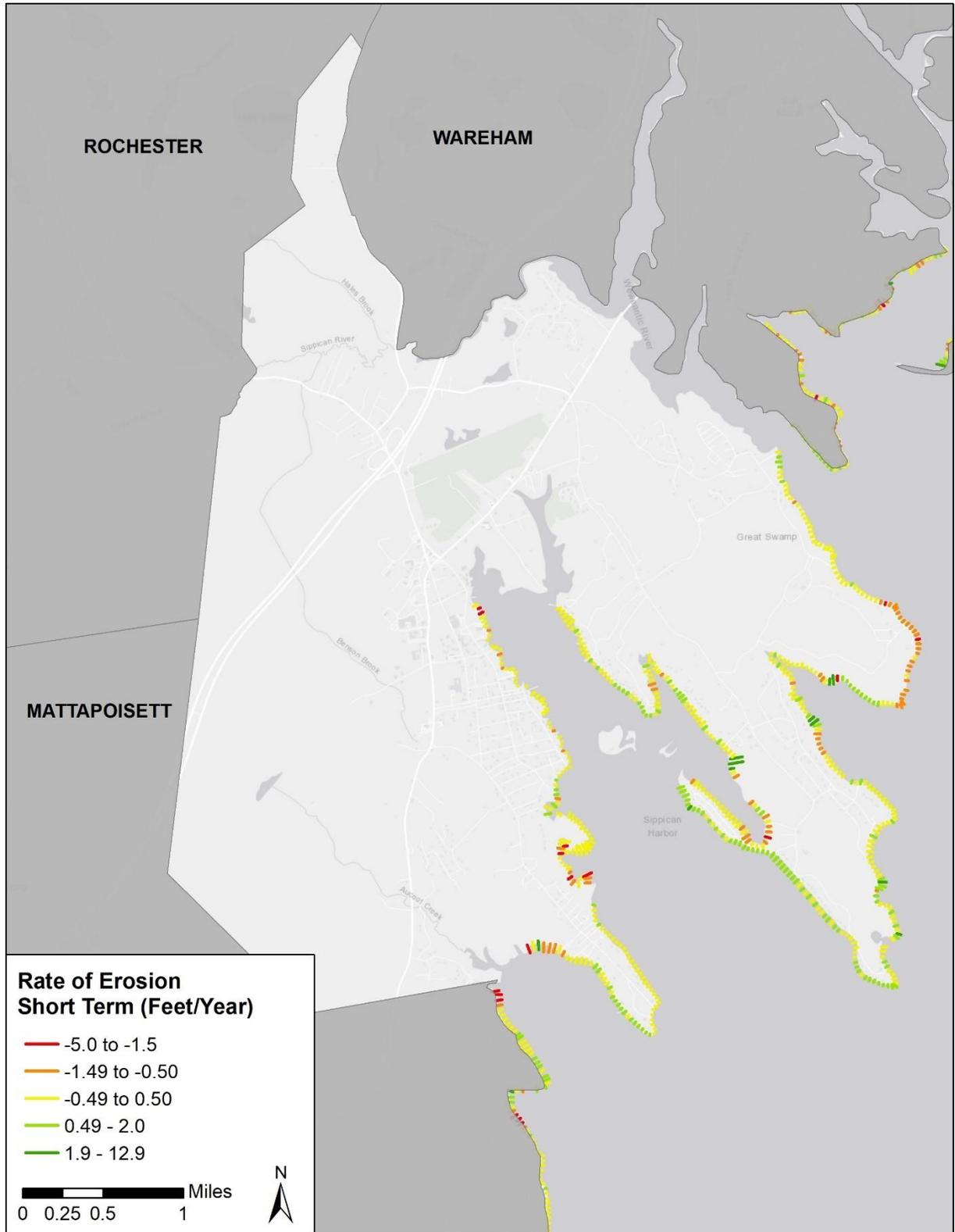


Figure 3-9. Short term (1978 to 2013) rates of shoreline change (feet/year).



The Report of the Massachusetts Coastal Erosion Commission tabulated the average shoreline change rate, in feet/year, for all coastal communities (CEC, 2015). The Coastal Erosion Commission calculated both short- and long-term average rates of change: the average short-term rate of change for the Marion shoreline is 0.1 ft/yr, indicating very minor accretion. The average long-term rate of change is -0.3 ft/yr, indicating minor erosion. These results are consistent with the data from CZM's Shoreline Change Project.

B1.c
B2.a,c

Previous Occurrences & Extent

As shown in Figures 3-8 and 3-9, minor to moderate coastal erosion has occurred in Marion in isolated locations. Most notably Aucoot Cove and around Great Hill Point and Warren Point. In addition, two private properties have previously submitted an Order of Conditions for nourishment to the Marion Conservation Commission.

B2.b

Probability

Based on the coastal erosion rates documented in the Massachusetts CZM Shoreline Change Project, it is highly likely (near 100% probability in the next year) that coastal erosion will occur in Marion; although the magnitude of these events are likely to be largely minor to moderate. As sea level rises and storms become more severe and frequent as a result of climate change, coastal and marine areas in Marion will likely experience increased rates of erosion.

B3.a

Impact

Below is a list of possible impacts that could result from coastal erosion:

- **People:** Public safety is jeopardized when buildings and structures collapse due to coastal erosion.
- **Emergency Response:** Erosion can collapse or damage roadways, which would impede emergency vehicles.
- **Infrastructure:** Erosion can expose septic systems, as well as break sewer pipes and water mains. Accreting sand can block outfall pipes, causing drainage issues and exacerbating flooding.
- **Buildings:** Erosion can undermine the foundations of buildings, making them more susceptible to settlement, lateral movement, or overturning. Debris from buildings that are damaged due to coastal erosion can be swept out to sea. Seawalls and other hard structures installed to reduce the effect of coastal erosion in one location can cause sediment losses at a downdrift area, affecting additional properties.
- **Economy:** Coastal erosion can adversely impact businesses by damaging a business's building. Relocation costs would be an additional economic burden to anyone forced to move to avoid coastal erosion impacts.
- **Natural Systems:** If engineered structures are used to stabilize shorelines, the natural process of erosion is altered, changing the amount of sediment available and the erosion rates at adjacent areas. The Town's natural ecosystem attractions (i.e. beaches, dunes, salt marshes, and estuaries) would also be threatened as sand sources that supply and sustain them are eliminated.
- **Transportation:** Roadways can become damaged through erosion.



3.3 HURRICANES & TROPICAL STORMS

Overview

A tropical cyclone is a rotating, organized system of clouds and thunderstorms that originates over tropical or subtropical waters. The hurricane season for the Atlantic Ocean extends from June 1st to November 30th, with the peak from mid-August to late October. However, deadly hurricanes can occur anytime during the hurricane season. Tropical cyclones are classified as follows (NHC, 2016a), depending on their intensity:

- **Tropical Depression:** A tropical cyclone with maximum sustained winds of 38 mph (33 knots) or less.
- **Tropical Storm:** A tropical cyclone with maximum sustained winds of 39 to 73 mph (34 to 63 knots).
- **Hurricane:** A tropical cyclone with maximum sustained winds of 74 mph (64 knots) or higher. In the western North Pacific, hurricanes are called typhoons; similar storms in the Indian Ocean and South Pacific Ocean are called cyclones.
- **Major Hurricane:** A tropical cyclone with maximum sustained winds of 111 mph (96 knots) or higher, corresponding to a Category 3, 4 or 5 on the Saffir-Simpson Hurricane Wind Scale.

Hurricanes are typically fast-moving storms (typically lasting 6 to 12 hours) with high winds in excess of 74 miles per hour and torrential rains averaging 6 to 8 inches, but possibly dropping as much as 15 to 20 inches of rainfall during a single event.

Hazard Location

The entire Town of Marion is vulnerable to hurricanes and tropical storms. Coastal areas are extremely susceptible to damage due to a combination of wind and storm surge. However, even inland areas can be affected by the flooding, strong winds and heavy rains associated with these events. Storm surge occurs when water is pushed towards shore by storm generated winds. Storm surge combines with the water elevation, which can substantially increase water levels. In addition, wind generated waves are superimposed on the storm surge. This rise in water level can cause severe flooding in coastal areas, especially when a storm surge coincides with a high tide. Figure 3-10 depicts the components of storm surge.

The US Army Corps of Engineers (USACE) New England Division, in cooperation with FEMA, prepared Sea, Lake and Overland Surge from Hurricanes (SLOSH) inundation maps. SLOSH maps show the extent of potential flooding from worst-case combinations of hurricane direction, forward speed, landfall point, and high astronomical tide. However, the model considers only storm surge height and does not consider the effects of waves. When selecting model parameters, the USACE considered the highest wind speed for each category, the highest surge level, and the worst-case forward motion of the storm to develop a “worst case” scenario. The resulting inundation areas are grouped in Category 1, Category 2, Category 3, and Category 4. Figure 3-11 shows the SLOSH results for Marion.

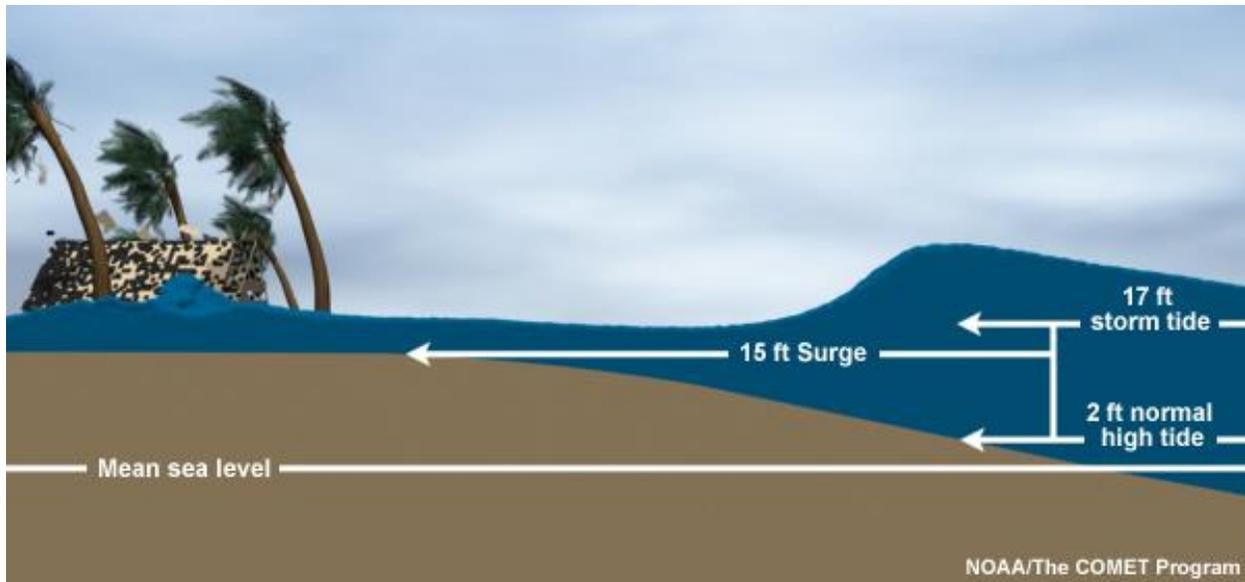


Figure 3-10. Schematic image of a storm surge and storm tide affecting a shoreline (NHC, 2016c).

Previous Occurrences & Extent

A hurricane has not made landfall in Massachusetts for almost 30 years (Hurricane Bob in 1991), and it has been more than 60 years since a major hurricane (Category 3 or higher) has occurred. The most treacherous storms in the Town's history include the Great New England Hurricane of 1938 and Hurricanes Carol and Edna in 1954 (Figure 3-12). Though not as severe as the previous events, Hurricane Bob caused significant damage to a number of Marion buildings (Figure 3-13). In a future storm of similar magnitude, a forced evacuation of the Town would be met with automobile congestion and difficulty for some residents in getting out of harm's way, particularly in neighborhoods with a single point of entry and exit.

Smaller tropical storms and depressions have affected the area, generally inflicting minor damage, such as downed tree limbs, power outages, and limited damage to boating-related infrastructure. Table 3-2 provides a summary of historic hurricanes that have impacted Massachusetts. However, due to the large diameter of many hurricanes and tropical storms, and the far-reaching effects of storm surge, even storms that don't make landfall in New England can have significant hazard impacts on Massachusetts, and on Marion. To illustrate the frequency of these storms, Figure 3-14 shows all hurricanes and tropical storms that have passed within 100 miles of Marion between 1951 and 2021. Note that although major hurricanes (Category 1, Category 2, etc.) occur approximately once every ten or twenty years in Massachusetts (Table 3-2), tropical storms and tropical depressions (represented by the green and blue lines in Figure 3-14) are relatively common, occurring every few years.

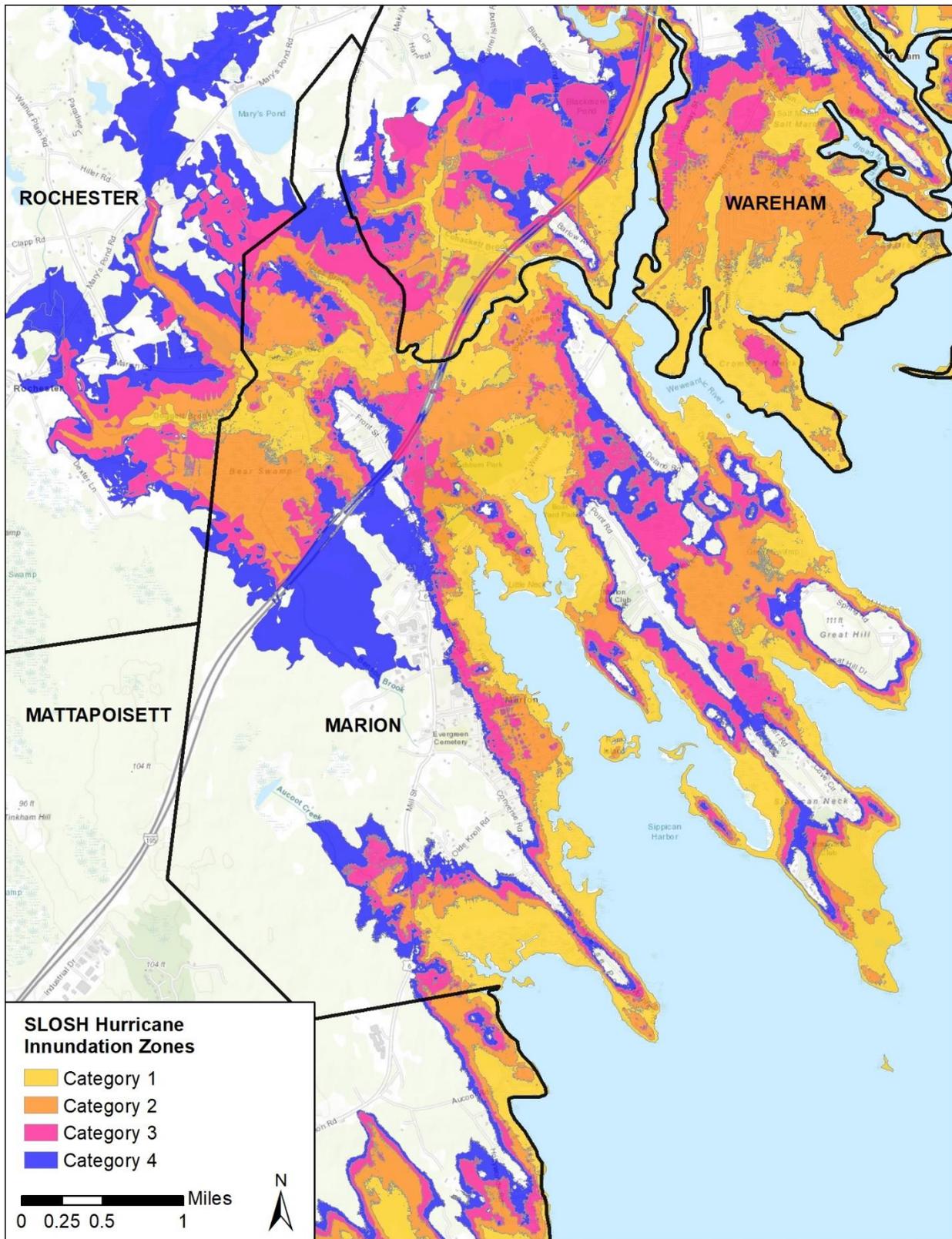


Figure 3-11. SLOSH Categories for Marion. Note: The SLOSH model considers only storm surge height and does not consider the added effects of wave height.



Figure 3-12. Impacts to the house at Kittansett Club from the Hurricane of 1938 (left) and to Front Street from Hurricane Carol in 1954 (right). Photos from the Sippican Historical Society archives.



Figure 3-13. Impacts to the Beverly Yacht Club after Hurricane Bob in 1991. Photo from the Sippican Historical Society archives.

**Table 3-2. Massachusetts hurricanes since 1938.**

Date	Name	Intensity (in MA)
August 19, 1991	Hurricane Bob	Category 2
September 27, 1985	Hurricane Gloria	Category 1
September 12, 1960	Hurricane Donna	Category 2
September 11, 1954	Hurricane Edna	Category 1
August 31, 1954	Hurricane Carol	Category 3
September 15, 1944	Great Atlantic Hurricane	Category 3
September 21, 1938	Great New England Hurricane	Category 3

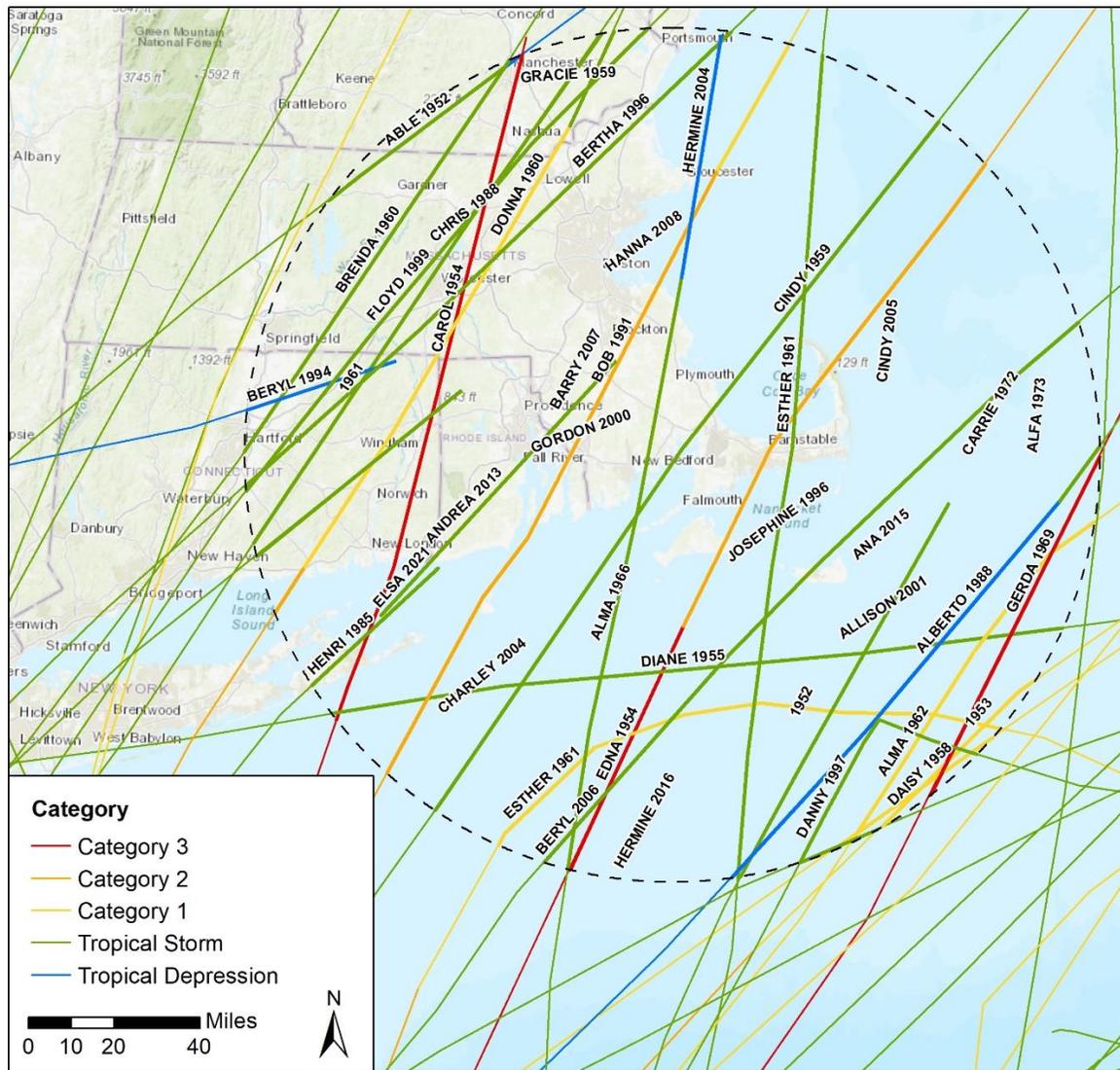


Figure 3-14. Hurricane and tropical storm tracks in the within 100 miles of Marion between 1951 and 2021 (NOAA, 2020b).

The Saffir-Simpson Hurricane Wind Scale is often used to classify tropical cyclones. The Saffir-Simpson Scale, described in Table 3-3, outlines a rating system from 1 to 5 based on the hurricane’s sustained wind speed. This scale is then used to estimate potential property damage. Hurricanes classified as a Category 3 or higher are considered major hurricanes due to their potential for devastating or catastrophic damage and loss of life.

Table 3-3. Saffir-Simpson Hurricane Wind Scale (NHC, 2016b).

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	75-95 mph	Very dangerous winds will produce some damage:



	64-82 kt 119-153 km/h	Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days
2	96-110 mph 83-95 kt 154-177 km/h	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

B2.b

Probability

Based on the hurricane and tropical storm frequency documented in this section, it is likely (between 10 and 100% probability) that a hurricane or tropical storm will impact Marion in the next year. In the future, higher category storms are predicted to increase as a result of climate change, meaning Marion may experience more of the severe weather associated with hurricanes and tropical storms.

B3.a

Impact

Below is a list of possible impacts that could result from a hurricane or tropical storm:



- **People:** Public safety is jeopardized when buildings and structures collapse due to coastal erosion, downed trees land on buildings or cars, or emergency response is blocked by flooded roadways. Danger of downed live electrical wires.
- **Emergency Response:** Heavy rains and flooding associated with hurricanes and tropical storms, as well as downed trees and branches caused by the high winds, can reduce the response time of emergency vehicles, or block access entirely. Danger of downed live electrical wires.
- **Infrastructure:** High winds, heavy rains and coastal storm surge can cause widespread power outages, limit access to other utilities such as drinking water and communications, and limit transportation. A significant hurricane could also damage wellfields and wells, disrupting drinking water supply.
- **Buildings:** High coastal winds and storm surge can cause substantial damage to homes and businesses and devastate coastal infrastructure such as marinas.
- **Economy:** Hurricanes and/or tropical storms can adversely impact businesses if a business's building is damaged by the storm, or if utilities or road access are affected.
- **Natural Systems:** Storm surge and wave action often associated with hurricanes and tropical storms can cause coastal erosion, potentially harming the Town's natural ecosystem attractions (i.e., beaches, dunes, barrier beaches, salt marshes and estuaries). Over time, coastal erosion can reduce the ability of coastal landforms to provide storm damage and flooding protection.
- **Transportation:** Roadways can become damaged through shoreline erosion or be made impassible due to flooding.



3.4 SEVERE WINTER WEATHER (SNOW/BLIZZARD/ICE STORM/NOR'EASTER)

Overview

Snowstorms and blizzards are common events in New England. These storms are often high duration events with significant winds and heavy snowfall. The majority of blizzards and ice storms in the region cause more inconvenience than they do serious property damage, injuries, or deaths. Sleet and ice storms result when temperatures are appropriate for precipitation to fall as frozen or mostly frozen raindrops, or liquid rain that freezes upon contact with structures and objects on the ground. Travel is often limited and disruptions to power and other utility delivery are a high potential. Coastal flooding can occur during these events, especially with westerly winds. However, periodically, a storm will occur that is a true disaster, and necessitates intense large-scale emergency response. On average Marion receives 35 inches of snow per year.

In addition to many of the same hazards posed by other natural disasters, winter storms have the added hazard associated with cold weather for prolonged periods of time. Unlike disasters occurring during the summer months such as hurricanes, power outages may result in extended periods of no heat. Prolonged contact with low temperatures can cause pipes to freeze and burst, damaging homes and businesses. Winter storms pose additional health problems with the added strain of exposure to freezing temperatures, especially for the elderly.

A nor'easter is a particular kind of cyclonic winter storm that moves along the east coast of North America, from south to north; once these storms reach New England, they often intensify. It is called a nor'easter because the winds associated with the storm blow from a northeasterly direction. Sustained wind speeds of 20 to 40 mph are common during a nor'easter, with gusting often reaching 50 to 60 mph. In some cases, the wind speed may actually meet or exceed hurricane force. The storm radius of a nor'easter can be as much as 1,000 miles, and the storm is often accompanied with heavy rain and/or snow, depending on temperature. Most nor'easters bring both storm surge and high winds to the coast of Massachusetts, making the coastline particularly vulnerable to erosion and flooding.

B1.c
B2.a

Hazard Location

The entire Town of Marion is at risk from severe winter weather. The Northeast Regional Climate Center has compiled 30-year annual snow totals in New England and the eastern United States. Based on this data, between 1981 and 2010, the Marion area averaged 20 to 40 inches of snowfall annually between 1981 and 2010 (Figure 3-15). Despite relatively low average annual snowfall, Plymouth County has still had 9 FEMA Declared Disasters between 1953 and 2017 (Figure 3-16).

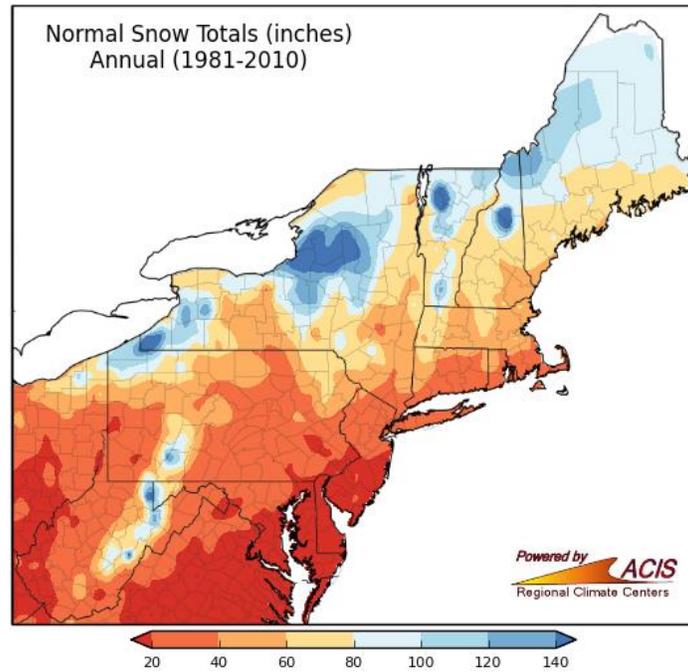


Figure 3-15. Annual average snow totals for New England between 1981 and 2010.

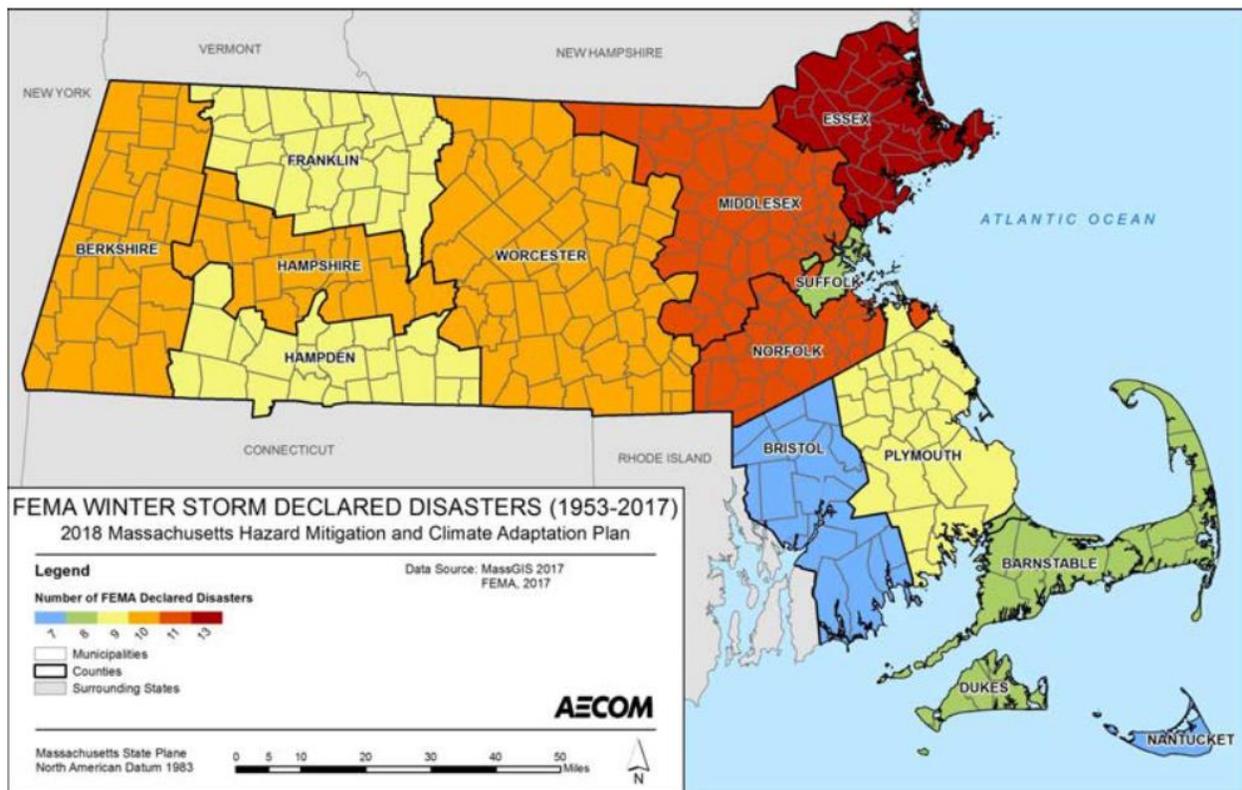


Figure 3-16. FEMA winter storm-related disasters by county (1953-2017) (from 2018 State Hazard Plan).

B1.c
B2.a,c

Previous Occurrences & Extent

Winter storms occur quite frequently, but due to preparation by the Town and its residents, typically amount to no more than a minor inconvenience. School delays and slow travel occur but crippling winter storms are a rarity. However, they do occur. The most severe winter storm to ever hit New England was the Blizzard of 1888, which occurred in March of that year. Snow accumulations reached 30 to 50 inches where precipitation was entirely snow. Boston received a mix of snow and rain creating up to nine inches of slush. The Blizzard of 1978 resulted in 24 to 38 inches of snow across New England, immobilizing the infrastructure and blocking major highways, and causing thousands of motorists to abandon their cars on the road. Two weeks were required to remove the snow. The Blizzard of 1978 resulted in a federal disaster declaration for many counties in Massachusetts. More recent blizzards and snowstorms occurred in March 1993, February 1996, March 2001, January 2005, February 2013 (Winter Storm Nemo) and January 2015 (Winter Storm Juno).

Winter Storm Juno, in January 2015 was a powerful nor'easter that impacted the northeast. A state of Emergency was declared in Massachusetts and travel bans were issued in preparation for the storm. The storm produced winds that gusted to 75 mph, a rain/snow mix that resulted in 15 to 18 inches of snowfall, coastal flooding that caused erosion in many areas across the state, and multi-day loss of electricity for many properties. This nor'easter resulted in a federal disaster declaration for many counties in Massachusetts, including Plymouth County (FEMA DR-4214). Table 3-4 below provides a list of major winter storms in New England from 2011 to 2021.

The Northeast Snowfall Impact Scale (NESIS) was developed by the National Weather Service to characterize and rank high-impact Northeast snowstorms. A "High-impact" snowstorm is one that produces large areas of 10-inch snowfall accumulations or greater. The NESIS has five categories: Notable, Significant, Major, Crippling, and Extreme (Table 3-5). This index differs from other meteorological indices, however, because it uses population information in addition to meteorological measurements; the NESIS gives a ranking to the societal impacts of a storm. NESIS values are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. The largest NESIS values result from storms producing heavy snowfall over large areas that include metropolitan centers. These values are then converted into one of the five NESIS categories (NOAA, 2019b).

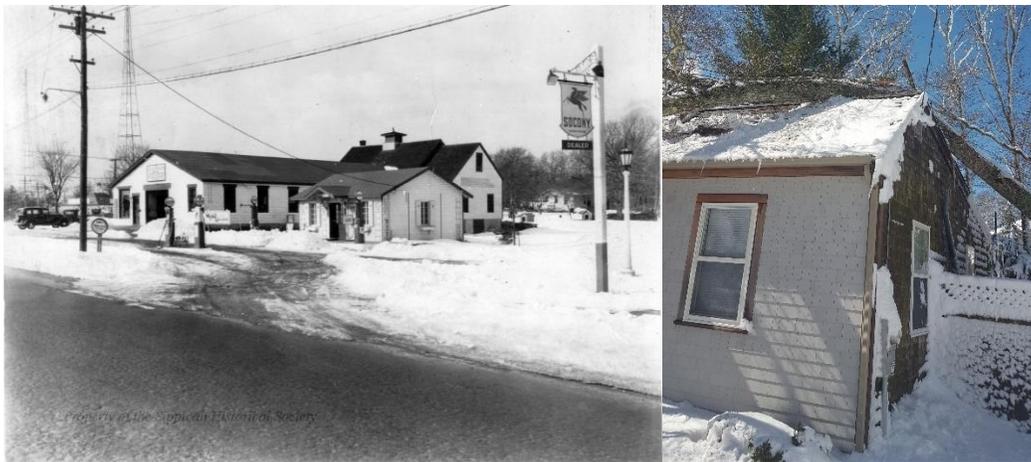


Figure 3-17. Winter weather impacting Stinson’s Chevrolet Garage in the 1930s (left; Sippican Historical Society) and a home in Marion in 2018 (right; online public survey).

Table 3-4. Major winter storms in New England (2011 to 2021).

Date	NESIS	Cat	Description
Jan 9-13, 2011	5.31	3	Major
Jan 26-27, 2011	2.17	1	Notable
Feb 1-3, 2011	5.3	3	Major
Oct 29-30, 2011	1.75	1	Notable
Feb 7-10, 2013	4.35	3	Major
Mar 4-9, 2013	3.05	2	Significant
Dec 13-16, 2013	2.95	2	Significant
Dec 30, 2013 - Jan 3, 2014	3.31	2	Significant
Jan 20-24, 2014	1.26	1	Notable
Jan 29-Feb 4, 2014	4.08	3	Major
Feb 11-14, 2014	5.28	3	Major
Nov 26-28, 2014	1.56	1	Notable
Dec 9-14, 2014	1.49	1	Notable
Jan 25-28, 2015	2.62	2	Significant
Jan 29-Feb 3, 2015	5.42	3	Major
Feb 8-10, 2015	1.32	1	Notable
Jan 22-24, 2016	7.66	4	Crippling
Mar 12-15, 2017	5.03	3	Major
Jan 3-5, 2018	1.71	1	Notable
Mar 2-8, 2018	3.45	2	Significant
Mar 11-15, 2018	3.16	2	Significant
Mar 20-22, 2018	1.63	1	Notable
Dec 14-18, 2020	3.21	2	Significant
Jan 30-Feb 3, 2021	4.93	3	Major

**Table 3-5. NOAA's Northeast Snowfall Impact Scale (NESIS).**

Category	NESIS Value	Description
1	1 – 2.499	Notable
2	2.5 – 3.99	Significant
3	4 – 5.99	Major
4	6 – 9.99	Crippling
5	10+	Extreme

B2.b

Probability

Based on the snow frequency of occurrence recorded from past events, it is likely (between 10 and 100% probability in the next year) that snow will occur in Marion. Climate change is predicted to increase moisture within the air, leading to an increase in the intensity and severity of winter storms in places that experience cold winter temperatures. Therefore, future storms that impact Marion may result in heavier snowfall.

B3.a

Impact

Below is a list of possible impacts that could result from severe winter weather:

- **People:** Walking and driving can become extremely dangerous due to icy roads and sidewalks, snow accumulation, and low visibility. Poor driving conditions often require people to shelter in place, and loss of utility function can result in dangerous conditions during extreme cold temperatures associated with snow events. Injury is also possible from slipping on ice, overexertion from shoveling, and frostbite.
- **Emergency Response:** Snow, icy roads, and trees felled by storm conditions can reduce emergency vehicle response time.
- **Infrastructure:** Culverts and roads can be washed out during a heavy flow after a snowmelt. Ice and heavy snowfall can impact and cut off utilities, such as heating, power, and communication services, for several hours or days. Water pipes can burst due to extreme cold temperatures. Utility outages can result from nor'easters.
- **Buildings:** Buildings and roofs can experience structural failure as a result of heavy snow loads.
- **Economy:** Poor driving conditions and closed roads prohibit businesses from opening and people from going to work. Heavy snowfalls result in increased cost to the Town for plowing, snow removal, and treatment of roads. Utility outages and damaged buildings can result in loss of business function.
- **Natural Systems:** Snow and ice accumulation can negatively impact vegetation and natural habitat. Trees and tree limbs can be knocked down by the weight of accumulated snow, by high winds, or both. Beaches, coastlines, and inlets can be reshaped by waves and storm surge associated with nor'easters.
- **Transportation:** Roadways can become extremely dangerous due to icy conditions, snow accumulation, and low visibility. Public transportation is also occasionally shutdown as a result of heavy snowfall.



3.5 WILDFIRE

Overview

Fire events can be broken into two major categories: urban fires and wildfires. Urban fires are the result of buildings and structures catching fire, with the potential for the fire to spread to neighboring properties. These events have a higher chance of spreading more rapidly in areas where residential and commercial buildings are clustered closely together. Urban fires tend to occur more frequently than wildfires, and often result from everyday activities such as cooking, smoking, or appliance malfunction.

A wildfire is an unplanned, unwanted fire burning in a natural area, such as a forest, scrubland, or grassy area. Wildfires and forest fires are naturally occurring events, and part of a normal, healthy ecosystem. Naturally occurring fires help keep forest floors free of excessive debris buildup, thin crowded trees, encourage growth of new vegetation, and recycle nutrients into the soil. Forest fires may occur at any time of year, however typically during hot, dry summer months, or during windy conditions during the spring and fall. Natural ignition most frequently occurs as the result of a lightning strike.

In Massachusetts, wildfires are typically caused by lightning or human activity (i.e. discarded cigarettes, unattended camp fires, downed power lines, etc.). The Bureau of Fire Control estimates that nearly 98% of fires in Massachusetts are started by human carelessness.

B1.c
B2.a

Hazard Location

Wildfire has played a role in shaping the Plymouth County landscape for thousands of years. As a result, there are an abundance of fire-adapted ecosystems in the region. Marion's forests are primarily composed of pitch pine, white pine, mixed conifer, oak, and oak mixed forests, which are considered by the State fire officials to be the forest types at highest risk for wildfires. Figure 3-18 displays aerial imagery illustrating where the most heavily forested areas, and therefore the areas with the highest risk of wildfire, are located in Marion. Within Marion, densely forested areas are located primarily to the west, where the Town borders Rochester and Mattapoisett. There is also a centrally located forested area within the northeastern area of town, bordered by Sippican Harbor to the south and the Weweantic River to the north. Forested areas are lowest along the waterfront, where residential and commercial development is highest.



Figure 3-18. Aerial imagery illustrating heavily forested areas within Marion (imagery acquired 2019).



B1.c
B2.a,c

Previous Occurrences & Extent

Forest fires vary in size, however thanks to modern detection and firefighting equipment methods, fires are typically kept to a reasonably small area. The Bureau of Fire Control estimates that the average fire 100 years ago consumed approximately 34 acres, while today the average fire burns only 1.2 acres. However, large fires have occurred nearby in the past, such as the 1957 fire in Myles Standish State Forest which burned over 18,000 acres, stopping only when it reached the ocean. Fortunately, most fires are quickly identified and suppressed, or extinguish themselves naturally due to wet weather conditions. The majority of wildfires occur in the spring, before “green-up”, or in late summer, following periods of drought.

Smaller fires are more common and are generally addressed quickly by the Marion Fire Department. Between January 2018 and April 2021, the Marion Fire Department responded to 26 wildfire incidents, all of which were less than 1 acre in size. Figure 3-19 below illustrates the number of fires that occurred within each year from 2018 to 2021.

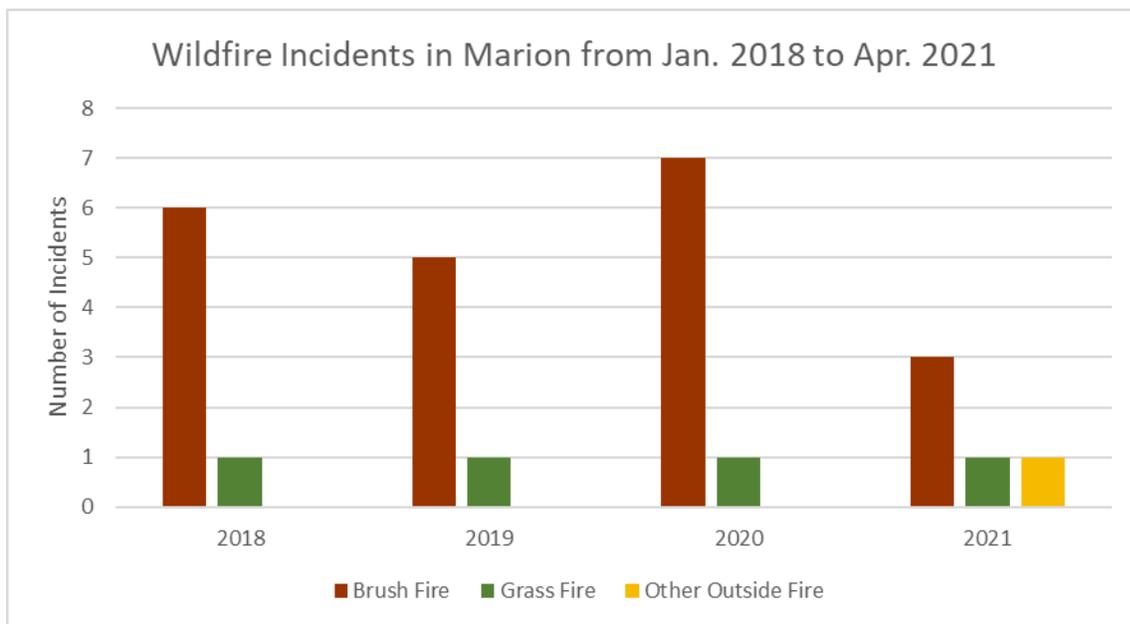


Figure 3-19. Number of wildfire incidents in Marion from January 2018 to April 2021.

Once a fire starts, location of the fire and the type of fuel consumed determines how severe the fire will be. There are four types of wildfires (Table 3-6). These fire types range from ground fires, which tend to travel relatively slowly and are easier to control, to canopy fires, in which flames can jump from tree to tree through the canopy relatively quickly. These are the most difficult to control and extinguish.

**Table 3-6. Wildfire types.**

Type	Location	Typical Fuel
Ground	At or below ground surface	Underground roots, buried leaves or other organic matter
Surface	Ground surface	Surface leaves, grass, low lying vegetation, underbrush
Ladder	Between the surface and canopy	Underbrush, downed logs, vines and small trees
Canopy	In the tree canopy	Tall trees, vines and branches

B2.b

Probability

The 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan identifies the Marion area as susceptible to wildfires due to the availability of fuel, impacts from offshore winds, and increasing development within wooded areas. Therefore, it is possible (1 – 10% probability in the next year) that a wildfire will occur in Marion. Increasing temperatures caused by climate change lead to dryer soil within forests and a higher flammability of vegetation. In addition, snow may melt earlier, meaning wooded areas will experience drier conditions for a longer period of time. All of these factors contribute to a higher risk of wildfire within the Town of Marion in the future as a result of climate change.

B3.a

Impact

Below is a list of possible impacts that could result from wildfire:

- **People:** Death or injury can result if people are trapped by urban or wildfires. Smoke inhalation can cause health issues.
- **Infrastructure:** Utility services may be disrupted; a large fire in the wellfield could negatively impact the wellfield itself, while a large enough fire could adversely impact well water quality. Roads may become impassible and transportation may be disrupted.
- **Buildings:** Buildings and structures can be damaged or destroyed, either by the fire directly, or through ignition from flying sparks and embers.
- **Economy:** Indirect economic losses can result from lost tourism due to a major fire. Disrupted utilities may halt businesses and other economic activities.
- **Natural Systems:** Extensive areas of forests and other natural areas can be burned. Wildfires can strip slopes of vegetation, increasing the potential for runoff and erosion.



3.6 TORNADO

Overview

Tornadoes are a vortex of rapidly rotating air moving along the ground. Tornadoes typically occur during the spring, summer and fall months, usually during the afternoon. Tornadoes may occur in unusually severe thunderstorms, bringing hazards such as very high wind speeds (typically anywhere from 100 to 300 miles per hour) along a localized area, localized heavy rainfall and flooding, frequent lightning, and damaging hail.

Tornadoes may be anywhere from less than 250 feet to over two miles in diameter. Typically, tornadoes dissipate after no more than a couple miles on the ground; however they have been known to stay on the ground for dozens of miles, causing substantial damage along the way. Although not common in the northeast, tornadoes have occurred in every state of the U.S. In Massachusetts, tornadoes occur most frequently in and around Worcester County, however they may occur wherever conditions are right. According to NOAA, Plymouth County is located in an area of very low probability of occurrence, with less than one tornado expected to occur every five years.

B1.c
B2.a

Hazard Location

NOAA’s National Weather Service maintains a database of tornado information in the United States. The data include information on date, start and end location, number of injuries and fatalities, and categories of property loss values from each storm. There have been 184 tornadoes documented in Massachusetts since 1951 (Figure 3-20); of these, only one (1) occurred in Marion and was relatively minor with a scale of F0, and only eight (8) have occurred within all of Plymouth County (Table 3-7).

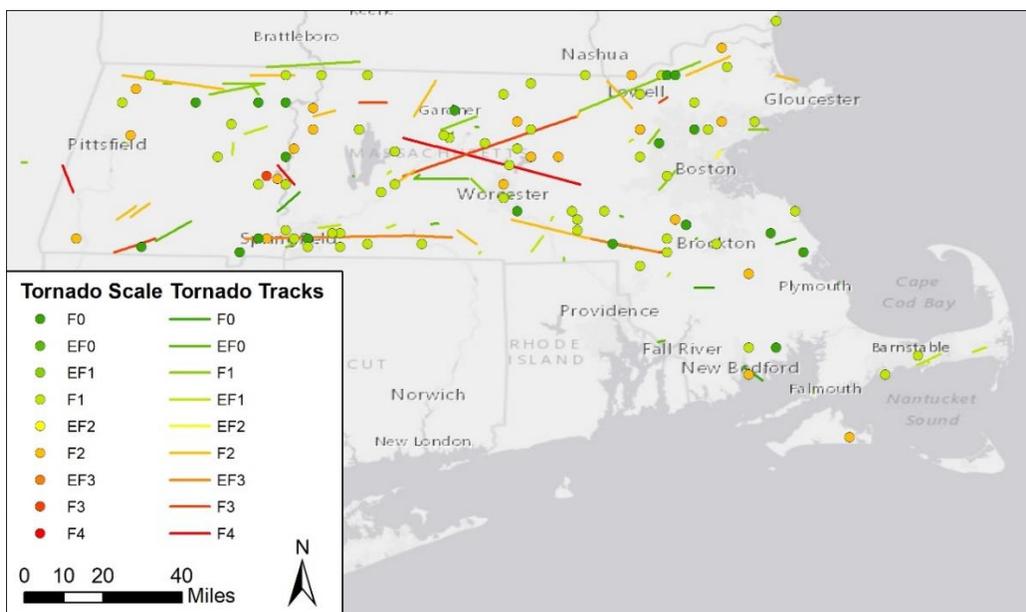


Figure 3-20. Massachusetts tornadoes between 1951 and 2021 (refer to Tables 3-8 and 3-9 for F and EF Scale descriptions).

**Table 3-7. Plymouth County tornadoes between 1951 and 2021.**

Date	Scale	Town	Death/Injury	Length/Width
9/7/1958	F0	Duxbury	1/1	0.1 mi / 33 yds
6/9/1965	F0	Marion	0/0	0.1 mi / 33 yds
11/18/1967	F2	Halifax	0/0	0.1 mi / 17 yds
9/16/1986	F1	Scituate	0/0	0.1 mi / 50 yds
7/10/1989	F1	Brockton	0/1	0.1 mi / 23 yds
7/10/1989	F0	Hanover	0/0	0.1 mi / 23 yds
8/20/1997	F0	Plymouth	0/0	0.1 mi / 5 yds
7/24/2012	EF0	Plymouth	0/0	0.1 mi / 15 yds

B1.c
B2.a,c**Previous Occurrences & Extent**

Although there has only been one tornado in Marion since 1950, as noted above, 6 tornadoes have occurred within Plymouth County during the same time period. Table 3-7 documents the characteristics of the 6 Plymouth County tornadoes; this table documents the F-scale (see description of the Fujita Tornado Damage Scale below) or EF-scale (see description of the Enhanced Fujita Scale below), number of injuries and fatalities, and the size of each tornado, as measured by the length and width of its track. Table 3-8 describes the Fujita Tornado Damage Scale developed by Dr. T. Theodore Fujita for winds, including tornadoes, which relates the degree of damage to the intensity of the wind, as well as the number of injuries and fatalities, and the value of any property loss associated with the event.

Recently, the National Weather Service has switched to using a revised rating system for tornadoes. The Enhanced Fujita Scale (EF-Scale) became operational in February 2007 and is similarly used to assign a tornado's rating based on estimated wind speeds and related damage. The EF-Scale was revised from the original Fujita Scale to better reflect the results of tornado damage surveys to align wind speeds more closely with associated storm damage. The new scale has to do with how most structures are currently designed. A summary of the EF-Scale ratings is provided in Table 3-9.

B2.b

Probability

Although a tornado has not been recorded in Marion since 1965, relatively small scale tornadoes do occur throughout Massachusetts on a regular basis. As such, it is possible (between 1 and 10% probability in the next year) that a tornado will occur in Marion. The effect of climate change on tornados is less clear than in the case of other hazards. Climate change is predicted to increase moisture within the air, an essential ingredient for tornadoes, however, another essential ingredient, wind shear, may decrease. As a result, the exact effect of climate change on tornadoes is still being determined.

**Table 3-8. Fujita tornado damage scale.**

Scale	Wind Estimate (mph)	Typical Damage
F0	< 73	Light damage: some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged
F1	73-112	Moderate damage: peels surface off roads; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable damage: roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground
F3	158-206	Severe damage: roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating damage: well-constructed houses level; structures with weak foundations moved; cars thrown; large missiles generated.
F5	261-318	Incredible damage: strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters; trees debarked; incredible phenomena will occur.

Table 3-9. Enhanced Fujita (EF) scale.

Scale	3 Second Wind Gust (mph)
EF0	65-85
EF1	86-110
EF2	111-135
EF3	136-165
EF4	166-200
EF5	Over 200

B3.a

Impact

Below is a list of possible impacts that could result from tornadoes:

- **People:** Airborne debris can cause injury or death. Hazardous driving conditions can result from blocked roadways. Tornadoes can cause water contamination, which can affect drinking water quality and human health.
- **Infrastructure:** Tornadoes can damage power lines, other utility infrastructure, and roads. Downed power lines can also cause electrical hazards.
- **Buildings:** Tornadoes that pass through highly developed areas can cause significant property damage, blowing off roofs, and in severe cases, leveling houses.
- **Economy:** Tornadoes can destroy farms and agricultural fields.
- **Natural Systems:** High winds associated with a tornado can break branches and snap or uproot trees. Wildlife can be killed or injured.



3.7 DROUGHT

Overview

Drought is an extended period of time where a region experiences a notable reduction in available water supply typically caused by a lack of precipitation. Drought can affect either surface water or groundwater sources. Though most droughts in Massachusetts last only a matter of months, it is possible for drought conditions to extend over a period of years due to reduced rainfall and snowfall accumulations contributing to lower groundwater and surface water levels.

B1.c
B2.a

Hazard Location

The entire Town of Marion is equally vulnerable to drought.

B1.c
B2.a,c

Previous Occurrences & Extent

Significant periods of drought have occurred in Plymouth County, and Marion specifically, in the past. The Massachusetts Department of Conservation and Recreation (DCR) compiles monthly water conditions reports, summarizing the rainfall and its departure from average conditions for each of the 6 regions in the state (Cape Cod and Islands, Central, Connecticut River, Northeast, Southeast, and Western). Data for the Southeast region from a recent eleven (11) month period (DCR, 2021) is summarized in Table 3-10.

Table 3-10. Summary of the Southeast Region rainfall from DCR Hydrologic Conditions Reports (2020).

Month-Year	Total Rainfall (inches)	Departure from normal (inches)
Jan 2020	1.63	-2.33
Feb 2020	3.10	-0.52
Mar 2020	4.03	-0.59
Apr 2020	7.14	2.84
May 2020	2.74	-0.92
Jun 2020	3.96	0.03
Jul 2020	1.67	-1.84
Aug 2020	2.68	-1.23
Sep 2020	1.26	-2.59
Oct 2020	5.39	0.87
Nov 2020	4.74	0.24
Total	38.34	-6.04



Based on the total rainfall from the eleven (11) months in Table 3-10, which is 6.04 inches below the average, Marion is currently experiencing a drought and droughts are likely to occur again in the future. In fact, during 2020, the entire state of Massachusetts, as well as Marion, experienced more severe drought conditions than in the past.

There are five levels of drought that have been developed to characterize the severity of the event:

- 15) Normal
- 16) Mild Drought (formerly Advisory prior to 2019)
- 17) Significant Drought (formerly Watch prior to 2019)
- 18) Critical Drought (formerly Warning prior to 2019)
- 19) Emergency Drought

These levels are based on the regional conditions and are designed to provide information about the current status of water resources. A Mild Drought calls for a heightened level of vigilance and increased data collection as conditions begin to deviate from normal. During a Significant Drought, increased assessment would continue, in addition to proactive public education about water conservation. Water restrictions might become necessary during the watch or warning stage, depending on the capacity and condition of each water supply system. A Critical Drought designation is issued during a severe situation and the possibility of a drought emergency may be issued. Finally, a Drought Emergency often requires mandatory water restrictions and/or the use of emergency water supplies (EOEEA, 2019). These categories and their associated characteristics are summarized in Table 3-11.

Based on the categories outlined in Table 3-11, the Massachusetts Executive Office of Energy and Environmental Affairs has compiled information about past drought declarations at a regional level. Drought declarations from 2015 to 2021 for the Southeast Region are detailed in Table 3-12. Most recently, there was a drought from March 1, 2021 to June 30, 2021 with a severity level of Mild (Table 3-12).



Table 3-11. Drought indices from the Massachusetts Drought Management Plan (EOEEA 2019).

Drought Level	Precipitation	Groundwater	Streamflow	Reservoir
Normal (0)	1 month below normal	2 consecutive months below normal	1 month below normal	Reservoir levels at or near normal for time of year
Mild (1) <i>(formerly Advisory)</i>	2 month cumulative total below 65% of normal	3 consecutive months below normal	At least 2 out of 3 consecutive months below normal	Small index reservoirs below normal
Significant (2) <i>(formerly Watch)</i>	1 of the following: 3 month cum. <65%; or 6 month cum. <70%; or 12 month cum. <70%	4-5 consecutive months below normal	At least 4 out of 5 consecutive months below normal	Medium index reservoirs below normal
Critical (3) <i>(formerly Warning)</i>	1 of the following: 3 month cum. <65% and 6 month cum. <65%; or 6 month cum. <65% and 12 month cum. <65%; or 3 month cum. <65% and 12 month cum. <65%	6-7 consecutive months below normal	At least 6 out of 7 consecutive months below normal	Large index reservoirs below normal
Emergency (4)	Same Warning and previous month was Warning or Emergency	>8 months below normal	>7 months below normal	Continuation of previous month's conditions



Table 3-12. Drought dates and levels from Massachusetts DCR for the Southeast Region between 2015 and 2019.

Year	Begin Date	End Date	Southeast Status
2016	7/1/2016	7/31/2016	Advisory
2016	8/1/2016	8/31/2016	Watch
2016-2017	9/1/2016	2/28/2017	Warning
2017	3/1/2017	3/31/2017	Watch
2017	4/1/2017	5/31/2017	Advisory
2020	7/1/2020	8/31/2020	Significant
2020	9/1/2020	9/30/2020	Critical
2020	10/1/2020	10/31/2020	Significant
2020	11/1/2020	11/30/2020	Mild
2021	3/1/2021	6/30/2021	Mild

B2.b

Probability

Based on the data summarized above about past drought conditions in Marion, the probability that a drought will occur in Marion in the future is likely (between 10% and 100% probability in the next year). Although climate change is predicted to increase precipitation in the Northeast, such as through snowfall, more frequent and severe droughts are still predicted to occur as a result of increased temperature and evaporation.

B3.a

Impact

Below is a list of possible impacts that could result from drought:

- **People:** Drought conditions can increase conflicts between water users. Water conservation actions may impact users' activities. Reduction in drinking water supply. Health related issues may arise due to dust inhalation.
- **Infrastructure:** Droughts can result in lower water levels in reservoirs. Drought can cause well water quality, and potentially quantity, to worsen. Drought can cause sanitary issues in the water distribution system, as well as increase water demand. Drought can also result in private residential wells to dry up, increasing requests to be connected to the municipal water supply system.
- **Economy:** Farmers experience financial losses if a drought destroys their crops. Finances may need to be diverted to provide additional irrigation or drill new wells. Businesses that depend on farming may lose business. Food costs may increase.
- **Natural Systems:** Loss of fish habitat such as streams, rivers, and ponds dry up. Lack of food and drinking water for wildlife. Wildlife may be forced to migrate to find adequate resources. Wildfires may become more common.



3.8 EXTREME TEMPERATURE

Overview

There is no defined cut-off for what defines extreme temperatures. Instead, extreme temperatures are considered relative to the usual weather in a region based on long-term climatic averages. According to the Massachusetts State Hazard Mitigation and Climate Adaptation Plan (2018), extreme heat for this region is usually defined as a period of three or more consecutive days with temperatures above 90°F. However, more generally it can be thought of as a prolonged period of excessively hot weather, which is often accompanied by high humidity. Similarly, extreme cold is also relative to normal climatic lows in the region. Temperatures that drop well below normal, especially when accompanied by high winds can produce dangerous wind-chill factors. The wind-chill is the perceived decrease in air temperature felt by the body on exposed skin due to the flow of air.

Since extreme temperatures are defined relative to normal conditions, it is important to know the average temperatures for the region for a particular season. The average low winter temperature (January) for Massachusetts is 22°F, while the average high summer temperature (July) is 81°F.

B1.c
B2.a

Hazard Location

The entire Town of Marion is equally vulnerable to extreme temperature hazards.

B1.c
B2.a,c

Previous Occurrences & Extent

NOAA's National Centers for Environmental Information houses a Storm Events Database (NOAA, 2021), which includes accounts of Cold/Wind Chill, Extreme Cold/Wind Chill, Heat, and Excessive Heat. Querying the data for these types of events for the past 10 years returned four occurrences of extreme temperature:

- 1) July 22, 2011: High temperatures and high humidity levels brought the heat index above 105 for several hours. Heat index values at the Plymouth Municipal Airport ranged between 105 and 108.
- 2) February 16, 2015: A winter storm brought significant snowfall, as well as frigid temperatures. The Automated Surface Observation Station at the Plymouth Municipal Airport recorded wind chill values as low as -28°F.
- 3) February 14, 2016: An arctic high-pressure system brought strong northwest winds and extremely cold wind chills to southern New England. Wind chills as low as -36°F were reported in Plymouth.
- 4) July 3, 2018: An area of high pressure brought high temperatures and humidity to southern New England. The Automated Surface Observation Station at the Plymouth Municipal Airport reported a heat index of 107.

NOAA's National Weather Service (NWS) has developed a Heat Index (NWS, 2016a), which measures how hot it feels when relative humidity is considered along with the actual air



temperature (Figure 3-21). Relative humidity is the amount of atmospheric moisture present relative to the amount that would be present if the air were fully saturated. For example, a 90°F day with 80% humidity would have a heat index of 113°F, and there is a dangerous likelihood of heat disorders with prolonged exposure or strenuous activity. The NWS issues alerts when the Heat Index is expected to exceed 105-110°F (depending on local climate) for at least 2 consecutive days. Wind chill temperature indicates how cold it feels outside, based on the rate of heat loss from exposed skin caused by the combination of wind and cold. Because wind draws heat from the body, reducing skin temperature, as well as internal body temperature, the wind actually makes it feel colder than the absolute temperature would indicate. Frostbite is the result of body tissue (i.e. skin) freezing. The most vulnerable parts of the body are the fingers, toes, ears and nose. The National Weather Service’s Wind Chill Temperature Index (NWS, 2016b) provides a useful method for calculating the dangers from extreme cold temperatures and winter winds, and the amount of time exposed skin will take to get frostbite (Figure 3-22). According to the chart in Figure 3-22, if it is 0°F with a 15 mph, the wind chill temperature would be -19°F and it would take exposed skin 30 minutes to get frostbite. The index calculates wind speed at an average height of 5 feet above the ground’s surface, the typical height of a person’s face, from the measured wind data collected from standard 33-foot high anemometers.

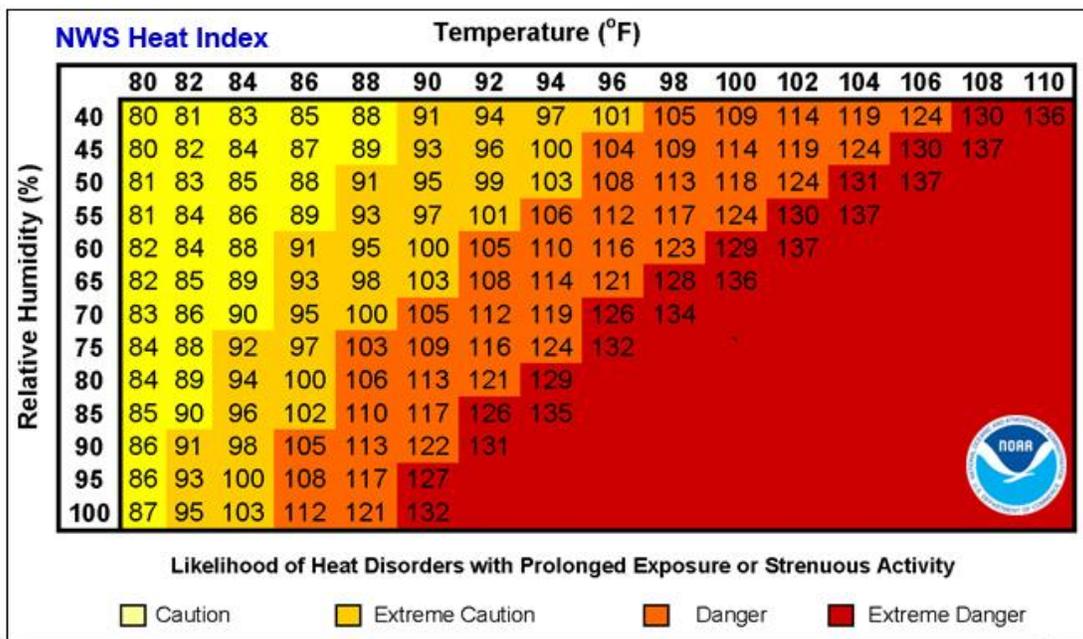


Figure 3-21. NWS’s Heat Index.

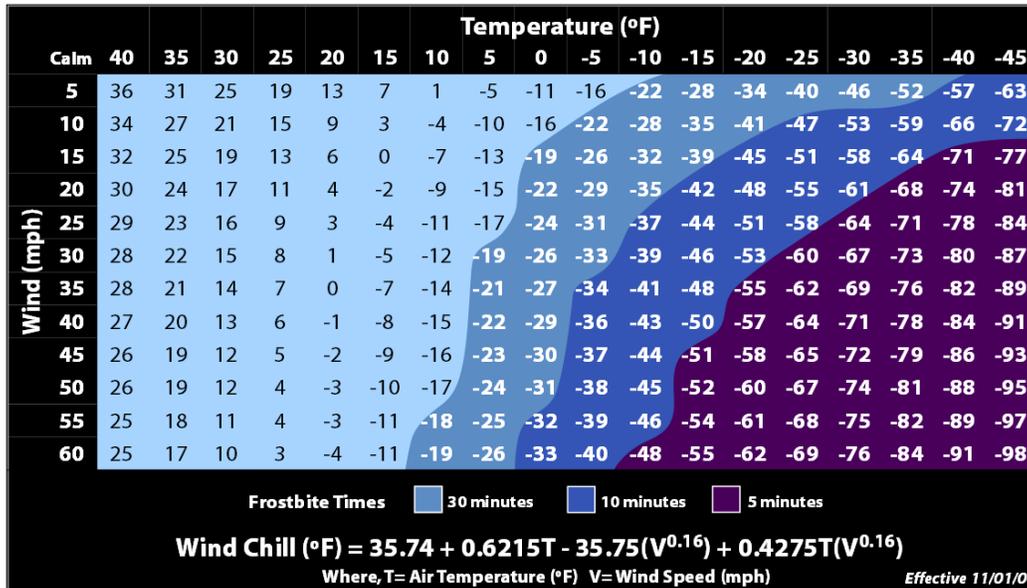


Figure 3-22. NOAA’s Wind Chill Chart.

B2.b

Probability

Based on the data summarized above about past extreme temperature conditions in Plymouth County, the probability that extreme temperatures will occur in Marion in the future is likely (between 10% and 100% probability in the next year). Overall, Massachusetts has been experiencing an increase in temperature as a result of climate change, meaning extreme summer temperatures are becoming more intense, while winter temperatures are becoming less severe.

B3.a

Impact

Below is a list of possible impacts that could result from extreme hot or cold temperatures:

- **People:** Excessive heat and severe cold poses serious health risks, including death.
- **Emergency Response:** Stress will be placed on the cooling systems of emergency vehicles in extreme heat.
- **Infrastructure:** Highways and roads can be damaged by excessive heat as asphalt softens. Both extreme heat and extreme cold can put significant strain on power utilities, as users’ energy needs increase to run air conditioners or heaters. Extreme heat can cause well water quality, and potentially quantity, to worsen. Extreme heat can cause sanitary issues in the water distribution system as the water in tanks and the groundwater heat up, as well as increase water demand.
- **Economy:** Transported refrigerated goods experience a higher degree of spoilage during excessive heat conditions. Agriculture and livestock can be adversely impacted by extreme heat.
- **Natural Systems:** Extreme heat can reduce water levels in natural ponds and reservoirs, as well as increase surface water temperatures to dangerous levels. Both can have an adverse impact on fish and wildlife.



3.9 EARTHQUAKE

Overview

An earthquake is a sudden, intense shaking of the Earth's surface caused by the movement of large portions of the Earth's crust. These movements tend to occur along faults, which are fractures in the Earth's crust along which two plates of crust can move against each other. Earthquakes can occur suddenly at any time, with virtually no warning.

The depth at which an earthquake occurs is called a focal depth. A focal depth of less than 43.5 miles is considered to be a shallow earthquake; the majority of earthquakes fall into this category. Earthquakes originating at focal depths of 43.5 to 186 miles are considered intermediate. However, focal depths of earthquakes can reach depths of more than 435 miles. The epicenter of an earthquake is the location on the Earth's surface directly above the focal point of an earthquake.

New England is located in the middle of the North American tectonic plate; the western edge of this plate is along the west coast where it is pushing up against the Pacific Ocean Plate, and the eastern edge is in the middle of the Atlantic Ocean where it is spreading away from the European and African plates. Because New England is located a considerable distance from either edge of the North American plate, most earthquakes that occur here are due to the cracking of crustal rocks due to compression as the plate is slowly squeezed by the global movement of other plates.

B1.c
B2.a

Hazard Location

Due to the configuration of the tectonic plates, the greatest threat from earthquakes in the United States occurs along the fault lines on the west coast. While earthquakes do occur in the eastern United States, they tend to be less frequent and less intense. Figure 3-23 shows earthquakes within 100 miles of the Town of Marion since the 1970s as reported by USGS; this includes 45 earthquakes ranging in magnitude from 2.5 to 3.7.

B1.c
B2.a,c

Previous Occurrences & Extent

Although there are no recorded earthquakes within Marion itself, there have been 45 occurrences of earthquakes since 1970 within 100 miles of Marion. The epicenter locations of these earthquakes are shown in Figure 3-23; the range in magnitude of each event is indicated by color. The Richter magnitude of these 45 events ranged from 2.5 to 3.7, which as described below, can often be felt, but only cause minor damage.

The Richter Scale (Table 3-13) is frequently used to measure the magnitude of earthquakes. It measures the maximum recorded amplitude of a seismic wave, which quantifies the ground motion and the energy released at the source of an earthquake.

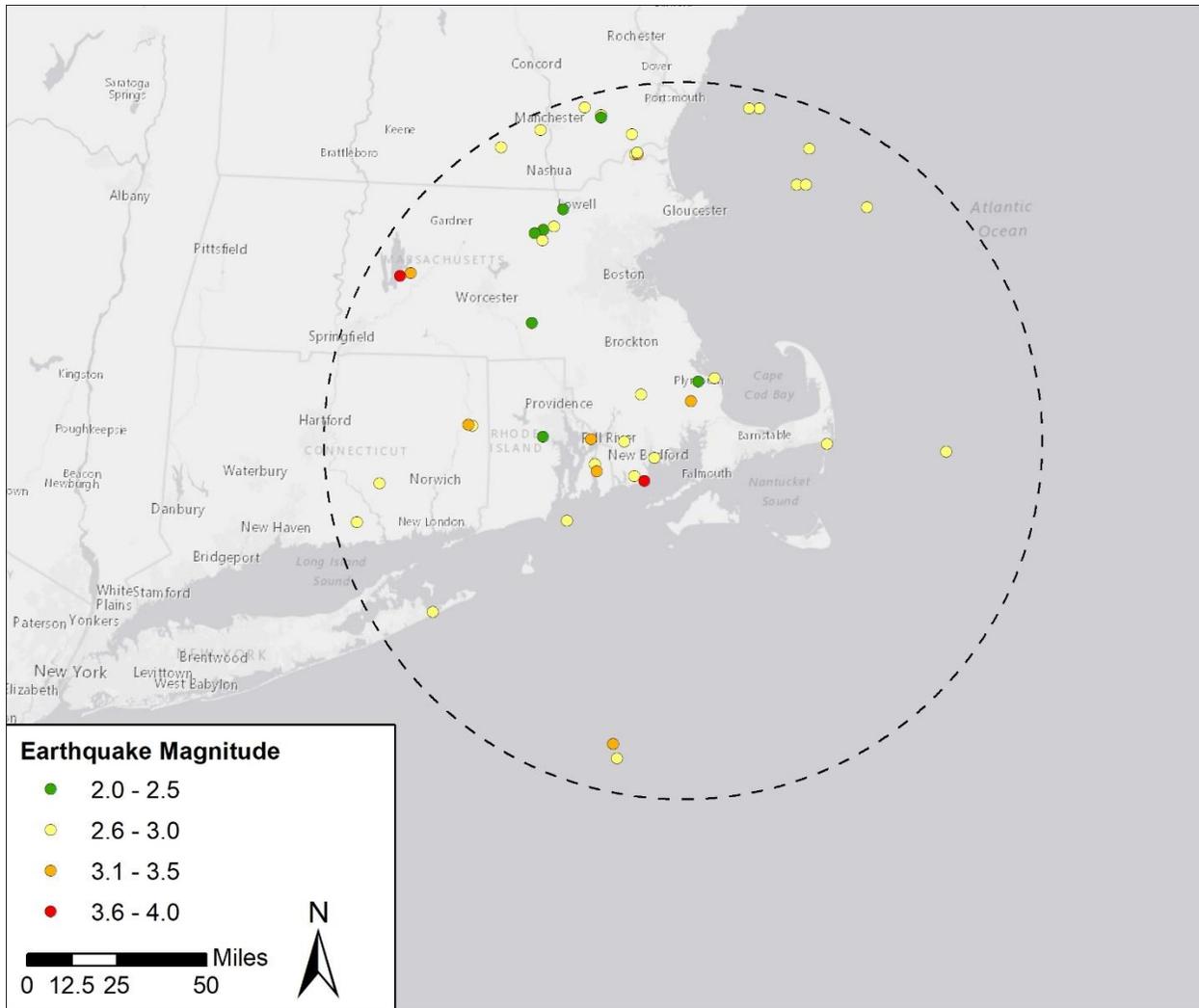


Figure 3-23. Earthquakes that have occurred within 100 miles of Marion since 1970.

Table 3-13. Richter scale.

Richter Magnitude	Earthquake Effects
2.5 or less	Not felt or felt mildly near the epicenter; can be recorded by seismographs
2.5 to 5.4	Often felt, but only causes minor damage
5.5 to 6.0	Slight damage to buildings and other structures
6.1 to 6.9	May cause a lot of damage in very populated areas
7.0 to 7.9	Major earthquake; serious damage
8.0 or greater	Great earthquake; can totally destroy communities near the epicenter



B2.b

Probability

Given that earthquakes have occurred in Massachusetts and in Plymouth County specifically in recent years, it is possible (1-10% probability in the next year) that an earthquake could occur in Marion. Any possible effects of climate change on earthquakes are still being determined.

B3.a

Impact

Below is a list of possible impacts that could result from an earthquake:

- **People:** Damage caused to buildings and other structures during an earthquake can lead to injury or loss of life.
- **Emergency Response:** Downed trees and power lines, as well as damaged roads caused by an earthquake can impede emergency vehicles.
- **Infrastructure:** Earthquakes can cause utility poles to fall and live wires to become exposed or to start fires. The shaking caused by an earthquake can also rupture gas lines causing the release of flammable substances and can break or separate sewer collection and water distribution pipes, resulting in loss of service.
- **Economy:** Earthquakes can damage foundations and buildings; most property damage is caused by the failure and collapse of structures during ground shaking. Concrete and masonry structures are brittle and thus more susceptible to damage and collapse.
- **Natural Systems:** Earthquakes can cause landslides and slope failure; this could have hazardous impacts on areas with steep slopes, such as coastal banks.



3.10 INVASIVE SPECIES

Overview

Invasive species are defined as non-native species that cause or are likely to cause harm to ecosystems, economies, and/or public health. Although invasive species can be any type of organism, including marine organisms, insects, and birds, the 2018 Massachusetts State Hazard and Climate Adaptation Plan focuses specifically on invasive terrestrial plants, as these are the most studied and managed type of invasive species. However, other categories of invasive species, such as insects and fungi, can cause significant damage to native flora, increasingly the likelihood for downed trees and limbs during many other natural hazard events.

B1.c
B2.a

Hazard Location

Although the entire Town of Marion is potentially vulnerable to the introduction and establishment of invasive species, they pose the biggest threat to native or minimally managed ecosystems. In addition, the ability of invasive species to travel far distances (either via natural means or accidental human interference) allows these species to propagate rapidly over large geographic areas.

B1.c
B2.a,c

Previous Occurrences & Extent

The Massachusetts Invasive Plant Advisory Group (MIPAG) recognizes 69 plant species as “Invasive”, “Likely Invasive”, or “Potentially Invasive.” In addition, the 2018 State Plan also lists a number of other invasive species, including gypsy moths (*Lymantria dispar*), the Dutch elm disease fungus (*Ophiostoma sp.*), European green crabs (*Carcinus maenas*), and Asian shore crab (*Hemigrapsis sanguineus*).

Similar to most coastal Massachusetts towns, Marion struggles to control common reed (*Phragmites australis*) stands, such those as around Sprague Cove, where a stormwater remediation project behind Silvershell Beach is occurring. Another invasive plant species affecting the Town is oriental bittersweet (*Celastrus orbiculatus*), which the Town has been attempting to control with the help of an outside firm. Stormwater infrastructure in the town has been negatively impacted by Japanese knotweed (*Fallopia japonica*), which can cause infrastructure to stop functioning properly. This species also affects Planting Island Causeway Beach, to the extent that an outside company was hired to remove the species.

B2.b

Probability

There are known invasive species within the Town of Marion, so it is 100% likely that invasive species occur in Town. However, the likelihood that a significant negative impact would occur due to the presence of these species is possible, but not as high. In the future, the Town of Marion may become more susceptible to additional invasive species as climate change facilitates the spread and establishment of invasive species.



B3.a

Impact

Below is a list of possible impacts that could result from invasive species:

- **People:** Those who rely on natural systems for their livelihood or well-being are more likely to experience negative repercussions from the expansion of invasive species.
- **Economy:** The agricultural sector is vulnerable to increased invasive species associated with increased temperatures. More pest pressure from insects, diseases, and weeds may harm crops and cause farms to increase pesticide use.
- **Natural Systems:** Biodiversity and ecosystem health may be impacted by invasive species. Aquatic invasive species pose a particular threat to water bodies. Impacts of aquatic invasive species include impairment of recreational uses, such as swimming, boating and fishing, degradation of water quality and wildlife habitat, declines in finfish and shellfish habitat, and diminished property values.



3.11 OTHER SEVERE WEATHER (HEAVY PRECIPITATION, HIGH WIND, THUNDER/LIGHTNING)

Overview

Heavy Precipitation: The Massachusetts State Hazard Mitigation and Climate Adaptation Plan notes that the Fourth National Climate Assessment published by the U.S. Global Change Research Program shows that heavy precipitation events have increased in both intensity and frequency over the past century across much of the country, with the largest increases occurring in the Northeast. Annual precipitation in Massachusetts is projected to increase by as much as 7.3 inches by the end of this century. Furthermore, increased precipitation will likely occur during more intense periods of precipitation coupled with more frequent episodic drought, causing more stormwater runoff, and higher surface water levels.

High Wind: Major wind events in coastal Massachusetts are hurricanes and nor'easters. Tornadoes are extremely rare, although they do occur. Water spouts have been seen in Cape Cod Bay, in the Cape Cod Canal, and in Buzzards Bay. Thunderstorms, especially in the summer months, do occur and can bring localized damage due to wind, especially to summer cottages of poorer construction and old or rotted tree limbs.

Thunder and Lightning: A thunderstorm is a storm that produces lightning and thunder and is usually accompanied by gusty winds, heavy rain, and sometimes hail. The National Weather Service defines a severe thunderstorm as one that produces a tornado, winds of at least 58 mph (50 knots or ~93 km/h), and/or hail at least 1 inch in diameter. Structural wind damage may imply the occurrence of a severe thunderstorm. A thunderstorm wind equal to or greater than 40 mph (35 knots or ~64 km/h) and/or hail of at least ½ inch is defined as approaching severe. Lightning is one of the most dangerous aspects of a thunderstorm, and it can strike up to 10 miles away from the main thunderstorm location; however, because lightning occurs during every thunderstorm, its presence does not indicate a “severe” thunderstorm.

Three basic ingredients required for a thunderstorm to form are moisture, rising unstable air (air that keeps rising when given a nudge), and a lifting mechanism. The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise—by hills or mountains, or areas where warm/cold or wet/dry air bump together—it will continue to rise as long as it weighs less and stays warmer than the air around it. As the air rises, it transfers heat from the surface of the earth to the upper levels of the atmosphere (the process of convection). The water vapor it contains begins to cool, releasing the heat; and it condenses into a cloud. The cloud eventually grows upward into areas where the temperature is below freezing. Some of the water vapor turns to ice, and some of it turns into water droplets. Both have electrical charges. Ice particles usually have positive charges, and rain droplets usually have negative charges. When the charges build up enough, they are discharged in a bolt of lightning, which causes the sound waves we hear as thunder.



B1.c
B2.a

Hazard Location

Heavy Precipitation: Heavy precipitation can affect all portions of the Town of Marion. Based on recent studies, New England has already experienced an increase in heavy precipitation events in the last 50 years. This is due to increased sea surface temperatures in the Atlantic Ocean that cause air moving north over the water to hold more moisture. As a result, when these warm fronts meet cold air systems from the north, an even greater amount of precipitation than normal can be anticipated to fall on Massachusetts. As shown in Figure 3-24, the percent change in the precipitation amount occurring as very heavy precipitation has increased by 38% in the northeast. This data compares a reference period from 1901-1960 with a more recent period: 1986-2016. The threshold used to define a heavy precipitation event is the top 1 percent of all days with precipitation.

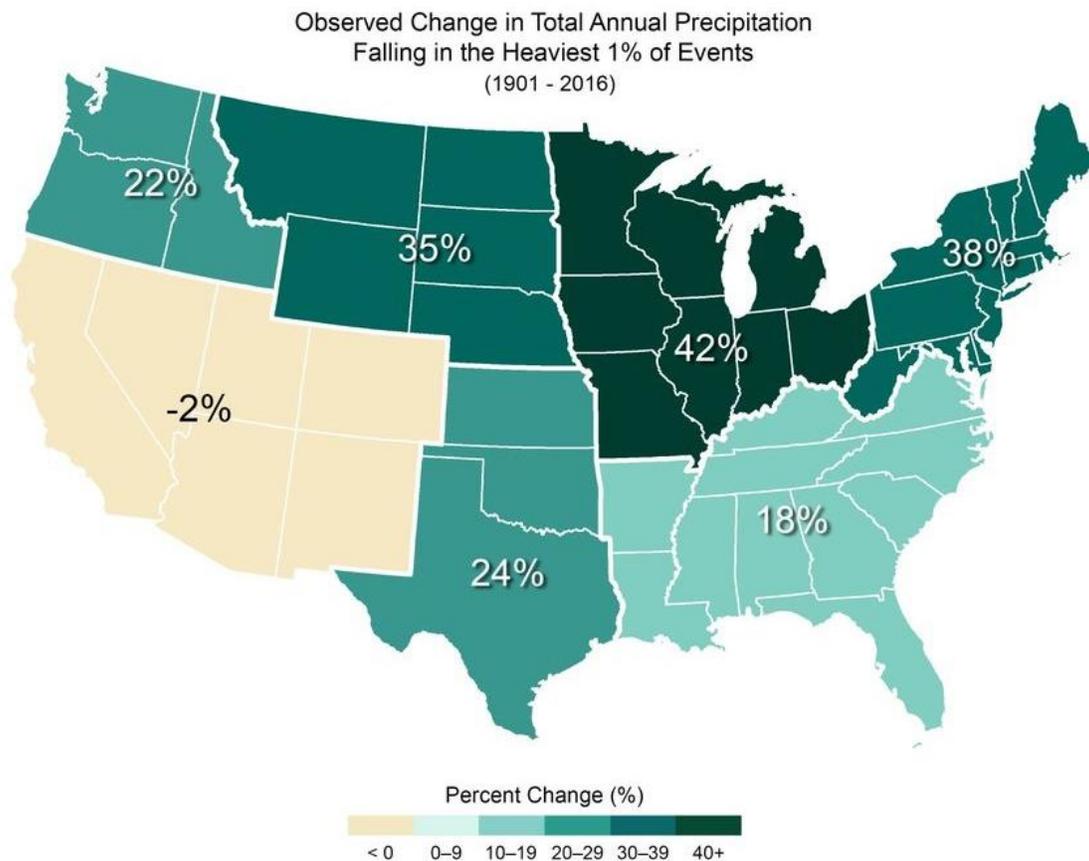


Figure 3-24. Observed changes in heavy precipitation (GlobalChange.gov, 2020).

High Wind: In their effort to research potential sites for wind energy facilities, the Executive Office of Energy and Environmental Affairs (EOEEA) put considerable effort into measuring wind velocities in Massachusetts. These efforts produced four sets of data, representing mean wind speed at different elevations above the land’s surface: 30, 50, 70 and 100 meters. The mean wind speed, in miles per hour, at 30 meters above the land’s surface is shown for Marion in Figure 3-25.

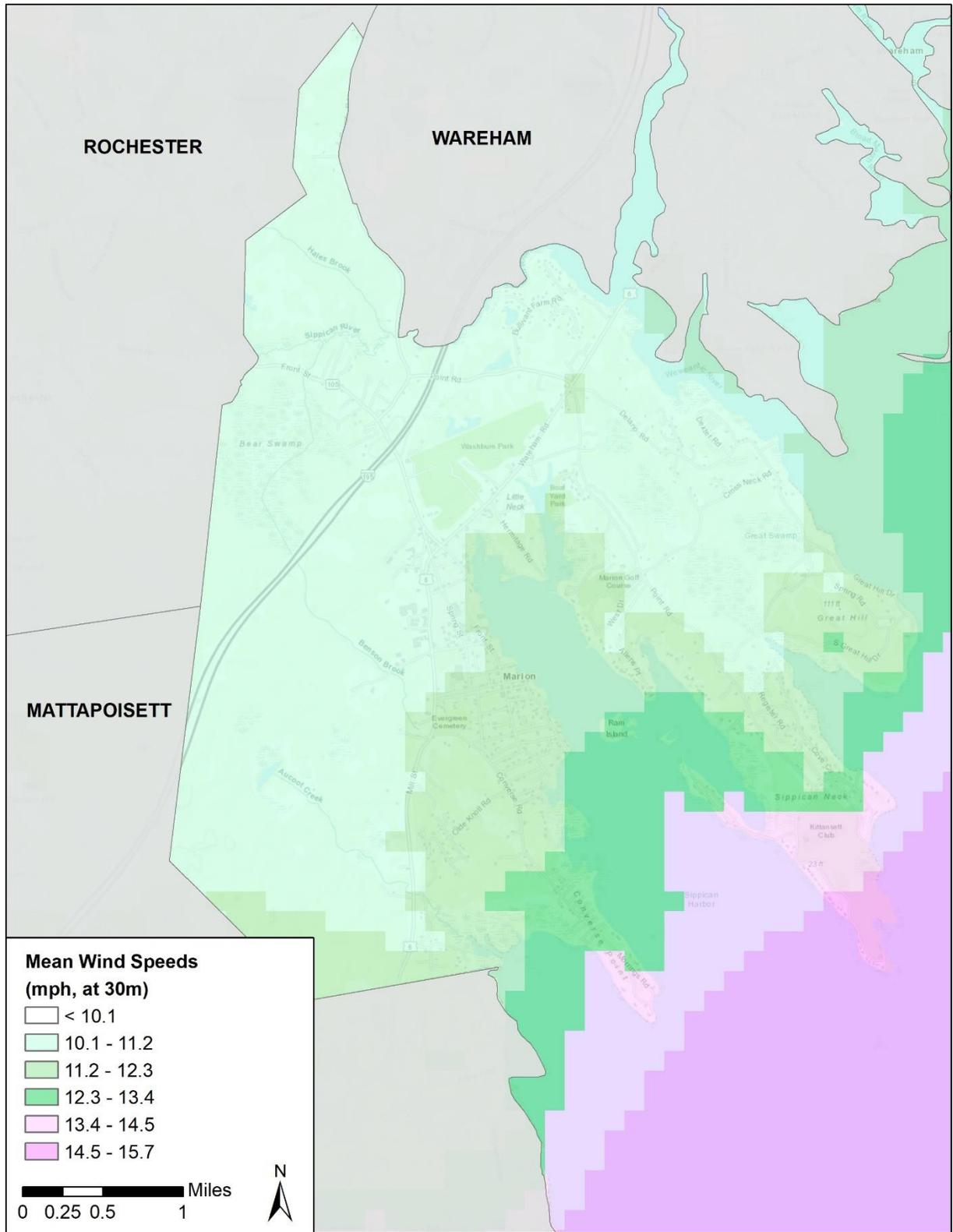


Figure 3-25. Mean wind speed (mph) at 30 meters above the surface.



Thunder and Lightning: The entire Town of Marion is at risk from thunderstorms. NOAA has compiled data about the annual number of thunderstorms across the United States. Figure 3-26 shows the annual number of thunderstorms in the northeastern United States. The arrow shows that all of eastern Massachusetts, including Marion, falls in the darker blue area, which receives, on average, 10-20 thunderstorms per year.



Figure 3-26. Annual number of thunderstorms.

B1.c
B2.a,c

Previous Occurrences & Extent

Heavy Precipitation: Because heavy rain is often associated with other major weather events (e.g., tropical storms, nor'easters, etc.) the list of heavy rain events from the NOAA NCDC Storm Events (NOAA, 2021) does not have many entries from the past 10 years:

- 1) July 4, 2014: Torrential rain produced significant flash flooding in southeast Massachusetts where storm totals of 4 to 8 inches were reported.
- 2) September 18, 2018: Heavy downpours and damaging thunderstorms occurred throughout Massachusetts. Storm total rainfall amounts reached 2 to 5 inches across Plymouth County. Numerous roads were flooded and impassable.
- 3) July 12, 2019: A warm front moving northward across southern New England brought heavy rain and thunderstorms, causing significant flooding. Plymouth airport recorded 5.3 inches of rain in just 6 hours.
- 4) June 28, 2020: A cold front met with a high humidity conditions to produce a severe thunderstorm and flashfloods throughout Massachusetts and within Plymouth County.

Given the tendency for heavy precipitation to occur during other weather events, it is likely that the frequency of these events is underestimated by this database.

Although not a hurricane when it passed through Massachusetts, the remnants of Hurricane Ida resulted in 7.5 inches of rain in Marion on September 1, 2021. The flash flooding from the heavy precipitation resulted in a number of impassible roads, including Route 6 by Lockheed, Spring Street and Front Street; a few vehicles needed to be towed after getting stuck in flooded areas. The roadway flooding also necessitated canceling school. Flooding also occurred in the basements of a few buildings, including the Town House, the library, and several private residences. Finally, Lagoon #1 at the Wastewater Treatment Plant filled with a significant amount of water; the lagoon had been dry in preparation for lining, but the flooding required pumping out the lagoon before construction could proceed, which delayed the project.



High Wind: A summary of the high wind events from the NOAA NCDC Storm Events database (NOAA, 2021) from the last five years shows that high wind events are relatively common in Marion (more than once per year):

- 1) February 24-25, 2016: A low pressure system brought showers, thunderstorms, and strong winds causing downed trees and wires on Spring Street and Ryder Lane in Marion.
- 2) September 5, 2016: The remnants of Hurricane Hermine, classified as a tropical system by the time it reached New England, resulted in moderate rainfall and high winds, although they were generally below tropical storm force. Because trees were still fully leaved and we had higher wind gusts, there was some wind damage.
- 3) October 9, 2016: The remnants of Hurricane Matthew merged with a cold front off the coast and moved past Cape Cod during the night of October 9th-10th. This caused wind damage in parts of Eastern Massachusetts.
- 4) December 18, 2016: A low pressure system brought strong gusty southwest winds to Southern New England, causing scattered tree and wire damage in Massachusetts.
- 5) March 14, 2017: A major winter storm moved up the east coast, producing significant snow amounts and high winds. It is estimated that winds gusted to 58 mph in southern Plymouth County during the storm.
- 6) October 29-30, 2017: The remnants of Tropical Storm Phillipe generated strong to damaging winds in eastern Massachusetts. In Marion, trees and/or wires were downed on Wareham Road, Pleasant Street and Point Road.
- 7) December 25, 2017: A fast-moving low-pressure system brought a several inches of snow to much of Southern New England, along with damaging west to northwest winds.
- 8) March 2-3, 2018: A storm brought heavy rain and strong winds to central and eastern Massachusetts. In Marion, many trees were downed, causing damage to private homes.
- 9) October 15-16, 2018: A cold front brought wind gusts of 40 to 60 mph to southeastern Massachusetts.
- 10) November 3, 2018: A low pressure brought heavy rain, severe thunderstorms, and strong to damaging westerly winds. Winds in the area were gusting to 50 to 60 mph.
- 11) December 21, 2018: A storm brought strong to damaging south winds and one to four inches of rain to Eastern Massachusetts.
- 12) January 24, 2019: A low pressure system brought high south winds and heavy rain to the area. Wind gusts as high as 64 mph were reported in surrounding towns.
- 13) January 30, 2019: A low pressure system brought a mix of snow and rain, as well as damaging west winds.
- 14) February 25, 2019: A coastal storm swept up Massachusetts bringing damaging west-northwest winds. Nearby towns reported wind speeds of up to 67 mph.
- 15) October 17, 2019: A powerful coastal storm developed in New Jersey before moving northeast across New England and into Massachusetts bringing heavy rain and damaging winds.
- 16) November 1, 2019: A strong cold front accompanied by showers and isolated thunderstorms brought damaging winds to the area.



- 17) January 12, 2020: A high pressure system traveled from the Midwest delivering southwest winds leading to minor damage. Wind speed was recorded as 58 mph at the Plymouth Airport.
- 18) February 7, 2020: Strong winds across Rhode Island and Massachusetts resulting in downed trees and wires on Point Road and Wareham Road in Marion.
- 19) April 13, 2020: A powerful pressure system brought strong southerly winds to Massachusetts.
- 20) September 30, 2020: A cold front moving west to east brought heavy rain and strong winds to Massachusetts. The Plymouth Airport recorded wind gusts of 46 mph.
- 21) November 30, 2020: A strong, low-pressure system generated wind gusts of 50 to 60 mph.
- 22) February 1, 2021: A storm resulted in strong winds from 45 to 60 mph, as well as minor coastal flooding, throughout coastal Massachusetts.

The National Weather Service issues a variety of warnings related to wind hazards. They are:

- High Wind Watch: Issued when the following conditions are possible – sustained winds of 40 mph or higher for one hour or more, or wind gusts of 58 mph for one hour or more.
- High Wind Warning: Issued when the following conditions are occurring or imminent – sustained winds of 40 mph or higher for one hour or more, or wind gusts of 58 mph for one hour or more.
- Hurricane Watch: Issued when a tropical cyclone containing winds of 74 mph or higher poses a possible threat, generally within 48 hours.
- Hurricane Warning: Issued when sustained winds of 74 mph or higher associated with a tropical cyclone are expected in 36 hours or less.
- Wind Advisory: Issued when the following conditions are expected for 3 hours or longer – sustained winds of 31 to 39 mph and/or wind gusts of 46 to 57 mph.
- Extreme Wind Warning: Issued for surface winds of 115 mph or greater associated with non-convective, downslope, derecho (not associated with tornado), or sustained hurricane winds are expected to occur within one hour.
- Small Craft Advisory: Issued when one or all of the following conditions are expected to occur within 36 hours – sustained winds of 18 to 33 knots or frequent gusts (with a duration of 2 hours or more) between 18 to 33 knots or waves of 4 feet or higher.
- Gale Warning: Issued when one or both of the following conditions are expected to occur within 36 hours and is not directly associated with a tropical cyclone – sustained winds of 34 to 47 knots or frequent gusts (with a duration of 2 hours or more) between 34 to 47 knots.
- Storm Warning: Issued when one or both of the following conditions are expected to occur within 36 hours and is not directly associated with a tropical cyclone – sustained winds of 48 to 63 knots or frequent gusts (with a duration of 2 hours or more) between 48 to 63 knots.
- Hurricane Force Wind Warning: Issued when one or both of the following conditions are expected to occur within 36 hours and is not directly associated with a tropical cyclone –



sustained winds of 64 knots or greater or frequent gusts (with a duration of 2 hours or more) between 64 knots or greater.



Figure 3-27. Downed trees commonly occur in Marion as a result of severe weather such as high winds (photos provided by online public survey participants).

Thunder and Lightning: The NOAA NCDC Storm Events database lists 25 lightning and/or thunderstorm wind events were reported for Plymouth County within the last 5 years (NOAA, 2021). Only one of the recorded events was listed with Marion as the specific location, which occurred on April 28, 2017. During this event, thunderstorms and rain showers occurred across coastal Massachusetts. In Marion, a house on Main Street was struck by lightning resulting in smoke and damage to the electrical system.

There are a variety of types of thunderstorms:

- Single-cell thunderstorms, which are small, brief, weak storms that can develop and then dissipate within an hour. They are typically produced by heating on a summer afternoon. Single-cell storms produce brief, heavy rain and lightning.
- Multi-cell storms form along the leading edge of rain-cooled air. Although individual cells that comprise the multi-cell storm can only last 30-60 minutes, the entire multi-cell storm system can persist for many hours. Multi-cell storms may produce hail, strong winds, brief tornadoes and flooding.
- A squall line is a group of storms arranged in line, often associated with “squalls” of heavy wind and rain. These storms tend to pass quickly and are less likely to produce tornadoes than supercells. A squall line can be hundreds of miles long but tend to only be 10-20 miles wide.
- A supercell is a highly organized, long-lived storm fueled by an updraft that is tilting and rotating. These tilting and rotating updrafts can produce severe tornadoes.

**Probability**

B2.b

Based on the data presented above, it is highly likely (near 100% probability in the next year) that other severe weather (heavy precipitation, high wind, and thunder/lightning) will occur in Marion. As mentioned with prior hazards, climate change is predicted to increase the frequency and intensity of storms and severe weather events, which includes heavy precipitation, high winds, and thunder/lightning storms.

B3.a

Impact

Below is a list of possible impacts that could result from other severe weather:

- **People:** Thunderstorms and high winds can result in power outages, leaving people without heat or other utilities. Lightning may cause injury or death to people who are outdoors during the onset of a thunderstorm if they are unable to seek shelter. Flooding in and around residential structures due to heavy precipitation can result in mold, which can cause serious health concerns, ranging from itching eyes, sneezing and coughing to serious allergic reactions, asthma attacks, and even permanent lung damage.
- **Emergency Response:** Trees and power lines felled by high winds and/or lightning can impede emergency vehicles.
- **Infrastructure:** Lightning and high winds can result in downed power lines. High wind events can generate significant waves which can damage coastal infrastructure and moored/docked vessels. Heavy rains associated with thunderstorms can result in flooded roads and overwhelm drainage systems.
- **Buildings:** Wind and wind-born debris can damage roofs, windows, and other portions of houses and buildings. Heavy rains and flooding can damage properties; the resulting water damage and mold may require removal and replacement of wall boards, insulation, etc. Lightning strikes can start fires, which can threaten buildings and structures.
- **Economy:** Power outages can force businesses to close temporarily.
- **Natural Systems:** Heavy winds can bring down trees and branches.



Figure 3-28. Flooding from heavy precipitation (caused by the remnants of Hurricane Ida on 9/1/21) pooling up against residential dwellings in Marconi Village.



3.12 LANDSLIDE

Overview

Landslides are a form of mass wasting in which there is a mass movement of rock, debris, or earth down a slope under the direct influence of gravity. There are five different types of slope movement that are considered landslides including falls, topples, slides, spreads, and flows. These categories can be further divided up by the type of material composing the landslide including bedrock, debris, or earth. The most common types of landslides are mudflows or mudslides, otherwise known as debris flows. Depending on the severity of the event, landslides can be a threat to human life, buildings, infrastructure, and the natural environment.

Landslides occur when down-slope forces exceed the strength of the earthen material on the slope. Landslides are often the result of a combination of factors increasing down-slope forces and decreasing strength of material. These factors can be brought on by heavy precipitation, snowmelt, stream erosion, earthquakes, and/or human disturbance. Landslides can travel as slow as millimeters per year, or in the case of severe debris flows, as fast as 200 mph, but more commonly 30 to 50 mph. Landslide speed is dependent on steepness of the slope, water composition, and debris volume and type. Generally, landslides are not common in Massachusetts. The coastal and mountainous areas of the west coast, as well as the Appalachian Mountains, Rocky Mountains, Alaska, and Hawaii all have more severe and frequent landslide events.

B1.c
B2.a

Hazard Location

In 2013, the Massachusetts Geologic Survey mapped potential landslide hazards for the entire state of Massachusetts. Maps were specifically produced for use in the upcoming 2018 Massachusetts Statewide Hazard Mitigation Plan and shows where past slope movement has occurred and/or may occur in the future under heavy precipitation events. Figure 3-29 shows the slope stability map for Marion. As the topography of Marion is stable across the majority of the Town, and there have been no past landslide events within the Town in since 1900, the risk of landslides is very low. There is one area of low stability adjacent to Benson Brook Road (yellow area in Figure 3-29) where the landfill is located. The landfill has slumped in the past but has since been stabilized by planting vegetation.

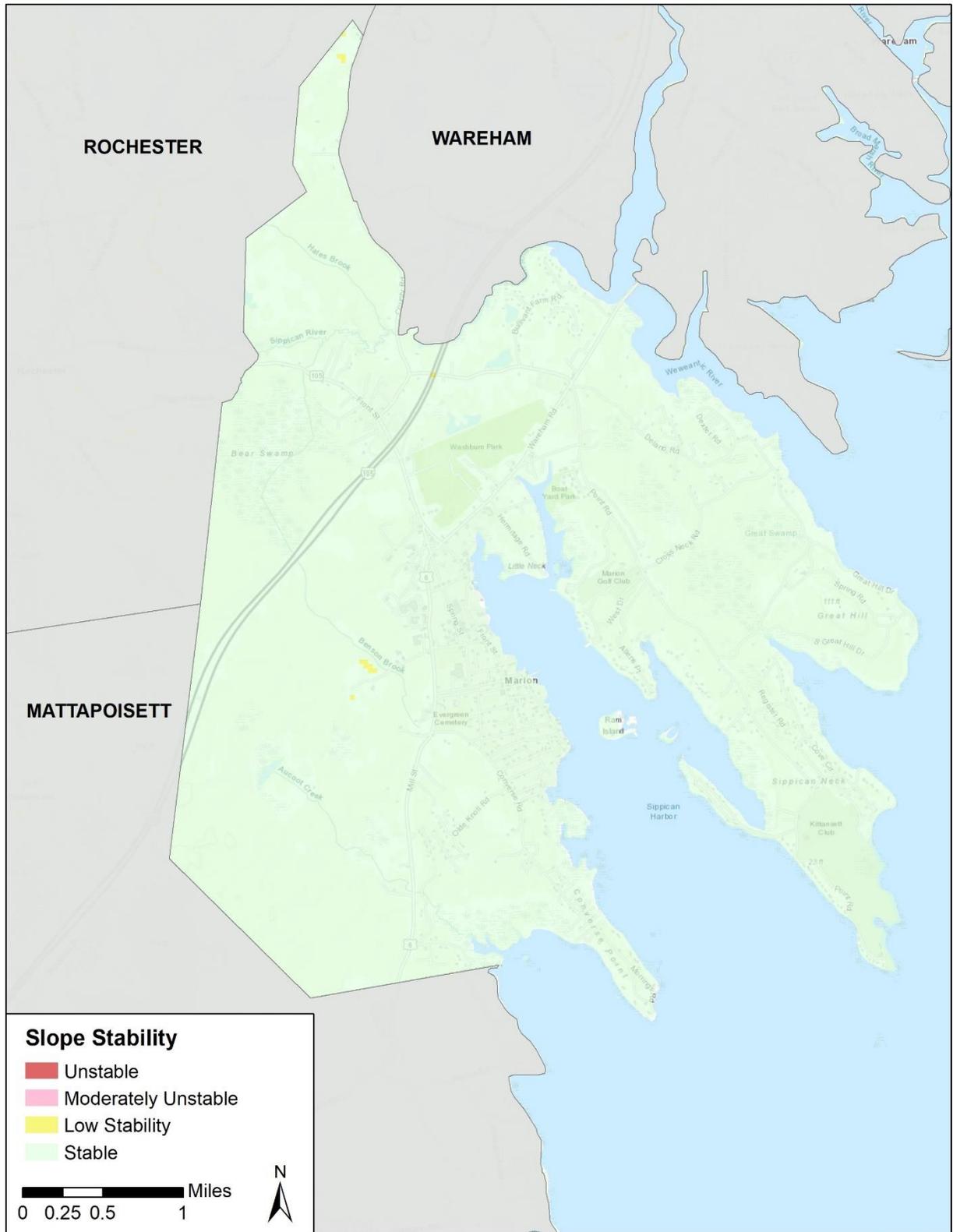


Figure 3-29. Slope stability of Marion (Massachusetts Geological Survey, 2013).



B1.c
B2.a,c

Previous Occurrences & Extent

Although there have been no reported landslides within the Town of Marion since 1900, there have been eight (8) reported landslides within 100 miles of Marion. These events are shown in Figure 3-30 and listed in Table 3-14. The U.S. Geological Survey, in cooperation with NASA, maintains a database of landslides across the U.S. from 1900 through 2019. The database includes landslides from a variety of sources, and thus, each landslide is reported with a confidence in the ground failure event and location. Landslide confidence categories and the number of landslides within 100 miles of Plympton in each category are listed below:

- High confidence in extent or nature of the landslide (0);
- Confident consequential landslide at this location (1);
- Likely landslide at or near this location (5);
- Probable landslide in the area (2); and
- Possible landslide in the area (0).

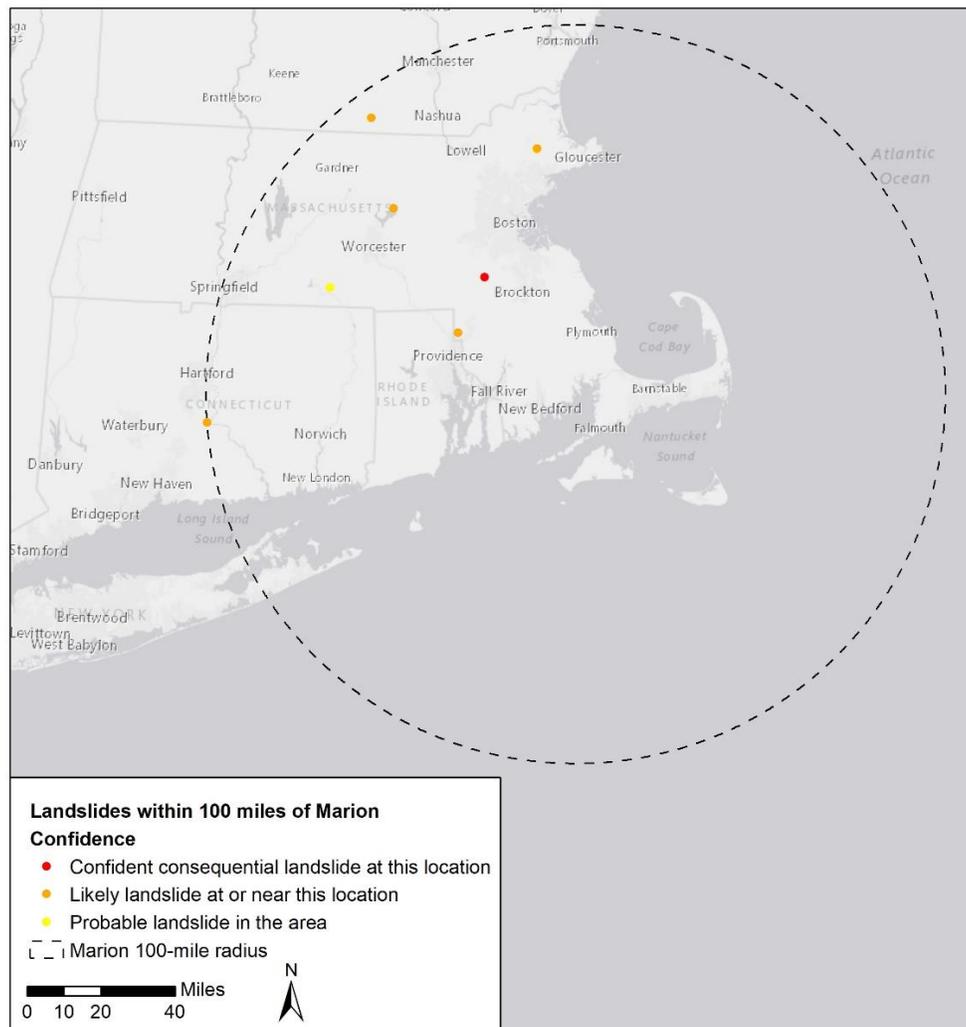


Figure 3-30. Landslides that have occurred within 100 miles of Marion from 1900 to 2019 (USGS, 2019).

**Table 3-14.** Landslide inventory from 1900 to 2019 within 100 miles of Marion.

Date	Location	Confidence
3/14/2010	Topsfield, MA	Probable landslide in the area
3/15/2010	Clinton, MA	Likely landslide at or near this location
3/15/2010	Walpole, MA	Confident consequential landslide at this location
3/30/2010	Middletown, CT	Likely landslide at or near this location
3/31/2010	Greenville, NH	Likely landslide at or near this location
9/30/2013	Southbridge, MA	Probable landslide in the area
11/4/2014	Attleboro, MA	Likely landslide at or near this location
12/9/2014	Topsfield, MA	Likely landslide at or near this location

B2.b

Probability

Considering the low occurrence of landslides within the vicinity of the Town of Marion, as well as the flat topography and lack of major hills, the likelihood of a landslide occurring within Marion is unlikely (less than 1% probability in the next year). Similar to hazards previously discussed, climate change is predicted to increase heavy precipitation events, which may result in destabilization of slopes and a higher frequency of landslides in some areas.

B3.a

Impact

Below is a list of possible impacts that could result from a landslide:

- **People:** Could become trapped or blocked by obstructed roads resulting from displaced sediment, vegetation, tree limbs, etc. In severe cases, landslide events can also lead to injury or death.
- **Infrastructure:** Could be damaged leading to an interruption in utilities such as electricity or water, due to damaged pipes or power lines near landslide.
- **Buildings:** Major landslides could lead to property and/or building damage.
- **Economy:** Businesses could experience economic losses due to obstructed roads prohibiting employees and/or customers from accessing certain areas of Town.
- **Natural Systems:** Landslides can result in the loss of habitat areas and vegetation. Debris and sediment can also accumulate in rivers or streams negatively affecting fish habitat and water quality.



3.13 TSUNAMI

Overview

A tsunami is a series of ocean waves generated by earthquakes, a sudden displacement of the ocean floor, underwater landslides or volcanic activity. In the deep ocean, a tsunami wave may only be a few inches high. However, as the wave nears shore, tsunamis generate a devastating onshore surge of water. Major tsunamis are produced by large (greater than 7 on the Richter scale), shallow focal depth (<30 km) earthquakes associated with continental plate movement. The waves associated with a tsunami move hundreds of miles per hour in the open ocean and can come ashore with wave heights of 100 feet or more. However, even waves that are 10 to 20 feet high can be extremely destructive.

B1.c
B2.a

Hazard Location

Although tsunamis most commonly occur in the Pacific Ocean, where dense oceanic plates slide under lighter continental plates, they can occur in the Atlantic Ocean as well.

B1.c
B2.a,c

Previous Occurrences & Extent

Although there are no records of a tsunami occurring in Marion, there are three (3) reported tsunamis within 100 miles of Marion since the mid-1500s (Figure 3-31), the most recent of which occurred in 1879.

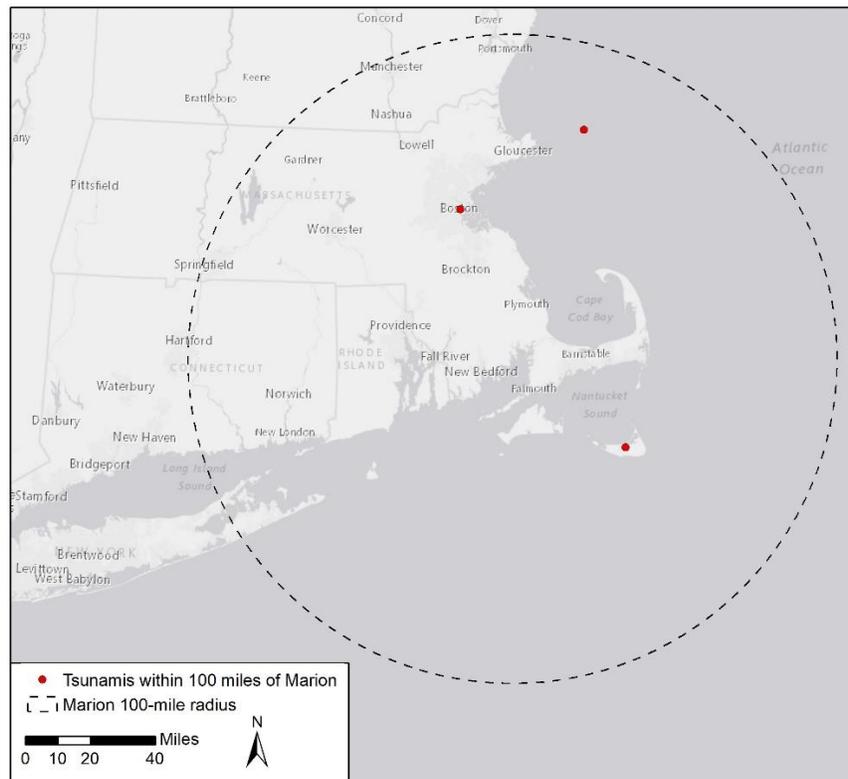


Figure 3-31. Tsunamis that have occurred within 100 miles of Marion from the mid 1500s to 2020 (NOAA NCEI, 2021).



B2.b

Probability

There is no record of tsunamis ever occurring in Marion, and only three occurrences within 100 miles since the mid-1500s. Therefore, it is unlikely (less than a 1% probability over the next 100 years) that a tsunami will occur in Marion. As sea level rises, the extent of inland flooding resulting from a tsunami will likely increase, however, the overall risk to Marion will still likely be very low.

B3.a

Impact

Below is a list of possible impacts that could result from a tsunami:

- **People:** The forces of a tsunami wave itself can injure people or lead to death. Floating debris can endanger human lives, and the effects of a tsunami may leave people without food or fuel.
- **Emergency Response:** Flooded roads and deposited debris may block emergency response.
- **Infrastructure:** Tsunami waves and floating debris can damage coastal infrastructure and piers. Ruptured utility pipes and storage containers can release oil and gas, resulting in fire hazards.
- **Buildings:** The force of the tsunami wave can destroy buildings, and floating debris can damage structures. Also, the scouring action of moving water can sweep away buildings.
- **Economy:** Utilities can be damaged and roadways blocked, which can adversely impact economic activities. Coastal systems impacted by tsunamis can also adversely impact the fishing and tourism industries.
- **Natural Systems:** Tsunamis can uproot trees and plants. Land animals can be killed by drowning and marine life can be killed by pollution if toxic chemicals are washed into the ocean.



3.14 DAM AND CULVERT FAILURE

Overview

A dam is any artificial barrier and/or any controlling structure that can or does impound or divert water. There are 2,903 public and privately owned dams in Massachusetts, six (6) of which are located in Marion (Figure 3-32).

Dam failure is any sudden, uncontrolled release of impounded water due to structural deficiencies in a dam. Dams can fail for a variety of reasons, including the dam being overtopped by floods that exceed its capacity, structural failure of the dam construction materials or the foundation supporting the dam, and inadequate maintenance and repair.

The hazards associated with a failing dam can also occur from culverts that act like dams during flooding events. A culvert is a structural opening under a roadway that allows water to pass from one side of the road to the other. They are typically made of concrete, steel or aluminum, and their size is calculated based on the location-specific volume of water expected to pass through that location. The primary function of a culvert is to prevent flooding during normal and extreme weather conditions and to provide proper road drainage. Culverts can fail due to the pipe becoming occluded by debris or improper maintenance, the pipe caving in due to structural deficiencies, or from a buildup of flood waters exceeding the capacity of the culvert. The Town of Marion's Municipal Maintenance Department has identified 28 culverts of particular concern (Figure 3-32). Although all the culverts displayed in Figure 3-32 are of concern to the Town, those where flooding has been observed around the structure or over the road in the past have been further called out in red.

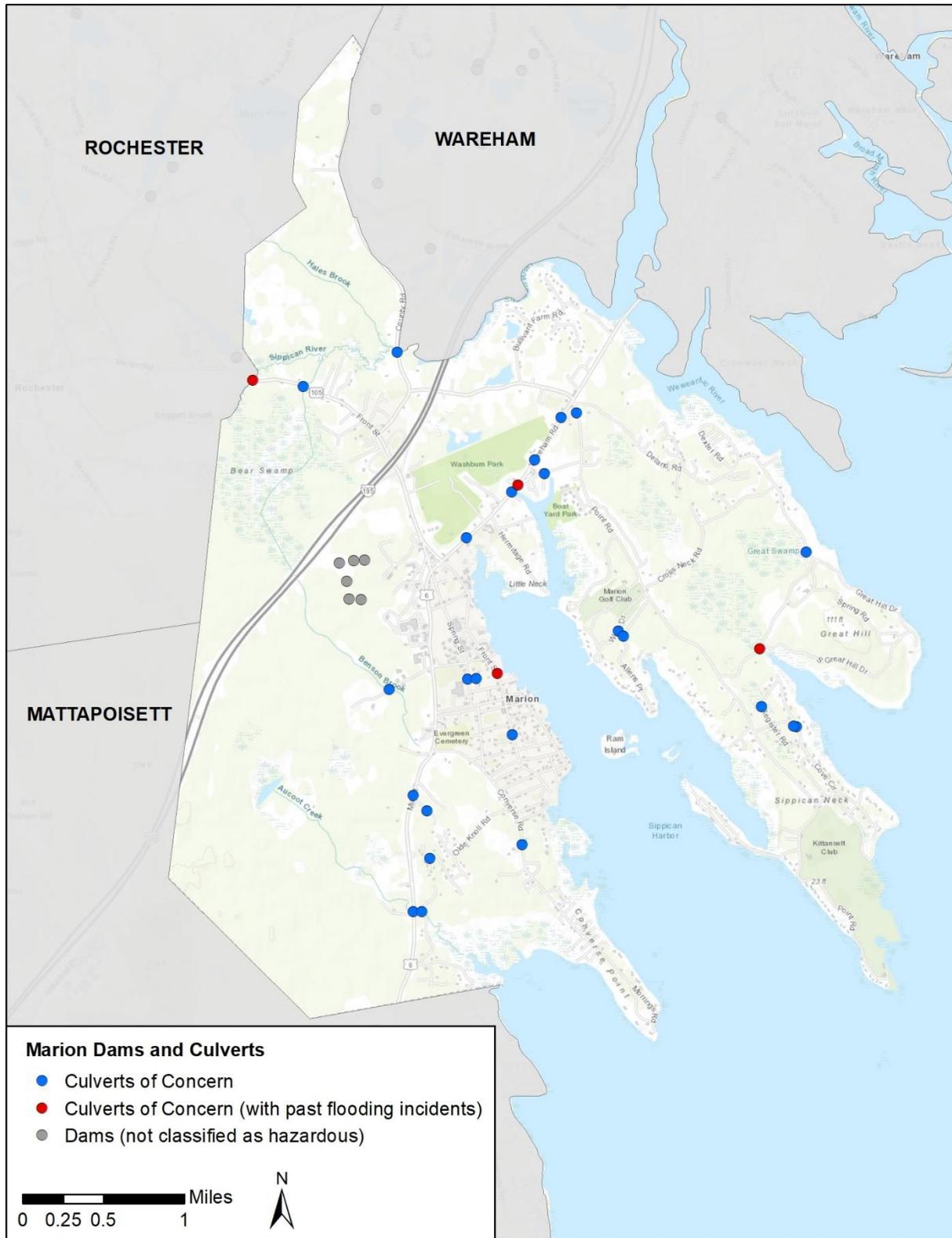


Figure 3-32. Locations of culverts of concern and dams (not classified as hazardous) within Marion.

B1.c
B2.a

Hazard Location

The Massachusetts Office of Dam Safety, within the Department of Conservation and Recreation, maintains a database of all the dams in Massachusetts, classified by their hazard potential. This database divides dams into three categories:

- 1) High Hazard Potential Dam: A dam location where failure will likely cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways or railroads.
- 2) Significant Hazard Potential Dam: A dam located where failure may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways, or railroads, or cause interruption of use or service of relatively important facilities.
- 3) Low Hazard Potential Dam: A dam located where failure may cause minimal property damage to other, and loss of life is not expected.

Hazards associated with dam failure are confined to the areas around existing dams. None of the six (6) dams within Marion are classified as a significant, high, or low hazard by the Office of Dam Safety. It is likely that these six dams have not been given a hazard code as they are very small dams located on cranberry bogs and are generally not considered to be a hazard in the event of failure. There are no Emergency Action Plans for any of the dams in Marion considering they are a very low hazard.

B1.c
B2.a,c

Previous Occurrences & Extent

There have been no previous occurrences of dam or culvert failure in the Town of Marion. But aging infrastructure, increased storm intensity and rising sea levels may produce such incidents in the future.

B2.b

Probability

As a dam or culvert failure has never occurred in the Town of Marion, the probability of it occurring is low, but possible (1-10% probability in the next year). The 2018 Massachusetts Hazard Mitigation and Climate Adaptation Plan describes two primary types of dam failure: catastrophic failure, characterized by the sudden, rapid, and uncontrolled release of impounded water, and design failure, which occurs as a result of minor overflow events. Dam overtopping is caused by floods that exceed the capacity of the dam, and it can occur as a result of inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors. Overtopping accounts for 34 percent of all dam failures in the U.S. More extreme precipitation events could increase the frequency of overtopping events. So, although climate change will not increase the probability of catastrophic failure, it may increase the probability of design failure.



B3.a

Impact

Below is a list of possible impacts that could result from dam or culvert failure:

- **People:** Could become trapped or blocked by flooded roads resulting from overtopped dams or culverts.
- **Infrastructure:** Utilities may be disrupted due to damaged pipes or power lines near the dam or culvert.
- **Buildings:** May be damaged by flooding caused by a failed dam or blocked culvert.
- **Economy:** Businesses could experience economic losses due to flooded or blocked roads prohibiting employees and/or customers from accessing certain areas of Town.
- **Natural Systems:** Dam and culvert failures can result in bank erosion. Debris and other materials can be deposited in natural systems.



3.15 SUMMARY OF HAZARDS

As suggested by the FEMA planning guidance, the Local Planning Team (LPT) reviewed the full range of natural hazards identified in the 2018 Massachusetts State Hazards and Climate Adaptation Plan and identified natural hazards that could impact Marion in the future, or that have impacted the Town in the past (Chapter 3). The 14 individual hazards discussed in Chapter 3 are evaluated below in Table 3-15 based on the likelihood of occurrence, severity and area. Likelihoods for each hazard, as described in Chapter 3, are scored from 1 (unlikely) to 4 (highly likely). The severity of the hazard was scored on a scale of 1 to 4, with 1 being minor and 4 being catastrophic. Finally, whether the hazard was likely to have isolated impacts or a town-wide effect was scored as 1 or 2 respectively. For both severity and area, an “X” was used in Table 3-15 to indicate the most likely severity, while a “P” indicates the anticipated severity of a worst case scenario (i.e., a “potential” scenario). The value associated with the “X”, rather than the “P”, was used to calculate the estimated cumulative risk from that hazard. These determinations were made using local expertise from LPT members, data from the 2018 Massachusetts State Hazard and Climate Mitigation Plan and other resources.

The LPT selected only a subset of hazards from Table 3-15 to consider during the quantitative vulnerability analysis in Chapter 4. This selection was based on:

- Area of influence: If a hazard is expected to impact the entire Town equally, all properties and critical facilities are equally vulnerable to this hazard and no specific vulnerability assessment is needed. Examples of this include severe winter weather, extreme temperature and earthquake.
- Lack of data: If spatial information about the likelihood of a hazard is not available, conducting a site-specific vulnerability assessment is not possible. Examples of this include thunderstorm, tornado and invasive species.
- Low estimated cumulative risk: If the estimated cumulative risk from a particular hazard is low, fully developing a vulnerability assessment to address it may be un-necessary. An example of this is tsunami.

The hazards that were selected for a quantitative or qualitative vulnerability assessment are indicated in Table 3-15 in bold font. Additional detail as to what data will be used to evaluate these selected hazards in the vulnerability assessment is provided in Section 4.1. Finally, it is important to acknowledge that the cumulative risk associated with each hazard may change in the future due to climate change (e.g., flooding frequency and extent will likely increase due to sea level rise, there will be an increased likelihood of extreme temperatures, etc.). These factors will be considered in future updates of this plan (i.e., every 5 years) and the cumulative risk score adjusted accordingly.



Table 3-15. Relative risk of hazards in Marion.

	Likelihood				Severity				Area		Estimated Cumulative Risk†
	Unlikely	Possible	Likely	Highly Likely	Minor	Serious	Extensive	Catastrophic	Isolated	Town Wide	
Score	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	
Severe Winter Weather*			X			X		P		X	12
Hurricane & Tropical Storm*			X			X		P		X	12
Flooding (Inland & Coastal)*			X				X		X		9
Other Severe Weather*				X		X		P	X	P	8
Extreme Temperature			X		X					X	6
Drought*			X		X					X	6
Coastal Erosion				X	X		P		X		4
Tornado		X				X		P	X		4
Wildfire*		X				X	P		X		4
Dam/Culvert Failure		X				X			X		4
Earthquake		X			X		P			X	4
Invasive Species				X	X				X	P	4
Landslide	X				X	P			X		1
Tsunami	X				X			P	X		1

X indicates the believed value, while P indicates an extreme potential.

*These **bolded** hazards were selected for specific vulnerability analyses in Chapter 4.

† This value is based on the formula Likelihood*Severity*Area. The Likelihood of the hazard is based on a scale of 1 to 4, with 1 being unlikely and 4 being highly likely. The Severity of the hazard was based on a scale from 1 to 4, with 1 being minor and 4 being catastrophic. Area was given a value of 1 for isolated and 2 for town-wide. The “P”s were not incorporated into the Estimated Cumulative Risk value.



A risk analysis involves identifying a potential hazard event, determining the likelihood of its occurrence and evaluating the consequence of it happening. Chapter 2 of the Marion Multi-Hazard Mitigation Plan profiled the local assets, natural resources, demographics, infrastructure and critical facilities, to document assets within the Town. Chapter 3 detailed the various natural hazards that have impacted or could impact the Town in the future. Chapter 4 combines the hazard descriptions and asset inventories to conduct an exposure analysis, that quantifies the number, type, and value of properties and critical facilities located in identified hazard areas.

This vulnerability assessment provides a foundation for the rest of the mitigation planning process, which is focused on identifying and prioritizing actions to reduce risks to hazards. In addition to informing the mitigation strategy, the vulnerability assessment also facilitates the establishment of emergency preparedness and response priorities, land use and comprehensive planning, and decision making by elected officials, city and county departments, businesses, and organizations in the community.



4.1 METHODOLOGY

This report includes two separate vulnerability assessments:

- 1) Vulnerability assessment of parcels and buildings; and
- 2) Exposure assessment of critical facilities

To estimate the total number of parcels, as well as both the value of the buildings on the property and the total property value (total property value is the sum of the value of the buildings, other structures, and the land itself within a given parcel), the planning team utilized the most current Assessor's Parcel dataset for the Town of Marion (2021). The dataset provides information about parcel size, land use type, assessed value, and building characteristics.

This parcel dataset was first classified into various land use types based on the Massachusetts Property Type Classification Codes according to the Land Use classifications presented in Figure 2-1. The outcome of this classification was presented in Table 2-4 where the number of parcels and total acreage within each land use category were quantified. Table 4-1 details the parcels Land Use Codes that are encompassed by each land use type used in this report.

Table 4-1. Marion Land Use Classifications Based on Property Land Use Codes

Land Use Type	Land Use Codes
Residential	0101, 0104, 0130, 0132, 0170, 1010, 1012, 1013, 1021, 1040, 1050, 1060, 1090, 1120, 1210, 1300, 1310, 1320, 1400, 106R, 111C
Commercial	0322, 0325, 0326, 0331, 0340, 0342, 0370, 3030, 3040, 3150, 3160, 3220, 3221, 3222, 3250, 3260, 3300, 3310, 3320, 3340, 3370, 3400, 3401, 3420, 3690, 3800, 3810, 3830, 3841, 3870, 3900, 3910, 3920, 3930, 034R, 315I, 316I, 318C, 322R, 325I, 325R, 340R, 387R
Industrial	4000, 4010, 4040, 4230, 4240, 4300, 4400, 4420, 4500
Chapter 61, 61A, or 61B	016R, 017R, 018R, 6010, 0710, 0712, 0717, 7102, 7170, 7200, 0805, 0811, 8050, 8110
Tax Exempt	995, 9110, 9190, 9300, 9310, 9410, 9500, 9530, 9600, 9890, 903I, 910V, 913C, 931I, 934C, 935C, 935I, 941C, 941I, 941R, 950V, 954C, 957C, 958C, 959R, 960C, 961R

To determine each parcel's vulnerability, a GIS analysis was conducted by overlaying extent maps for a subset of the hazards shown in Chapter 3 with the parcel data. Below is a list of the hazard types selected for this vulnerability analysis, and a description of the data used for the evaluation:

1. **Flooding:** FEMA Hazard Maps (effective 2021) (see Figure 3-2).
2. **Sea-Level Rise:** MC-FRM Results produced by Woods Hole Group for MassDOT (see Figures 3-5 through 3-7)
3. **Hurricanes and Tropical Storms:** The extent of storm surge and flooding during a hurricane was estimated using the SLOSH model (Figure 3-13).



Once the parcels affected by each hazard type were identified, the number of parcels in each land use category was totaled, as well as the value of the buildings and total property value associated with each parcel. In this way, the percent of the Town's parcels and the percent of the Town's property value potentially affected by each hazard type was quantified. These parcel totals and property values also represent the potential impact from secondary issues associated with each hazard (e.g., mold, mildew and other water damage impacts associated with flood hazard events). These results are summarized in Tables 4-3 to 4-15. To convert the potential value losses from flooding to potential revenue loss for the Town with respect to property taxes, the current tax rate can be applied to any of the values in Tables 4-3 to 4-15. The Town of Marion tax rate for fiscal year 2021 is \$11.32 per thousand.

To assess the vulnerabilities of Marion's critical facilities, as discussed in Chapter 2, the planning team first developed a list of the critical facilities and structures. Each location was mapped in GIS (Figure 2-2). The same hazards that were mapped and applied to the parcel vulnerability assessment were again overlaid on the map of critical infrastructure (i.e., flooding, sea-level rise, and hurricanes). If a critical facility was located in a hazard area, that particular facility was considered to be exposed, and therefore vulnerable, to that particular hazard. For the same reasons listed above in the description of the parcel vulnerability analysis, potential impacts from other hazards, such as earthquakes and tsunamis were not directly evaluated for critical facilities. Results from the vulnerability analysis for critical facilities are summarized in Table 4-2.



4.2 RESULTS

Table 4-2. Critical Facility Vulnerability Assessment

ID	Name	Category	FEMA Flood Zone	Min Hurricane Category That Will Affect Facility	Storm Surge Inundation Risk 2030	Storm Surge Inundation Risk 2050	Storm Surge Inundation Risk 2070	
1	Police Station	Public Safety						
2	Fire Station 1			3				
3	Fire Station 2			3	0.02%	0.2%	1%	
4	Harbormaster Building		VE	1	83%	84%	85%	
5	Wastewater Treatment Plant	Sanitation						
6	Marion Sewer Department							
7	Creek Road Pump Station		VE	1	34%	52%	70%	
8	Front Street Pump Station		AE	1	21%	40%	61%	
9	Silvershell Pump Station		AE	2	4%	16%	36%	
10	Point Road Pump Station		AE	2	2%	7%	20%	
11	Parkway Lane Pump Station		AE	2	3%	13%	31%	
12	Little Neck Pump Station		AE	2	0.3%	3%	8%	
13	Stoney Run Pump Station		AE	2	0.2%	1%	3%	
14	Oakdale Ave Pump Station		AE	1	67%	73%	75%	
15	Great Hill Tank							
16	Benson Brook Road Tank							
17	Main Pumping Station				2	0.2%	1%	2%
18	East Well				4			
19	West Well				4			
20	Mary's Pond Wellfield		A		4			
21	North Well	AE						
22	South Well	AE						
23	Wolf Island Road Well			4				



Table 4-2 (cont.). Critical Facility Vulnerability Assessment

ID	Name	Category	FEMA Flood Zone	Min Hurricane Category That Will Affect Facility	Storm Surge Inundation Risk 2030	Storm Surge Inundation Risk 2050	Storm Surge Inundation Risk 2070
24	Meter Pit	Sanitation					
25	Transfer Station						
26	Town House	Town Buildings					
27	Sippican Elementary School						
28	Marion Music Hall		AE	1	4%	15%	35%
29	Town Barn						
30	Old Rochester Regional & Jr. High School						
31	Elizabeth Taber Library & Museum						
32	Benjamin D. Cushing Community Center						
33	Town Barn Fueling Station		Hazardous Materials				
34	Cumberland Farms			4			
35	Wells Gas Station						
36	Hiller Fuels Inc			2	0.1%	1%	4%
37	Burr Brothers Boats, Inc.	VE		1	74%	75%	88%
38	Barden's Boat Yard	VE		1	71%	74%	78%
39	A & J Boat Corporation	VE		1	11%	26%	48%
40	Saltworks Marine	AE		1	4%	15%	33%
41	Lockheed Martin						
42	Verizon						
43	Proposed Propane Storage Facility						
44	Benson Brook Marine Park						
45	Media One of Massachusetts				4		



Table 4-2 (cont.). Critical Facility Vulnerability Assessment

ID	Name	Category	FEMA Flood Zone	Min Hurricane Category That Will Affect Facility	Storm Surge Inundation Risk 2030	Storm Surge Inundation Risk 2050	Storm Surge Inundation Risk 2070	
46	Tabor Academy (215 Front St)	Private Buildings	AE	1	22%	45%	66%	
47	Post Office			2	0.1%	1%	4%	
48	Eastern Bank			3			0.2%	
49	Abington Bank			4				
50	Sippican Historical Society			3	0.1%	1%	3%	
51	First Congregational Church of Marion			3	0.04%	0.5%	2%	
52	St. Gabriel's Church/Loft School			3	0.1%	1%	2%	
53	Kitansett Club			VE	1	26%	45%	65%
54	Beverly Yacht Club			AE	1	20%	37%	58%
55	Marion Art Center							
56	Fieldstone Market	Food		4				
57	Marion General Store			3	0.04%	0.4%	2%	
58	Seahorse Seafoods		AE	2	1%	7%	19%	
59	Little Neck Village	Healthcare	AE	2	0.2%	2%	5%	
60	Marconi Village							
61	Sippican Health Care Center Inc			4				
62	Cooperative Production							
63	Department of Mental Health			4				
64	Countryside Child Care Center	Child Care						
65	Children's Academy of Marion							
66	Benson Brook Road Cell Tower	Communications						

**Table 4-2 (cont.). Critical Facility Vulnerability Assessment**

ID	Name	Category	FEMA Flood Zone	Min Hurricane Category That Will Affect Facility	Storm Surge Inundation Risk 2030	Storm Surge Inundation Risk 2050	Storm Surge Inundation Risk 2070
67	Police & Fire Communication Antenna 1 / Water Tank (Mill Street)	Communications					
68	Police & Fire Communication Antenna 2 (Point Road)						
69	Arne Excavating LLC	Heavy Equipment					
70	CF Briggs, Inc						
71	Bird Island Light	Historic Buildings			100%	100%	100%
72	H.R. Reed House			2	0.1%	1%	4%
73	H.H. Richardson House (Percy Browne House)			4	0.01%	0.1%	0.3%
74	Ryder House		AE	2	1%	4%	11%
75	Historical House 1 (15 Main St)			3	0.5%	3%	8%
76	Historical House 2 (3 Main St)		AE	2	5%	11%	23%
77	Two Captains House		AE	2	2%	9%	23%
78	Old Schoolhouse			4			
79	Tabor Hall		VE	2	17%	33%	50%
80	The Old Stone Studio			3			
81	Historical House 3 (173 Front St)	VE	1	35%	50%	74%	

In the case a critical facility does not have any flood information listed, it is not vulnerable.



Table 4-3. Parcels and buildings vulnerable to flooding in the VE Zone.

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	720	25%	\$762,729,300	\$238,210,900	31%	\$1,678,247,651	\$716,666,561	43%	87%
Commercial	123	33	27%	\$30,961,700	\$8,556,800	28%	\$67,474,867	\$27,544,575	41%	3%
Industrial	21	1	5%	\$11,628,800	\$0	0%	\$16,846,500	\$45,600	0%	<1%
Chapter 61, 61A, or 61B	54	13	24%	\$9,125,000	\$7,404,400	81%	\$26,240,049	\$23,237,688	89%	3%
Tax Exempt	378	119	31%	\$91,165,400	\$16,169,000	18%	\$198,761,736	\$58,152,290	29%	7%
Total	3,475	886	25%	\$905,610,200	\$270,341,100	30%	\$1,987,570,803	\$825,646,714	42%	

Table 4-4. Parcels and buildings vulnerable to flooding in the AE Zone.

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	611	21%	\$762,729,300	\$151,471,200	20%	\$1,678,247,651	\$299,915,252	18%	83%
Commercial	123	20	16%	\$30,961,700	\$3,764,300	12%	\$67,474,867	\$7,628,934	11%	2%
Industrial	21	3	14%	\$11,628,800	\$0	0%	\$16,846,500	\$75,000	0%	<1%
Chapter 61, 61A, or 61B	54	11	20%	\$9,125,000	\$1,107,000	12%	\$26,240,049	\$1,695,900	6%	0%
Tax Exempt	378	67	18%	\$91,165,400	\$29,489,000	32%	\$198,761,736	\$52,433,614	26%	14%
Total	3,475	712	20%	\$905,610,200	\$185,831,500	21%	\$1,987,570,803	\$361,748,700	18%	



Table 4-5. Parcels and buildings vulnerable to flooding in Other Flood Zones (AO, A).

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	12	0%	\$762,729,300	\$1,419,000	0%	\$1,678,247,651	\$4,089,263	0%	54%
Commercial	123	3	2%	\$30,961,700	\$26,900	0%	\$67,474,867	\$911,058	1%	12%
Industrial	21	1	5%	\$11,628,800	\$0	0%	\$16,846,500	\$81,100	0%	1%
Chapter 61, 61A, or 61B	54	5	9%	\$9,125,000	\$0	0%	\$26,240,049	\$51,500	0%	1%
Tax Exempt	378	16	4%	\$91,165,400	\$0	0%	\$198,761,736	\$2,442,500	1%	32%
Total	3,475	37	1%	\$905,610,200	\$1,445,900	0%	\$1,987,570,803	\$7,575,421	0%	

Table 4-6. Parcels and buildings vulnerable to a category 1 hurricane (SLOSH 1).

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	223	8%	\$762,729,300	\$25,827,400	3%	\$1,678,247,651	\$73,624,561	4%	64%
Commercial	123	11	9%	\$30,961,700	\$2,875,500	9%	\$67,474,867	\$7,209,488	11%	6%
Industrial	21	0	0%	\$11,628,800	\$0	0%	\$16,846,500	\$0	0%	0%
Chapter 61, 61A, or 61B	54	3	6%	\$9,125,000	\$0	0%	\$26,240,049	\$160,528	1%	0%
Tax Exempt	378	66	17%	\$91,165,400	\$9,688,200	11%	\$198,761,736	\$34,538,175	17%	30%
Total	3,475	303	9%	\$905,610,200	\$38,391,100	4%	\$1,987,570,803	\$115,532,752	6%	



Table 4-7. Parcels and buildings vulnerable to a category 2 hurricane (SLOSH 2).

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	403	14%	\$762,729,300	\$111,195,900	15%	\$1,678,247,651	\$294,151,765	18%	91%
Commercial	123	24	20%	\$30,961,700	\$5,732,900	19%	\$67,474,867	\$20,075,105	30%	6%
Industrial	21	3	14%	\$11,628,800	\$0	0%	\$16,846,500	\$75,000	0%	<1%
Chapter 61, 61A, or 61B	54	2	4%	\$9,125,000	\$0	0%	\$26,240,049	\$29,700	0%	<1%
Tax Exempt	378	43	11%	\$91,165,400	\$1,290,000	1%	\$198,761,736	\$8,379,740	4%	3%
Total	3,475	475	14%	\$905,610,200	\$118,218,800	13%	\$1,987,570,803	\$322,711,310	16%	

Table 4-8. Parcels and buildings vulnerable to a category 3 hurricane (SLOSH 3).

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	574	20%	\$762,729,300	\$159,428,900	21%	\$1,678,247,651	\$376,114,158	22%	89%
Commercial	123	21	17%	\$30,961,700	\$3,866,300	12%	\$67,474,867	\$8,037,016	12%	2%
Industrial	21	2	10%	\$11,628,800	\$0	0%	\$16,846,500	\$79,200	0%	<1%
Chapter 61, 61A, or 61B	54	4	7%	\$9,125,000	\$122,100	1%	\$26,240,049	\$1,078,767	4%	<1%
Tax Exempt	378	56	15%	\$91,165,400	\$19,316,200	21%	\$198,761,736	\$38,757,753	19%	9%
Total	3,475	657	19%	\$905,610,200	\$182,733,500	20%	\$1,987,570,803	\$424,066,894	21%	



Table 4-9. Parcels and buildings vulnerable to a category 4 hurricane (SLOSH 4).

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	1,096	38%	\$762,729,300	\$322,426,300	42%	\$1,678,247,651	\$687,739,933	41%	82%
Commercial	123	46	37%	\$30,961,700	\$14,389,700	46%	\$67,474,867	\$24,028,600	36%	3%
Industrial	21	8	38%	\$11,628,800	\$8,307,600	71%	\$16,846,500	\$11,603,900	69%	1%
Chapter 61, 61A, or 61B	54	30	56%	\$9,125,000	\$8,744,600	96%	\$26,240,049	\$24,530,012	93%	3%
Tax Exempt	378	141	37%	\$91,165,400	\$52,960,400	58%	\$198,761,736	\$88,406,876	44%	11%
Total	3,475	1,321	38%	\$905,610,200	\$406,828,600	45%	\$1,987,570,803	\$836,309,321	42%	

Table 4-10. Parcels and buildings vulnerable to flooding during a major storm event (1% to less than 20% chance of inundation) in 2030.

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	350	12%	\$762,729,300	\$90,141,400	12%	\$1,678,247,651	\$185,220,133	11%	92%
Commercial	123	14	11%	\$30,961,700	\$2,514,500	8%	\$67,474,867	\$5,767,300	9%	3%
Industrial	21	1	5%	\$11,628,800	\$0	0%	\$16,846,500	\$12,600	0%	<1%
Chapter 61, 61A, or 61B	54	6	11%	\$9,125,000	\$0	0%	\$26,240,049	\$144,300	1%	<1%
Tax Exempt	378	48	13%	\$91,165,400	\$2,199,900	2%	\$198,761,736	\$9,879,273	5%	5%
Total	3,475	419	12%	\$905,610,200	\$94,855,800	10%	\$1,987,570,803	\$201,023,606	10%	



Table 4-11. Parcels and buildings vulnerable to flooding during a minor storm event (20% or greater chance of inundation) in 2030.

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	745	26%	\$762,729,300	\$240,066,900	31%	\$1,678,247,651	\$708,466,858	42%	83%
Commercial	123	29	24%	\$30,961,700	\$7,968,000	26%	\$67,474,867	\$26,152,309	39%	3%
Industrial	21	1	5%	\$11,628,800	\$0	0%	\$16,846,500	\$45,600	0%	<1%
Chapter 61, 61A, or 61B	54	15	28%	\$9,125,000	\$7,772,600	85%	\$26,240,049	\$23,765,288	91%	3%
Tax Exempt	378	123	33%	\$91,165,400	\$40,700,400	45%	\$198,761,736	\$94,390,255	47%	11%
Total	3,475	913	26%	\$905,610,200	\$296,507,900	33%	\$1,987,570,803	\$852,820,310	43%	

Table 4-12. Parcels and buildings vulnerable to flooding during a major storm event (1% to less than 20% chance of inundation) in 2050.

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	510	18%	\$762,729,300	\$121,322,900	16%	\$1,678,247,651	\$247,027,555	15%	91%
Commercial	123	22	18%	\$30,961,700	\$4,926,700	16%	\$67,474,867	\$9,594,100	14%	4%
Industrial	21	3	14%	\$11,628,800	\$0	0%	\$16,846,500	\$75,000	0%	<1%
Chapter 61, 61A, or 61B	54	8	15%	\$9,125,000	\$1,040,400	11%	\$26,240,049	\$1,631,200	6%	1%
Tax Exempt	378	58	15%	\$91,165,400	\$2,121,600	2%	\$198,761,736	\$11,773,622	6%	4%
Total	3,475	601	17%	\$905,610,200	\$129,411,600	14%	\$1,987,570,803	\$270,101,477	14%	



Table 4-13. Parcels and buildings vulnerable to flooding during a minor storm event (20% or greater chance of inundation) in 2050.

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	859	30%	\$762,729,300	\$275,370,000	36%	\$1,678,247,651	\$779,505,900	46%	84%
Commercial	123	35	28%	\$30,961,700	\$8,954,900	29%	\$67,474,867	\$28,239,609	42%	3%
Industrial	21	1	5%	\$11,628,800	\$0	0%	\$16,846,500	\$45,600	0%	<1%
Chapter 61, 61A, or 61B	54	17	31%	\$9,125,000	\$7,772,600	85%	\$26,240,049	\$23,835,288	91%	3%
Tax Exempt	378	136	36%	\$91,165,400	\$41,542,500	46%	\$198,761,736	\$97,273,906	49%	10%
Total	3,475	1,048	30%	\$905,610,200	\$333,640,000	37%	\$1,987,570,803	\$928,900,303	47%	

Table 4-14. Parcels and buildings vulnerable to flooding during a major storm event (1% to less than 20% chance of inundation) in 2070.

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	600	21%	\$762,729,300	\$146,647,300	19%	\$1,678,247,651	\$294,388,614	18%	89%
Commercial	123	22	18%	\$30,961,700	\$4,683,600	15%	\$67,474,867	\$8,368,300	12%	3%
Industrial	21	3	14%	\$11,628,800	\$0	0%	\$16,846,500	\$96,000	1%	<1%
Chapter 61, 61A, or 61B	54	7	13%	\$9,125,000	\$1,040,400	11%	\$26,240,049	\$1,563,270	6%	<1%
Tax Exempt	378	68	18%	\$91,165,400	\$11,677,000	13%	\$198,761,736	\$25,624,757	13%	8%
Total	3,475	700	20%	\$905,610,200	\$164,048,300	18%	\$1,987,570,803	\$330,040,941	17%	



Table 4-15. Parcels and buildings vulnerable to flooding during a minor storm event (20% or greater chance of inundation) in 2070.

Land Use	Number of Parcels			Value of Buildings			Value of Total Property			
	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	% Total Value in Hazard by Land Use
Residential	2,899	1,017	35%	\$762,729,300	\$312,226,700	41%	\$1,678,247,651	\$855,580,601	51%	84%
Commercial	123	43	35%	\$30,961,700	\$10,482,500	34%	\$67,474,867	\$31,919,609	47%	3%
Industrial	21	2	10%	\$11,628,800	\$0	0%	\$16,846,500	\$58,200	0%	<1%
Chapter 61, 61A, or 61B	54	20	37%	\$9,125,000	\$7,772,600	85%	\$26,240,049	\$23,903,588	91%	2%
Tax Exempt	378	166	44%	\$91,165,400	\$42,900,300	47%	\$198,761,736	\$104,074,728	52%	10%
Total	3,475	1,248	36%	\$905,610,200	\$373,382,100	41%	\$1,987,570,803	\$1,015,536,726	51%	



The Local Planning Team (LPT) decided not to quantitatively evaluate the vulnerability from the remaining natural hazards listed in Table 3-15, for the following reasons:

1. **Coastal Erosion:** Although rates of erosion are available from MassCZM, a detailed vulnerability assessment for this hazard was not performed since most of the Town's shoreline showed little to no change in the short term. Additionally, it is assumed that any waterfront parcel has a risk of erosion.
2. **Severe Winter Weather, Other Severe Weather, Drought, Extreme Temperature, Tornado, Wildfire, Earthquake, Invasive Species, and Tsunami:** Location specific data within Marion is not available meaning a detailed vulnerability assessment could not be completed.
3. **Dam and Culvert Failure:** Although the locations of potentially problematic dams are known, location specific data for areas that would be impacted by a failure of any of these structures is not available. Therefore, a detailed vulnerability assessment could not be completed.
4. **Landslide:** This hazard is unlikely to occur (i.e. less than 1% chance), meaning a vulnerability assessment for this hazard would not have a high value to the Town.

However, the impacts from hazards ranked highly in Table 3-15, including Severe Winter Weather, Hurricane/Tropical Storm, Other Severe Weather, Drought, and Wildfire on critical facilities were qualitatively discussed with the LPT and are summarized below in Table 4-18.

Table 4-18. Results of the qualitative vulnerability assessment of critical facilities.

Vulnerability	Applicable Critical Facilities
Roof vulnerable to heavy snowfall (especially followed by severe precipitation)	Wastewater Treatment Plant Sippican Elementary School Old Rochester Regional School Elizabeth Taber Museum & Library A&J Boat Corporation Tabor Academy
Located in a waterfront area and therefore vulnerable to high wind and severe waves	Harbormaster Building Burr Brothers Boats Barden's Boat Yard A&J Boat Corporation Tabor Academy
Lightning	Fire Station (50 Spring St) Wastewater Treatment Plant

B3.b

4.3 VULNERABLE PROPERTIES AND CRITICAL FACILITIES

Although the tables in Section 4.2 provide a detailed summary of the potential impacts from each type and magnitude of risk analyzed, this section will summarize the main risks identified from



this analysis. The discussion below will focus on hazards that have the potential to harm the most properties or cost the most economic damage, critical facilities that are impacted by the most hazards, and vulnerabilities of the highest concern to the Town. This summary was also used to guide the development of mitigation actions.

Tables 4-3, 4-4, and 4-5 summarize the number of parcels that overlap with the VE, AE, or other types of flood zones, respectively. Although individual parcels may overlap with more than one flood zone, because the risk to each parcel was noted as the highest hazard flood type, the values in Tables 4-3, 4-4, and 4-5 are additive. For example, a single property can contain both a VE and an AE zone, but would only be listed in the VE zone risk table. Therefore, by summing the total values from those three tables, the total value of all structures and property at risk from flooding is approximately \$1.2 billion. Additionally, because flooding often causes more permanent damage to structures than to the land itself, it is worth noting that the total value of buildings within the SFHA in Marion is approximately \$458 million. Also resulting in substantial financial impact, the surge inundation (i.e., flooding) that would result from a Category 2 hurricane would impact properties valuing approximately \$323 million, with the structures and buildings on those properties valuing \$118 million (Table 4-7). Finally, although based on the mapping criteria alone, it appears that flooding will cause similar damage to hurricanes, this does not account for the Town-wide impacts that hurricanes can produce from heavy rains and high winds; these additional forces would likely make the financial impacts of a Category 2 hurricane much more substantial than would be expected with flooding alone.

Most of the critical facilities likely to be impacted by flooding are sewer pump stations and wells (Table 4-2), located within VE, AE, and A flood zones. Other critical facilities within both AE and VE flood zones include the Harbormaster Building, Marion Music Hall, Kitansett Club, Beverly Yacht Club, Seahorse Seafoods, Little Neck Village, Ryder House, Historical House 2 (3 Main Street), Two Captains House (2 Main Street), Tabor Hall, and several hazardous materials facilities (Burr Brothers Boats, Inc., Barden's Boat Yard, A & J Boat Corporation, and Saltworks Marine).

It is also worth acknowledging the breakdown of land use types impacted by these hazards. The inundation projected within the VE and AE flood zones will impact primarily residential properties (720 and 611 parcels, respectively, out of a total of 2,899 residential parcels), which cumulatively represents 46% of the residential land use category. The inundation projected from a Category 2 hurricane will also impact primarily residential properties (403 parcels out of a total of 2,899 residential parcels), which represents 14% of that land use category.

The MC-FRM results (see Section 3.1) were utilized to evaluate how climate change and sea level rise could affect the Town's vulnerability to flooding in the future. For the vulnerability assessment, two categories of vulnerability to flooding were selected: a probability of inundation from 1% to less than 20% (representing larger storm events) and a probability of inundation of 20% or greater (representing smaller, more frequent storm events). These results are based on a high sea level rise projection for 2030 and 2070. In 2030, 419 parcels have between a 1% and 20% chance of inundation in a given year of experiencing some level of coastal flooding (Table 4-10), while an additional 913 parcels have a 20% chance or greater in any given year (Table 4-11).



This means that during a 100-year flood event (i.e., the 1% chance event) in 2030, a total of 1,332 parcels are at risk of coastal inundation. These numbers increase to 700 and 1,248 parcels with between a 1% and 20% chance of inundation (Table 4-14) and a greater than 20% chance of inundation (Table 4-15), respectively, in 2070. This means that during a 100-year flood event (i.e., the 1% chance event) in 2070, a total of 1,948 parcels are at risk of coastal inundation.

Although the grinder pump neighborhoods were not specifically included in the critical facilities list and were not specifically evaluated as part of this report, the recent Vulnerability Assessment of Marion’s Wastewater Pumping Infrastructure (CDM Smith 2019) did consider the vulnerability of the Town’s three grinder pump neighborhoods: Berry, Dexter Beach, and South Converse. The vulnerability analysis was conducted using two datasets: (1) the 2017 FEMA Effective FIRM (see Section 3.1 for a more detailed discussion of FEMA data) and (2) the SLOSH model, which simulates flooding extents from storm surge based on hurricane categories (see Section 3.3 for a more detailed discussion of SLOSH data). The results are summarized in Table 4-19 as a percentage of each neighborhood that overlaps either in the FEMA flood zones or the SLOSH categories. The results of this analysis indicate that the Dexter Beach Area is most at risk based on area in both the FEMA flood zones and the SLOSH storm surge zones. The South Converse area is second, while the Berry Area is third for grinder pump areas.

Table 4-19. Vulnerability of grinder pump areas.

Neighborhood	FEMA Effective (2017)		SLOSH Hurricane Storm Surge Zone			
	VE Zone (% of neighborhood area)	AE Zone (% of neighborhood area)	CAT 1 (% of neighborhood area)	CAT 2 (% of neighborhood area)	CAT 3 (% of neighborhood area)	CAT 4 (% of neighborhood area)
Berry Area	0.0	2.1	0.1	6.7	28.2	67.0
South Converse Area	28.8	7.5	23.7	37.9	52.6	71.2
Dexter Beach Area	27.9	40.0	38.7	61.9	74.6	87.3



4.4 VULNERABLE POPULATIONS

Marion has several vulnerable populations, including areas with a high concentration of elderly residents, several childcare facilities, and several healthcare facilities.

Concentrations of Elderly People

Marion has two senior living communities, known as Little Neck Village and Marconi Village, located on Wareham Road and Mill Street, respectively. These locations will need special attention during emergencies or if evacuations become necessary, as residents may need additional help to exit buildings during an emergency. The locations of these communities are shown in Figure 4-1 in green and listed in Table 4-20. While Marconi Village is not vulnerable to flooding, Little Neck Village is vulnerable to flooding resulting from heavy precipitation and/or storms (Table 4-2).

Concentrations of Children

The Town of Marion has multiple areas with a high concentration of young children including Countryside Child Care Center, Children’s Academy of Marion, Sippican Elementary School, Old Rochester Regional High School and Junior High School, and Tabor Academy (shown in Figure 4-2 in purple and listed in Table 4-20). During a natural hazard emergency, these locations may need additional assistance evacuating children and coordinating a safe pick-up system for parents. Tabor Academy is the only area with a high concentration of children that is vulnerable to flooding (Table 4-2).

Health Care Facilities

Within the Town of Marion there are several health care centers including Sippican Health Care Center, Cooperative Production, and the Department of Mental Health (shown in Figure 4-2 in orange and listed in Table 4-20). During a natural hazard emergency, these locations may need increased support in order to safely evacuate patients in a variety of conditions. Sippican Health Care Center and the Department of Mental Health are both vulnerable to at least a category 4 hurricane (Table 4-2).

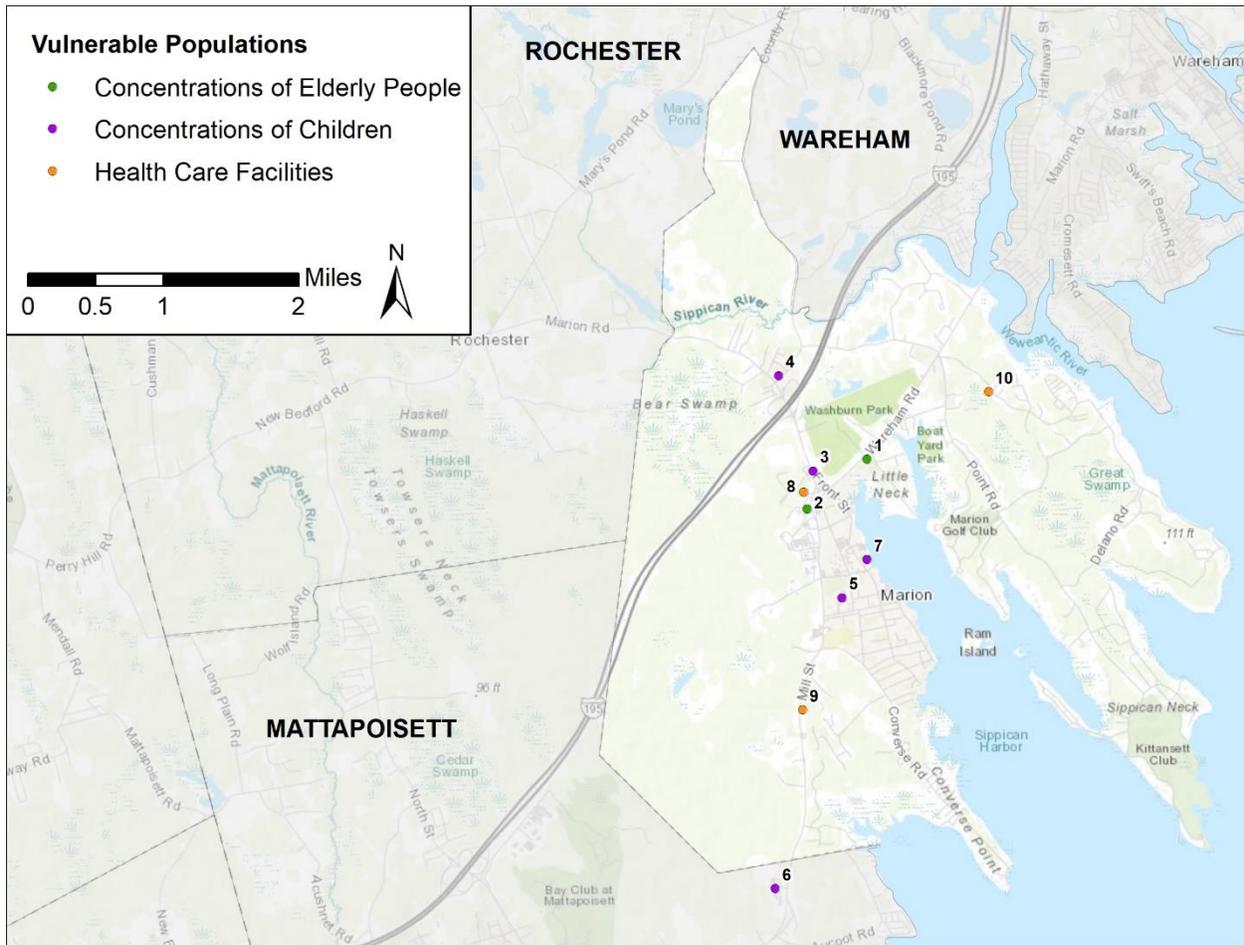


Figure 4-1. Locations of vulnerable populations in Marion.

**Table 4-20. List of vulnerable populations in Marion.**

#	Name	Address
Concentrations of Elderly People		
1	Little Neck Village	330 Wareham Road
2	Marconi Village	41 Mill Street
Concentrations of Children		
3	Countryside Child Care Center	381 Front Street
4	Children's Academy of Marion	13 County Road
5	Sippican Elementary School	16 Spring Street
6	Old Rochester Regional High School & Jr. High School	135 Marion Road
7	Tabor Academy	232 Front Street
Health Care Facilities		
8	Sippican Health Care Center	15 Mill Street
9	Cooperative Production	760 Mill Street
10	Department of Mental Health	551 Delano Road



The first sections of this plan discuss the potential hazards that could occur in Marion and some of the potential losses and vulnerabilities associated with each of these hazards. An important next step in hazard mitigation planning is to develop specific strategies and actions that will help mitigate or minimize the risk to these natural hazards. A mitigation action is a specific action, project, activity, or process taken to reduce or eliminate short- or long-term risks to people and property from hazards and their impacts. Implementing mitigation actions helps achieve the plan's mission and goals. These mitigation strategies are the heart of the mitigation plan. They describe how Marion will accomplish their mitigation goals.

This chapter documents Marion's mitigation goals and existing and ongoing mitigation actions, as well as its proposed mitigation actions. The purpose, responsibility, priority, and timeline are detailed for each of the proposed mitigation actions.



The central component of a hazard mitigation plan is the strategy for reducing the community's vulnerability to natural hazard events. Responding to the analysis of risk, vulnerabilities, potential impacts, and anticipated future development, the process for developing this strategy is one of setting goals, understanding what actions the community is already taking that contribute to mitigating the effects of natural hazards and assessing where more action is needed to complement or modify existing measures. The following sections include descriptions of the Town's mitigation goals, existing capabilities and ongoing mitigation actions, a status update on mitigation measures identified in previous plans, and descriptions of proposed new mitigation measures. All mitigation measures are evaluated by their benefits and potential costs to arrive at a prioritized list of action items.

5.1 MITIGATION GOALS AND OBJECTIVES

C3.a
C3.b
D3.a

During planning team meetings for this update of the plan, the Local Planning Team (LPT) developed a series of hazard mitigation goals. These goals are meant to prevent and mitigate injury, loss of life, and damage to property, critical infrastructure, and cultural resources from the impacts of natural hazards. The following seven (7) goals were endorsed by the LPT for this Multi-Hazard Mitigation Plan:

1. Invest in improvements that will prevent and reduce damage to critical facilities, infrastructure, and vulnerable areas in Marion from the impacts of natural hazards and changing climate.
2. Integrate hazard mitigation planning in all relevant municipal departments, committees, and boards to ensure that future development meets all local, state, and federal requirements.
3. Encourage the business community, institutions, and non-profits to be active in hazard mitigation planning.
4. Coordinate with neighboring communities, state, regional and federal agencies on regional solutions for hazards affecting multiple communities.
5. Improve public education related to natural hazards, including informing the public about hazard-prone areas to mitigate damage and losses where possible and what to expect during natural disasters.
6. Ensure adequate evacuation routes and means to maintain adequate access during an emergency.
7. Provide residents with public utilities, such as electricity, drinking water, and communications, during and after natural disasters or alternatively, access to emergency shelters equipped with sufficient provisions, climate control, and emergency electricity.

C1.a
C6

5.2 EXISTING CAPABILITIES

Marion has a unique set of capabilities, including Town plans, policies, staff, funding, and other resources available to accomplish mitigation actions and reduce short- and long-term vulnerability. These capabilities are summarized in this section. Opportunities for how these capabilities could be expanded or improved upon are also described.



Town Plans and Policies

Marion has a series of planning documents that address natural hazards. These documents include measures associated with the Town's mitigation strategy and could be useful when implementing mitigation actions. Through the implementation of these plans, Marion can guide and manage growth and development within the Town, with the goal of reducing hazard vulnerability. These plans include:

1. Master Plan (2017): Addresses topics such as land use, economic development, services and facilities, transportation, housing, resilience to climate change, open space and recreation, and natural and cultural resources.
2. Comprehensive Emergency Management Plan (2020): Coordinates emergency management response that may require cooperation of multiple agencies. This document also includes a Continuity of Operations Plan.
3. Assessment of Climate Change Threats to Wastewater Infrastructure (2018): Assesses the vulnerability of eight critical pump stations and develops climate adaptation strategies.
4. Municipal Vulnerability Preparedness (MVP) Workshop Summary of Findings Report (2018).

These plans provide important background for hazard planning, particularly with respect to flooding and climate change, and affirm municipal goals to improve hazard resilience and response. In the future, the Town's capacities, with respect to planning documents, could be improved by developing more departmental-, sector-, and asset-specific hazard reduction recommendations. Many of the proposed mitigation actions in Section 5.3 provide actionable, specific recommendations, which will help the Town move towards a more inter-departmental and inter-sector approach to hazard mitigation.

Many of the existing Town policies and ordinances also provide an effective means of mitigating hazards. Marion relies on the Massachusetts state building code (780 CMR) to ensure that new buildings and structures are built safely and to the state-standards for hazard preparedness. Marion also has Town-specific Zoning and Floodplain ordinances. The Floodplain Overlay District is established as an overlay district to all other districts within the Zoning bylaw.

Town Staff

The Town of Marion has a very capable staff that includes a Facilities Manager, Building Commissioner (who also serves as the Floodplain Administrator), Emergency Manager, Town Planner, and an engineer within the Department of Public Works. Together these staff allow the Town to effectively plan for and implement specific mitigation actions. The capacity of the existing staff and committee members could be further improved through continuing education and trainings, and/or additional staff with specialized skills could be hired, such as a GIS Coordinator or a designated grant-writing staff member.

Financial Capabilities

Financial capabilities are the resources that a Town has to fund mitigation actions. The costs to implement mitigation activities vary from relatively low-cost to relatively high-cost activities.



Low-cost actions include building assessments or outreach efforts, which require little to no costs other than staff time and existing operating budgets. Alternatively, higher cost actions, such as major infrastructure redesigns, could require a substantial monetary commitment from local, state, and federal funding sources.

The Town of Marion has the following potential sources of funding to implement hazard mitigation activities:

1. Capital improvements funding;
2. Authority to levy taxes for specific purposes;
3. Fees from water and sewer services;
4. Fees from new development; and
5. Incurring debt through general obligation bonds and/or special tax bonds.

The Town's annual revenue from taxes can be used to fund some mitigation actions, but other larger actions may need additional outside funding, such as from state and federal grant programs. Grant funding that has been used in the past includes Complete Streets, Community Compact, Coastal Zone Management Resilience Grant, and SRPEDD District Local Technical Assistance Grants. Additional financial assistance in the form of grant funding will likely be required to implement some of the larger proposed mitigation actions in Section 5.3.

C1.a

Existing Mitigation Measures

The following are existing and ongoing mitigation measures performed by the Town of Marion:

1. **Emergency Response Plans:** The Town maintains a Comprehensive Emergency Management Plan to address preparedness and response for a variety of natural and man-made emergencies. The Water Department also has an Emergency Response Plan specific for water infrastructure. However, there is no official Town-wide Emergency Evacuation Route, which will need to account for road flooding when it is developed. Mitigation Goal #4 is intended to enhance the Town's emergency preparedness capacity in this way.
2. **Communications System:** The Town has an array of communications equipment that would assist public safety efforts during a natural hazard event. Marion also utilizes the Plymouth County Sheriff's Department's CodeRED emergency alert system, which can reach residents via phone call, text message, or email. Home phone numbers can be alerted automatically, but residents need to sign up for email or cell phone alerts. Many residents are unaware of the need to actively sign up for this service. To this end, mitigation action 5a (i.e., to better advertise the current CodeRED emergency response system to residents, highlighting the need to enroll for certain types of alerts) was added to this plan. Part of Fire and Police Mutual Aid Plan and communicate frequently with neighboring communities when they need assistance, specifically with Mattapoisett, Rochester, and Wareham.
3. **Emergency Power Generators:** Emergency power generators can be found in a number of Town buildings. These generators serve to protect government functionality during and immediately after a natural hazard event and also support the operation of the emergency shelter. Generator locations include the Police Department, Fire



Departments, Department of Public Works garage, the Wastewater Treatment Plant and Sippican Elementary School. The Town House does not currently have a generator, but the Town plans to acquire one soon.

4. **Massachusetts State Building Code:** The Massachusetts State Building Code contains many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing, and snow loads.
5. **Public Information and Outreach:** The Town provides information to residents and business owners relating to a range of potential natural hazards. Many departments have an active social media presence through which important hazard mitigation information can be disseminated to the public. The extent of public outreach capacity could, however, be improved. To this end, mitigation actions 1f, 5b and 5c were added to this plan to better communicate and distribute existing resources to residents.
6. **Tree Committee:** Town staff are responsible for the care and planting of trees along Town streets and parks. This committee works in cooperation with the Tree Warden and the Department of Public Works.
7. **Snow Disposal:** The Town conducts general snow removal operations and has adequate space for snow storage as needed.
8. **Water Restrictions:** Even/odd numbered homes have outside watering restrictions in effect from June 15th through September 15th.
9. **Wetland Protection Standards:** The purpose of the Marion Wetland Protection Standards is to protect the wetlands, water resources and adjoining land areas.

C2.a

Participation in the National Flood Insurance Program (NFIP)

Marion currently participates in FEMA's National Flood Insurance Program (NFIP). Per FEMA's Local Multi-Hazard Mitigation Planning Guidance document, the NFIP has three basic aspects:

1. Floodplain identification and mapping – adopt flood maps depicting hazards;
2. Floodplain management – adopt and enforce floodplain management regulations; and
3. Flood insurance – require property owners to purchase insurance in exchange for floodplain management regulations that reduce future flood damages.

Flood Hazard Boundary Maps (FHBMs) were first established in 1979, with flood insurance rate maps (FIRMs) following in 1981. The most recent FEMA Flood Insurance Study became effective on July 6, 2021.

Loss statistics as of April 2021 for the Town of Marion include a total of 181 closed cases, of which the total payments amounted to \$2,896,862 (FEMA 2021b). There are currently 417 active policies in effect.

As part of ongoing NFIP requirements, Marion regulates new development within the Special Flood Hazard Area (SFHA). The Town follows NFIP regulations and guidelines for all new construction, as well as substantial improvements to existing structures, within the flood plain.



D2.a

5.3 PROGRESS ON MITIGATION ACTIONS SINCE 2004

Before identifying new mitigation actions for the 2021 Marion Multi-Hazard Mitigation Plan, the LPT discussed the status of the mitigation actions identified in the 2004 SPREDD Regional Natural Hazard Disaster Mitigation Plan. One of the following status determinations was given to each mitigation action identified from the 2004 plan:

- **Complete:** The project was implemented and completed in 2004-2021.
- **Existing Capability:** The project was implemented and completed in 2004-2021, and it will continue to be implemented on an annual basis.
- **In Progress:** The project was started in the 2004-2021 timeframe and is still in progress.
- **Deferred:** The project is important, but it was deferred because there was no funding available, or it was not feasible to complete the project in this timeframe.
- **Deleted:** The project is no longer relevant to the community.

Table 5-1. Status of 2004 proposed mitigation actions.

Objective Addressed	Action	Current Status
Identify implementing body and pursue funding that builds local capacity and supports grant-writing for the mitigation actions identified in the regional and local PDM plans.	Consider use of SRPEDD municipal assistance hours for assistance.	Existing Capability – The Town of Marion does not need outside grant writing assistance.
Increase communication/coordination between federal, state, regional, county, municipal, private, and non-profit agencies in the area of pre-disaster mitigation. In particular, coordinate planning around prisons, colleges, and large employers.	Develop or use existing town websites.	Deleted – Communication and coordination exist between these entities, but other methods are utilized.
Maintain and enhance working relationships with the utilities including the annual meetings with emergency personnel, and satellite spaces within each community for temporary emergency headquarters.	Already exists – Local communities maintain relationship.	Existing Capability – The Town of Marion maintains good working relationships with utility companies (e.g., Eversource).
Improve hazard warning systems and notification to vulnerable populations.	Coordinate this action with Homeland Security planning and implementation actions. Review Cable capabilities.	Existing Capability – The Town coordinates with MEMA.
	Share ideas on successful ways of tracking vulnerable populations through SRPEDD/DCR/MEMA newsletters such as Visiting nurses, self-identify card with tax bill, or COA coordination.	Existing Capability – The Town has recently completed a Comprehensive Emergency Management Plan, which includes actions for the Town’s public health nurse and Police and Fire Departments to conduct wellness checks for vulnerable populations.
Combat complacency and foster appropriate individual responsibility for mitigating disaster	Use all existing websites – town and SRPEDD.	In Progress – Sea level rise and floodplain risk maps are linked

Objective Addressed	Action	Current Status
<p>impacts by educating all parts of the community including school children, elderly, employers, school administrators, and municipal employees.</p>		<p>from the Town Planning website. Additional actions to better communicate hazard mitigation information to the public have been added to this 2021 plan.</p>
	<p>Display PDM mapping series at local libraries and at major regional events.</p>	<p>Deferred – The LPT would like to schedule future interactive public meetings with the community to answer questions and share info about hazard impacts, what can be done to mitigate, emergency evacuation routes, etc.</p>
<p>Promote use of full range of federal and state resources related to disaster mitigation such as educational materials, training, and National Weather Service forecasts.</p>	<p>Set a goal of 5 communities certified as “Storm Ready” by 2010.</p>	<p>Deleted – The Town is adequately prepared to respond to natural hazards and storms without a specific designation, particularly with the recent completion of the CEMP.</p>
<p>Incorporate disaster mitigation actions into appropriate local and regional plans – Master Plan, Open Space Plan, Transportation Plan, and Capital Programming.</p>	<p>SRPEDD educate communities as they update all of these plans; local representatives also indicate a need for this. Annexes should identify connections.</p>	<p>In Progress – The Town’s 2017 Master Plan included a section on resiliency. The Town also plans to include hazard mitigation concepts into the upcoming Open Space Plan update.</p>
<p>Integrate disaster mitigation concerns into transportation projects (e.g. drainage improvements, underground utilities, etc.).</p>	<p>SRPEDD and local representatives need to speak about these concerns during project development.</p>	<p>In Progress – Phase 1 of the recent Village work addressed drainage improvements. Drainage still needs improvement along the Route 6 corridor; the</p>

Objective Addressed	Action	Current Status
		Town is currently working with MassDOT on Route 6 modifications.
<p>Identify PDM actions that are consistent with the objectives of other interest groups and reach out to collaborate on achieving these initiatives (for example, conservation or environmental groups that support wetlands protection, river corridor acquisition, or reducing runoff).</p>	<p>Local representatives must identify these common goals – especially through the Open Space or Master Plan planning process.</p>	<p>Complete - Marion has included these common goals in recent Open Space and Master Plan updates, as well as by putting some of these goals into action. For example, more than 30% of Marion’s land is protected as open space through community purchases, Sippican Land Trust, Trustees of Reservations, the State, and other organizations; some of this land was protected for hazard mitigation and flood reduction purposes.</p>

5.4 PROPOSED MITIGATION

C4.a
C5.a
C5.b

Planning Process

To identify, evaluate, and prioritize specific mitigation actions and projects to reduce the effects of a natural disaster, the LPT used a prioritization method focusing on four key themes as follows:

- **Benefits:** Determine whether the proposed mitigation measure will improve property protection, natural resource protection, technical capacity, public awareness, or post-hazard emergency response;
- **Feasibility:** Determine whether the proposed mitigation measure is feasible in terms of Town staffing, public and Town support, and whether it is technically feasible;
- **Economic:** Evaluate each mitigation measure in terms of estimated cost and potential funding sources; and
- **Regulatory:** Evaluate each mitigation measure for consistency with local, state, and federal permitting/regulatory requirements and goals.

Each proposed mitigation action presented in this section was given a score based on 13 subcategories within these four larger categories documented above (i.e. Benefits, Feasibility, Economic, Regulatory). For each of these subcategories, the proposed action was given a score of 3 if the action was thought to be a “good” fit with a particular category (likely to provide the benefit under consideration, required little additional training or funding, feasible, etc.), 2 if it was “average”, or 1 if it was “poor” (did not provide the benefit under consideration, difficult to permit, costly, etc.). For a detailed overview of how each action was scored, see Appendix C.

During the planning meetings where potential mitigation measures were discussed and prioritized, a few proposed actions were dismissed from the final Plan. These actions are documented in Appendix C, along with an explanation for dismissal.

When evaluating estimated costs for proposed mitigation actions, the following general cost categories were used:

- High:** Estimated costs greater than \$250,000
- Medium:** Estimated costs between \$50,000 and \$250,000
- Low:** Estimated costs less than \$50,000 and/or staff time only

C4.a
C4.b
C4.c
C5.c

Proposed Mitigation Actions

The final proposed mitigation actions developed during the planning process are summarized in this section. A total of 20 actions were developed. These actions address risks due to flooding, severe weather, hurricanes and tropical storms, and wildfire, as well as more general public outreach and multi-hazard mitigation actions. Specific actions range from public education to increase awareness to actions that involve the modifications of existing buildings or infrastructure to protect them from a hazard.

Proposed mitigation actions are grouped according to their associated mitigation goal. For each action identified below, a brief description is provided, as well as the responsible department(s), potential funding sources, priority, and anticipated timeline.

Goal 1: Invest in improvements that will prevent and reduce damage to critical facilities, infrastructure, and vulnerable areas in Marion from the impacts of natural hazards and changing climate.

Mitigation Action 1a: Elevate/floodproof sewer pump stations and other wastewater infrastructure vulnerable to flooding.	
HAZARD ADDRESSED	Flooding, Tropical Storms/Hurricanes
PURPOSE	Many of the Town’s sewer pump stations are in low-elevation areas that are extremely vulnerable to flooding. One high priority site, the Creek Road Station, is currently permitted and ready for construction. This station was identified as the most vulnerable pumping station in the 2019 wastewater infrastructure vulnerability assessment. Other stations, including Front Street – a critical hub in the wastewater system, are high priority sites for future action. It would also benefit the overall wastewater system if the town provided information to property owners serviced by grinder pumps within the Berry, Dexter Beach, and South Converse Areas that will increase their awareness and enable them to take steps toward mitigating the impacts of adverse weather conditions to their grinder stations.
RESPONSIBILITY	Department of Public Works
ESTIMATED COST	High
POTENTIAL FUNDING SOURCES	BRIC Grants; CZM Resilience Grants
PRIORITY	High
TIMELINE	Design and permitting already completed for Creek Road Station (2021); Creek Road Station construction by 2023. Ongoing: consider other highly vulnerable locations.

Mitigation Action 1b: Increase the flood resiliency of the Harbormaster Building.	
HAZARD ADDRESSED	Flooding, Tropical Storms/Hurricanes
PURPOSE	Although the main portion of the existing building is already elevated, the building is aging and requires significant repairs and the lower storage areas are not floodproof. The new building will be elevated and will include a more resilient design.
RESPONSIBILITY	Harbormaster
ESTIMATED COST	High
POTENTIAL FUNDING SOURCES	BRIC Grants; CZM Resilience Grants
PRIORITY	High
TIMELINE	Currently in the design phase (2021); Construction by 2024.

Mitigation Action 1c: Conduct a town-wide roof assessment of town-owned buildings to identify buildings vulnerable to heavy snowfall.	
HAZARD ADDRESSED	Nor'easter, Severe Winter Weather
PURPOSE	There are a number of large flat roofs in Marion that cannot support a heavy snow load, especially if followed immediately by rain. Conducting a town-wide roof assessment will identify which buildings need immediate clearing after a storm and/or if any of the buildings need repairs or upgrades to increase their resilience.
RESPONSIBILITY	Facilities Department
ESTIMATED COST	Low
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	Medium
TIMELINE	Complete assessment by 2024

Mitigation Action 1d: Remove debris from forested areas within close proximity to municipal facilities to reduce risk of damage to buildings and infrastructure from wildfire.	
HAZARD ADDRESSED	Wildfire
PURPOSE	Removing fuel sources (i.e., debris, downed branches, etc.) from close proximity to municipal facilities will reduce the chance that a wildfire will directly impact critical infrastructure if one occurs.
RESPONSIBILITY	Fire Department; Department of Public Works
ESTIMATED COST	Medium
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	Medium
TIMELINE	Initial removal/clearing by 2023, then ongoing.

Mitigation Action 1e: Replace and/or enlarge culverts under roads that experience flooding during heavy precipitation and complete upcoming scheduled repairs on damaged culverts to ensure adequate flow/function.	
HAZARD ADDRESSED	Flooding, Other Severe Weather (e.g., Heavy Precipitation)
PURPOSE	Appropriately sized and managed culverts are less vulnerable to clogging, failure and overtopping during high water events. When designing new system, future climate projections should be considered; periodic reconsideration of design criteria will be necessary as future projections become more solidified.
RESPONSIBILITY	Department of Public Works
ESTIMATED COST	Medium
POTENTIAL FUNDING SOURCES	Chapter 90; DER Culvert Replacement Municipal Assistance Grant Program
PRIORITY	Medium
TIMELINE	Complete scheduled repairs: As needed. Replace/enlarge culverts: Initial assessment and/or plans for which culverts to prioritize by 2024.

Mitigation Action 1f: Coordinate with residents in areas vulnerable to coastal flooding to apply for hazard mitigation grants and provide information on building and design guidance (i.e., building code in flood zones) and permitting steps for installation of resiliency improving actions (i.e., living shorelines, home elevation, etc.).	
HAZARD ADDRESSED	Flooding, Tropical Storms/Hurricanes
PURPOSE	Much of this information is already available but could be better advertised and disseminated to residents. There are also groups of coastal homeowners that could benefit from the Flood Mitigation Assistance Program.
RESPONSIBILITY	Planning Board and Building Commissioner
ESTIMATED COST	Medium
POTENTIAL FUNDING SOURCES	Operating Budget; Flood Mitigation Assistance Program
PRIORITY	Medium
TIMELINE	Start 2022; then ongoing outreach efforts.

Goal 2: Integrate hazard mitigation planning in all relevant municipal departments, committees and boards to ensure that future development meets all local, state, and federal requirements.

Mitigation Action 2a: Hold annual or semi-annual meetings with relevant municipal departments, committees and boards to discuss how hazard mitigation planning could be incorporated into their respective activities.	
HAZARD ADDRESSED	Multiple Hazards
PURPOSE	By having regular inter-departmental communication about hazard planning, the Town will be able to better coordinate its hazard mitigation efforts. Discussions could include how each department and committee could incorporate hazard mitigation planning and climate change resiliency into their respective mission statements and ongoing activities.
RESPONSIBILITY	All municipal departments and committees
ESTIMATED COST	Low
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	High
TIMELINE	Annually starting in 2022

Mitigation Action 2b: Ensure future municipal plans (e.g., updates to master plan, open space plan, etc.) incorporate hazard mitigation planning and climate change resiliency.	
HAZARD ADDRESSED	Multiple Hazards
PURPOSE	By incorporating hazard mitigation planning and climate change resiliency into future municipal plan updates, hazard mitigation actions are more likely to be implemented and the public will be better informed of critical hazard mitigation and climate change information.
RESPONSIBILITY	Select Board
ESTIMATED COST	Low
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	High
TIMELINE	Ongoing, starting in 2022, whenever a plan is scheduled for an update

**Mitigation Action 2c:
Formulate bylaws that require more resilient designs (e.g., requiring new buildings to plan for future flood elevation).**

HAZARD ADDRESSED	Multiple Hazards
PURPOSE	Current state and local regulations are helpful in planning for today's risk (e.g., local building code requires new structures to be built above today's flood elevation), but with the long lifetime of roads, buildings and other infrastructure, it may be necessary to formulate bylaws that require more resilient designs to plan for future conditions.
RESPONSIBILITY	Planning Department
ESTIMATED COST	Medium
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	Low
TIMELINE	Start: 2022; Complete by 2026

Goal 3: Encourage the business community, institutions, and non-profits to be active in hazard mitigation planning.

Mitigation Action 3a: Work with hazardous-materials-containing private facilities located in high hazard areas, such as along the waterfront (e.g., boatyards), to develop hazardous materials management plans.	
HAZARD ADDRESSED	Multiple Hazards
PURPOSE	If buildings or storage facilities with hazard materials are flooded or damaged during a natural hazard, a hazardous materials release or spill can occur. Working with private facilities to develop hazardous material management plans can help plan for future hazards and prevent this occurrence.
RESPONSIBILITY	Fire Department
ESTIMATED COST	Low
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	Medium
TIMELINE	Start: 2022; Complete by 2026

Mitigation Action 3b: Encourage private organizations, businesses, and facilities to develop disaster response plans and/or implement flood protection measures.	
HAZARD ADDRESSED	Multiple Hazards
PURPOSE	Working with private organizations, businesses and facilities to develop disaster response plans and/or implement flood protection measures can ensure that these facilities are well prepared for a future hazard event, better protecting those facilities and their staff, and reducing the amount of emergency response effort required by the Town.
RESPONSIBILITY	Planning Board; Fire Department
ESTIMATED COST	Low
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	High
TIMELINE	Start: 2022; Complete by 2026

Goal 4: Coordinate with neighboring communities, state, regional and federal agencies on regional solutions for hazards affecting multiple communities.

Mitigation Action 4a: Coordinate with neighboring communities to develop a regional evacuation plan.	
HAZARD ADDRESSED	Multiple Hazards
PURPOSE	Due to the unique topography of Marion, there are multiple areas of Town that could be completely isolated due to flooding in a major storm. Having an evacuation plan will help ensure that residents in vulnerable locations can be informed early and directed to safer locations until conditions are safe to return home. Since the main transportation routes leaving Marion run through neighboring communities, regional coordination will be important.
RESPONSIBILITY	Emergency Management
ESTIMATED COST	Medium
POTENTIAL FUNDING SOURCES	MVP Action Grant
PRIORITY	High
TIMELINE	Start 2022; Complete by 2024
OTHER GOALS ADDRESSED	Goal 6

Goal 5: Improve public education related to natural hazards, including informing the public about hazard-prone areas to mitigate damage and losses where possible and what to expect during natural disasters.

Mitigation Action 5a: Better advertise the current CodeRED emergency response system to residents, highlighting the need to enroll for certain types of alerts.	
HAZARD ADDRESSED	Multiple Hazards
PURPOSE	The Town currently utilizes the Plymouth County Sherriff Department’s CodeRED system (i.e., “reverse 911) to disseminate important emergency information to residents. Landlines are automatically contacted, but many residents are unaware that this service exists, and that if they want to receive calls or messages on their cell phone or via email they need to actively enroll. The system is otherwise effective and can be used to send a message to the entire Town or a specific sub-region depending on the event.
RESPONSIBILITY	Emergency Management
ESTIMATED COST	Low
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	High
TIMELINE	Start 2022; then ongoing outreach efforts.

Mitigation Action 5b: Develop educational materials for residents about defensible space techniques and the dangers of wildfires, potentially drawing from national level programs like Firewise.	
HAZARD ADDRESSED	Wildfire
PURPOSE	Educate residents about fire prevention measures, including keeping a safe zone clear around their house.
RESPONSIBILITY	Fire Department
ESTIMATED COST	Low
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	Low
TIMELINE	Material development by 2023; then ongoing outreach efforts.

Mitigation Action 5c: Circulate regular “resiliency tips” to keep the public well informed about hazard mitigation planning.	
HAZARD ADDRESSED	Multiple Hazards
PURPOSE	These could take any of a variety of forms, including Facebook posts, newspaper articles, and/or website announcements. By having regular posts, the concept of hazard mitigation planning will stay in the forefront of people’s minds. Tips could include where to find key information, how to sign up for CodeRED, how to prepare your home/yard for a hurricane, etc. To keep mitigation planning at the forefront, each department could post a “resiliency tip” on a rotating basis, creating a shared and relatively nondemanding task.
RESPONSIBILITY	All departments; coordinated by Town Administrator
ESTIMATED COST	Low
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	Medium
TIMELINE	Begin in 2022; then ongoing outreach efforts.

Goal 6: Ensure adequate evacuation routes and means to maintain adequate access during an emergency.

Mitigation Action 6a: Create a forest management plan that prioritizes management of roads used for evacuation and to access shelters, particularly in areas vulnerable to downed trees.	
HAZARD ADDRESSED	Multiple Hazards
PURPOSE	A forest management plan would include tree trimming and maintenance along major transportation corridors to minimize the incidence of downed trees and wires and blocked roads. The plan may also include outreach to and recommendations for residents for how to best manage trees and forests on private property.
RESPONSIBILITY	Fire Department and Department of Public Works
ESTIMATED COST	Medium
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	Medium
TIMELINE	Begin in 2024; Complete by 2026.

Mitigation Action 6b: Improve roadway drainage through stormwater system upgrades to decrease flooding on high-trafficked roads.	
HAZARD ADDRESSED	Multiple Hazards
PURPOSE	Some roadways experience flooding during heavy rainfall events due to stormwater systems that are inadequately sized to handle the volume of precipitation. This results in impassible roadways, inaccessible parking lots and businesses, and stranded vehicles. When designing new system, future climate projections should be considered; periodic reconsideration of design criteria will be necessary as future projections become more solidified.
RESPONSIBILITY	Department of Public Works
ESTIMATED COST	High
POTENTIAL FUNDING SOURCES	Town Meeting; MVP Action Grant; Community Development Block Grant; Chapter 90
PRIORITY	Medium
TIMELINE	Begin in 2022; then ongoing as future roadwork is needed.

Goal 7: Provide residents with public utilities, such as electricity, drinking water, and communications, during and after natural disasters or alternatively access to emergency shelters equipped with sufficient provisions, climate control and emergency electricity.

Mitigation Action 7a: Increase generator capacity at local emergency shelter (i.e., Sippican School). There are currently generators, but they cannot currently support running the cooling system, and although cooking facilities and showers are available, hot water is not.	
HAZARD ADDRESSED	Multiple Hazards
PURPOSE	Increasing the generator capacity at the local emergency shelter would ensure that emergency services provided could continue even in the event of a power-outage during a natural hazard.
RESPONSIBILITY	Emergency Management, School District
ESTIMATED COST	Medium
POTENTIAL FUNDING SOURCES	FEMA Pre-Disaster Mitigation Grant, Town Meeting
PRIORITY	Low
TIMELINE	Complete by 2024

Mitigation Action 7b: Coordinate with private facilities for expanding or specific emergency sheltering capacity.	
HAZARD ADDRESSED	Multiple Hazards
PURPOSE	Coordination with private facilities could help the Town better meet shelter capacity while utilizing existing resources already present in Town. For example, Tabor Academy has a generator array and the capacity for hot showers, the Sippican Long Term Healthcare Center can support residents that have a medical condition that need extra attention, etc.
RESPONSIBILITY	Emergency Management
ESTIMATED COST	Low
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	Low
TIMELINE	Initiate discussions with private facilities by 2023; ongoing coordination thereafter.

Mitigation Action 7c: Increase the number of staff/volunteers at emergency shelters.	
HAZARD ADDRESSED	Multiple Hazards
PURPOSE	The Town is looking to expand the number of people who can help run the emergency shelters by switching from a Medical Reserve Corps (MRC) to a Community Emergency Response Team (CERT). The Town will be putting together a new CERT this summer/fall and plans to hold initial informational introductory meetings shortly after the team is assembled.
RESPONSIBILITY	Emergency Management
ESTIMATED COST	Low
POTENTIAL FUNDING SOURCES	Operating Budget
PRIORITY	High
TIMELINE	Begin staff/volunteer trainings in 2021; ongoing maintenance and training of staff thereafter.



The Marion Multi-Hazard Mitigation Plan is not meant to be a static document. As conditions change, new information becomes available, or mitigation actions progress or are completed over the life of the plan, adjustments and updates may be necessary to maintain its relevance. This chapter describes how the Plan will be tracked, updated, and enhanced in the coming years. The plan must be fully reviewed and revised as necessary at least once every five years. Keeping the plan up-to-date also means continuing to provide opportunities for public involvement and comment on the plan and its implementation.



As required by FEMA, this Plan must outline a maintenance process to ensure the Plan remains active and relevant to the current conditions of the Town. The process must identify the following items:

- Plan Monitoring, Evaluation and Updates – Method and schedule for monitoring, evaluating and updating the plan once every five years;
- Incorporation of Mitigation Strategies – Explanation of how local governments will incorporate mitigation strategies into existing mechanisms; and
- Continued Public Involvement – Requirements that public participation continue throughout the plan maintenance process.

This section details how Marion will meet these Plan maintenance requirements.

A6.a-d

6.1 PLAN MONITORING, EVALUATION AND UPDATES

As required by FEMA, the written plan will be evaluated and updated at least once every five years by relevant Town departments, boards, and agencies. In the interim, select members of the LPT will conduct annual reviews of the progress of mitigation actions and update as necessary. If a major disaster occurs in the interim, the plan may be evaluated or updated if Town personnel feel that the plan failed in some way, or imminent changes are required to better respond to future disasters. As necessary, LPT members and/or departments may be added or removed from the LPT to obtain the most accurate and applicable information possible.

Evaluations and updates will take place in much the same way this updated plan was developed. The process will include meetings of the LPT, review of goals and objectives, updating the community profile, review and modification of potential hazards and hazard related data, review of existing hazard-prone areas and the addition of any new areas, updating existing and planned hazard mitigation measures, and an evaluation as to the effectiveness of the plan to date. The next update will begin in year 4 of this plan, to ensure that the subsequent update is ready within the required 5-year window.

6.2 INCORPORATION OF MITIGATION STRATEGIES

Mitigation strategies outlined in this Plan will be incorporated into existing plans, bylaws, and regulations as feasible. During Plan updates, existing and proposed mitigation actions will be evaluated for effectiveness, level of completion, and continued appropriateness. Mitigation strategies will also need to be included in the annual budget process.

Upon approval of this plan, the LPT will provide all interested parties and implementing departments with a copy of the plan and will initiate a discussion regarding how the plan can be integrated into that department's ongoing work. At a minimum, the plan will be reviewed and discussed with the following departments:

- Emergency Management
- Fire Department
- Police Department



- Department of Public Works
- Planning Board
- Conservation Commission
- Building Department

C6.e

After this plan has been approved by both FEMA and the local government, links to the final plan will be emailed to all Town staff, boards, and committees, with a reminder to review the plan periodically and work to incorporate its contents, especially the proposed mitigation actions presented in Chapter 5, into other planning processes, documents, and plans. In addition, during annual review meetings for the Multi-Hazard Mitigation Plan implementation process, the Local Planning Team (LPT) will review whether any of these plans are in the process of being updated. If so, the LPT will remind people working on these plans, policies, etc., of the Multi-Hazard Mitigation plan, and urge them to incorporate the Multi-Hazard Mitigation Plan data, findings, and actions into their respective efforts. The Multi-Hazard Mitigation Plan will also be incorporated into future updates of the Town's Comprehensive Emergency Management Plan.

6.3 CONTINUED PUBLIC INVOLVEMENT

A5.a

During the periodic five-year update process, the LPT will hold at least one public workshop or similar meeting to solicit feedback from the general public on the progress made to date. Concerned citizens will also be invited to review the revised Plan and submit any additional comments or recommendations for improving the Plan. All events will be publicly advertised in the local newspaper and/or similar method. Copies of the Plan will be provided in public places such as the Town House. The Plan will also be made available to the general public via the Town's website.

6.4 PLAN ADOPTION

E1.a

At the conclusion of planning efforts conducted by the Local Planning Team (LPT), the draft of the Marion Multi-Hazard Mitigation Plan was reviewed by the Local Planning Team, stakeholders and the general public, and informally approved by all applicable Town departments, boards, and other agencies identified as members of the LPT. The plan was then submitted to the State Hazard Mitigation Officer (SHMO) of the Massachusetts Department of Resource Conservation, the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency (FEMA) for review and approval. If approved by MEMA and FEMA, the plan will be brought before the Marion Selectboard for adoption, and the Plan will enter the five year "maintenance" phase. A draft of the certificate of adoption is provided on the following page. Proof of plan adoption will also be included at the front of this report.



REFERENCES:

- AECOM. 2018. Massachusetts State Hazard Mitigation and Climate Adaptation Plan. Prepared by an AECOM consulting team for the State of Massachusetts. September 2018.
- BBNEP. 2020. Red Tide and PSP. Buzzards Bay National Estuary Program. <https://buzzardsbay.org/living-resources/nuisance-algae-hab/red-tide-bsp/>
- Bosma, K., E. Douglas, P. Kirshen, K. McArthur, S. Miller, and C. Watson, MassDOT Report: Climate Change and Extreme Weather Vulnerability Assessments and Adaptation Options for the State of Massachusetts, 2019 (in publication).
- CDM Smith. 2019. Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure. Prepared for the Town of Marion. June 26, 2019.
- DCR. 2021. Hydrologic Conditions Reports. <http://www.mass.gov/service-details/hydrologic-conditions-reports>
- EOEEA. 2019. Massachusetts Drought Management Plan. Massachusetts Executive Office of Energy and Environmental Affairs. September 2019.
- EOEEA. 2018. Massachusetts State Hazard Mitigation and Climate Adaptation Plan.
- EEA. 2018. Massachusetts Climate Change Projections - Statewide and for Major Drainage Basins. Produced by Northeast Climate Adaptation Science Center. Published by Massachusetts Executive Office of Energy and Environmental Affairs (EEA). March 2018. <https://resilientma.org/resources/resource::2152/massachusetts-climate-change-projections-statewide-and-for-major-drainage-basins>.
- FEMA. 2011. Local Mitigation Plan Review Guide. October 1, 2011.
- FEMA. 2021a. Disaster Declarations. <https://www.fema.gov/disasters>
- FEMA. 2021b. FEMA Community Information System (CIS) database, accessed on April 27, 2021.
- FEMA. 2020. Loss Statistics. <https://bsa.nfipstat.fema.gov/reports/1040.htm>
- GlobalChange.gov. 2020. Heavy Precipitation. <https://www.globalchange.gov/browse/indicators/heavy-precipitation>
- Kemp, A.C., B.P. Horton, J.P. Donnelly, M.E. Mann, M. Vermeer, and S. Rahmstorf. 2011. Climate related sea-level variations over the past two millennia. Proceedings of the National Academy of Sciences. 108 (27) 11017-11022.



- National Hurricane Center. 2016a. Tropical Cyclone Climatology. <http://www.nhc.noaa.gov/climo/>
- National Hurricane Center. 2016b. Saffir-Simpson Hurricane Wind Scale. <http://www.nhc.noaa.gov/aboutsshws.php>
- National Hurricane Center. 2016c. Storm Surge Overview. <http://www.nhc.noaa.gov/surge/>
- National Weather Service. 2016a. Heat Index. http://www.nws.noaa.gov/om/heat/heat_index.shtml
- National Weather Service. 2016b. Wind Chill/Temperature Index. <http://www.weather.gov/oun/safety-winter-windchill>
- NOAA. 2021. NOAA NCDC Storm Events Database. <https://www.ncdc.noaa.gov/stormevents/>
- NOAA NCEI. 2021. Global Historical Tsunami Database. <https://www.sciencebase.gov/catalog/item/5c7065b4e4b0fe48cb43fbd7>
- NOAA. 2020a. Mean Sea Level Trend 8447930 Woods Hole, Massachusetts. [NCEI Hazard Tsunami Search \(noaa.gov\)](#)
- NOAA. 2020b. Historical Hurricane Tracks. <https://coast.noaa.gov/hurricanes/>.
- Pare Corporation. 2016a. Emergency Action Plan: Route 25 Dam #1 MA02560/7-12-310-28. Prepared for Massachusetts Department of Transportation (MassDOT). Prepared by Pare Corporation. Pare Project Number 13048.03. October 2016.
- Pare Corporation. 2016b. Emergency Action Plan: Mill Pond (Route 28) Dam MA00027/7-12-310-3. Prepared for Massachusetts Department of Transportation (MassDOT). Prepared by Pare Corporation. Pare Project Number 13048.03. October 2016.
- Pare Corporation. 2013. Parker Mills Pond Dam Emergency Action Plan MA00150/7-12-310-2. Prepared for the Town of Marion. Prepared by Pare Corporation. Original: June 2007. Updated: June 2013.
- Thieler, E.R, T.L. Smith, J.M. Knisel, and D.W. Sampson. 2013. Massachusetts Shoreline Change Mapping and Analysis Project, 2013 Update. Open File Report 2002-1189.
- UCS. 2015. Causes of Sea Level Rise Fact Sheet. www.ucsus.org/sealevelrisescience
- USGS. 2019. Landslide Inventories Across the United States. <https://www.sciencebase.gov/catalog/item/5c7065b4e4b0fe48cb43fbd7>
- Marion, Town of. 2020. Town of Marion Website. <https://www.Marion.ma.us/>



Woods Hole Group. 2020. Marion Climate Change Flood Vulnerability Assessment and Adaptation Planning.



Appendix A: Local Mitigation Plan Review Guide

1. Local Mitigation Plan Review Guide
2. CRS Scoring Checklist

Local Mitigation Plan Review Guide

October 1, 2011



FEMA

SECTION 4:

REGULATION CHECKLIST

This section provides detailed guidance on how FEMA interprets the various requirements of the regulation for all Local Mitigation Plan reviews through a Regulatory Checklist. The guidance is limited only to the minimum requirements of *what* must be in a Local Mitigation Plan, and does not provide guidance on *how* the community should develop a plan. The Regulation Checklist includes the following Elements:

- 4.1 ELEMENT A: Planning Process
- 4.2 ELEMENT B: Hazard Identification and Risk Assessment
- 4.3 ELEMENT C: Mitigation Strategy
- 4.4 ELEMENT D: Plan Review, Evaluation, and Implementation
- 4.5 ELEMENT E: Plan Adoption
- 4.6 ELEMENT F: Additional State Requirements

Many requirements in the Checklist call for the plan to “document” or “describe” information. FEMA does not require specific formats for the plan or its content. Required information to “document” can be provided in the plan through a variety of formats, such as narrative, tables, lists, maps, etc. Examples provided in this *Guide* are samples of one or more approaches to meeting that particular requirement. Examples are not inclusive of all possible solutions to meet a requirement, and they are not necessarily considered “best practices” or exemplary. FEMA will recognize that there are many formats and types of documentation that may meet a particular requirement.

Terms from the regulation are defined in this *Guide*, where necessary. For example, many of the plan requirements ask for a “discussion” or “description.” FEMA considers the plan as the written record, or documentation, of the planning process. Therefore, many of these terms have the same meaning to document *what* was done. In addition, this *Guide* uses the terms “jurisdiction” and “community” interchangeably. For purposes of this *Guide*, these terms are equal to any local government developing a Local Mitigation Plan. This is defined at 44 CFR §201.2 as:

“any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.”

Finally, an important distinction must be made between the words “shall” and “should” in the Mitigation Planning regulation at 44 CFR Part 201. The Regulation Checklist only includes the requirements where the regulation uses the words “shall” and “must,” and does not include the “should.” When the word “should” is used, the item is strongly recommended to be included in the plan, but its absence will not cause FEMA to disapprove the plan.

4.1 ELEMENT A: PLANNING PROCESS

Requirement §201.6(b)	An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:
§201.6(b)(1)	(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
§201.6(b)(2)	(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
§201.6(b)(3)	(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
§201.6(c)(1)	[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.
§201.6(c)(4)(i)	[The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
§201.6(c)(4)(iii)	[The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

Overall Intent. The planning process is as important as the plan itself. Any successful planning activity, such as developing a comprehensive plan or local land use plan, involves a cross-section of stakeholders and the public to reach consensus on desired outcomes or to resolve a community problem. The result is a common set of community values and widespread support for directing financial, technical, and human resources to an agreed upon course of action, usually identified in a plan. The same is true for mitigation planning. An effective and open planning process helps ensure that citizens understand risks and vulnerability, and they can work with the jurisdiction to support policies, actions, and tools that over the long-term will lead to a reduction in future losses.

Leadership, staffing, and in-house knowledge in local government may fluctuate over time. Therefore, the description of the planning process serves as a permanent record that explains how decisions were reached and who involved. FEMA will accept the planning process as defined by the community, as long as the mitigation plan includes a narrative

description of the process used to develop the mitigation plan—a systematic account about how the mitigation plan evolved from the formation of a planning team, to how the public participated, to how each section of the plan was developed, to what plans or studies were incorporated into the plan, to how it will be implemented. Documentation of a current planning process is required for both new and updated plans.

<u>ELEMENT</u>	<u>REQUIREMENTS</u>
<p>A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? 44 CFR 201.6(c)(1)</p> <p><i>Intent: To inform the public and other readers about the overall approach to the plan’s development and serve as a permanent record of how decisions were made and who was involved. This record also is useful for the next plan update.</i></p>	<p>a. Documentation of how the plan was prepared must include the schedule or timeframe and activities that made up the plan’s development as well as who was involved. Documentation typically is met with a narrative description, but may also include, for example, other documentation such as copies of meeting minutes, sign-in sheets, or newspaper articles.</p> <p><i>Document means provide the factual evidence for how the jurisdictions developed the plan.</i></p> <p>b. The plan must list the jurisdiction(s) participating in the plan that seek approval.</p> <p>c. The plan must identify who represented each jurisdiction. The Plan must provide, at a minimum, the jurisdiction represented and the person’s position or title and agency within the jurisdiction.</p> <p>d. For each jurisdiction seeking plan approval, the plan must document how they were involved in the planning process. For example, the plan may document meetings attended, data provided, or stakeholder and public involvement activities offered. Jurisdictions that adopt the plan without documenting how they participated in the planning process will not be approved.</p> <p><i>Involved in the process means engaged as participants and given the chance to provide input to affect the plan’s content. This is more than simply being invited (See “opportunity to be involved in the planning process” in A2 below) or only adopting the plan.</i></p> <p>e. Plan updates must include documentation of the current planning process undertaken to update the plan.</p>
<p>A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? 44 CFR 201.6(b)(2)</p>	<p>a. The plan must identify all stakeholders involved or given an opportunity to be involved in the planning process. At a minimum, stakeholders must include:</p> <ol style="list-style-type: none"> 1) Local and regional agencies involved in hazard mitigation activities; 2) Agencies that have the authority to regulate development; and 3) Neighboring communities. <p><i>An opportunity to be involved in the planning process means that the stakeholders are engaged or invited as participants and given the chance to provide input to affect the plan’s content.</i></p>

<u>ELEMENT</u>	<u>REQUIREMENTS</u>
<p><i>Intent:</i> <i>To demonstrate a deliberative planning process that involves stakeholders with the data and expertise needed to develop the plan, with responsibility or authority to implement hazard mitigation activities, and who will be most affected by the plan’s outcomes.</i></p>	<p>b. The Plan must provide the agency or organization represented and the person’s position or title within the agency.</p> <p>c. The plan must identify how the stakeholders were invited to participate in the process.</p> <p>Examples of stakeholders include, but are not limited to:</p> <ul style="list-style-type: none"> • Local and regional agencies involved in hazard mitigation include public works, zoning, emergency management, local floodplain administrators, special districts, and GIS departments. • Agencies that have the authority to regulate development include planning and community development departments, building officials, planning commissions, or other elected officials. • Neighboring communities include adjacent counties and municipalities, such as those that are affected by similar hazard events or may be partners in hazard mitigation and response activities. • Other interests may be defined by each jurisdiction and will vary with each one. These include, but are not limited to, business, academia, and other private and non-profit interests depending on the unique characteristics of the community.
<p>A3. Does the Plan document how the public was involved in the planning process during the drafting stage? 44 CFR 201.6(b)(1) and 201.6(c)(1)</p> <p><i>Intent:</i> <i>To ensure citizens understand what the community is doing on their behalf, and to provide a chance for input on community vulnerabilities and mitigation activities that will inform the plan’s content. Public involvement is also an opportunity to educate the public about hazards and risks in the community, types of activities to mitigate those risks, and how these impact them.</i></p>	<p>a. The plan must document how the public was given the opportunity to be involved in the planning process and how their feedback was incorporated into the plan. Examples include, but are not limited to, sign-in sheets from open meetings, interactive websites with drafts for public review and comment, questionnaires or surveys, or booths at popular community events.</p> <p>b. The opportunity for participation must occur during the plan development, which is prior to the comment period on the final plan and prior to the plan approval / adoption.</p>

ELEMENT	REQUIREMENTS
<p>A4. Does the Plan document the review and incorporation of existing plans, studies, reports, and technical information? 44 CFR 201.6(b)(3)</p> <p><i>Intent: To identify existing data and information, shared objectives, and past and ongoing activities that can help inform the mitigation plan. It also helps identify the existing capabilities and planning mechanisms to implement the mitigation strategy.</i></p>	<p>a. The plan must document <i>what</i> existing plans, studies, reports, and technical information were reviewed. Examples of the types of existing sources reviewed include, but are not limited to, the state hazard mitigation plan, local comprehensive plans, hazard specific reports, and flood insurance studies.</p> <p>b. The plan must document <i>how</i> relevant information was incorporated into the mitigation plan.</p> <p><i>Incorporate means to reference or include information from other existing sources to form the content of the mitigation plan.</i></p>
<p>A5. Is there discussion on how the community(ies) will continue public participation in the plan maintenance process? 44 CFR 201.6(c)(4)(iii)</p> <p><i>Intent: To identify how the public will continue to have an opportunity to participate in the plan’s maintenance and implementation over time.</i></p>	<p>a. The plan must describe how the jurisdiction(s) will continue to seek public participation after the plan has been approved and during the plan’s implementation, monitoring and evaluation.</p> <p><i>Participation means engaged and given the chance to provide feedback. Examples include, but are not limited to, periodic presentations on the plan’s progress to elected officials, schools or other community groups, annual questionnaires or surveys, public meetings, postings on social media and interactive websites.</i></p>
<p>A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? 44 CFR 201.6(c)(4)(i)</p> <p><i>Intent: To establish a process for jurisdictions to track the progress of the plan’s implementation. This also serves as the basis of the next plan update.</i></p>	<p>a. The plan must identify how, when, and by whom the plan will be monitored. <i>Monitoring means tracking the implementation of the plan over time. For example, monitoring may include a system for tracking the status of the identified hazard mitigation actions.</i></p> <p>b. The plan must identify how, when, and by whom the plan will be evaluated. <i>Evaluating means assessing the effectiveness of the plan at achieving its stated purpose and goals.</i></p> <p>c. The plan must identify how, when, and by whom the plan will be updated. <i>Updating means reviewing and revising the plan at least once every five years.</i></p> <p>d. The plan must include the title of the individual or name of the department/ agency responsible for leading each of these efforts.</p>

4.2 ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT

Requirement	[The risk assessment shall include a] description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
§201.6(c)(2)(i)	
§201.6(c)(2)(ii)	[The risk assessment shall include a] description of the jurisdiction’s vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:
§201.6(c)(2)(ii)(A)	(A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;
§201.6(c)(2)(ii)(B)	(B) An estimate of the potential dollar losses to vulnerable structures identified in ... this section and a description of the methodology used to prepare the estimate.
§201.6(c)(2)(ii)(C)	(C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.
§201.6(c)(2)(iii)	For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction’s risks where they vary from the risks facing the entire planning area.

Overall Intent. The risk assessment provides the factual basis for activities proposed in the strategy that will reduce losses from identified hazards. A quality risk assessments makes a clear connection between the community’s vulnerability and the hazard mitigation actions. In other words, it provides sufficient information to enable the jurisdiction(s) to identify and prioritize appropriate hazard mitigation actions.

Local risk assessments do not need to be based on the most sophisticated technology, but do need to be accurate, current, and relevant. During a plan update, local jurisdictions assess current and expected future vulnerability to all hazards and integrate new hazard data such as recent hazard events and new flood studies. In the mitigation plan review, FEMA looks at the quality of the information in the risk assessment, not the quantity of information in the risk assessment.

The Mitigation Planning regulation includes several “optional” requirements for the vulnerability assessment. These are easily recognizable with the use of the term “should” in the requirement (See §201.6(c)(2)(ii)(A-C)). Although not required, these are strongly recommended to be included in the plan. However, their absence will not cause FEMA to disapprove the plan. These “optional” requirements were originally intended to meet the overall vulnerability assessment, and this analysis can assist with identifying mitigation actions.

<u>ELEMENT</u>	<u>REQUIREMENTS</u>
<p>B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and 44 CFR 201.6(c)(2)(iii)</p> <p><i>Intent: To understand the potential and chronic hazards affecting the planning area in order to identify which hazard risks are most significant and which jurisdictions or locations are most adversely affected.</i></p>	<p>a. The plan must include a description of the natural hazards that can affect the jurisdiction(s) in the planning area.</p> <p><i>A natural hazard is a source of harm or difficulty created by a meteorological, environmental, or geological event³. The plan must address natural hazards. Manmade or human-caused hazards may be included in the document, but these are not required and will not be reviewed to meet the requirements for natural hazards. In addition, FEMA will not require the removal of this extra information prior to plan approval.</i></p> <p>b. The plan must provide the rationale for the omission of any natural hazards that are commonly recognized to affect the jurisdiction(s) in the planning area.</p> <p>c. The description, or profile, must include information on location, extent, previous occurrences, and future probability for each hazard. Previous occurrences and future probability are addressed in sub-element B2.</p> <p>The information does not necessarily need to be described or presented separately for location, extent, previous occurrences, and future probability. For example, for some hazards, one map with explanatory text could provide information on location, extent, and future probability.</p> <p><i>Location means the geographic areas in the planning area that are affected by the hazard. For many hazards, maps are the best way to illustrate location. However, location may be described in other formats. For example, if a geographically-specific location cannot be identified for a hazard, such as tornados, the plan may state that the entire planning area is equally at risk to that hazard.</i></p> <p><i>Extent means the strength or magnitude of the hazard. For example, extent could be described in terms of the specific measurement of an occurrence on a scientific scale (for example, Enhanced Fujita Scale, Saffir-Simpson Hurricane Scale, Richter Scale, flood depth grids) and/or other hazard factors, such as duration and speed of onset. Extent is not the same as impacts, which are described in sub-element B3.</i></p>

³ DHS Risk Lexicon, 2010 Edition. <http://www.dhs.gov/xlibrary/assets/dhs-risk-lexicon-2010.pdf>

ELEMENT	REQUIREMENTS
	<p>d. For participating jurisdictions in a multi-jurisdictional plan, the plan must describe any hazards that are unique and/or varied from those affecting the overall planning area.</p>
<p>B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)</p> <p><i>Intent: To understand potential impacts to the community based on information on the hazard events that have occurred in the past and the likelihood they will occur in the future.</i></p>	<p>a. The plan must include the history of previous hazard events for each of the identified hazards.</p> <p>b. The plan must include the probability of future events for each identified hazard.</p> <p><i>Probability means the likelihood of the hazard occurring and may be defined in terms of general descriptors (for example, unlikely, likely, highly likely), historical frequencies, statistical probabilities (for example: 1% chance of occurrence in any given year), and/or hazard probability maps. If general descriptors are used, then they must be defined in the plan. For example, “highly likely” could be defined as equals near 100% chance of occurrence next year or happens every year.</i></p> <p>c. Plan updates must include hazard events that have occurred since the last plan was developed.</p>
<p>B3. Is there a description of each identified hazard’s impact on the community as well as an overall summary of the community’s vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)</p> <p><i>Intent: For each jurisdiction to consider their community as a whole and analyze the potential impacts of future hazard events and the vulnerabilities that could be reduced through hazard mitigation actions.</i></p>	<p>a. For each participating jurisdiction, the plan must describe the potential impacts of each of the identified hazards on the community.</p> <p><i>Impact means the consequence or effect of the hazard on the community and its assets. Assets are determined by the community and include, for example, people, structures, facilities, systems, capabilities, and/or activities that have value to the community. For example, impacts could be described by referencing historical disaster impacts and/or an estimate of potential future losses (such as percent damage of total exposure).</i></p> <p>b. The plan must provide an overall summary of each jurisdiction’s vulnerability to the identified hazards. The overall summary of vulnerability identifies structures, systems, populations or other community assets as defined by the community that are susceptible to damage and loss from hazard events. A plan will meet this sub-element by addressing the requirements described in §201.6(c)(2)(ii)(A-C).</p> <p>Vulnerable assets and potential losses is more than a list of the total exposure of population, structures, and critical facilities in the planning area. An example of an overall summary is a list of key issues or problem statements that clearly describes the community’s greatest vulnerabilities and that will be addressed in the mitigation strategy.</p>

ELEMENT	REQUIREMENTS
<p>B4. Does the Plan address NFIP insured structures within each jurisdiction that have been repetitively damaged by floods? 44 CFR 201.6(c)(2)(ii)</p> <p><i>Intent: To inform hazard mitigation actions for properties that have suffered repetitive damage due to flooding, particularly problem areas that may not be apparent on floodplain maps. Information on repetitive loss properties helps inform FEMA hazard mitigation assistance programs under the National Flood Insurance Act.</i></p>	<p>a. The plan must describe the types (residential, commercial, institutional, etc.) and estimate the numbers of repetitive loss properties located in identified flood hazard areas.</p> <p><i>Repetitive loss properties are those for which two or more losses of at least \$1,000 each have been paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978.</i></p> <p><i>Severe repetitive loss properties are residential properties that have at least four NFIP payments over \$5,000 each and the cumulative amount of such claims exceeds \$20,000, or at least two separate claims payments with the cumulative amount exceeding the market value of the building.</i></p> <p>Use of flood insurance claim and disaster assistance information is subject to The Privacy Act of 1974, as amended, which prohibits public release of the names of policy holders or recipients of financial assistance and the amount of the claim payment or assistance. However, maps showing general areas where claims have been paid can be made public. If a plan includes the names of policy holders or recipients of financial assistance and the amount of the claim payment or assistance, the plan cannot be approved until this Privacy Act covered information is removed from the plan.</p>

4.3 ELEMENT C. MITIGATION STRATEGY

Requirement §201.6(c)(3)	[The plan shall include the following:] A <i>mitigation strategy</i> that provides the jurisdiction’s blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.
§201.6(c)(3)(i)	[The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.
§201.6(c)(3)(ii)	[The hazard mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction’s participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.
§201.6(c)(3)(iii)	[The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
§201.6(c)(3)(iv)	For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.
§201.6(c)(4)(ii)	[The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvements, when appropriate.

Overall Intent. The mitigation strategy serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The Stafford Act directs Local Mitigation Plans to describe hazard mitigation actions and establish a strategy to implement those actions.⁴ Therefore, all other requirements for a Local Mitigation Plan lead to and support the mitigation strategy.

⁴ Section 322(b), Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended, 42 U.S.C. 5165.

The mitigation strategy includes the development of goals and prioritized hazard mitigation actions. Goals are long-term policy statements and global visions that support the mitigation strategy. A critical step in the development of specific hazard mitigation actions and projects is assessing the community’s existing authorities, policies, programs, and resources and its capability to use or modify local tools to reduce losses and vulnerability from profiled hazards.

In the plan update, goals and actions are either reaffirmed or updated based on current conditions, including the completion of hazard mitigation initiatives, an updated or new risk assessment, or changes in State or local priorities.

<u>ELEMENT</u>	<u>REQUIREMENTS</u>
<p>C1. Does the plan document each jurisdiction’s existing authorities, policies, programs and resources, and its ability to expand on and improve these existing policies and programs? 44 CFR 201.6(c)(3)</p> <p><i>Intent: To ensure that each jurisdiction evaluates its capabilities to accomplish hazard mitigation actions, through existing mechanisms. This is especially useful for multi-jurisdictional plans where local capability varies widely.</i></p>	<p>a. The plan must describe each jurisdiction’s existing authorities, policies, programs and resources available to accomplish hazard mitigation.</p> <p>Examples include, but are not limited to: staff involved in local planning activities, public works, and emergency management; funding through taxing authority, and annual budgets; or regulatory authorities for comprehensive planning, building codes, and ordinances.</p>
<p>C2. Does the Plan address each jurisdiction’s participation in the NFIP and continued compliance with NFIP requirements, as appropriate? 44 CFR 201.6(c)(3)(ii)</p> <p><i>Intent: To demonstrate flood hazard mitigation efforts by the community through NFIP activities. Where FEMA is the official administering Federal agency of the NFIP, participation in the program is a basic community capability and resource for flood hazard mitigation activities.</i></p>	<p>a. The plan must describe each jurisdiction’s participation in the NFIP and describe their floodplain management program for continued compliance. Simply stating “The community will continue to comply with NFIP,” will <u>not</u> meet this requirement. The description could include, but is not limited to:</p> <ul style="list-style-type: none"> • Adoption and enforcement of floodplain management requirements, including regulating new construction in Special Flood Hazard Areas (SFHAs); • Floodplain identification and mapping, including any local requests for map updates; or • Description of community assistance and monitoring activities. <p>Jurisdictions that are currently not participating in the NFIP and where an FHBM or FIRM has been issued may meet this requirement by describing the reasons why the community does not participate.</p>

ELEMENT	REQUIREMENTS
<p>C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? 44 CFR 201.6(c)(3)(i)</p> <p><i>Intent: To guide the development and implementation of hazard mitigation actions for the community(ies). Goals are statements of the community’s visions for the future.</i></p>	<p>a. The plan must include general hazard mitigation goals that represent what the jurisdiction(s) seeks to accomplish through mitigation plan implementation.</p> <p><i>Goals are broad policy statements that explain what is to be achieved.</i></p> <p>b. The goals must be consistent with the hazards identified in the plan.</p>
<p>C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? 44 CFR 201.6(c)(3)(ii) and 44 CFR 201.6(c)(3)(iv)</p> <p><i>Intent: To ensure the hazard mitigation actions are based on the identified hazard vulnerabilities, are within the capability of each jurisdiction, and reduce or avoid future losses. This is the heart of the mitigation plan, and is essential to leading communities to reduce their risk. Communities, not FEMA, “own” the hazard mitigation actions in the strategy.</i></p>	<p>a. The plan must include a mitigation strategy that 1) analyzes actions and/or projects that the jurisdiction considered to reduce the impacts of hazards identified in the risk assessment, and 2) identifies the actions and/or projects that the jurisdiction intends to implement.</p> <p><i>Mitigation actions and projects means a hazard mitigation action, activity or process (for example, adopting a building code) or it can be a physical project (for example, elevating structures or retrofitting critical infrastructure) designed to reduce or eliminate the long term risks from hazards. This sub-element can be met with either actions or projects, or a combination of actions and projects.</i></p> <p>The mitigation plan may include non-mitigation actions, such as actions that are emergency response or operational preparedness in nature. These will not be accepted as hazard mitigation actions, but neither will FEMA require these to be removed from the plan prior to approval.</p> <p><i>A comprehensive range consists of different hazard mitigation alternatives that address the vulnerabilities to the hazards that the jurisdiction(s) determine are most important.</i></p> <p>b. Each jurisdiction participating in the plan must have mitigation actions specific to that jurisdiction that are based on the community’s risk and vulnerabilities, as well as community priorities.</p> <p>c. The action plan must reduce risk to existing buildings and infrastructure as well as limit any risk to new development and redevelopment. <i>With emphasis on new and existing building and infrastructure means that the action plan includes a consideration of actions that address the built environment.</i></p>

ELEMENT	REQUIREMENTS
<p>C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? 44 CFR 201.6(c)(3)(iii) and 44 CFR (c)(3)(iv)</p> <p><i>Intent: To identify how the plan will directly lead to implementation of the hazard mitigation actions. As opportunities arise for actions or projects to be implemented, the responsible entity will be able to take action towards completion of the activities.</i></p>	<ul style="list-style-type: none"> a. The plan must describe the criteria used for prioritizing implementation of the actions. b. The plan must demonstrate when prioritizing hazard mitigation actions that the local jurisdictions considered the benefits that would result from the hazard mitigation actions versus the cost of those actions. The requirement is met as long as the economic considerations are summarized in the plan as part of the community’s analysis. A complete benefit-cost analysis is not required. Qualitative benefits (<i>for example</i>, quality of life, natural and beneficial values, or other “benefits”) can also be included in how actions will be prioritized. c. The plan must identify the position, office, department, or agency responsible for implementing and administering the action (for each jurisdiction), and identify potential funding sources and expected timeframes for completion.
<p>C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? 44 CFR 201.6(c)(4)(ii)</p> <p><i>Intent: To assist communities in capitalizing on all available mechanisms that they have at their disposal to accomplish hazard mitigation and reduce risk.</i></p>	<ul style="list-style-type: none"> a. The plan must describe the community’s process to integrate the data, information, and hazard mitigation goals and actions into other planning mechanisms. b. The plan must identify the local planning mechanisms where hazard mitigation information and/or actions may be incorporated. <p><i>Planning mechanisms means governance structures that are used to manage local land use development and community decision-making, such as comprehensive plans, capital improvement plans, or other long-range plans.</i></p> <ul style="list-style-type: none"> c. A multi-jurisdictional plan must describe each participating jurisdiction’s individual process for integrating hazard mitigation actions applicable to their community into other planning mechanisms. d. The updated plan must explain how the jurisdiction(s) incorporated the mitigation plan, when appropriate, into other planning mechanisms as a demonstration of progress in local hazard mitigation efforts. e. The updated plan must continue to describe how the mitigation strategy, including the goals and hazard mitigation actions will be incorporated into other planning mechanisms.

4.4 ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (Plan Updates Only)

Requirement §201.6(d)(3)	A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit if for approval within 5 years in order to continue to be eligible for mitigation project grant funding.
---------------------------------	--

Overall Intent. In order to continue to be an effective representation of the jurisdiction’s overall strategy for reducing its risks from natural hazards, the mitigation plan must reflect current conditions. This will require an assessment of the current development patterns and development pressures as well as an evaluation of any new hazard or risk information. The plan update is an opportunity for the jurisdiction to assess its previous goals and action plan, evaluate progress in implementing hazard mitigation actions, and adjust its actions to address the current realities.

Where conditions of growth and revisions in priorities may have changed very little in a community, much of the text in the updated plan may be unchanged. This is acceptable as long as it still fits the priorities of their community, and it reflects current conditions. The key for plan readers to recognize a good plan update is documentation of the community’s progress or changes in their hazard mitigation program, along with the community’s continued engagement in the mitigation planning process.

<u>ELEMENT</u>	<u>REQUIREMENTS</u>
<p>D1. Was the plan revised to reflect changes in development? 44 CFR 201.6(d)(3)</p> <p><i>Intent: To ensure that the mitigation strategy continues to address the risk and vulnerabilities to existing and potential development, and takes into consideration possible future conditions that can impact the vulnerability of the community.</i></p>	<p>a. The plan must describe changes in development that have occurred in hazard prone areas and increased or decreased the vulnerability of each jurisdiction since the last plan was approved. If no changes in development impacted the jurisdiction’s overall vulnerability, plan updates may validate the information in the previously approved plan.</p> <p>Changes in development means recent development (<i>for example</i>, construction completed since the last plan was approved), potential development (<i>for example</i>, development planned or under consideration by the jurisdiction), or conditions that may affect the risks and vulnerabilities of the jurisdictions (<i>for example</i>, climate variability, declining populations or projected increases in population, or foreclosures). Not all development will affect a jurisdiction’s vulnerability.</p>

<u>ELEMENT</u>	<u>REQUIREMENTS</u>
<p>D2. Was the plan revised to reflect progress in local mitigation efforts? 44 CFR 201.6(d)(3)</p> <p><i>Intent: To evaluate and demonstrate progress made in the past five years in achieving goals and implementing actions outlined in their mitigation strategy.</i></p>	<p>a. The plan must describe the status of hazard mitigation actions in the previous plan by identifying those that have been completed or not completed. For actions that have not been completed, the plan must either describe whether the action is no longer relevant or be included as part of the updated action plan.</p>
<p>D3. Was the plan revised to reflect changes in priorities? 44 CFR 201.6(d)(3)</p> <p><i>Intent: To ensure the plan reflects current conditions, including financial, legal, and political realities as well as post-disaster conditions.</i></p>	<p>a. The plan must describe if and how any priorities changed since the plan was previously approved.</p> <p>If no changes in priorities are necessary, plan updates may validate the information in the previously approved plan.</p>

4.5 ELEMENT E. PLAN ADOPTION

Requirement §201.6(c)(5)	[The plan shall include...] Documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County commissioner, Tribal Council). For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.
---------------------------------	---

Overall Intent. Adoption by the local governing body demonstrates the jurisdiction’s commitment to fulfilling the hazard mitigation goals and actions outlined in the plan. Adoption legitimizes the plan and authorizes responsible agencies to execute their responsibilities. Updated plans also are adopted anew to demonstrate community recognition of the current planning process, changes that have occurred within the previous five years, and validate community priorities for hazard mitigation actions.

<u>ELEMENT</u>	<u>REQUIREMENTS</u>
<p>E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? 44 CFR 201.6(c)(5)</p> <p><i>Intent: To demonstrate the jurisdiction’s commitment to fulfilling the hazard mitigation goals outlined in the plan, and to authorize responsible agencies to execute their responsibilities.</i></p>	<p>a. The plan must include documentation of plan adoption, usually a resolution by the governing body or other authority.</p> <p>If the local jurisdiction has not passed a formal resolution, or used some other documentation of adoption, the clerk or city attorney must provide written confirmation that the action meets their community’s legal requirements for official adoption and/or the highest elected official or their designee must submit written proof of the adoption. The signature of one of these officials is required with the explanation or other proof of adoption.</p> <p>Minutes of a council or other meeting during which the plan is adopted will be sufficient if local law allows meeting records to be submitted as documentation of adoption. The clerk of the governing body, or city attorney, must provide a copy of the law and a brief, written explanation such as, “in accordance with section ___ of the city code/ordinance, this constitutes formal adoption of the measure,” with an official signature.</p> <p>If adopted after FEMA review, adoption must take place within one calendar year of receipt of FEMA’s “Approval Pending Adoption.” See Section 5, <i>Plan Review Procedure</i> for more information on “Approvable Pending Adoption.”</p>

<u>ELEMENT</u>	<u>REQUIREMENTS</u>
<p>E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? 44 CFR 201.6(c)(5)</p> <p><i>Intent: To demonstrate the jurisdiction’s commitment to fulfilling the hazard mitigation goals outlined in the plan, and to authorize responsible agencies to execute their responsibilities.</i></p>	<p>a. Each jurisdiction that is included in the plan must have its governing body adopt the plan prior to FEMA approval, even when a regional agency has the authority to prepare such plans.</p> <p>As with single jurisdictional plans, in order for FEMA to give approval to a multi-jurisdictional plan, at least one participating jurisdiction must formally adopt the plan within one calendar year of FEMA’s designation of the plan as “Approvable Pending Adoption.” See Section 5, <i>Plan Review Procedure</i> for more information on “Approvable Pending Adoption.”</p>

APPENDIX A:

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA’s evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan’s strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Town of Marion, Massachusetts	Title of Plan: Marion Multi-Hazard Mitigation Plan	Date of Plan: September 2021
Local Point of Contact: Meghan Davis	Address: Marion Town House 2 Spring Street Marion, MA 02738	
Title: Engineering Manager		
Agency: Public Works Department		
Phone Number: 508.748.3540 x 204	E-Mail: mdavis@marionma.gov	

State Reviewer:	Title:	Date:
------------------------	---------------	--------------

FEMA Reviewer:	Title:	Date:
Date Received in FEMA Region (insert #)		
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

**SECTION 1:
REGULATION CHECKLIST**

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been ‘Met’ or ‘Not Met.’ The ‘Required Revisions’ summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is ‘Not Met.’ Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT A. PLANNING PROCESS				
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Sections 1.2 & 1.3 (pages 1-2 to 1-6)			
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Sections 1.2 & 1.3 (pages 1-3 to 1-6)			
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section 1.2 (pages 1-2 to 1-6)			
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section 1.2 (pages 1-4 to 1-5)			
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Section 6.3 (page 6-3)			
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Section 6.1 (page 6-2)			
ELEMENT A: REQUIRED REVISIONS				

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT				
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Section 3 (throughout)			
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Section 3 (throughout)			
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Section 3 (throughout); Sections 4.3 & 4.4 (pages 4-15 to 4-18)			
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Section 2.9 (page 2-6)			
<u>ELEMENT B: REQUIRED REVISIONS</u>				
ELEMENT C. MITIGATION STRATEGY				
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 5.2 (pages 5-2 to 5-5)			
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Section 5.2 (page 5-5)			
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Section 5.1 (page 5-2)			
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Section 5.4 (pages 5-10 to 5-20)			
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Section 5.4 (pages 5-10 to 5-20)			
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Section 5.2 (page 5-2 to 5-4)			
<u>ELEMENT C: REQUIRED REVISIONS</u>				

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)				
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section 2.5 (pages 2-3 to 2-4)			
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Section 5.3 (pages 5-6 to 5-9)			
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Section 5.1 (page 5-2)			
<u>ELEMENT D: REQUIRED REVISIONS</u>				
ELEMENT E. PLAN ADOPTION				
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Section 6.4 (page 6-3)			
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	N/A			
<u>ELEMENT E: REQUIRED REVISIONS</u>				
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)				
F1.				
F2.				
<u>ELEMENT F: REQUIRED REVISIONS</u>				



Appendix B: Planning Process and Public Outreach

1. Local Hazard Mitigation Planning Committee Member List
2. Online Public Survey Results
3. Meeting Agendas
4. Copy of Announcements for Public Presentations
5. Screenshot of Town Homepage with Link to Draft Report
6. Email Sent to Neighboring Towns
7. Comment Response Document

Local Planning Team Members:

Name	Title	Department
James McGrail	Town Administrator	Select Board
Gil Hilario	Town Planner	Planning Board
Norman Hills	Chairman	Select Board
Eileen Marum	Vice-Chair	Planning Board
Brian Jackvony	Fire Chief	Fire Department
Richard Nighelli	Police Chief	Police Department
Jeff Habicht	Police Lieutenant	Police Department
Frank Cooper	WPCF Manager	Department of Public Works
Nathaniel Munafo	Director	Department of Public Works
Meghan Davis	Engineering Manager	Department of Public Works
Scott Shippey	Building commissioner/ Zoning Officer	Building Department
Shaun Walsh	Chair	Conservation Commission
Isaac Perry	Harbormaster	Harbormaster
Judith Mooney	Finance Director/Town Accountant	Finance Department

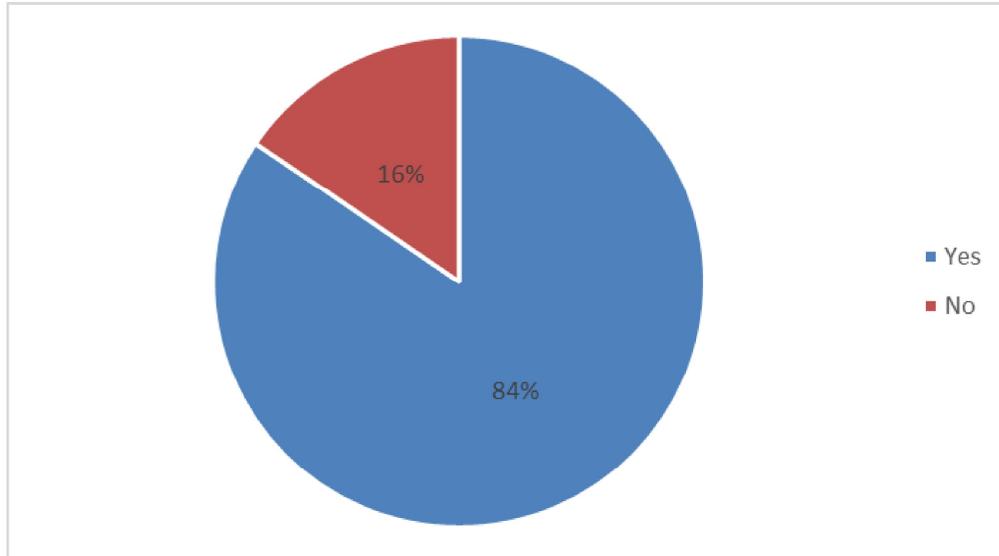
Marion Natural Hazard Mitigation Public Opinion Survey Results

Online Responses: 186

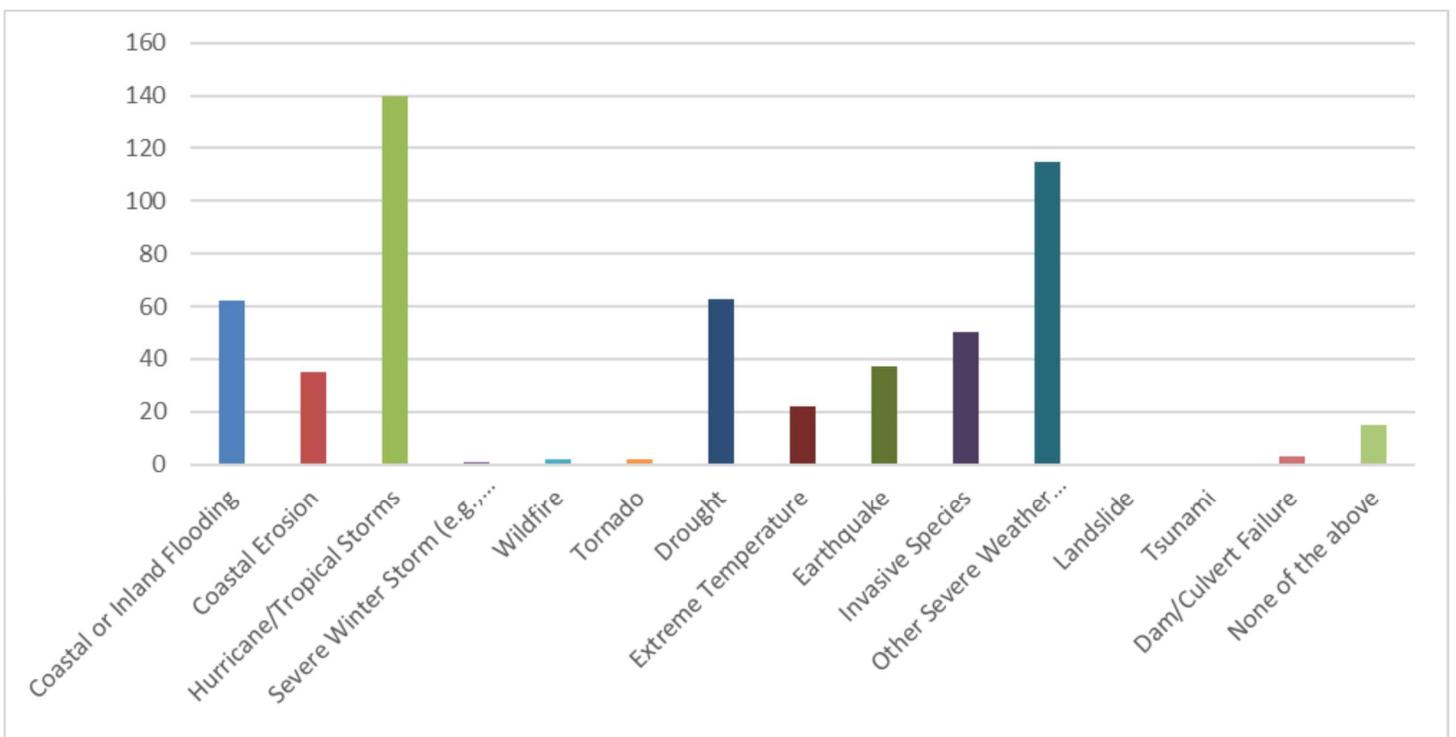
Hardcopy Responses: 1

Total: 187

1. Have you experienced a natural hazard while living, working, or visiting Marion?



2. Which of the following natural hazards have you experienced while in Marion?

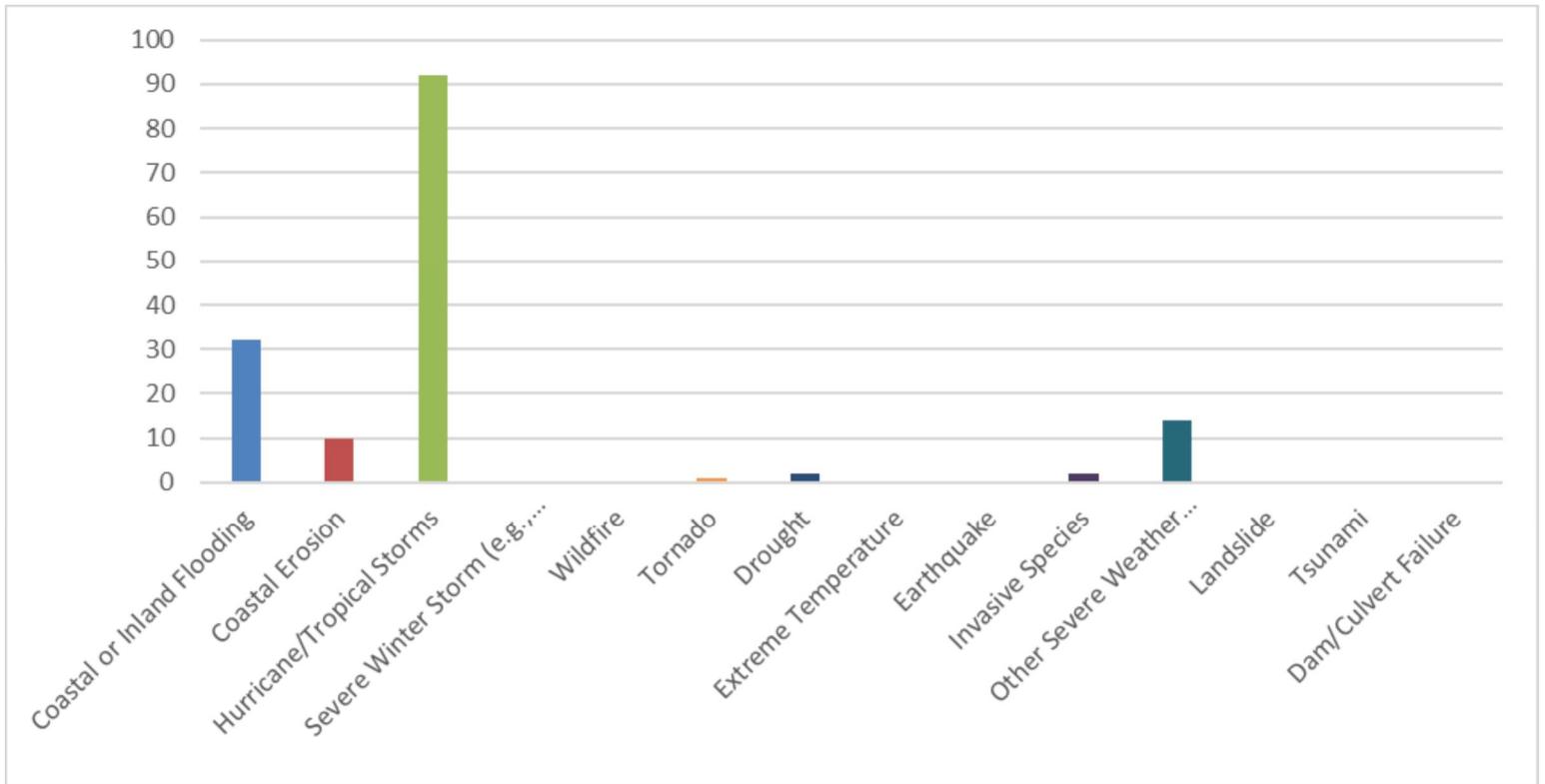


3. Do you have pictures documenting natural hazards (flooding, severe weather events, wildfires, etc.) in Marion that you would like to share for possible use in the Marion Hazard Mitigation Plan? If so, please upload them here.

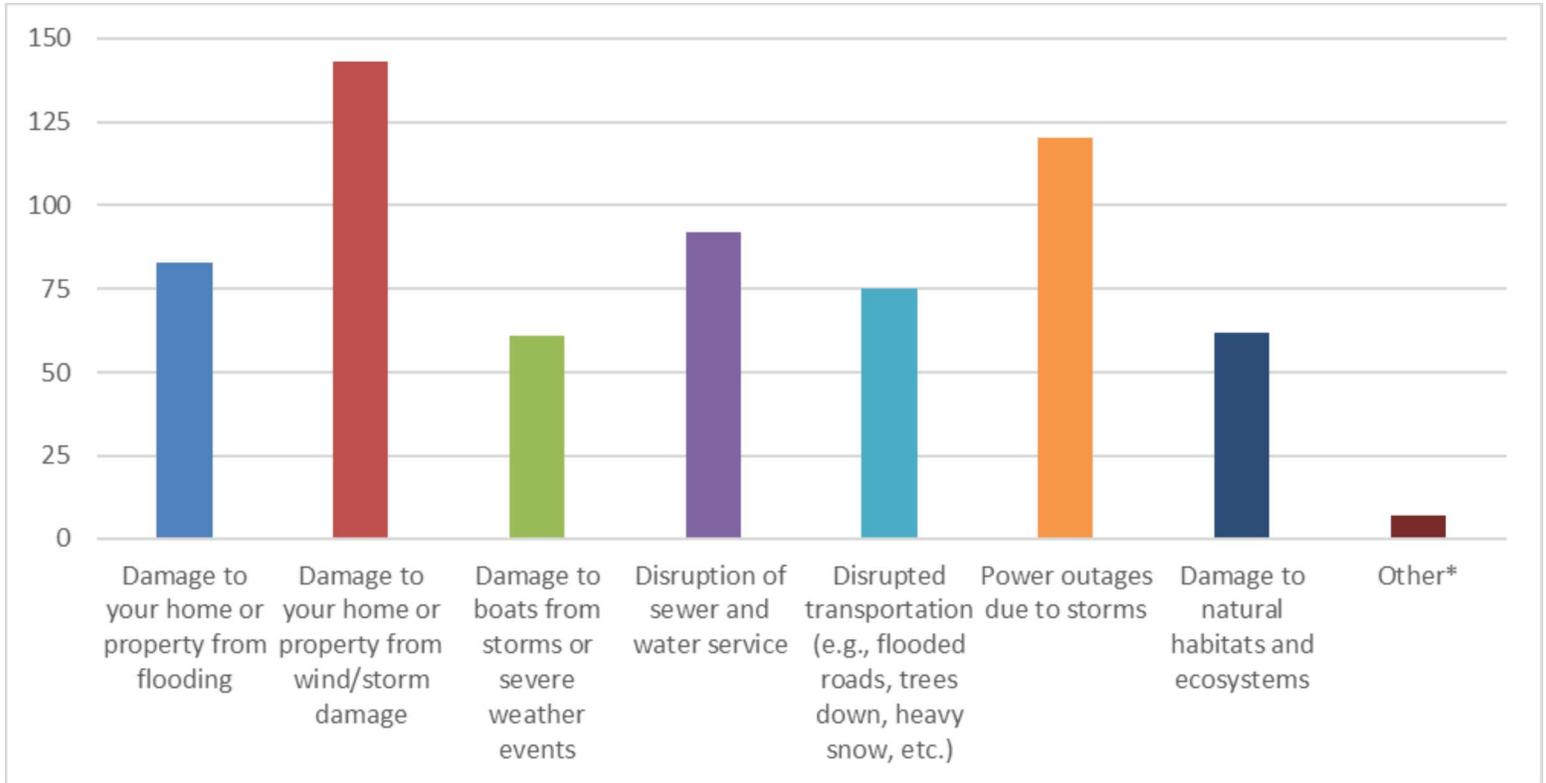
Online Only



4. Which of the following natural hazards are you most concerned about causing damage or disrupting daily life in Marion?



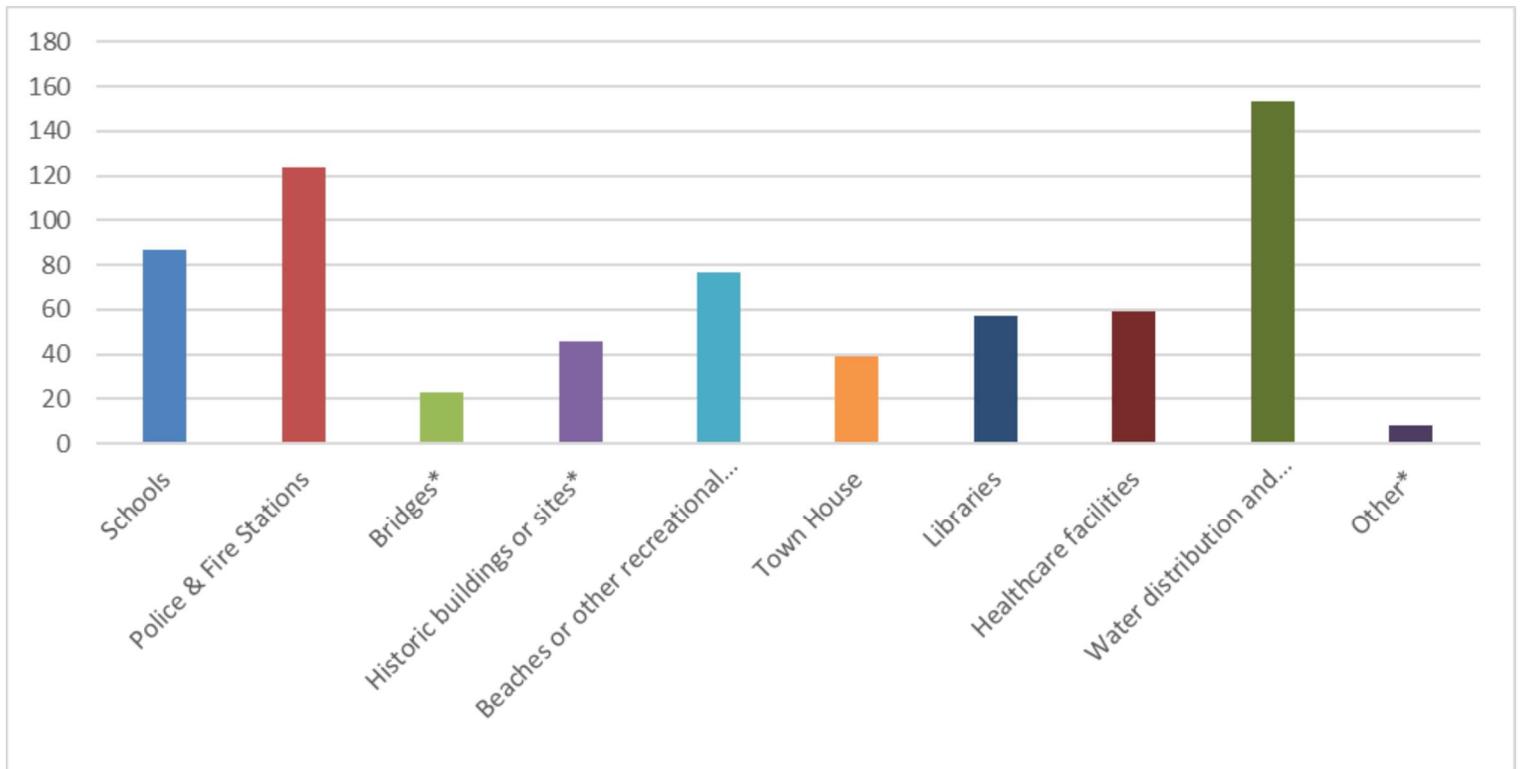
5. What are your biggest concerns related to natural hazards impacting Marion?



Other:

- Infectious disease/bio-terrorism/cyber security
- Impact on people, especially the elderly
- Damage to waterfront residences/facilities/infrastructure
- Damage to municipal infrastructure and properties in low-elevation areas

6. What specific community assets are most important to you?



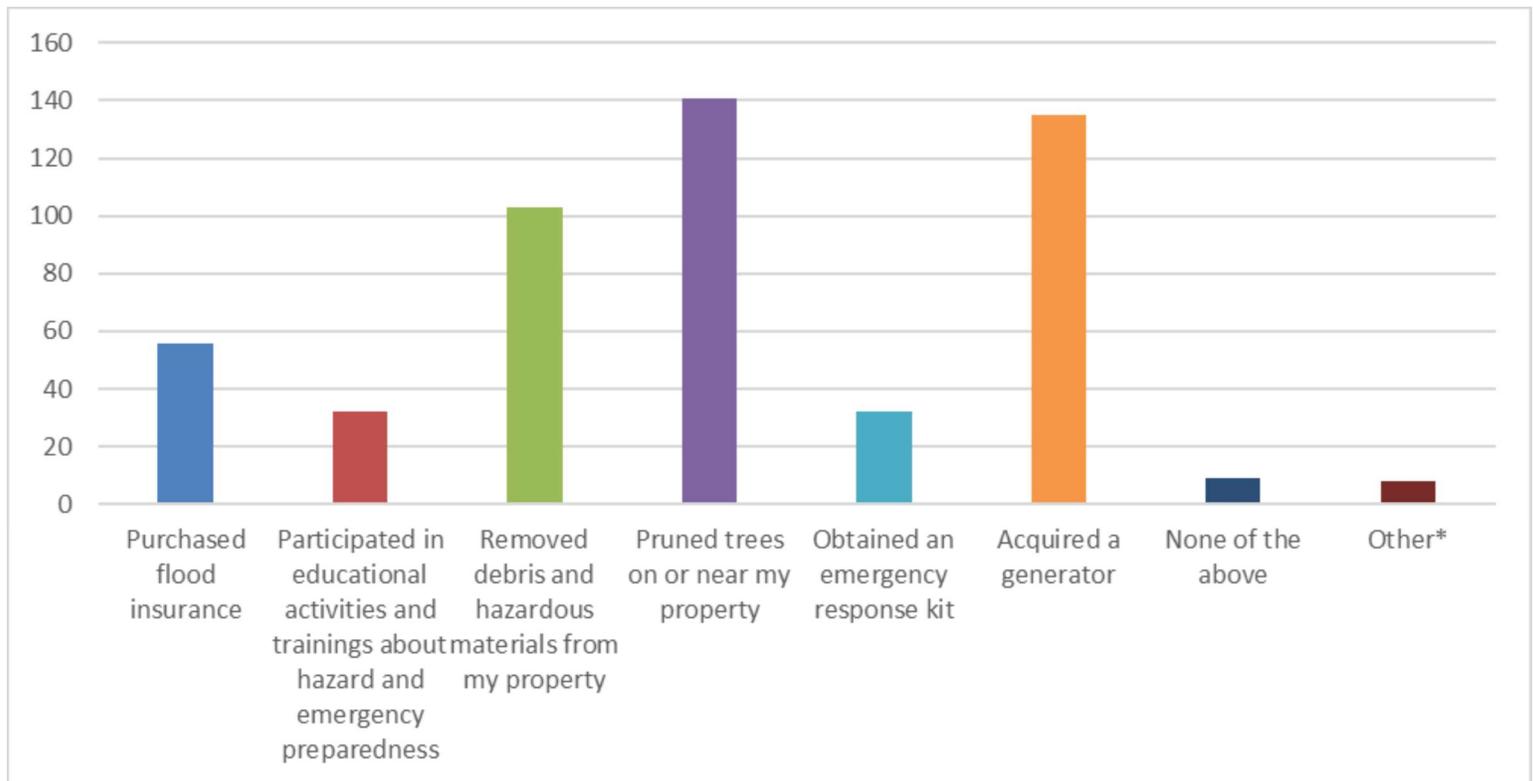
Other:

- The people
- Tabor facilities on the harbor side art Center 1st Congregational Church
- Marsh and other habitats such as Bird Island, a breeding colony for common terns, rare roseate terns and other abundant wildlife

Bridges/historical buildings or sites/beaches or other recreational facilities:

- Silvershell Beach
- Aucoot Cove
- Weweantic Bridge
- Town buildings such as Town House, Library, Music Hall, historical buildings, General Store, etc.
- Natural areas including Sippican Harbor and surrounding area, Planting Island, Piney Point, public lands

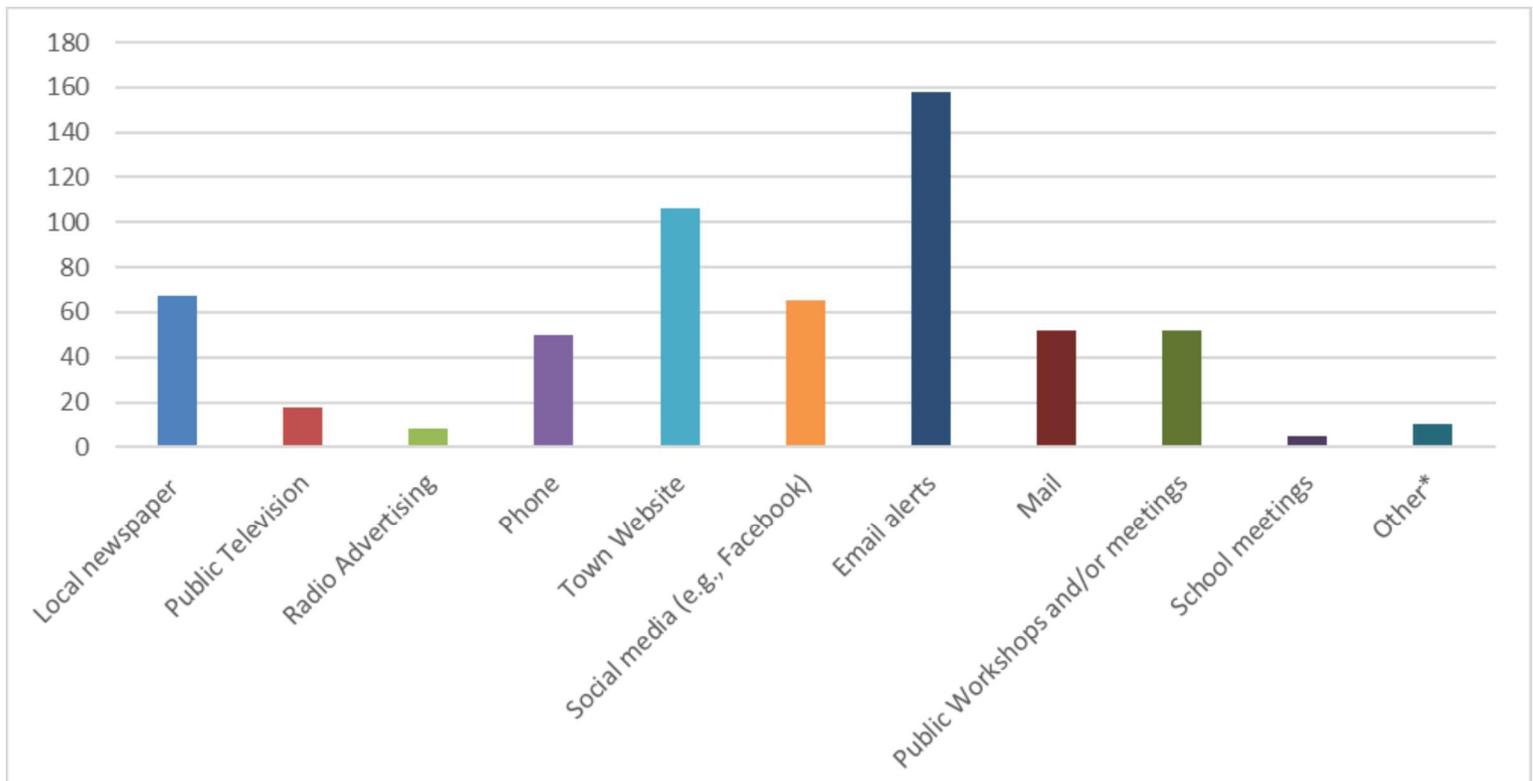
7. Which of the following actions have you taken to be more hazard resistant?



Other:

- We built our home above flood plain and have breakaway windows in case of high water due to storms
- Removed trees purchased a second sump pump in case of existing pump's failure
- Purchased earthquake insurance
- Attempted to have a town tree removed which is a hazard to my home

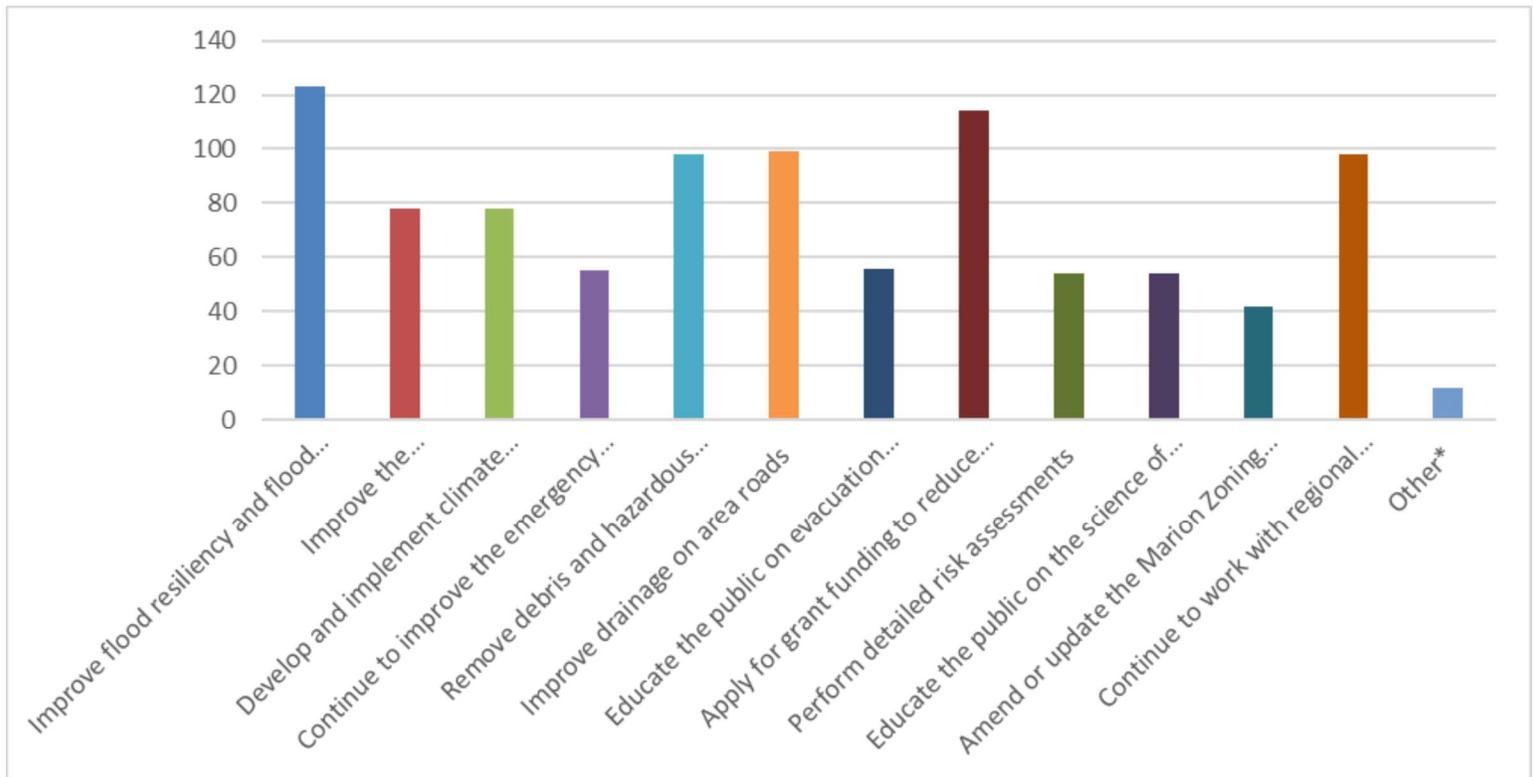
8. What is the most effective way to engage you in hazard planning and emergency preparedness activities?



Other:

- Tv news broadcasts
- Text messages, audible smart phone warnings, siren
- Note: social media is never a reliable form of communication
- Town Meeting
- Email

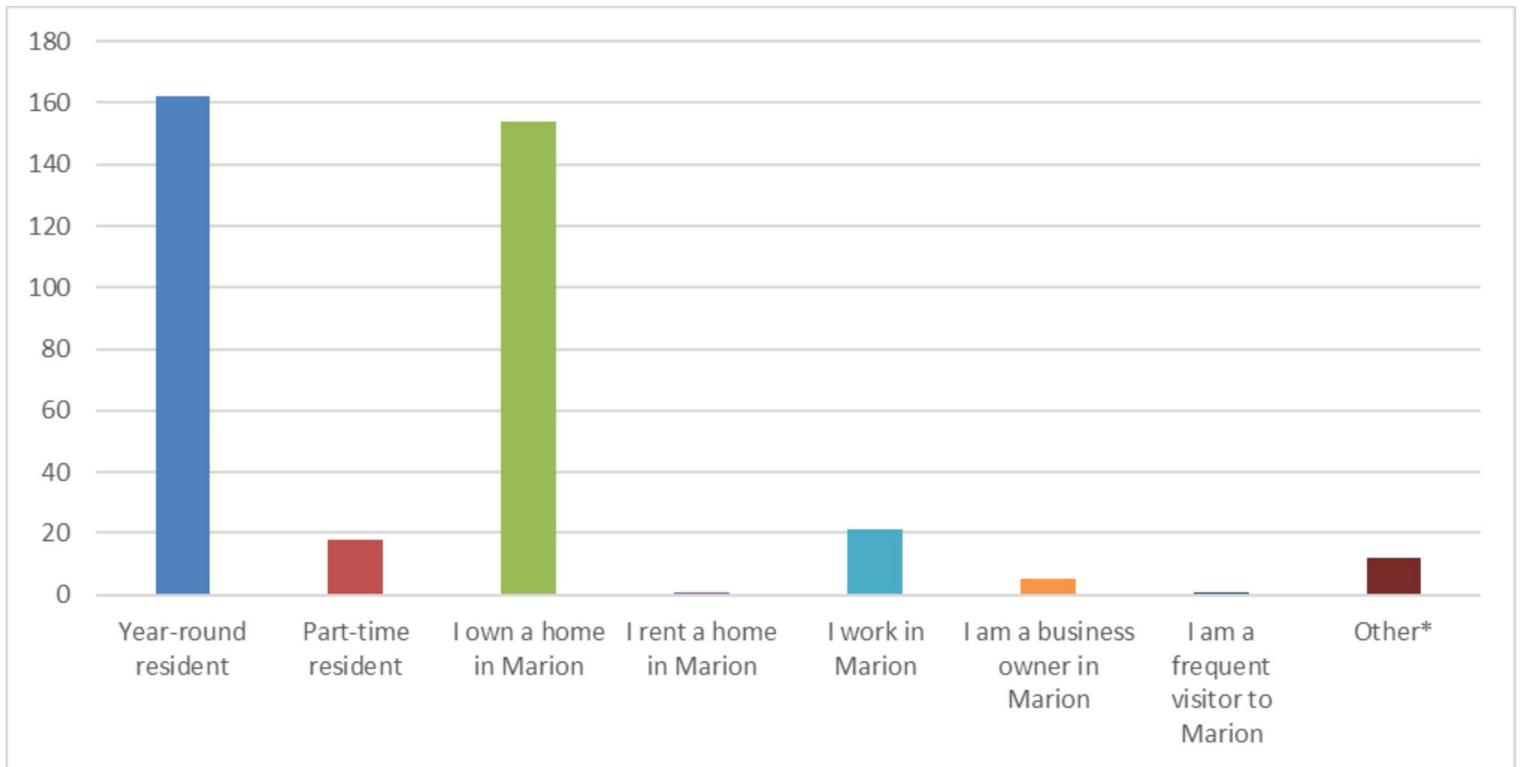
9. What steps can your local government take to reduce its risk from natural hazards and protect the buildings and people of Marion?



Other:

- Invest in public health
- Improve drainage on Delano Rd
- Electric and cable lines should be buried underground
- Communicate what the current alert/warning system is because I don't know

10. Please tell us about yourself.



Other:

- Volunteer in Marion
- Retired in Marion

**Town of Marion
Hazard Mitigation Plan
Kick-off Meeting**

Time: 1:00PM

Date: April 21, 2021

Agenda Items:

1. Welcome and Introductions

2. Overview of the HMP Process

- a. What is a Hazard Mitigation Plan and why should Marion have one?
 - Previous MHMP Plan → Regional and outdated (2004), but we can update this plan rather than start from scratch
- b. Review Scope of Work
- c. Discussion of Public Outreach Strategy
- d. Review State Hazard List (see page 3)

3. Data Requirements

- a. Marion Data:
 - Any newly available hazard related data?
 - Recent records/photos (storms, flooding, major repairs, wildfire incidents, etc.)
 - Selection of critical facilities
 - Current assessor's parcel database – ArcGIS format (MassGIS Jan. 2021)
 - Repetitive loss data
 - Mitigation measures completed since 2004
 - Land use categories (from the 2017 Master Plan):
 - Residential
 - Commercial
 - Industrial
 - Chapter 61, 61A, 61B
 - Tax-Exempt (Churches, Schools, Land Trusts)
 - Permanent Conservation
 - No Data
- b. State issued climate change projections/modeling

**Town of Marion
Hazard Mitigation Plan
Working Meeting 1**

Time: 1:00PM

Date: May 5, 2021

Agenda Items:

- 1. Review outstanding tasks from previous meeting (pg. 2)**
- 2. Review Critical Facilities List (to be provided by Gil)**
 - a. Additional facilities to add?
 - b. Any to be removed?
- 3. Hazard Selection (pg. 3)**
 - a. Discuss/approve data to be used
 - b. Additional data sources to consider?
- 4. Eileen Marum's outline**
- 5. Present Online Public Survey**
 - a. Overview of draft questions (email attachment)
 - b. Survey platform
 - c. Town will provide link website? Distribute a hardcopy?
- 6. Town Capabilities Assessment (email attachment)**
 - a. FEMA's Capabilities Assessment Questionnaire will help identify and document Town capabilities
- 7. Grant opportunities**

**Town of Marion
Hazard Mitigation Plan
Working Meeting 2**

Time: 1:00PM

Date: June 2, 2021

Agenda Items:

- 1. Review Outstanding Tasks (pg. 2)**
- 2. Review and Finalize Critical Facilities (email attachment)**
- 3. Review Public Outreach Efforts**
 - a. Results of online public survey (email attachment)
- 4. Review of Hazard Profiles**
 - a. Data gaps
 - Local invasive species data/records
 - History of dam failure
 - b. Review hazard maps (pgs. 3-12)
 - c. Review hazard ranking process (pg. 13)
- 5. Develop Hazard Mitigation Plan Goals (pg. 14)**
- 6. WHG Next Steps**
 - a. Vulnerability Assessment

Schedule Next Meeting: July 6-8, 2021

**Town of Marion
Hazard Mitigation Plan
Working Meeting 3**

Time: 1:00PM

Date: July 14, 2021

Agenda Items:

1. Review Outstanding Tasks (pg. 2)

2. Vulnerability Assessment

- a. Review results of flooding vulnerability assessment (pgs. 3-9)
- b. Perform qualitative vulnerability assessment of critical facilities to other hazards (email attachment)

3. Data Gaps

- a. Marion emergency evacuation routes
- b. Vulnerable populations to include
 - Elderly populations, childcare centers/schools, healthcare facilities, and/or low-income areas?

4. Mitigation Goals & Actions

- a. Develop hazard mitigation plan goals (pgs. 10-11)
- b. Review/update mitigation actions from the SPREDD Regional Natural Hazard Disaster Mitigation Plan from 2004 (email attachment)
- c. Develop additional draft hazard mitigation actions (pgs. 12-13)

5. Public Outreach Presentation

- a. Select date and time (July 26-30, 2021)
- b. Determine platform

Schedule Next Meeting: August 4-6 or 16-18, 2021

**Town of Marion
Hazard Mitigation Plan
Working Meeting 4**

Time: 1:00 – 2:30 PM

Date: August 4, 2021

Agenda Items:

- 1. Review Outstanding Tasks (pg. 2)**
- 2. Public Outreach Presentation Review (July 27th Presentation)**
- 3. Review Hazard Mitigation Plan Goals and Proposed Mitigation Actions (email attachment)**
- 4. Discuss Additional Details for Each Mitigation Action Retained (see example below)**

Mitigation Action #1: <Name of Action>	
HAZARD ADDRESSED	Flooding/Fire/Erosion/etc.
PURPOSE	<Description of action and purpose>
RESPONSIBILITY	<Responsible Department(s)>
POTENTIAL FUNDING SOURCES	Examples: Capital Improvements/Utility Fee/Town Meeting/Community Preservation Act (CPA)/Specific Grants
PRIORITY	High/Medium/Low
TIMELINE	Short-term/Long-term/Ongoing (including specific planned start and completion dates)
GOAL(S) ADDRESSED	1-7

5. Finalize Remaining Schedule:

- 8/20/21: Draft plan for planning team to review
- **8/25-27/21:** Working meeting #5 (*Review/revise draft plan, fill in remaining data gaps*)
- 9/1/21: Revised plan for neighboring towns and public to review; open public comment period
- 9/7-9/21: Public presentation
- 9/15/21: Close public comment; incorporate any needed changes to plan
- **9/30/21: Submit plan to MEMA/FEMA**

**Town of Marion
Hazard Mitigation Plan
Working Meeting 5**

Time: 1:00 – 2:30 PM

Date: August 26, 2021

Agenda Items:

- 1. Review Mitigation Action Details** (see Chapter 5 of the DRAFT plan)

- 2. Review Mitigation Action Prioritization** (see separate email attachment)

- 3. Review Draft Hazard Mitigation Plan**
 - Local Planning Team Comments on Draft
 - Data Gaps: (e.g., Repetitive Loss Property Data)
 - Next steps: Solicit comments from public, neighboring towns, SRPEDD, other?

- 4. Remaining Schedule:**
 - 9/1/21: Revised plan for neighboring towns and public to review; open public comment period
 - 9/7/21: Public presentation
 - 9/15/21: Close public comment; incorporate any needed changes to plan
 - **9/30/21: Submit plan to MEMA/FEMA**
 - TBD: Plan Adoption by Selectboard (after FEMA approval)

Town of Marion, Massachusetts
@marionma1852

Home
About
Videos
Posts
Events
Photos
Community

Town of Marion, Massachusetts
July 21 · 🌐

Join us on Zoom to learn about a Hazard Mitigation Plan on Tuesday, July 27th at 6 PM. The Town of Marion is working collaboratively with the Woods Hole Group on a Hazard Mitigation Plan. Having a Hazard Mitigation Plan makes the Town eligible for mitigation grants and non-emergency disaster assistance programs. Woods Hole Group will be hosting a public virtual workshop on what is a Hazard Mitigation Plan, what programs it makes the Town available for, and what vulnerabilitie... See More

2 Shares

Like Comment Share

2 Spring Street (15.19 mi)
Marion, MA, MA 02738
Get Directions
(508) 748-3500
Contact Town of Marion, Massachusetts on Messenger
www.marionma.gov
Government Organization
Hours 8:00 AM - 4:30 PM
Open Now

Page Transparency See More
Facebook is showing information to help you better understand the purpose of a Page. See actions taken by the people who manage and post content.
Page created - May 23, 2019

People >

Sippican Week

Classifieds Business Directory Real Estate
Legal Ads Advertise Contact Us Login
Visit our partners: Wareham Week Dartmouth Week

Home News Police Sports Arts Schools Obituaries Calendar Weather

Get your daily Marion, Mattapoisett & Rochester news delivered to your in-box every morning!
CLICK TO SIGN UP

eEdition
Click here to read the current edition of Sippican Week as it looks in print

Marion to host hazard mitigation information session

Jul 22, 2021



MARION — The Town is hosting a Zoom call to inform community members about its Hazard Mitigation Plan on Tuesday, July 27 at 6 p.m.

Marion is working with the Woods Hole Group on the plan. Having a Hazard Mitigation Plan makes the Town eligible for mitigation grants and non-emergency disaster assistance programs. Woods Hole Group will be hosting a public virtual workshop on what Hazard Mitigation Plan is, what programs it makes the Town available for, and what vulnerabilities and mitigation actions the Town can do to better prepare us for the future of hazards.

Residents can join the Zoom meeting via the link and information below:

Topic: Hazard Mitigation Plan Public Workshop
Time: Jul 27, 2021 06:00 PM Eastern Time (US and Canada)

Join Zoom Meeting
<https://us02web.zoom.us/j/81461102735?pwd=UHBWR3lnOGtpamFpK1JyS1dVYWd0Zz09>

Meeting ID: 814 6110 2735
Passcode: 606622

Residents can also join by phone by calling 646-558-8665.

DAWSON REAL ESTATE
Selling on the South Coast since 1978
508-758-3838
DAWSONRE.COM

Tri-Town coronavirus news

Help support Sippican Week
Click here to **DONATE**

Classifieds
Class A and Tow Truck Drivers...
DUMP RUNS
Gomez Landscaping



Get your daily Marion, Mattapoisett & Rochester news delivered to your in-box every morning!

[CLICK TO SIGN UP](#)

eEdition

[Click here to read the current edition of Sippican Week as it looks in print](#)

Marion Hazard Mitigation Plan public hearing Sept. 9

Aug 19, 2021



MARION — The town will hold a public hearing on Sept. 9 to inform residents about the Hazard Mitigation Plan.

The Marion Hazard Mitigation Planning team in partnership with the Woods Hole Group is developing a plan for long-term risk reduction of disasters associated with natural hazards. The mitigation plan team consists of the police and fire chiefs, harbormaster, building commissioner, the DPW superintendent, the town administrator, the Conservation Commission chair, and Planning Board representatives.

The draft of the Hazard Mitigation Plan identifies impacts of climate change and natural hazards on residents, buildings, and infrastructure. It also identifies and evaluates risks associated with the impacts. From there, mitigation actions that focus resources on the greatest risk areas are developed.

The public hearing will be at 6 p.m. via zoom. It will aim to help the community learn about the plan, participate, and offer comments and recommendations during the final draft stage and prior to submittal to MEMA and FEMA for final approval.

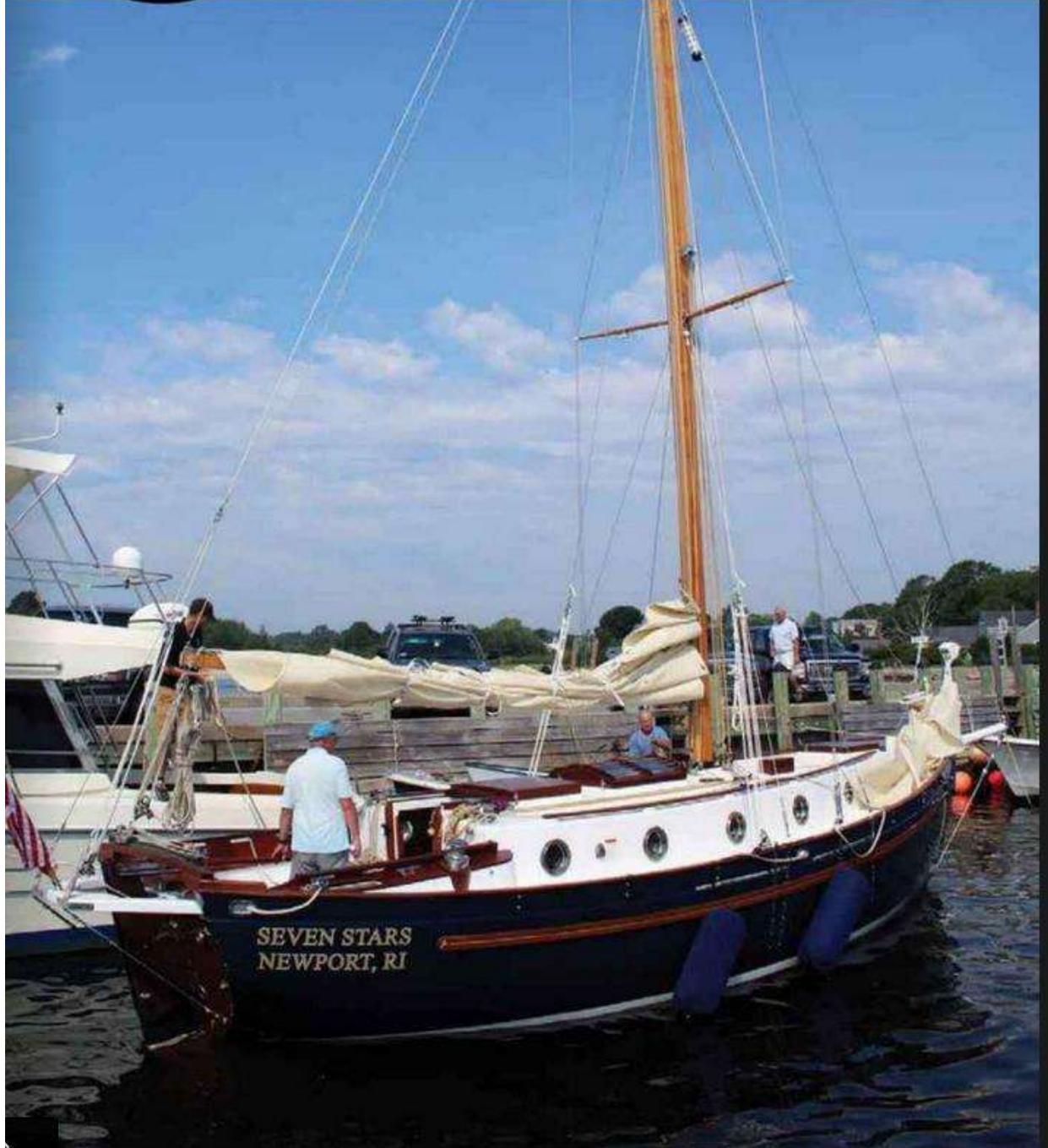
See the meeting agenda here: https://www.marionma.gov/sites/g/files/vyhlf3406/f/agendas/hazard_mitigation_planning_team_public_hearing_9.9.21.pdf



The Wanderer.com

FREE
PRESORTED
STANDARD
U.S. Postage
PAID
Rochester, MA
02770 - permit #14

Volume 30, Issue 33 - Number 1478 *Serving the Tri-Town Since 1992* August 19, 2021



Regional Lunch Menus

Coastline Elderly Nutrition Program

Monday, August 23: Chicken a la king, confetti rice, Scandinavian blend, whole wheat roll, Mandarin oranges;
Tuesday, August 24: Cheeseburger, ketchup, potato wedges, hot German slaw, hamburger roll, cantaloupe;
Wednesday, August 25: Roasted chicken w/ red pepper pesto sauce, Italian pasta, Tuscan vegetables, multigrain bread, mini lemon cake, diet: sugar-free cookie;
Thursday, August 26: Beef & broccoli, Asian rice, oatmeal roll, pineapple;
Friday, August 27: Potato pollock filet, tartar sauce, mashed potatoes, Riviera vegetables, wheat bread, mixed fruit

Old Colony Regional

Monday, August 23: No school;
Tuesday, August 24: No school;
Wednesday, August 25: Cheese pizza quesadilla & fries;
Thursday, August 26: Cherry blossom chicken bowl &

dinner roll;

Friday, August 27: Linguica sandwich & fries

Marion's Hazard Mitigation Team Public Hearing

The Marion Hazard Mitigation Planning (HMP) team in partnership with the Woods Hole Group is developing a plan for long-term risk reduction of disasters associated with natural hazards. The HMP team consists of the police chief, fire chief, harbor master, building commissioner, DPW superintendent, town administrator, Conservation Commission Chair, and Planning Board representatives.

The draft of the Hazard Mitigation Plan identifies impacts of climate change and natural hazards on residents, buildings, and infrastructure. Risks associated with the impacts are identified and evaluated. Mitigation actions that focus resources on the greatest risk areas are developed. Documenting the mitigation items and

integrating the necessary actions into our future planning and budgeting will help protect our residents and infrastructure. It demonstrates Marion's commitment to preparing for potential future disasters.

The HMP team will hold a public hearing on Thursday, **September 9**, at 6:00 pm via Zoom. This is an opportunity for the community to learn about the plan, participate, and offer comments and recommendations during the final draft stage and prior to submittal to MEMA and FEMA for final approval. The team looks forward to seeing you; please save the date, Thursday, September 9, at 6:00 pm via Zoom.

'Prayer Stop' in Mattapoisett

An outdoor "Prayer Stop" will be held in Mattapoisett as a non-denominational outreach for prayer. Our prayer team is here to provide encouragement, compassion, comfort, and peace with prayer to anyone who wishes to stop by. There is never any cost or fee for this faith-based outreach, and Mattapoisett was chosen because one of the pastors was born in the town and felt led to pray for the town residents, first responders, and the town's government.

The event will take place on Saturday, **August 21**, from 10:00 am to 2:00 pm on Route 6, next to Ying Dynasty in the vacant back parking lot (Previous Bowlmor Lanes).



**BAY STATE VETERINARY
EMERGENCY & SPECIALTY SERVICES**
DR. FAULKNER BESANCON
DVM, Diplomate of the American College of Veterinary Surgeons-Small Animal



If you are seeking high quality surgical care for your pet, talk to your family veterinarian about referring you to Dr. Besancon and the team at BSVES. With skill, knowledge and compassion, BSVES provides high level, personalized and convenient care for pets in the Southcoast area and beyond.

Talk to your veterinarian if your pet may benefit from a referral to BSVES.

76 Baptist Street • Swansea, MA 02777
508-379-1233 www.bsves.com
24 HOUR EMERGENCY SERVICE



Home



Marion Multi-Hazard Mitigation Plan Available for Review

POSTED ON: SEPTEMBER 3, 2021 - 3:14PM

The Marion Hazard Mitigation Planning (HMP) team, in partnership with the Woods Hole Group, has prepared the **Marion Multi-Hazard Mitigation Plan (Plan)**, dated September 2021, for public review and comment. The Plan identifies impacts of climate change and natural hazards on residents, buildings, and infrastructure. Risks associated with the impacts are identified and evaluated. Mitigation actions that focus resources on the greatest risk areas are developed. Documenting the mitigation items and integrating the necessary actions into our future planning and budgeting will help protect our residents and infrastructure. The Plan demonstrates Marion's commitment to preparing for potential future disasters.

Everyone is encouraged to review the Plan. **The Plan can be obtained from the News Page on the Town's website and is also attached here.** Please submit any questions and/or comments relative to the Plan via email to Meghan Davis, Town of Marion Engineering Manager: mdavis@marionma.gov. The public comment period will end at September 17, 2021, at 3:00PM. Any public comments received after this date/time will not be considered.

Reminder, the HMP team will hold a public hearing on Thursday, September 9, 2021, at 6:00PM via Zoom. This is an opportunity for the public to learn about the Plan, participate, and offer comments and recommendations during the final draft stage and prior to submittal to MEMA and FEMA for final approval. Please refer to the meeting agenda on the Town of Marion website for access to Zoom: https://www.marionma.gov/sites/g/files/vyhllf3406/ff/agendas/hazard_mitig...

The HMP team looks forward to hearing from you.

Attachment	Size
 marion_mhmp_draft_090221_wappendices.pdf	11.11 MB



Leduc Elise

From: Meghan Davis <mdavis@marionma.gov>
Sent: Friday, September 3, 2021 12:25 PM
To: Leduc Elise
Subject: FW: Marion Multi-Hazard Mitigation Plan
Attachments: Marion_MHMP_DRAFT_090221_wAppendices.pdf

Categories: Marion MHP

CAUTION: This message comes from an external server, do not click on links or open attachments unless you know the sender and are sure the content is safe.

Please see below.

From: Meghan Davis <mdavis@marionma.gov>
Sent: Friday, September 3, 2021 12:07 PM
To: 'Wendy Graves' <wgraves@fairhaven-ma.gov>
Subject: Marion Multi-Hazard Mitigation Plan

Hi Wendy,

The Marion Hazard Mitigation Planning (HMP) team, in partnership with the Woods Hole Group, has prepared the Marion Multi-Hazard Mitigation Plan (Plan), dated September 2021, for public review and comment. The Plan identifies impacts of climate change and natural hazards on residents, buildings, and infrastructure. Risks associated with the impacts are identified and evaluated. Mitigation actions that focus resources on the greatest risk areas are developed. Documenting the mitigation items and integrating the necessary actions into our future planning and budgeting will help protect our residents and infrastructure. The Plan demonstrates Marion's commitment to preparing for potential future disasters.

The Plan is attached to this email. Everyone is encouraged to review the Plan. Please submit any questions and/or comments relative to the Plan via email to Meghan Davis, Town of Marion Engineering Manager: mdavis@marionma.gov. The public comment period will end at September 17, 2021, at 3:00PM. Any public comments received after this date/time will not be considered.

In addition, the HMP team will hold a public hearing on Thursday, September 9, 2021, at 6:00PM via Zoom. This is an opportunity for the public to learn about the Plan, participate, and offer comments and recommendations during the final draft stage and prior to submittal to MEMA and FEMA for final approval. Please refer to the meeting agenda on the Town of Marion website for access to Zoom: https://www.marionma.gov/sites/g/files/vyhli3406/f/agendas/hazard_mitigation_planning_team_public_hearing_9.9.21.pdf

Please reply to this email to confirm receipt of the Plan. The HMP team looks forward to hearing from you.

Thank you!

Sincerely,

Meghan Davis
Town of Marion

Leduc Elise

From: Meghan Davis <mdavis@marionma.gov>
Sent: Friday, September 3, 2021 12:25 PM
To: Leduc Elise
Subject: FW: Marion Mult-Hazard Mitigation Plan
Attachments: Marion_MHMP_DRAFT_090221_wAppendices.pdf

Categories: Marion MHP

CAUTION: This message comes from an external server, do not click on links or open attachments unless you know the sender and are sure the content is safe.

Please see below.

From: Meghan Davis <mdavis@marionma.gov>
Sent: Friday, September 3, 2021 12:07 PM
To: 'administration@wareham.ma.us' <administration@wareham.ma.us>
Subject: Marion Mult-Hazard Mitigation Plan

Hello,

The Marion Hazard Mitigation Planning (HMP) team, in partnership with the Woods Hole Group, has prepared the Marion Multi-Hazard Mitigation Plan (Plan), dated September 2021, for public review and comment. The Plan identifies impacts of climate change and natural hazards on residents, buildings, and infrastructure. Risks associated with the impacts are identified and evaluated. Mitigation actions that focus resources on the greatest risk areas are developed. Documenting the mitigation items and integrating the necessary actions into our future planning and budgeting will help protect our residents and infrastructure. The Plan demonstrates Marion's commitment to preparing for potential future disasters.

The Plan is attached to this email. Everyone is encouraged to review the Plan. Please submit any questions and/or comments relative to the Plan via email to Meghan Davis, Town of Marion Engineering Manager: mdavis@marionma.gov. The public comment period will end at September 17, 2021, at 3:00PM. Any public comments received after this date/time will not be considered.

In addition, the HMP team will hold a public hearing on Thursday, September 9, 2021, at 6:00PM via Zoom. This is an opportunity for the public to learn about the Plan, participate, and offer comments and recommendations during the final draft stage and prior to submittal to MEMA and FEMA for final approval. Please refer to the meeting agenda on the Town of Marion website for access to Zoom: https://www.marionma.gov/sites/g/files/vyhli3406/f/agendas/hazard_mitigation_planning_team_public_hearing_9.9.21.pdf

Please reply to this email to confirm receipt of the Plan. The HMP team looks forward to hearing from you.

Thank you!

Sincerely,

Meghan Davis
Town of Marion
Engineering Manager

Leduc Elise

From: Meghan Davis <mdavis@marionma.gov>
Sent: Friday, September 3, 2021 12:25 PM
To: Leduc Elise
Subject: FW: Marion Mult-Hazard Mitigation Plan
Attachments: Marion_MHMP_DRAFT_090221_wAppendices.pdf

Categories: Marion MHP

CAUTION: This message comes from an external server, do not click on links or open attachments unless you know the sender and are sure the content is safe.

Please see below.

From: Meghan Davis <mdavis@marionma.gov>
Sent: Friday, September 3, 2021 12:07 PM
To: 'administration@wareham.ma.us' <administration@wareham.ma.us>
Subject: Marion Mult-Hazard Mitigation Plan

Hello,

The Marion Hazard Mitigation Planning (HMP) team, in partnership with the Woods Hole Group, has prepared the Marion Multi-Hazard Mitigation Plan (Plan), dated September 2021, for public review and comment. The Plan identifies impacts of climate change and natural hazards on residents, buildings, and infrastructure. Risks associated with the impacts are identified and evaluated. Mitigation actions that focus resources on the greatest risk areas are developed. Documenting the mitigation items and integrating the necessary actions into our future planning and budgeting will help protect our residents and infrastructure. The Plan demonstrates Marion's commitment to preparing for potential future disasters.

The Plan is attached to this email. Everyone is encouraged to review the Plan. Please submit any questions and/or comments relative to the Plan via email to Meghan Davis, Town of Marion Engineering Manager: mdavis@marionma.gov. The public comment period will end at September 17, 2021, at 3:00PM. Any public comments received after this date/time will not be considered.

In addition, the HMP team will hold a public hearing on Thursday, September 9, 2021, at 6:00PM via Zoom. This is an opportunity for the public to learn about the Plan, participate, and offer comments and recommendations during the final draft stage and prior to submittal to MEMA and FEMA for final approval. Please refer to the meeting agenda on the Town of Marion website for access to Zoom: https://www.marionma.gov/sites/g/files/vyhli3406/f/agendas/hazard_mitigation_planning_team_public_hearing_9.9.21.pdf

Please reply to this email to confirm receipt of the Plan. The HMP team looks forward to hearing from you.

Thank you!

Sincerely,

Meghan Davis
Town of Marion
Engineering Manager

Leduc Elise

From: Meghan Davis <mdavis@marionma.gov>
Sent: Friday, September 3, 2021 11:47 AM
To: info@srpedd.org
Cc: Leduc Elise
Subject: Marion Multi-Hazard Mitigation Plan
Attachments: Marion_MHMP_DRAFT_090221_wAppendices.pdf

Categories: Marion MHP

CAUTION: This message comes from an external server, do not click on links or open attachments unless you know the sender and are sure the content is safe.

Hello,

The Marion Hazard Mitigation Planning (HMP) team, in partnership with the Woods Hole Group, has prepared the Marion Multi-Hazard Mitigation Plan (Plan), dated September 2021, for public review and comment. The Plan identifies impacts of climate change and natural hazards on residents, buildings, and infrastructure. Risks associated with the impacts are identified and evaluated. Mitigation actions that focus resources on the greatest risk areas are developed. Documenting the mitigation items and integrating the necessary actions into our future planning and budgeting will help protect our residents and infrastructure. The Plan demonstrates Marion's commitment to preparing for potential future disasters.

The Plan is attached to this email for your review and comment. Please submit any questions and/or comments relative to the Plan via email to Meghan Davis, Town of Marion Engineering Manager: mdavis@marionma.gov. The public comment period will end at September 17, 2021, at 3:00PM. Any public comments received after this date/time will not be considered.

In addition, the HMP team will hold a public hearing on Thursday, September 9, 2021, at 6:00PM via Zoom. This is an opportunity for the public to learn about the Plan, participate, and offer comments and recommendations during the final draft stage and prior to submittal to MEMA and FEMA for final approval. Please refer to the meeting agenda on the Town of Marion website for access to Zoom: https://www.marionma.gov/sites/g/files/vyhli3406/f/agendas/hazard_mitigation_planning_team_public_hearing_9.9.21.pdf

The HMP team looks forward to hearing from you. Thank you!

Sincerely,

Meghan Davis
Town of Marion
Engineering Manager
mdavis@marionma.gov
(508) 748-3540 x 204

Marion MHMP Comment Response

Comments from Barry Gaffey (8/3/21):

1. I really consider the LPS sewer and E1 as critical infrastructure. They are our mini pumping stations and then we are dependent of rest of the Town's pumping stations to get to Benson Brook. So, we are all in this together not just center folks. If we had gravity for our system, I think the town would have another 21 town pumping stations to worry about. So please make LPS system part of the resilience plan. At the very least for now educate the 500 homes with them near the water how to protect them from storm surge as I'm pretty sure they won't work after 2 feet of saltwater over them near water in Aucoot or Dexter.

***Response:** See response to comment #16 below.*

2. The marshes are our best defense to storms. They also need ground for them to retreat naturally. Once they are fully under saltwater they just die and turn to silt.

***Response:** Agreed. A note has been added regarding the importance of, and the long-term sea level rise threat to, salt marshes in Section 2.4.*

Comments from Trevor Hatton (9/4/21):

3. Thank you for including the photo I sent you of extensive inland flooding to my property, shown as figure 3.1. I would ask the Town to note that flooding of this nature has occurred at least 3 times in the months of July and August 2021 alone.

***Response:** Additional text has been added to the Figure 3.1 caption regarding the frequency of flooding at this location.*

4. I feel that the plan does not give a high enough risk factor to Inland flooding. In Table 3-15 it is given a rating of "Likely". I think recent experience shows it is at least "Highly Likely". In fact, my experience shows that it is inevitable and certainly more likely than Hurricane and Tropical Storm. If Inland Flooding is rated a "Highly Likely" risk, it would have an overall priority score of 12, the same as Hurricane and Severe Winter Weather. This feels about right to me.

***Response:** The concern is noted, but after reconsidering the likely future probability of Flooding (Inland & Coastal), the Local Planning Team decided to keep its original Likelihood classification for this hazard as "Likely". It should be noted, however, that even with a total score of 9, rather than 12, Flooding (Inland & Coastal) is still a hazard of high concern for the Town and many of the proposed mitigation actions in Section 5 directly address flooding.*

5. As for my own property at 183 Front St, I would like the plan to be amended to make it a higher priority for the following reasons: It is a historic property and should be included on the list of Critical Facilities. It was originally built in 1696, so is one of the oldest extant buildings in Marion. It was a private residence for many years and in the "Golden Age" was the summer home of various prominent writers who wrote for Century Magazine. The most notable of these were John Hay and John G. Nicolay who were private secretaries and biographers of President Abraham

Lincoln. Nicolay went on to be US Ambassador to France and Marshall of the Supreme Court and Hay held many government posts, including US Ambassador to the UK and US Secretary of State. The house was later gifted to Tabor Academy and was used as a dormitory and faculty accommodation, known as "Pond House". It passed back into private ownership (and back on the Marion tax roll) in 2006 when I acquired it from Tabor. I would note that the house next door at 173 Front St is on the list of historic houses and therefore critical infrastructure. I would suggest that this house is no more nor less historic than my house, and we both face the same risk from inland flooding, costal erosion and storm surges. Both houses are in the VE velocity zone. I think 183 Front St should be evaluated on exactly the same basis as 173 Front St.

Response: *The list of historic properties included in the critical facilities list includes those listed on the National Register of Historic Places, those specifically called out on the Marion Historic Commission website, and those suggested for addition by the Sippican Historical Society. We recognize that there are many more private buildings in town that would classify as historic, but it is outside the scope of this plan to tabulate all of those locations. The Sippican Historical Society and the Marion Historic Commission are working to tabulate a full list of all the historic houses in town. In the future, if such a list exists, it can be incorporated into future updates of this plan.*

6. The boundary of the property to the south is a brook which runs between 183 and 173 Front St. The course of the brook was originally directed by large granite boulders inset into the ground. Over time, these have eroded and fallen into the brook, preventing water from flowing freely into the harbor. This causes flooding to my property every time it rains heavily. But, more important to the rest of the town, the culvert under Front St cannot cope with the water backing up and Front St itself floods. I have attached further photos and video to show the effect of heavy rain. Front St is the major access road into the village. In extreme weather events the flooding can be so severe that it is impassible to traffic. I feel that resolving the flooding risk to my property and to the Town should be a very high priority.

Response: *This culvert was already included in the map of culverts of particular concern to the Town in Figure 3-31, but the figure has been updated to identify this, as well as 3 other culverts, as being of higher concern due to documented past flooding incidents.*

Comments from Paul Ciaburri, Rochester Emergency Management Director (9/8/21):

7. Paul made the following observations during Ida:
 - a. The storm provided the biggest influx of water he has ever seen for the area (working for Rochester since 1988), specifically in the Sippican River that flows from Rochester to Marion.
 - b. There are quite a few bogs along the Sippican River, many of which are abandoned and therefore the dams are not in operation.
 - c. The abandoned bogs created a lot of flooding to the surrounding areas.
 - d. He suggested the Sippican River be evaluated for flood events, including impacts from the abandoned bogs.

Response: *Although evaluating the specific flood impacts of abandoned cranberry bogs in Rochester is outside the scope of work of this plan, a note has been added about the*

potential for cranberry bogs to result in flooding to surrounding properties and infrastructure to the Previous Occurrences & Extent section of Section 3.1.

Comments from Public Presentation (9/9/21):

Comments from John Waterman:

8. The plan needs to clearly distinguish between sewer and water infrastructure

***Response:** The critical facilities map (Figure 2-2) was updated to include two new categories: "Sewer Infrastructure" and "Water Infrastructure". The Critical Facilities table in Appendix C was also updated to reflect this change.*

9. The plan needs to factor in the different importance of assets. For example, some sewer pump stations are more critical, as some route through others. Front Street and Creek Road are hubs. Similarly, the Main Well only pumps approximately 100 gallons a day. Other wells, including those in Rochester, are more critical.

***Response:** In 2019, the Town completed a system wide sewer system study, titled *Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure*. This study identified the Creek Road Station as the most at-risk wastewater pumping station in Town. Although other stations may be more consequential to the functioning of the system, they have a lower risk of flooding and damage. The Creek Road wastewater pump station has been prioritized for infrastructure upgrades because almost half of the town's wastewater passes through that station and it is particularly vulnerable to storm surge. Permitting and design have already been completed for these upgrades, and construction on an upgraded pump station can occur in a short-term time frame. The Town acknowledges, and the 2019 Wastewater vulnerability assessment confirms, that the Front Street station is also highly vulnerable; that study ranked it number 2, after Creek Road. All wastewater in Marion passes through this single station to the wastewater treatment plant. Failure at the Front Street station would be catastrophic for the Town. To acknowledge the importance of addressing this station in the near future as well, it has been specifically mentioned in Mitigation Action 1a.*

Comments from Jennifer Francis:

10. Would love to see more discussion in the plan's introduction about how Marion is vulnerable to a number of effects of climate change. The urgency needs to be spelled out up front.

***Response:** An additional section on Climate Change has been added (Section 1.5) that gives this plan more context in relation to climate change.*

11. Current stormwater design guidance is based on past information. We need to be more forward thinking when looking at infrastructure projects (i.e., there will likely be more heavy rain events in the future)

***Response:** The text "When designing new system, future climate projections should be considered; periodic reconsideration of design criteria will be necessary as future*

projections become more solidified.” has been added to *Actions 1e and 6b*. *Actions 2b and 2c are already directly addressing this concept.*

12. Add a column to the hazard ranking table that shows the trend in risk due to climate change.

Response: *Because it is not possible to quantify how each hazard will be impacted by climate change, the Local Planning Team did not think it was appropriate to add a separate column to this table (Table 3-15). Additional narrative was, however, added to the discussion of that table to acknowledge that the cumulative risk from these hazards may change in the future due to climate change.*

13. For the parcel vulnerability analysis tables, it would be useful to translate the potential value of buildings and properties at risk into Town revenue from property tax.

Response: *A note was added to the narrative to describe how the values in Tables 4-3 to 4-15 could be converted to potential revenue loss for the town, by applying the municipal tax rate (rate was given for fiscal year 2021).*

Comments from Lance Scott:

14. Expressing the urgency that the whole Town is at risk is important. There should be some effort to educate the general population.

Response: *There are three actions specifically geared towards educating Marion residents about hazards (5a, 5b, 5c).*

15. There are substantial grant opportunities available, some of which could look at regional solutions. You can't force residents to participate, but it would be great to have the option.

Response: *Action 1f addresses this directly.*

Comments from Barry Gaffey:

16. The Town has installed about 500 E1 low pressure system (LPS) grinders for various sewer stations. But according to the sewer regs, these systems are not considered pumping stations. All E1s pump up to a force main on Congress Road that goes to Cove/Beach then Front St/Lewis then Taber (the only force main) to Benson Brook. Creek Road isn't a force main. Some of the homes on Point road/Dexter beach have E1s essentially at sea level today. They have electronics, and if they're flooded, they're out of business. There's no redundancy. No alternate force mains. Town should share how to protect these E1s - water fences? Quick set up barriers? The E1s are on individual properties but are owned by the Town.

Response: *Narrative was added to specifically identify the grinder pump neighborhoods in Marion and acknowledge the importance of these components to the overall wastewater system in Town (see Section 2.9). Discussion of the vulnerability of these*

systems to flooding was also added to Section 4.3. Action 1a was also edited to include grinder pump systems.

Comments from Norman Hills (9/9/21):

17. I believe that the SLOSH maps do not include wave heights which may give some false security to the uneducated.

Response: *This was already stated in the narrative describing this data, but an additional note has been added to the figure caption (Figure 3-11) for clarity.*

Comments from Dot Brown (9/13/21):

18. I would like to expand on the comment made by Barry Gaffey during the meeting. Barry brought up the fact that many of the grinder pumps in our neighborhood are buried very low and already flood on a regular basis. All of the flooding of these town assets that I have seen in the nine years I have lived here is coming directly from Converse Road during major rain events. There has not been a flooding event from a hurricane in that time. If you drive down Converse Road, almost every private road has a downhill slope from Converse Road and there are no drainage mitigation structures. I recommend that the plan include two different lines of protection for these town-owned facilities. First, the height of all the grinder pumps should be raised where possible. Second, plan drainage mitigation for all of Converse Road. The way it is now, each homeowner, and many of the associations, are putting up berms that pass the excess water on to their neighbors or to the common roads. Much of it will end up pooling on Converse.

Response: *See response to comment #16 above.*

Comments from Eileen Marum (9/17/21):

19. In Chapter 2 of the Marion HMP, pg 2-2 section 2.1 overview, 2nd sentence eliminate the 2010 census and please use the latest 2020 census which is 5,347. I confirmed that information this morning with Lisa in the Town Clerk's Office--508-748-3502.

Response: *This number has been updated.*



Appendix C: Critical Facilities and Vulnerability

1. Critical Facilities List
2. Mitigation Actions Prioritization

Critical Facilities List

Category	Facility #	Name	Address
Public Safety	1	Police Station	550 Mill Street
	2	Fire Station 1	50 Spring Street
	3	Fire Station 2	871 Point Road
	4	Harbormaster Building	1 Island Wharf Road
Sewer Infrastructure	5	Wastewater Treatment Plant & Lagoons	50 Benson Brook Road
	6	Marion Sewer Department	723 Mill Street
	7	Creek Road Pump Station	Creek Road
	8	Front Street Pump Station	Front Street
	9	Silvershell Pump Station	36 Lewis Street
	10	Point Road Pump Station	Point Road
	11	Parkway Lane Pump Station	Parkway Lane
	12	Little Neck Pump Station	330 Wareham Road
	13	Stoney Run Pump Station	Stoney Run
	14	Oakdale Avenue Pump Station	Oakdale Avenue
Water Infrastructure	24	Meter Pit	Industrial Drive
	15	Great Hill Tank	Great Hill Farm
	16	Benson Brook Road Tank	61 Benson Brook Road
	17	Main Pumping Station	Pumping Station Road
	18	East Well	Marys Pond Road
	19	West Well	Marys Pond Road
	20	Mary's Pond Wellfield	Marys Pond Road
	21	North Well	189 New Bedford Road
	22	South Well	189 New Bedford Road
	23	Wolf Island Road Well	Wolf Island Road
Sanitation	25	Transfer Station	57 Benson Brook Road
Town Buildings	26	Town House	2 Spring Street
	27	Sippican Elementary School	16 Spring Street
	28	Marion Music Hall	164 Front Street
	29	Town Barn	630 Mill Street
	30	Old Rochester Regional High School & Jr. High School	135 Marion Road
	31	Elizabeth Taber Library & Museum	8 Spring Street
	32	Benjamin D. Cushing Community Center	465 Mill Street
	Hazardous Materials	33	Town Barn Fueling Station
34		Cumberland Farms	406 Wareham Road
35		Wells Gas Station	439 Wareham Road
36		Hiller Fuels Inc	147 Front Street
37		Burr Brothers Boats, Inc.	309 Front Street
38		Barden's Boat Yard	2 Island Wharf Road
39		A & J Boat Corporation	840 Point Road
40		Saltworks Marine	291 Wareham Road
41		Lockheed Martin	7 Barnabas Road
42		Verizon	600 Mill Street
43		Proposed propane storage facility	Luce Avenue & Highland Road
44		Benson Brook Marine Park	35 Benson Brook Road
45		Media One of Massachusetts	13 Mill Street

Category	Facility #	Name	Address
Private Buildings	46	Tabor Academy	232 Front Street
	47	Post Office	143 Front Street
	48	Eastern Bank	340 Front Street
	49	Abington Bank	350 Front Street
	50	Sippican Historical Society	139 Front Street
	51	First Congregational Church of Marion	28 Main Street
	52	St. Gabriel's Church	124 Front Street
	53	Kitansett Club	11 Point Road
	54	Beverly Yacht Club	99 Water Street
	55	Marion Art Center	80 Pleasant Street
Food	56	Fieldstone Market	806 Mill Street
	57	Marion General Store	140 Front Street
	58	Seahorse Seafoods	173 Wareham Road
Healthcare	59	Little Neck Village	330 Wareham Road
	60	Marconi Village	41 Mill Street
	61	Sippican Health Care Center Inc	15 Mill Street
	62	Cooperative Production	760 Mill Street
	63	Department of Mental Health	551 Delano Road
Child Care	64	Countryside Child Care Center	381 Front Street
	65	Children's Academy of Marion	13 County Road
Communications	66	Benson Brook Road Cell Tower	55 Benson Brook Road
	67	Police & Fire Communication Antenna 1 / Mill Street Standpipe	630 Mill Street
	68	Police & Fire Communication Antenna 2	599 Point Road
Heavy Equipment	69	Arne Excavating LLC	340 Converse Road
	70	CF Briggs, Inc	525 County Road
Historic Buildings	71	Bird Island Light	Sippican Harbor
	72	H.R. Reed House	46 Water Street
	73	H.H. Richardson House (Percy Browne House)	192 Front Street
	74	Ryder House	21 Main Street
	75	Historical House 1	15 Main Street
	76	Historical House 2	3 Main Street
	77	Two Captains House	2 Main Street
	78	Old Schoolhouse	72 Pleasant Street
	79	Tabor Hall	13 Cottage Street
	80	The Old Stone Studio	46 Spring Street
	81	Historical House 3	173 Front Street

Mitigation Actions Prioritization

3=Best/Most Benefit/Least Cost/Easy or no permitting; 2=Some benefit/Moderate Cost/Some potential permitting complications; 1=Little to no benefit/Expensive/Complicated permitting required

	Goals and Potential Mitigation Actions	Benefits					Feasibility				Economic		Regulatory		Total Score
		Protects Properties and Structures	Protects Natural Resources	Technical/Capacity Improvement (Training, Evaluations, Regulations, etc)	Improves Public Awareness	Improves Emergency Response or Public Protection After an Emergency	Appropriate Staffing Available	Technically Feasible	Public Support	Town/Political Support	Cost	Funding Available / Attainable	Permitting/Regulatory Feasibility	Consistent with Local, State, & Federal Goals	
Goal 1. Invest in improvements that will prevent and reduce damage to critical facilities, infrastructure, and vulnerable areas in Marion from the impacts of natural hazards and changing climate.															
1	1a. Elevate/floodproof sewer pump stations vulnerable to flooding.	3	3	1	3	1	3	3	3	3	1	3	3	3	33
2	1b. Increase the flood resiliency of the Harbormaster Building.	3	1	1	3	3	3	3	3	1	3	3	3	33	
3	1c. Conduct a town-wide roof assessment of town-owned buildings to identify buildings vulnerable to heavy snowfall.	3	1	1	1	1	3	3	3	3	3	3	3	31	
4	1d. Remove debris from forested areas within close proximity to municipal facilities to reduce risk of damage to buildings and infrastructure from wildfire.	3	3	1	1	2	3	3	3	3	2	2	3	3	32
5	1e. Replace and/or enlarge culverts under roads that experience flooding during heavy precipitation and complete upcoming scheduled repairs on damaged culverts to ensure adequate flow/function.	3	2	1	1	3	3	3	3	3	2	2	3	3	32
6	1f. Coordinate with residents in areas vulnerable to coastal flooding to apply for hazard mitigation grants and provide information on building and design guidance (i.e., building code in flood zones) and permitting steps for installation of resiliency improving actions (i.e., living shorelines, home elevation, etc.).	3	1	1	3	1	2	3	3	3	2	3	3	3	31
Goal 2. Integrate hazard mitigation planning in all relevant municipal departments, committees and boards to ensure that future development meets all local, state, and federal requirements.															
7	2a. Hold annual or semi-annual meetings with relevant municipal departments, committees and boards to discuss how hazard mitigation planning could be incorporated into their respective activities.	2	2	3	2	2	3	3	3	2	3	3	3	3	34
8	2b. Ensure future municipal plans (e.g., updates to master plan, open space plan, etc.) incorporate hazard mitigation planning and climate change resiliency.	2	2	3	3	2	3	3	3	3	3	3	3	36	
9	2c. Formulate bylaws that require more resilient designs (e.g., requiring new buildings to plan for future flood elevation).	3	2	3	2	1	2	2	1	2	2	2	3	3	28
Goal 3. Encourage the business community, institutions, and non-profits to be active in hazard mitigation planning.															
10	3a. Work with hazardous-materials-containing private facilities located in high hazard areas, such as along the waterfront (e.g., boatyards), to develop hazardous materials management plans.	1	3	3	3	1	2	3	2	3	3	2	3	3	32
11	3b. Encourage private organizations, businesses, and facilities to develop disaster response plans and/or implement flood protection measures.	3	2	3	3	2	2	3	2	3	3	2	3	3	34
Goal 4. Coordinate with neighboring communities, state, regional and federal agencies on regional solutions for hazards affecting multiple communities.															
12	4a. Coordinate with neighboring communities to develop a regional evacuation plan.	2	2	3	3	3	2	3	3	3	2	3	3	3	35
Goal 5. Improve public education related to natural hazards, including informing the public about hazard-prone areas to mitigate damage and losses where possible and what to expect during natural disasters.															
13	5a. Better advertise the current CodeRED emergency response system to residents, highlighting the need to enroll for certain types of alerts.	1	1	3	3	3	2	3	3	3	3	3	3	3	34
14	5b. Develop educational materials for residents about defensible space techniques and the dangers of wildfires, potential drawing from national level programs like Firewise.	1	1	1	3	1	2	3	3	3	3	3	3	3	30
15	5c. Circulate regular "resiliency tips" to keep the public well informed about hazard mitigation planning.	1	1	2	3	1	3	3	3	3	3	3	3	3	32
Goal 6. Ensure adequate evacuation routes and means to maintain adequate access during an emergency.															
16	6a. Create a forest management plan that prioritizes management of roads used for evacuation and to access shelters, particularly in areas vulnerable to downed trees.	1	2	3	2	3	2	2	3	3	2	2	3	3	31
17	6b. Improve roadway drainage through stormwater system upgrades to decrease flooding on high-trafficked roads.	3	2	1	2	3	2	3	3	3	1	2	3	3	31
Goal 7. Provide residents with public utilities, such as electricity, drinking water, and communications, during and after natural disasters or alternatively access to emergency shelters equipped with sufficient provisions, climate control and emergency electricity.															
18	7a. Increase generator capacity at local emergency shelter (i.e., Sippican School). There are currently generators, but they cannot currently support running the cooling system, and although cooking facilities and showers are available, hot water is not.	1	1	2	1	3	3	3	3	3	2	2	3	3	30
19	7b. Coordinate with private facilities for expanding or specific emergency sheltering capacity.	1	1	2	2	3	2	3	3	3	3	3	3	3	32
20	7c. Increase the number of staff/volunteers at emergency shelters.	1	1	2	2	3	3	3	3	3	3	3	3	3	33

Low	<=30
Med	31-32
High	>=33