Marshfield Multi-Hazard Mitigation Plan
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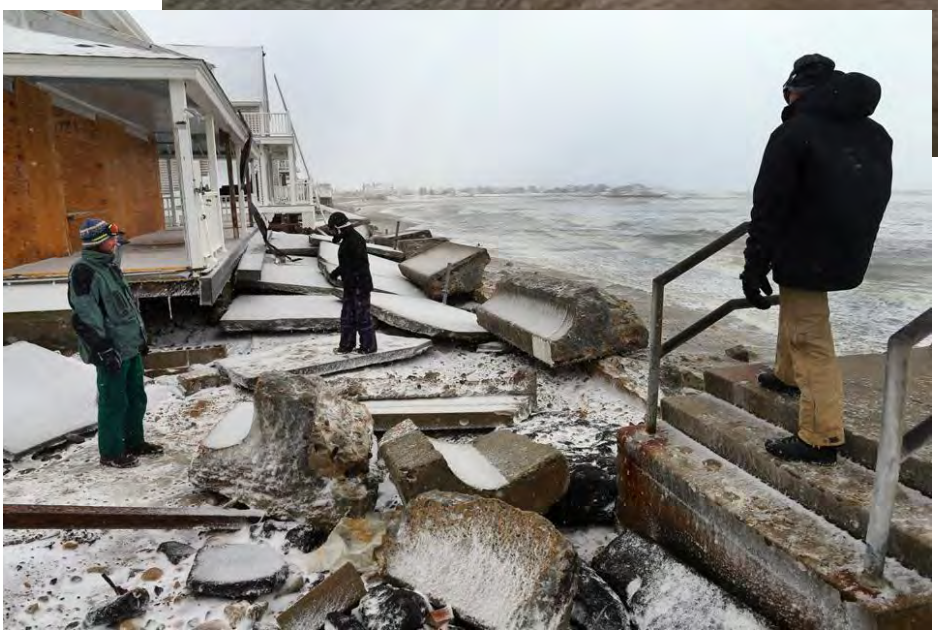

Prepared For:
Town of Marshfield
870 Moraine Street
Marshfield, MA 02050

Prepared By:
Woods Hole Group, Inc.
81 Technology Park Drive
East Falmouth, MA 02536

February 2018

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(508) 540-8080

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Virtually every type of weather has been and will be experienced along the South Shore of Massachusetts. From freezing temperatures and blizzard conditions in the winter to heat and humidity in the summer, Marshfield 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, Marshfield's location along the Atlantic coast exposes the Town to wave energy capable of coastal erosion, flooding, and property damage.

In addition to these regional weather factors, Marshfield has approximately 4.7 miles of shoreline open to the Atlantic Ocean. The combination of these factors results in the potential for unique natural hazards associated with ocean based storm events, such as flooding and coastal erosion.

Natural hazards of all kinds can result in injury, loss of life, 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 Mutli-Hazard Mitigation Plan, the Town of Marshfield is proactively trying to prepare for and mitigate potential impacts from the various natural hazards.

1.1 PURPOSE OF THE PLAN

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 Marshfield produced this Updated 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 on 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; and

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 post-disaster remediation, and expedite disaster recovery. The Plan will also help to reduce or eliminate repetitive flood losses.

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.

1.2 THE PLANNING PROCESS

A1.a
A1.e

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 Update, the planning process included the following:

- A public online survey to assess the community's experience with local natural hazards and their perception of the Town's risk to natural hazards;
- An opportunity for the public to comment on the plan during the drafting state 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
- Review and incorporate existing plans, studies, reports and data.

A1.b

This Multi-Hazard Mitigation Plan is the third iteration of hazard mitigation for the Town of Marshfield; previous plans were approved by FEMA in 2005 and 2013. The Local Hazard Mitigation Planning Committee (LHMPC), which had a large role in the development of this Multi-Hazard Mitigation Plan Update consists of various Town officials and was able to provide critical local knowledge of the community to facilitate update of this Plan.

A1.c A1.d

The LHMPC was formed by the Town Administrator, which included the Chiefs of the Police and Fire Departments, the Town Engineer and other members of the Department of Public Works, the Town Planner, the Conservation Agent, and the Harbor Master.

In addition to the LHMPC input, public participation in the hazard mitigation planning process is also important, both for plan development and for later 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 of the concept of hazard mitigation, potentially creating support for mitigation actions taken in the future to implement the plan. To gather this information and educate residents on hazard mitigation, the Town hosted two public meetings:

A2.a

- Meeting #1: August 29, 2017
- Meeting #2: December 6, 2017

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

Copies of the announcements and attendance lists from these two meetings, as well as a master list of LHMPC 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 LHMPC meets to review and update the Marshfield Multi-Hazard Mitigation Plan.

A public online survey was also administered to not only assess the community's experience with local natural hazards and their perception of the risk, but also to reach a wider demographic that may not be available to attend public meetings in person. The results of this online public survey are including in Appendix B.

The following steps were taken during the planning process:

1) Develop a LHMPC in charge of updating this Plan;
2) Define the potential natural hazards that could affect Marshfield;
3) Determine high hazard locations and critical infrastructure potentially affected;
4) Conduct a vulnerability assessment of buildings and infrastructure;
5) Outline existing hazard mitigation measures in place;

6) Determine gaps in hazard mitigation preparedness;
7) Define proposed hazard mitigation measures to fill these gaps;
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 Marshfield's website, with a notification on the Town's homepage, a direct link to the plan, and directions for how to submit questions or comments. The draft Plan was also presented at a public Board of Selectmen meeting (Meeting date #3) to gather additional public input and Town approval. Announcements were made on the website, in the local newspaper and on social media that public comment was being sought. Screenshots documenting the Town's website posting and a copy of a local newspaper article are provided in Appendix B. The draft plan was posted on the website for 30 days prior to finalization. Comments received during this time, and responses to these comments are provided in Appendix B.

A2.a

The Plan was also sent to Town Planners in Scituate, Norwell, Pembroke, and Duxbury. A copy of the letter sent to neighboring towns soliciting their feedback on the Plan is also provided in Appendix B.

A4

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

- Massachusetts State Hazard Mitigation Plan (2013);
- Marshfield's Master Plan (2015)
- Sea Level Rise Study for Marshfield, Duxbury, and Scituate (2013); and
- Local bylaws and regulations.

In 2013, the State Hazard Mitigation Team, comprised of staff from the MEMA and Department of Conservation and Recreation, updated its existing Commonwealth of Massachusetts State Hazard Mitigation Plan. This was the plan's seventh revision from its initial preparation in 1986. The planning team worked with a number of state and federal agencies to develop a plan outlining actions that should be taken by federal, state, local governments and the general public to manage the risks of natural hazards.

The Marshfield Master Plan was prepared by VHB in 2015 to codify planning goals for land use, housing, economic development, natural and open space, public service and facilities, and transportation.

The Sea Level Rise Study for the Towns of Marshfield, Duxbury, and Scituate, MA was prepared by Kleinfelder in 2013, and provides a regional approach to identifying the effects of sea-level rise and possible ways to mitigate those impacts.

A1.d
A2.b
A2.c

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. Bylaws and regulations are discussed further in Chapter 5. Technical information from the plans, regulations and bylaws described above was incorporated into the Marshfield Multi-Hazard Mitigation Plan in a number of ways, including:

1. Guide the planning process;
2. Help develop mitigation actions;
3. Provide recent data on various hazards and their impacts; and

4. Ensure that mitigation actions in this plan were consistent with current activities and plans already in place at the state and local level.

1.3 Plan Description

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 box in the margin.

1.4 Previous Federal/ State Disasters

The Town of Marshfield has experienced 21 natural hazards that triggered federal or state disaster declarations since 1991. These are listed in Table 1 below. The vast majority of these events involved flooding.

Table 1. Disaster declarations for the Town of Marshfield since 1991.

Disaster Name (Date of Event)	Type of Assistance	Declared Areas
Hurricane Bob (August 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (16 projects)
No-Name Storm (October 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	FEMA Individual Household Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (10 projects)
December Blizzard (December 1992)	FEMA Public Assistance Project Grants	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk (7 projects)
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	All 14 Counties
May Windstorm (May 1996)	State Public Assistance Project Grants	Counties of Plymouth, Norfolk, Bristol (27 communities)

Table 1 (Continued). Disaster declarations for the Town of Marshfield since 1991.

Disaster Name (Date of Event)	Type of Assistance	Declared Areas
October Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk (36 projects)
1997	Community Development Block Grant - HUD	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
June Flood (June 1998)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (19 projects)
1998	Community Development Block Grant - HUD	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
March Flood (March 2001)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (16 projects)
February Snowstorm (Feb 17-18, 2003)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (Jan 22-23, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
Hurricane Katrina (August 29, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
May Rainstorm/Flood (May 12-23, 2006)	Hazard Mitigation Grant Program	Statewide
April Nor'easter (April 15-27, 2007)	FEMA Public Assistance Project Grants	Barnstable, Berkshire, Dukes, Essex, Franklin, Hampden, Hampshire, Plymouth
	Hazard Mitigation Grant Program	Statewide
Flooding (March 2010)	FEMA Public Assistance FEMA Individuals and Households Program SBA Loan	Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Statewide

Table 1 (Continued). Disaster declarations for the Town of Marshfield since 1991.

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

Chapter 2 Local Profile

One of the first steps in hazard mitigation planning is to determine the Town's assets. Without a detailed and accurate understanding of the social, historical, infrastructure and environmental resources present within the Town, it is impossible to develop a plan to protect them. The goal of this chapter is to develop 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, historical locations throughout Town, and a description of Repetitive Loss Properties.

Although all community assets may be affected by hazards, 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 Marshfield.

2.1 Overview

The Town of Marshfield is located in Southeastern Massachusetts in Plymouth County. A coastal community 30 miles from Boston, Marshfield has a yearly population of about 24,000 people which grows to about 40,000 in the summer months. The town has a traditional New England government structure with a three-member Board of Selectmen, a Town Administrator, and an open town meeting. Among the basic services provided to residents are public safety, schools, water and sewer, trash removal, recreation, public library, and senior center.

The town maintains a website at http://www.townofmarshfield.org

2.2 Geography

Marshfield is situated in the center of the SouthShore Towns, 30 miles southeast of Boston, 12 miles north of Plymouth, and 60 miles northeast of Providence, Rhode Island. It is approximately 29 square miles in area. Marshfield is bordered on the north by the town of Scituate, on the west by Norwell and Pembroke, and on the south by Duxbury.

Marshfield is composed of ten distinct villages or areas: North Marshfield, Marshfield Hills, Seaview, West Marshfield (Plain Street), Downtown, Rexhame, Fieldston, Ocean Bluff, Brant Rock and Green Harbor. It is a coastal community with many beaches, marshes, and tidal waterways. Marshfield and the Town of Scitaute share the waters of the South and North Rivers, a sensitive and important natural resource area.

2.3 Climate

Marshfield averages approximately 48.8 inches of rain per year with an average annual snowfall of 59 inches. Average temperatures range from highs in the upper 70's and low 80's during the summer months to lows in the low to mid 20's during winter months. Marshfield's location along the Atlantic Ocean generally keeps temperatures cooler in the summer and warmer in the winter than other nearby, inland Massachusetts communities.

2.4 Natural Environment

Marshfield's natural environment and natural resources are important to the Town's identity and quality of life. In fact, the most important factor in why people move to Marshfield is its beaches. Natural resources, including water bodies, beaches, forests, wetlands and others, 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 and riparian 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 beaches.

2.5 Land Use

Marshfield was one of the early pilgrim towns belong to the area known as the "New Colony of New Plimoth in New England," established in 1640. Cattle farming was one of Marshfield's original and major industries. The other important historical industry was commercial fishing, which continues to be an important economic and recreational activity in Marshfield today. Marshfield was named because of the large

number of salt water tidal marshes scattered throughout the Town along the Green Harbor River and the North and South Rivers, near their confluence with Massachusetts Bay.

The broad land use patterns that shaped Marshfield were driven by four trends:

1. The colonial and subsequent 18th century agricultural and early industrial development of Marshfield. From the Town's settlement in 1632 through to the 1800's, Marshfield was a farming and ocean -oriented community. This period established several villages, the winding road system, farms and fields, and the historic homes and civic buildings found throughout Marshfield. This historic community development pattern lends the Town most of its charm and character.
2. Early 20th century vacation subdivisions and associated vacation oriented businesses along the beach. This occurred at sufficiently high densities along Ocean Street that there have been few changes in the overall character of that area. Seasonal homes are being converted to year round housing, but the basic land use pattern of single family homes on small lots along beach areas remains.
3. The construction of Route 3 in the 1960s brought increasing suburbanization to Marshfield, establishing Marshfield as a Boston suburb and spurring increased residential and commercial development.
4. Today, Marshfield is largely a seaside community with many residents commuting by car to jobs in Boston. Marshfield becomes a vibrant center of activity with a large influx of summer visitors, especially those that rent summer homes near Marshfield's beaches.

Figure 2-1 shows major land uses throughout Marshfield. The numbers of parcels and areas within each land use category are summarized in Table 2-1. The majority of Marshfield's area is residential, with more than 7,200 acres. The next largest categories by acreage are Open Space and Vacant

Areas that are likely to be developed within the next 10 years include:

1. Garden Gate – Four lot residential development.
2. Cranberry Cover – 13 lot Open Space Residential Development (OSRD).
3. Marshawk – 13 lot OSRD.
4. John Shem & White Oaks – 18 total residential lots.
5. Matuxet – 15 lot residential development
6. Welch Healthcare – 140 unit age restricted multi-family development.
7. Enterprise Park – Industrial park with mixed use commercial, 900,000 square feet.
8. Wind Chime Lane – Four lot residential development.

Table 2-1. Land Use Summary for Marshfield (based on the 2017 Assessor's parcel dataset).

Land Use Category	# of Parcels	Total (acres)
Residential (Single Family)	9,146	6,597.6
Residential (Multi-Family)	230	605.0
Commercial (Retail/Offices/Services)	176	238.9
Commercial (Manufacture/Distribution)	53	270.2
Public Services	176	1,021.1
Temporary Lodging (i.e. Hotels, Inns)	2	0.5
Agriculture	41	567.4
Open Space	620	5,333.9
Vacant	1,338	3,409.9
Recreation	5	282.1

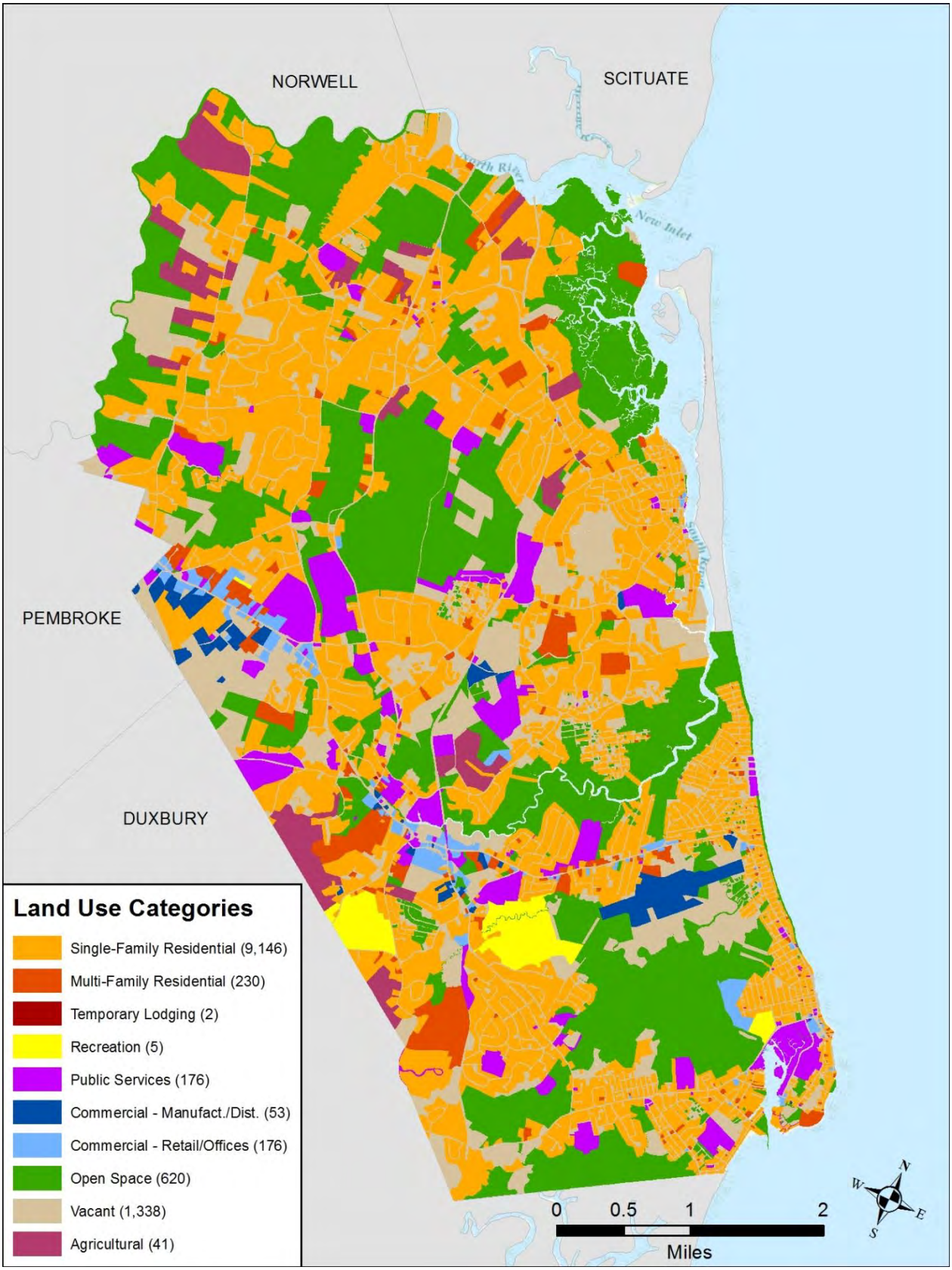


Figure 2-1. Land Use in Marshfield (based on the 2017 Assessor's parcel dataset).

2.6 INFRASTRUCTURE

The Town of Marshfield has approximately 140 miles of roadway maintained by the Department of Public Works. Certain roadways (e.g. Route 3A and portions of Route 139) are maintained by the Mass. Highway Division. The road network operates satisfactorily during the off-season months; however, due to the large population increases in the summer months, there can be considerable congestion on some of the arterial roadways. Major roadways in Town also function as evacuation routes during an emergency. Figure 2-2 highlights the Town's current evacuation routes in red. The evacuation route follows Route 139 to Route 3. Residents are then asked to travel north to Exit 20 for Route I-93 south, and continue on I-93 south to Exit 6 (Route 37 in Braintree) to get to the Braintree Emergency Reception Center located at the Braintree High School.

In addition to a number of major roadways, Marshfield is also serviced by the Greater Attleboro Taunton Regional Transit Authority (GATRA) service.

The Marshfield Department of Public Works – Water Division is responsible for providing an adequate supply of safe water for Marshfield's needs (domestic use and fire protection). This responsibility involves the installation, maintenance and repair of water mains and services lines, including fire hydrants on public ways, the maintenance and operation of wells, pumps and related infrastructure, water meter installation and reading, and water sampling. The Town's municipal drinking water supply consists of six aquifers and sixteen active gravel-packed wells. The sixteenth well came online in June 2016. The Marshfield water supply is obtained entirely from underground sources within the Town's boundaries.

Figure 2-2. Emergency evacuation routes in Marshfield.

2.9 CRITICAL FACILITIES

Critical infrastructure facilities are essential to the health and welfare of the Town and are especially important for response and recovery following hazard events. Critical infrastructure includes buildings and infrastructure such as emergency operations centers and shelters, critical municipal buildings, transportation features, utilities and communications infrastructure, water and wastewater facilities, etc. The LHMPC developed a list of critical infrastructure and facilities, which is provided in Appendix C. Due to the potential for compounded adverse impacts if they were compromised during a natural hazard, facilities containing hazardous materials and gas stations within the flood plain were also included in the critical facilities list. The critical facilities in Marshfield are shown in Figure 2-4. Only a portion of critical infrastructure 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 2-3. Fieldston Beach seawall (looking north from the end of Hartford Road).

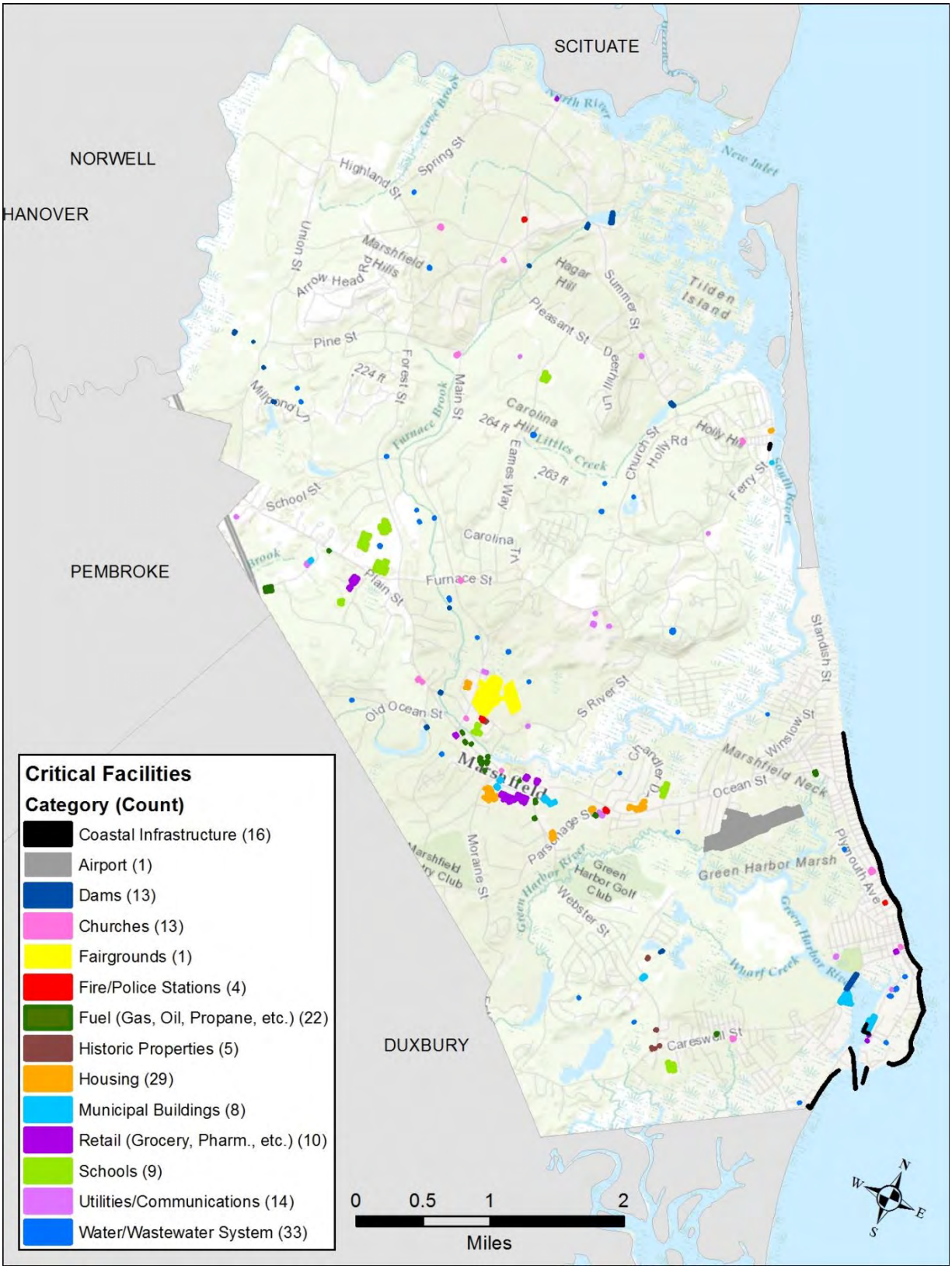


Figure 2-4. Critical infrastructure locations in Marshfield.

2.10 HISTORIC PROPERTIES

Marshfield has a rich history that is reflected in a wide-range of historic and archaeological resources. Three historical groups exist in Marshfield: The Marshfield Historical Society, the Historic Winslow House Association, and the Marshfield Historic Commission.

Marshfield has 4 individual properties and one district on the National Register of Historic Places. They are:

1) Hatch Homestead and Mill Historic District (385 Union Street)
2) Marshfield Hills Historic District (Bow, Highland, Main, Old Main, Pleasant, Glen, and Prospect Streets)
3) Thomas-Webster Estate (238 Webster Street) (Figure 2-5).
4) Daniel Webster Law Office and Library (Careswell and Webster Streets)
5) Issac Winslow House (634 Careswell Street)

Additional historic sites of cultural importance within Marshfield include the Marcia Thomas House and Seth Ventress.

Figure 2-5. Thomas-Webster Estate

2.11 REPETITIVE LOSS PROPERTIES

B4.a

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 2017, the Town of Marshfield has 149 Repetitive Loss Properties, of which 19 are Severe Repetitive Loss (SRL) properties; 137 of these properties are single-family residential, while 4 are mutli-family residential, 6 are commercial (retail/offices/ services), and 1 is public service.

All Repetitive Loss Properties in Marshfield are located on or near the coast or tidal waterway or marsh. In almost all cases, the flooding has been caused by storm surge. Storm surge is a temporary increase in the elevation of the water level caused by a storm, which can cause extreme flooding in coastal areas particularly when the storm surge coincides with a normal high tide. Many of these repetitive loss structures are located at low elevations and are within a velocity zone (VE), which makes them particularly susceptible to the hazards of storm surge and coastal flooding. Low-lying Repetitive Loss Areas with-in a VE Zone, that contain clusters of Repetitive Loss Properties, include the Rexhame Area, the Brant Rock Esplanade Area, the Brant Rock High Road Area, the Blue Fish Rock Area and the Bay Avenue Area. Other Repetitive Loss Areas, such as the Barlett Island Area and the Ferry Street / Ridge Road Area are vulnerable to storm surge inundating low-lying properties adjacent to tidal rivers or marshes.

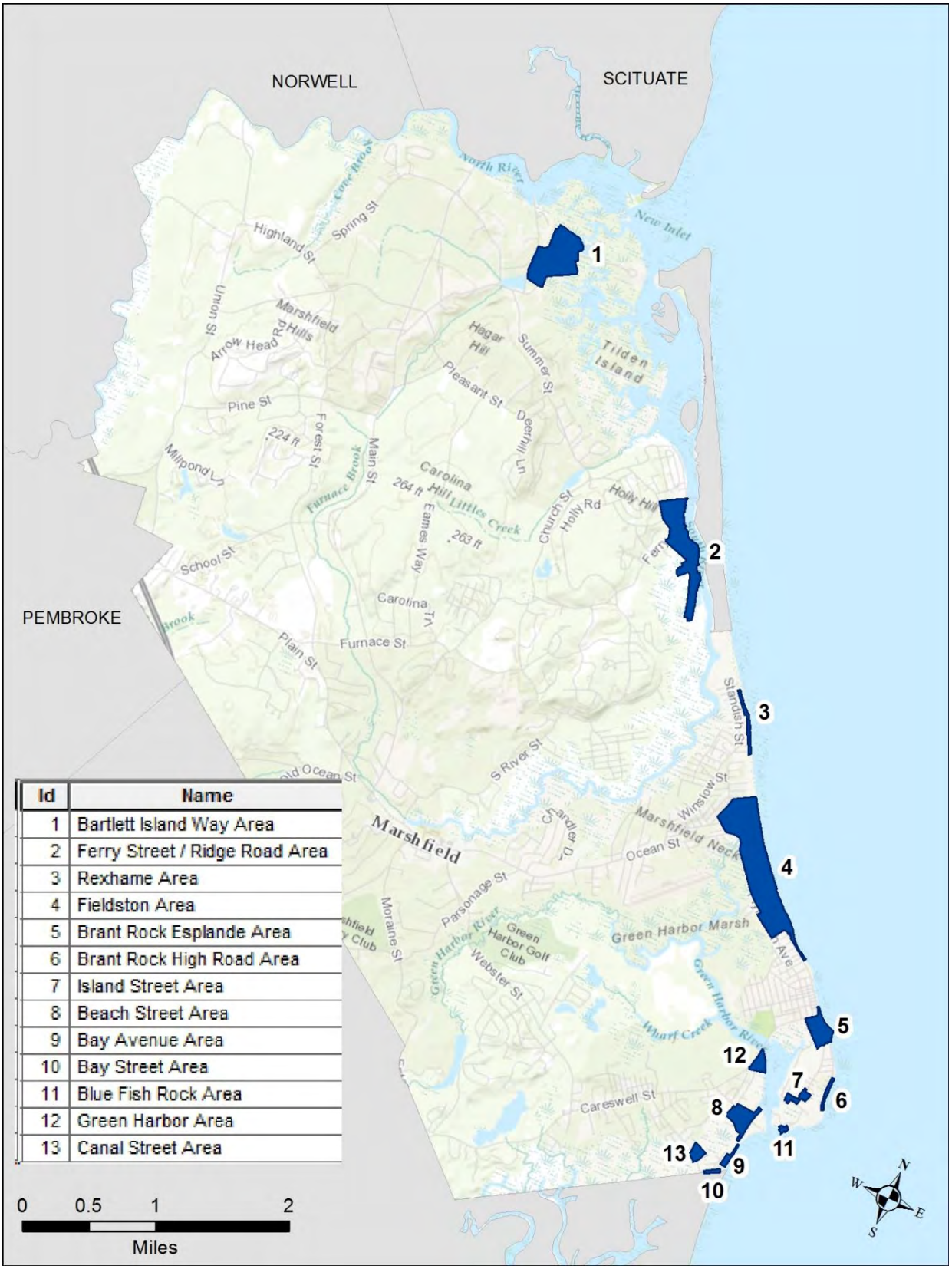
It is important to note the emphasis on Repetitive Loss "Areas", as opposed to specific properties. While locating specific repetitive loss properties is important for some purposes, these properties only appear

on FEMA's list because the structure had flood insurance and received two or more claims of at least $1,000 during any ten-year period. Other nearby structures may have been uninsured during the floods, may have only had one flood insurance claim, or may have had multiple claims under different policies. The properties that are listed by FEMA as Repetitive Loss Properties simply represent a sampling of Marshfield's repetitive flooding problem, and are a good indication of the Town's vulnerable and repetitively flooded areas.

As of 2017, Marshfield has 13 Repetitive Loss Areas:

1. Bartlett Island Area: Losses due to storm surge inundating low-lying properties adjacent to tidal marshes
2. Ferry Street / Ridge Road Area: Losses due to storm surge inundating low-lying properties adjacent to the South River
3. Rexhame Area: Losses due to coastal storm surge and wave action along low-lying beachfront properties
4. Fieldston Area: Losses due to 1.) coastal storm surge and wave action along low-lying beachfront properties and 2.) flooding of low-lying properties adjacent to Bass Creek
5. Brant Rock Esplanade Area: Losses due to 1.) coastal storm surge and wave action along low-lying properties and 2.) flooding of low-lying properties adjacent to Green Harbor Estuary
6. Brant Rock 'High Road' Area: Losses due to coastal storm surge and wave action along beachfront properties
7. Island Street Area: Losses due to storm surge inundating low-lying properties between tidal marshes
8. Beach Street Area: Losses due to storm surge inundating low-lying properties adjacent to Cut River tidal marshes
9. Bay Avenue Area: Losses due to coastal storm surge and wave action along beachfront properties
10. Bay Street Area: Losses due to storm surge from the ocean and tidal marshes inundating low-lying properties surrounded by higher properties
11. Blue Fish Rock Area: Losses due to coastal storm surge and wave action along beachfront properties
12. Green Harbor Area: Losses due to storm surge inundating low-lying properties from Green Harbor
13. Canal Street Area: Losses due to storm surge inundating low-lying properties adjacent to tidal marshes

These Repetitive Loss Areas are shown in Figure 2-6.



Id	Name
1	Bartlett Island Way Area
2	Ferry Street / Ridge Road Area
3	Rexhame Area
4	Fieldston Area
5	Brant Rock Esplande Area
6	Brant Rock High Road Area
7	Island Street Area
8	Beach Street Area
9	Bay Avenue Area
10	Bay Street Area
11	Blue Fish Rock Area
12	Green Harbor Area
13	Canal Street Area

Figure 2-6. Repetitive Loss Areas in Marshfield.

Marshfield is vulnerable to a wide range of natural hazards that can threaten the people, the economy, the infrastructure and the natural resources of the Town. As suggested under FEMA planning guidance, the Town of Marshfield reviewed the full range of natural hazards identified in the 2013 Massachusetts State Hazards Plan, which included:

1) *Flooding*
2) *Coastal Erosion*
3) *Hurricanes and Tropical Storms*
4) *Severe Nor'easters*
5) *Severe Winter Weather (snow, blizzards, and ice storms)*
6) *Severe Weather (thunder-storms, wind, drought, extreme temperatures, and tornadoes)*
7) *Fire*
8) *Dam/Culvert Failure*
9) *Landslide*
10) *Earthquake*
11) *Tsunami*

In addition to the hazards above, the Town of Marshfield also included Sea-Level Rise as an additional hazard. This chapter provides a description of each hazard, the location(s) within Marshfield 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. Down trees and limbs also limit emergency access and complicate cleanup efforts. Through the development and continued update of this Plan, Marshfield 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 Marshfield include high winds, heavy rains/snows and coastal flooding. Natural disasters occurring less frequently, such as tornadoes, earthquakes or forest fires, pose other hazards and present unique challenges to residents and community officials, given a relatively short-term institutional memory.

The 2013 Massachusetts State Hazard Plan identifies 11 natural hazards that could have an impact or have a history of impacting communities in the Commonwealth of Massachusetts.

These hazards are:

1) Flooding
2) Coastal Erosion
3) Hurricanes and Tropical Storms
4) Severe Nor'easters
5) Severe Winter Weather (including snow, blizzards, and ice storms)
6) Severe Weather (including thunderstorms, high wind, drought, extreme temperatures, and tornadoes)
7) Fire
8) Dam Failure
9) Landslide
10) Earthquake
11) Tsunami

As suggested under FEMA planning guidance, the Town of Marshfield reviewed the full range of natural hazards identified in the 2013 Massachusetts State Hazards Plan. Also, Marshfield is a coastal community, bordering the Atlantic Ocean, sea-level rise was considered separately as an additional hazard in this plan. Additionally, given the high number of culverts in the Town, and the potential risk associated with their failure, culvert failure was also evaluated along with dam failure. The Local Hazard Mitigation Planning Committee (LHMPC) did not believe the topography in Marshfield would be able to produce landslides, and as such, this hazard was not addressed directly in this plan. In addition to the 2013 Massachusetts State Hazard Mitigation Plan, other resources consulted during the drafting of this plan included news articles and other media sources, and local knowledge from LHMPC members. All resources are referenced in the text of each hazard profile.

B1.b

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

1. **Flooding**
2. **Coastal Erosion**
3. **Sea-Level Rise**
4. **Hurricane/ Tropical Storm**
5. **Nor'easter**
6. **Severe Winter Weather**
7. **Thunderstorm**
8. **High Wind**
9. **Drought**
10. **Extreme Temperature**
11. **Tornado**
12. **Fire**
13. **Dam/Culvert Failure**
14. **Earthquake**
15. **Tsunami**

3.1 FLOODING

OVERVIEW

Flooding was the most prevalent serious natural hazard identified by local officials in Marshfield. Flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and, thunderstorms. Sea level rise has the potential to exacerbate these issues over time.

The Town of Marshfield is subject to two kinds of flooding: coastal flooding where wind and tides leads to flooding along the shore and tidal waterways and inland flooding where the rate of precipitation or amount of water overwhelms the capacity of natural and structured drainage systems to convey water causing it to overflow the system. These two types of flooding are often combined as inland flooding is prevented from draining by the push of wind and tide driven water. Both types of flooding can be caused by major storms, known 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. Marshfield, being north of Cape Cod, is particularly vulnerable to nor'easters because the area is not protected by the sheltering arm of Cape Cod. Nor'easters cover a larger area than hurricanes although the winds are not as high. They also generally last long enough to include at least one high tide, which causes the most severe flooding. Large rain storms or snowfalls can also lead to inland flooding. See later sections for more specific details on these other 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, rivers, and stormwater conveyance systems. This can results 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 and cannot drain out. Drainage systems are made up of ditches, storm sewers, retention ponds and other infrastructure designed to transport storm water away from roadways and parking lots, to receiving streams, lakes, or the ocean. When most of these systems were built, they were designed to withstand a 10-year storm event. Larger storms can overwhelm these systems, and blocked or clogged drainage ditches and grates 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 surges, which occur when water is pushed onshore during powerful storms, such as hurricanes and nor'easters. These storms often cause a storm surge, which 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. Major hurricanes are capable of producing VE zones with base flood elevations as high as 23 feet. 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.

B1.c B2.a

Hazard Location

Figure 3-2 shows the 2016 FEMA Flood Insurance Rate Map (FIRM) for Marshfield. This map depicts the areas of Marshfield in VE, AE, A, and AO zones and within the 0.2% flood area (an area expected to be inundated during a 500-year storm event). However, flooding also occurs during less severe storms (the FEMA FIRM represents the risk of flooding from a 100-year storm). Figure 3-3 shows areas of repeated flooding (red), as well as potential flooding (blue), as identified by the Town.

Although this is not a comprehensive list of the areas identified in Figure 3-3, specific problematic areas identified as frequently flooded within the Town of Marshfield include:

1. Brant Rock: Flooding in the Brant Rock area occurs primarily in the esplanade area, a low-lying area just inland from the sea wall where there is a collection of businesses and residences. Flooding is caused by sea splash over as waves overtop the sea wall and lack of drainage. The esplanade area floods two to three times a year to a depth of one to two feet.
2. Bass Creek/Fieldston: The Fieldston area is subject to frequent flooding during rainfall events and wash over of the sea wall during coastal storms. This flood water collects in the vicinity of Monitor and Mayflower Roads due to low elevations, high water table, and restrictions in the drainage ditch into Bass Creek. The upper reaches of Bass Creek are heavily impacted by sediment and overgrown with little elevation change further limiting drainage. The Town has begun work on improving drainage conditions in Bass Creek.
3. Sea Wash Over or Splash Over: Most of Marshfield's ocean coastline is protected by sea walls and along the entire length of these walls there is periodic sea splash over where ocean waters top the sea wall. These waves carry debris, including cobble stones, and can bring enough water over the wall as to cause flooding in adjacent low lying streets and properties. Splash over occurs during storm events and can also occur at times when storms pass further out at sea and drive waves towards the coast. Many of the locally identified flood areas listed here that are along the coast flood, at least in part, due to sea wash over events.
4. Rexhame Beach
5. Neptune Road
6. Damon's Point
7. Green Harbor
8. Veteran's Park
9. Ocean Street & South River

Previous Occurrences & Extent

B2.a B2.c

There have been a number of major floods that have affected the South Shore region over the last fifty years. Significant historic flood events in Marshfield have included:

- March 1968
- The blizzard of 1978
- January 1979
- April 1987
- October 1991 ("The Perfect Storm")
- October 1996

- June 1998
- March 2001
- April 2004
- May 2006
- April 2007
- March 2010

Below is a list of rain and flooding events in Marshfield from 2013 to 2017, from NOAA's NCDC Storm Events Database. This database lists a number of specific flooding incidents for Marshfield:

February 9, 2013: Coastal flooding occurred throughout eastern Plymouth County as a result of the February 2013 blizzard. The blizzard produced a storm surge of 3 to 4 feet along much of the Massachusetts east coast south of Boston. In Marshfield, numerous streets were flooded and impassable. Cars were stuck in flood waters on Plymouth Avenue. Water flowed around and under buildings. Significant beach erosion occurred, damaging stairs. Brook Street was washed out.

March 7-9, 2013: Coastal flooding occurred along Massachusetts' east coast for two high tide cycles as a result of a major winter storm. In Marshfield, the Brant Rock and Esplanade sections were flooded and impassable with rocks and other debris on roadways. Ocean Street from Colonial Road to Dyke Road had rocks and other debris in the road from significant splashover. Damage to the seawall at Foster Avenue and Brook Street resulted in those streets flooding. Numerous coastal streets were flooded with water flowing around the buildings and rocks and other ocean debris on the roads.

January 3, 2014: Coastal flooding resulted along much of southern New England as a result of a major winter storm. In Marshfield, coastal flooding closed the Esplanade area, Ocean Street from Samoset Avenue to Reed Street, Bay Avenue, Canal Street, Plymouth Avenue at West Brook Street, and Old Ferry Street. The Bay Avenue sea wall opening lost its batter boards in the Avon Street area, which resulted in flooding.

October 23, 2014: Coastal flooding resulted during a low pressure system that moved up the east coast depositing a significant amount of rain. In Marshfield, minor splashover occurred in the normally vulnerable locations, especially on Nantasket Street. Coastal roadways in Brant Rock were inundated.

November 2, 2014: Coastal flooding resulted from a coastal storm producing strong wind and waves. In Marshfield, part of Ocean Street near the Esplanade was flooded. Also, streets in the Brant Rock section were flooded.

January 27, 2015: Coastal flooding resulted from a major winter storm with blizzard conditions. Dyke Road was flooded to the Esplanade. Ocean Street and Foster Road were impassable. Numerous sections of seawall were damaged, resulting in additional flooding.

February 15, 2015: Coastal flooding resulted from a major winter storm with blizzard conditions. In Marshfield, two feet of street flooding occurred by the Esplanade in Brant Rock. Up to six inches of street flooding occurred on Ocean Street. Bay Avenue was flooded by water coming over the part of the sea wall near Brighton Street that was compromised in the previous storm.

January 24, 2016: Coastal flooding resulted from a major winter storm producing strong wind and waves. In Marshfield, the north side of Boundary Road was closed due to flooding. Splashover occurred in a parking lot in the area of Brant Rock. The Brant Rock esplanade area along Ocean Street was flooded.

January 4, 2018: Coastal flooding associated with a major winter storm. Still water levels reached elevations not seen since the Blizzard of 1978. Major roadways were flooded and impassible. Businesses in the Esplanade area flooded, with some areas reporting more than 3 feet of standing water (Figure 3-1). Frigid temperatures less some area roads encased in ice.

Figure 3-1. Flooding in the Esplanade area during the January 4, 2018 winter storm.

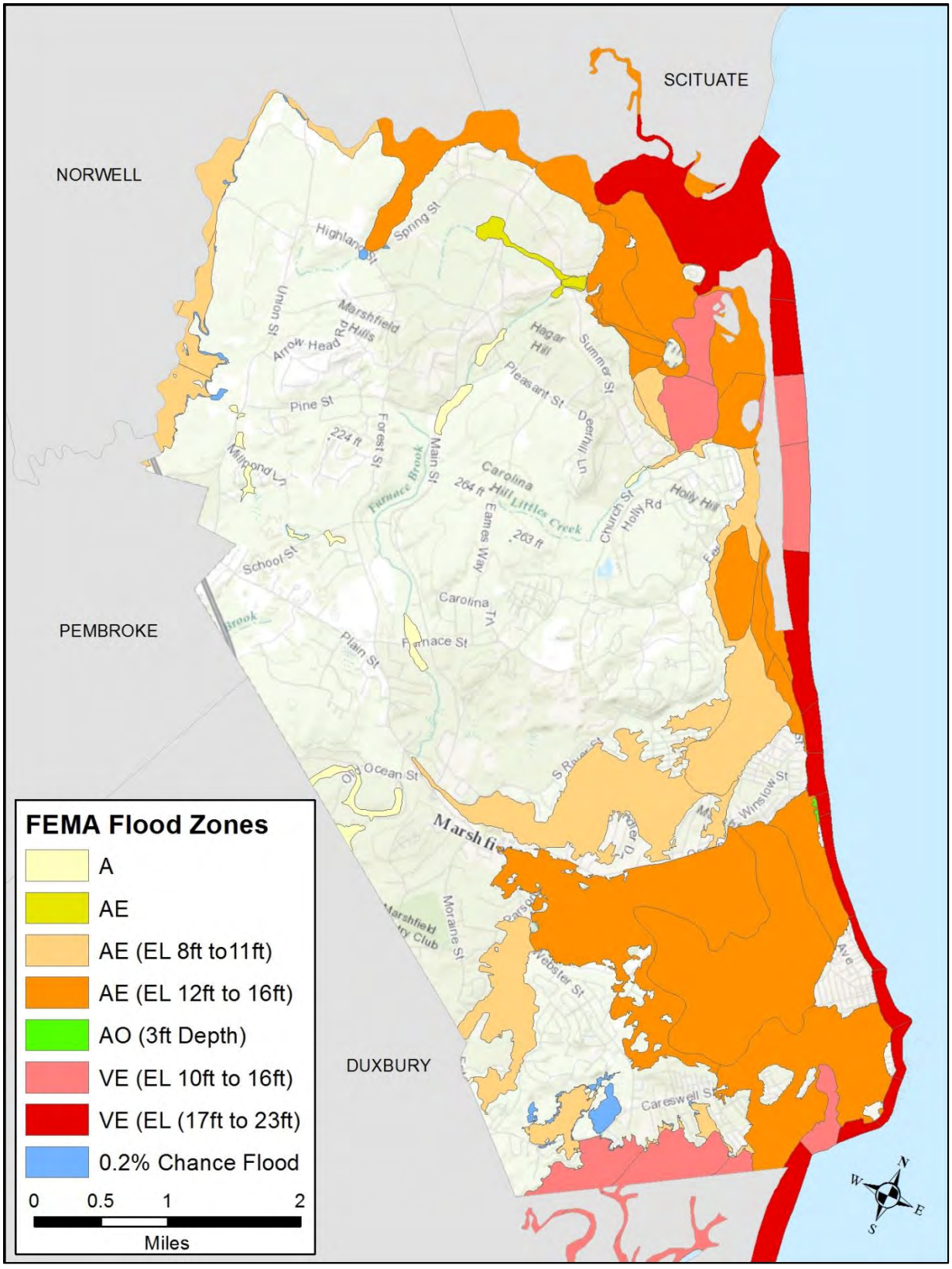


Figure 3-2. FEMA Special Flood Hazard Areas in Marshfield (Effective 2016).

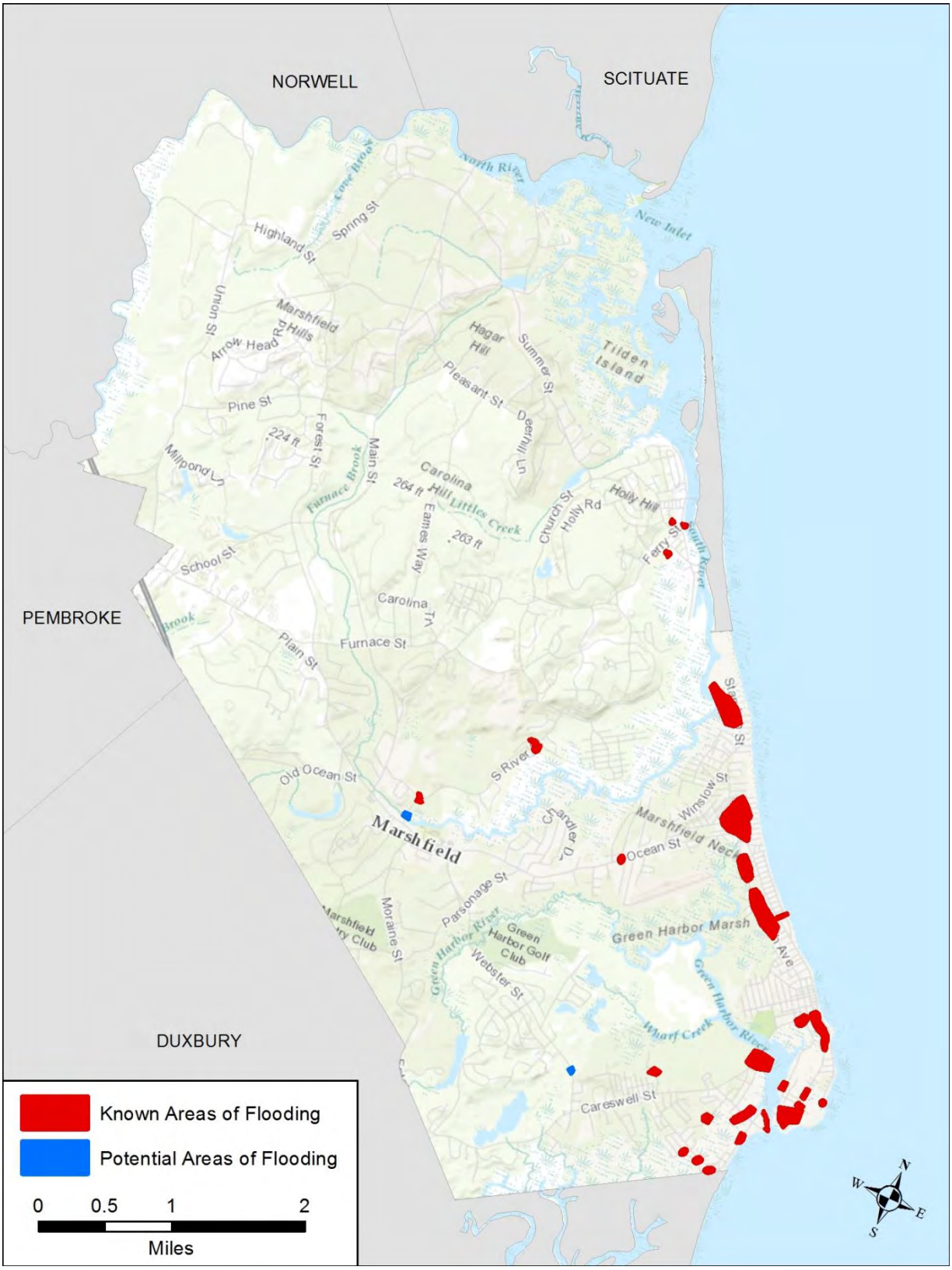


Figure 3-3. Areas of locally identified flooding.

B2.b PROBABILITY

Based on the frequency of past flooding occurrences described above, it is highly likely (near 100% probability in the next year) that flooding will occur in Marshfield.

B3.a IMPACT

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

- **People:** People can be knocked down or washed off their feet while walked 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.

- **Emergency Response:** Flooded roadways can inhibit emergency response access.

- **Infrastructure:** Flooding cause deposit debris and sediment on town infrastructure and roads. Storm surges and associated waves can damage utility poles, roadways, water mains, sewer pipes and other town infrastructure.

- **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 or ferry 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.

The Town of Marshfield has approximately 4 miles of shoreline at least partially protected with shorefront coastal structures (e.g., seawalls, bulkheads and jetties). Sea wall failure and coastal erosion are related issues increasingly impacting towns along the Massachusetts coast. Rising sea levels have led to increased rates of erosion along beaches and coastlines and the undermining of sea walls, some of which in the Boston region are many decades old. Sea walls protect the buildings behind them from storm damage and their failure can lead to increased property damage. Similarly, intact beaches with dunes dissipate wave energy, protecting buildings behind them. As the beaches erode away, this protection is lost. In some cases, sea walls can accelerate beach erosion. In April of 2010, 500 feet of sea wall in Marshfield collapsed due to undermining of its foundation from erosion. In addition, many areas have no remaining high tide beach for recreation (Figure 3-4).

Hazard Location

B1.c

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 (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.

B2.a B2.c

Figure 3-5 displays the long-term shoreline change data in Marshfield from CZM's Shoreline Change Project. Figure 3-4 shows the long-term rates of change, from 1848 to 2008, in feet per year, where negative values indicate erosion and positive values indicate accretion. From these data, it is evident that the majority of the Town's coastline (55%) is experiencing some level of coastal erosion. Additionally, there is a localized area of greater erosion in the Rexhame area, where the long-term rates of erosion are significantly higher than the rest of Town (i.e. more than 1 feet per year). As shown in Figure 3-5, based on CZM's Shoreline Change Project data, coastal erosion has been occurring along much of the Marshfield coastline since at least the 1800s. However, this erosion is often episodic, as a result of significant storm flooding and wave impacts, rather than continuous erosion.

The rates of shoreline change between 1978 and 2008 are shown in Figure 3-6. It is notable that erosion in the last few decades has increased along much of Marshfield's coastline, despite the large percentage the coastline that is armored with sea walls. Howerver, due to the presence of seawalls, these shoreline retreat rates will not continue indefinitely. Given that there is currently little to no dry high tide beach in many areas, it is likely that the seawalls will

prevent any further horizontal retreat of the shoreline. Vertical erosion, which must be measured through targeted low-tide LiDAR data or through field topographic surveys, can and likely will continue to occur. If the beach profile is lowered enough, the stability of the seawalls will be threatened.

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 0.1 ft/yr as both the short- and long-term shoreline change rates for the Town of Marshfield. While this implies a stable or even slightly accretional shoreline, the standard deviation was 2.5 and 1.0 for the short- and long-term rates, respectively, indicating that some areas of town are in fact experiencing erosion. In fact, the area from Brant Rock to Fieldstone Beach and along Bay Avenue were considered to be erosion "hot spot" areas. The CEC defines "hot spots" as known locations where the combination of erosion, storm surge, flooding, and waves have caused damage to buildings and/or infrastructure during coastal storm events over the past five years. That the average rate indicates essentially no change is likely a result of the large percentage of the Town's shoreline that is armored.

Figure 3-4. There is no dry high tide beach along much of Marshfield's coastline, including this location south of the main Brant Rock groin.

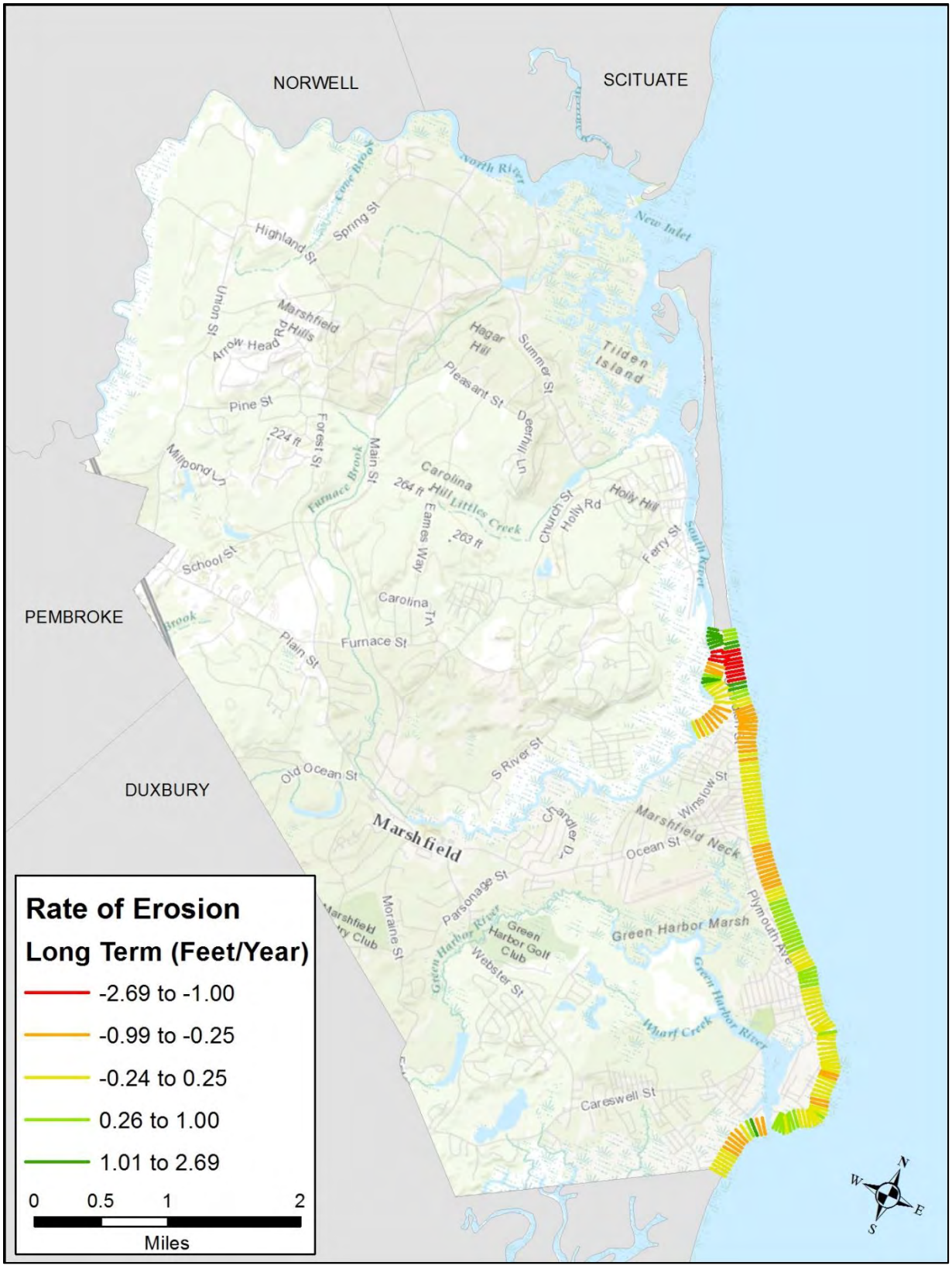


Figure 3-5. CZM Shoreline Change Project data from 1848 to 2008 in Marshfield.

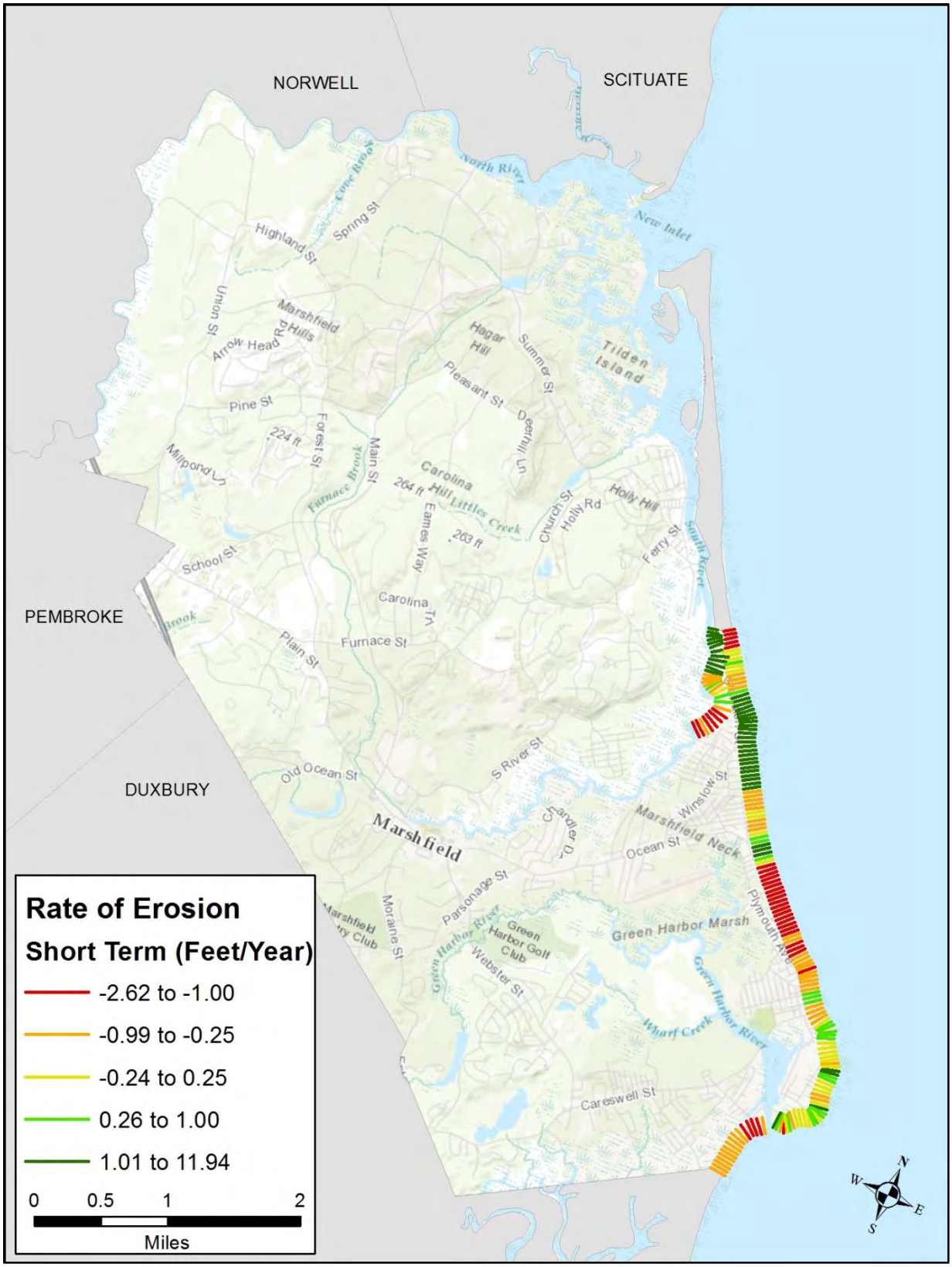


Figure 3-6. CZM Shoreline Change Project data from 1978 to 2008 in Marshfield.

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 Marshfield.

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 reduce the response time of emergency vehicles.
- **Infrastructure:** Erosion can expose septic systems, and 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. Buildings and 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 if a business's building is damaged by erosion. 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 Sea-Level Rise

Overview

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. However, when a more recent time period is considered, 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 a number of factors, including thermal expansion of ocean water and freshwater inputs from melting glaciers and ice fields. Local relative sea-level rise is a combination of two phenomena:

- Eustatic changes: Global scale changes, including thermal expansion of sea water as it warms and the addition of water volume from melting glacial ice sheets.
- Isostatic changes: Localized changes in land surface elevations, such as subsidence or uplift.

Because sea level sets a baseline for storm surge, sea-level rise will exacerbate already existing flood issues. As local sea level rises, it allows coastal storm surge to extend farther inland. With the higher sea levels predicted in 2050 and 2100, 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 3-7).

Hazard Location

B1.c
B2.a

The entire coast of Marshfield is vulnerable to sea level rise. Figure 3-8 presents potential areas of inundation based on elevation data for Marshfield, adjusted to Mean Higher High Water (MHHW). The sea-level rise is shown as a simple representation of a change in water elevation, commonly referred to as a "bathtub" model, without accounting for the effects of velocity and resulting erosion caused by wave action.

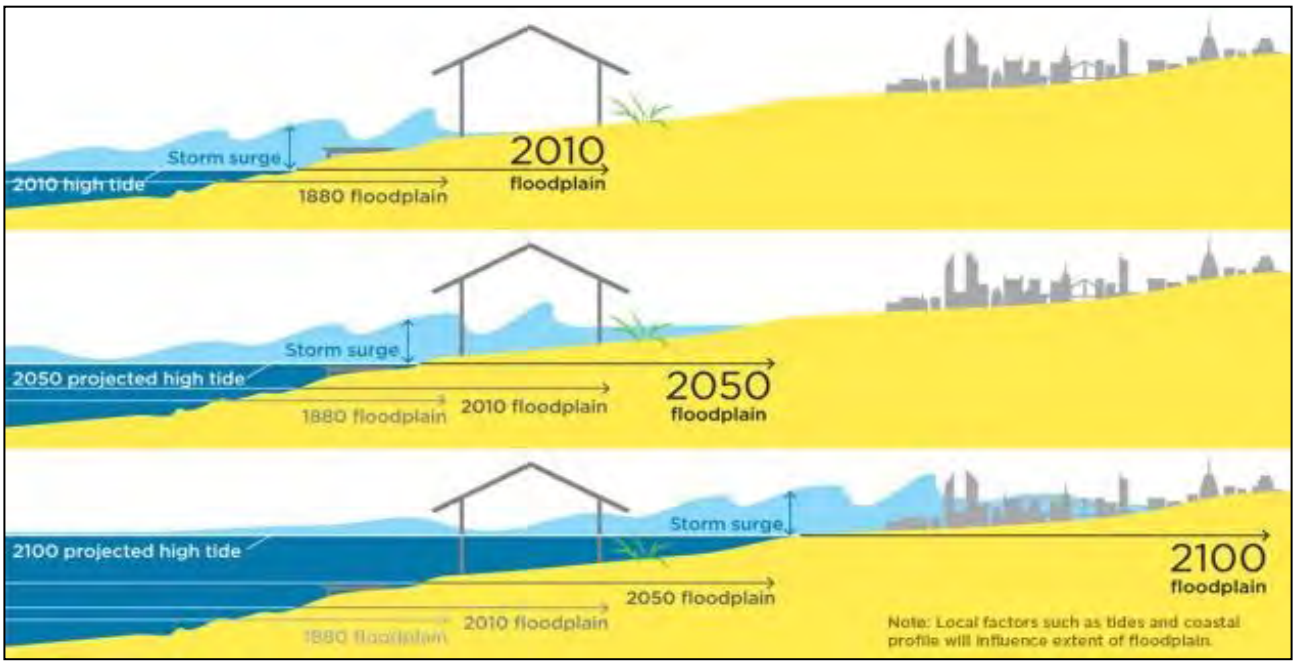


Figure 3-7. Storm surge and high tides magnify the risks of local sea-level rise (UCS 2015)

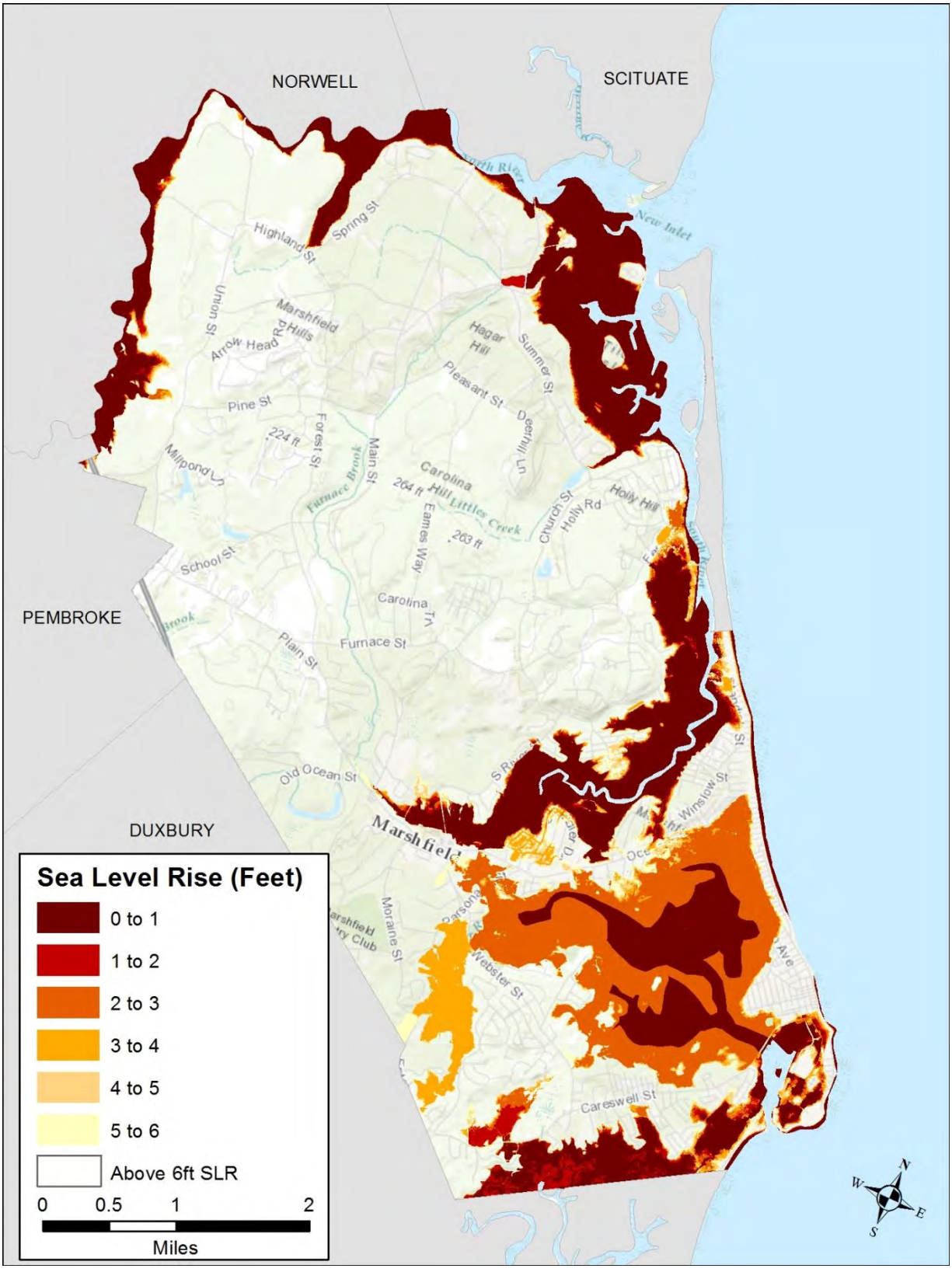


Figure 3-8. Projected inundation given varying degrees of sea-level rise (relative to MHHW).

The SLR impacts in the area behind Dyke Road (Figure 3-8) were also modified based on the Green Harbor Tide Gate Study (June 2017), which states that SLR impacts can be controlled at 1 or 2 feet of SLR. At 3 feet of SLR, however, the elevations of portions of Dyke Road are low enough to along tidal inundation to overtop the road and flood the upstream area. As a result no increase in flooding is mapped in the area upstream of Dyke Road until the 2-3 feet of SLR scenario.

B1.c B2.a B2.c

Previous Occurrences & Extent

According to the National Academy of Sciences, the Earth's surface temperature has risen by about 1° Fahrenheit in the past century, with accelerated warming during the past two decades. As average temperatures increase, sea level is expected to rise as freshwater inputs from glacier and ice sheet melting occurs. 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 indicate that our relative sea level has risen at a rate of 2.81 mm/yr, resulting in a change of approximately 11 inches in 100 years (Figure 3-9). As sea level rises, low-lying coastal areas will be particularly vulnerable to coastal storm hazards such as erosion and flooding. While some low-lying areas may be permanently inundated, other inland areas not currently subject to coastal storm impacts may be impacted by storm surge and other flooding events.

Probability

B2.b

Based on the sea-level rise trend documented by NOAA (Figure 3-9), it is highly likely (near 100% probability in the next year) that sea-level rise will occur in Marshfield.

There is still some uncertainty, however, about the magnitude of future sea-level rise. Projections of increase in global sea-level by 2100 range from an additional 0.2 m (0.7 ft) to 2.0 m (6.6 ft) (Figure 3-10). A consortium of government agencies has completed a National Climate Assessment (Parris et al., 2012) that provides guidance on the appropriate selection of sea-level rise (SLR) scenarios. Under this guidance, four

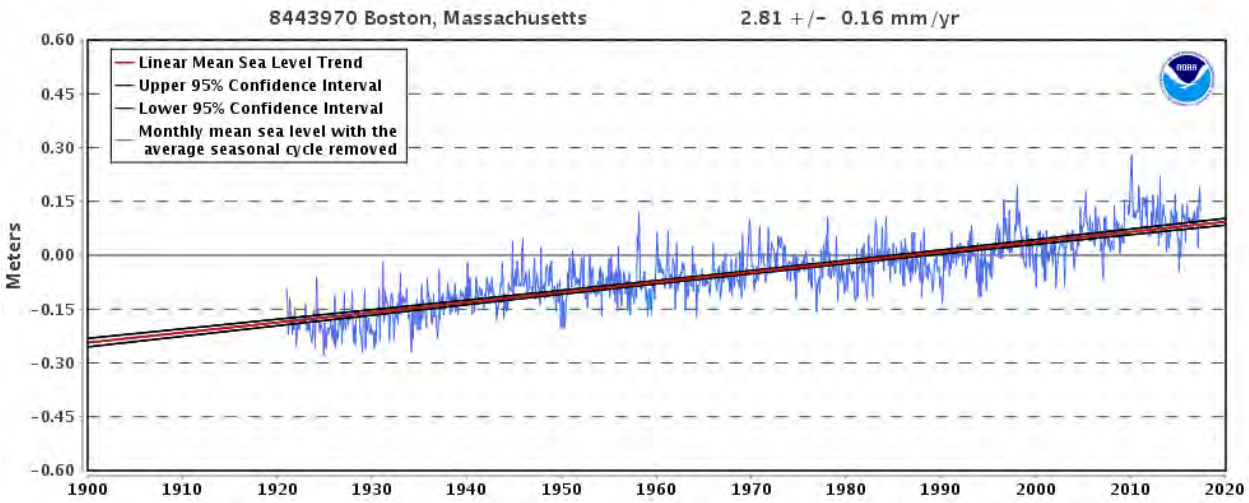


Figure 3-9. Sea-level rise trend from Boston, Massachusetts (NOAA 2016b).

(4) projected rates of sea-level rise (highest, intermediate-high, intermediate-low, and low) have been developed. Given the range of uncertainty in future global SLR, using multiple scenarios encourages experts, planners and decision makers to consider a range of future conditions and to develop multiple response options. The highest scenario from Parris et al. (2012) combines thermal expansion estimates from Intergovernmental Panel on Climate Change (IPCC) SLR projections with the maximum possible glacier and ice sheet loss by the end of the century, and is therefore useful to consider in situations where there is little tolerance for risk. A recent article by Bamber and Aspinall (2013) supports using a high sea-level rise projection based on the likely impact of glacier ice sheet melting. Various Commonwealth of Massachusetts agencies, such as the Office of Coastal Zone Management (CZM), Massachusetts Department of Transportation (MassDOT) and Massport also rely on the projections produced by Parris et al. (2012). The SLR

IMPACT

B3.a

As relative sea level rises, high water lines will move landward, coastal shorelines will retreat, and low-lying areas will be increasingly exposed to erosion, tidal inundation, and coastal storm flooding. Developed parts of the coast are especially vulnerable because of the presence of infrastructure that can be damaged or destroyed by coastal storms. In addition, development often impedes the ability of natural coastal systems to buffer inland areas from storm damage, further exacerbating the problem. Many coastal habitats are also vulnerable to rising sea levels, including salt marshes, beaches, and dune systems, because they are generally at or within a few feet of existing sea level.. These areas provide significant environmental benefits, including habitat value, filtering of pollutants for improved water quality, protection of inland areas from flooding and storm surge, and extensive recreational opportunities.

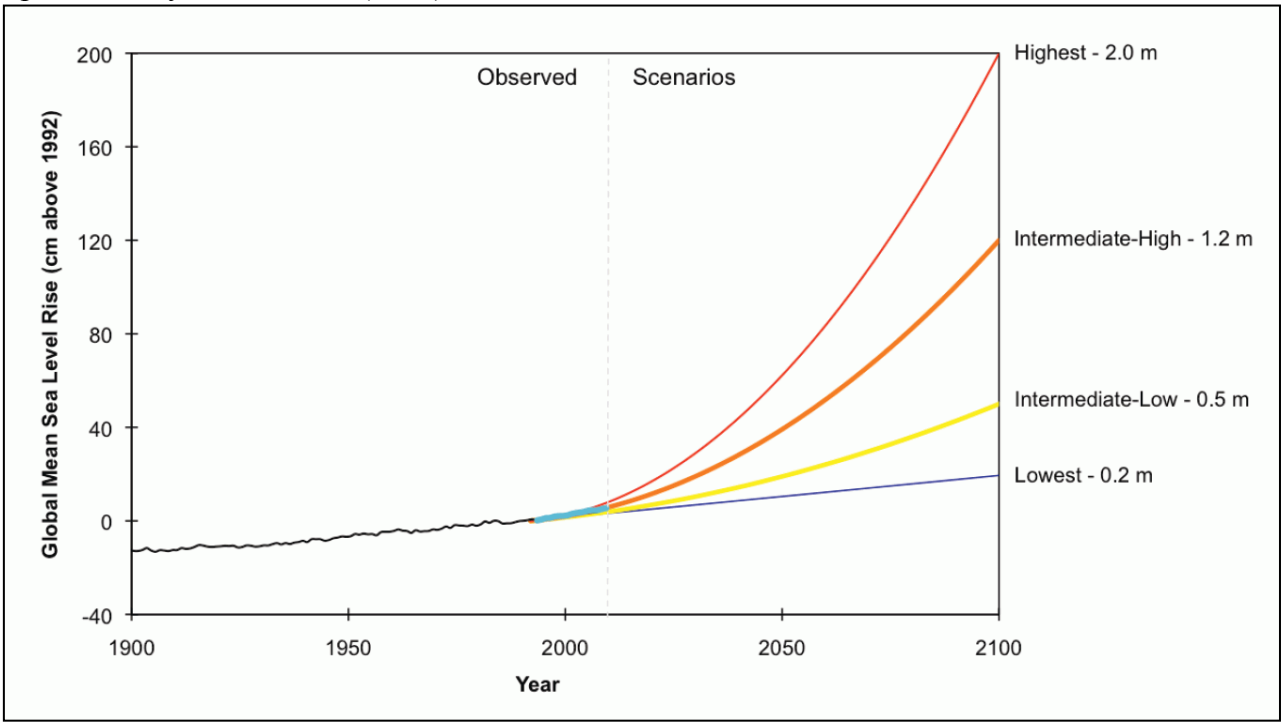


Figure 3-10. Sea-level rise projections from the National Climate Assessment (Parris et al. 2012).

A sea-level rise study was also completed for the Towns of Scituate, Marshfield and Duxbury by Kleinfelder in 2013. This study evaluated areas of inundation for 2038, 2063, and 2088. The report summarized impacts from sea-level rise in Marshfield, including:

1. **Marshes:** Negative impacts to marshes if they cannot keep pace with sea-level rise through natural or assisted vertical growth; marshes that cannot keep up with sea-level rise will transition to intertidal mudflats or subtidal open water areas.

2. **Beaches:** If beaches are not nourished or raised, there could be partial or complete loss of some ocean front beaches.

3. **Wildlife**: Loss of tidal salt marsh areas will likely disrupt spawning grounds and wildlife habitat for nurerous species.

4. **Roadways and Bridges**: A number of roads along the coast will be affected by higher tides and storm events. Roads that appear particularly vulnerable include: Sections of Gurnet Road and Bay Avenue; Dyke Road (Figure 3-11); Ocean Street, Island Street and Cove Street in the Brant Rock Area; Town Pier Road and the parking area at the Town Pier; Plymouth Avenue; numerous streets in the Rexhame area; Revere Street; Macombers Ridge and Macombers Way; and Bartletts Isle Way.

5. **Coastal Stabilization Structures**: Rising sea levels, combined with the effects of higher frequency and intensity of coastal storms, will result in more damage to coastal stabilization structures and more over-topping during major storms.

6. **Wastewater Treatment Plant:** Although Kleinfelder's projections did not show flooding at the Wastewater Treatment Plant facility on Joseph Driebeck Way during the 25- and 50-year projections, the 75-year sea-level rise projections did indicate that some minor flooding will occur on the access road after 5.16 feet of sea-level rise. Their results showed little to no flooding of the plant itself.

It is important to note, however, that although sea-level rise has been occurring for thousands of years, the changes that are likely to occur in the next five years (the lifespan of this document) are relatively small (14 mm – based on the Boston SLR trend). Although the true hazard from SLR is decades out, the time to start planning for it is now.

Figure 3-11. Beach comfort station at Brant Rock during present day (top) and by 2088 based on Kleinfelder's sea-level rise projections (bottom).

3.4 Hurricanes and 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

B1.c
B2.a

The entire Town of Marshfield 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 tropical cyclones.

Storm surge happens when water is pushed towards shore by the force of storm generated winds. An advancing storm surge combines with the water elevation of the normal tides to create a hurricane storm tide, 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. A general schematic showing the components of storm surge is displayed in Figure 3-12.

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 and 2, Category 3, and Category 4. Figure 3-14 shows the SLOSH results for Marshfield.

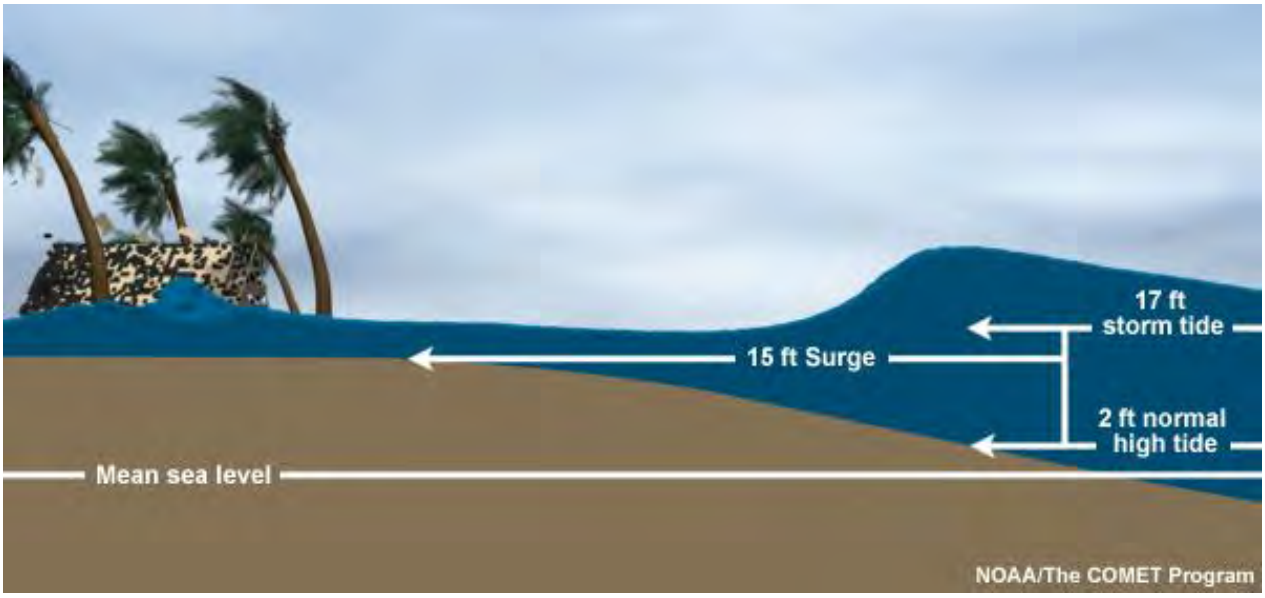


Figure 3-12. Schematic image of a storm surge and storm tide affecting a shoreline (NHC 2016c)

B1.c
B2.a
B2.c

Previous Occurrences & Extent

A hurricane has not made landfall in Massachusetts for more than 25 years, and it has been more than 60 years since a major hurricane (Category 3 or higher). Smaller tropical storms and depressions have affected the area, generally inflicting minor damage such as some downed tree limbs, power outages, and limited damage to boating-related infrastructure. Table 3-4 provides a summary of historic hurricanes that have impacted the Town of Marshfield.

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 Marshfield. To illustrate the frequency of these storms, Figure 3-13 shows all hurricanes and tropical storms that have passed through the region between 1950 and 2016. Note that although major hurricanes occur approximately once every ten or twenty years in Massachusetts (Table 3-4), tropical storms (represented by the thin blue lines in Figure 3-13) are relatively common, occurring every few years.

Table 3-4. 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

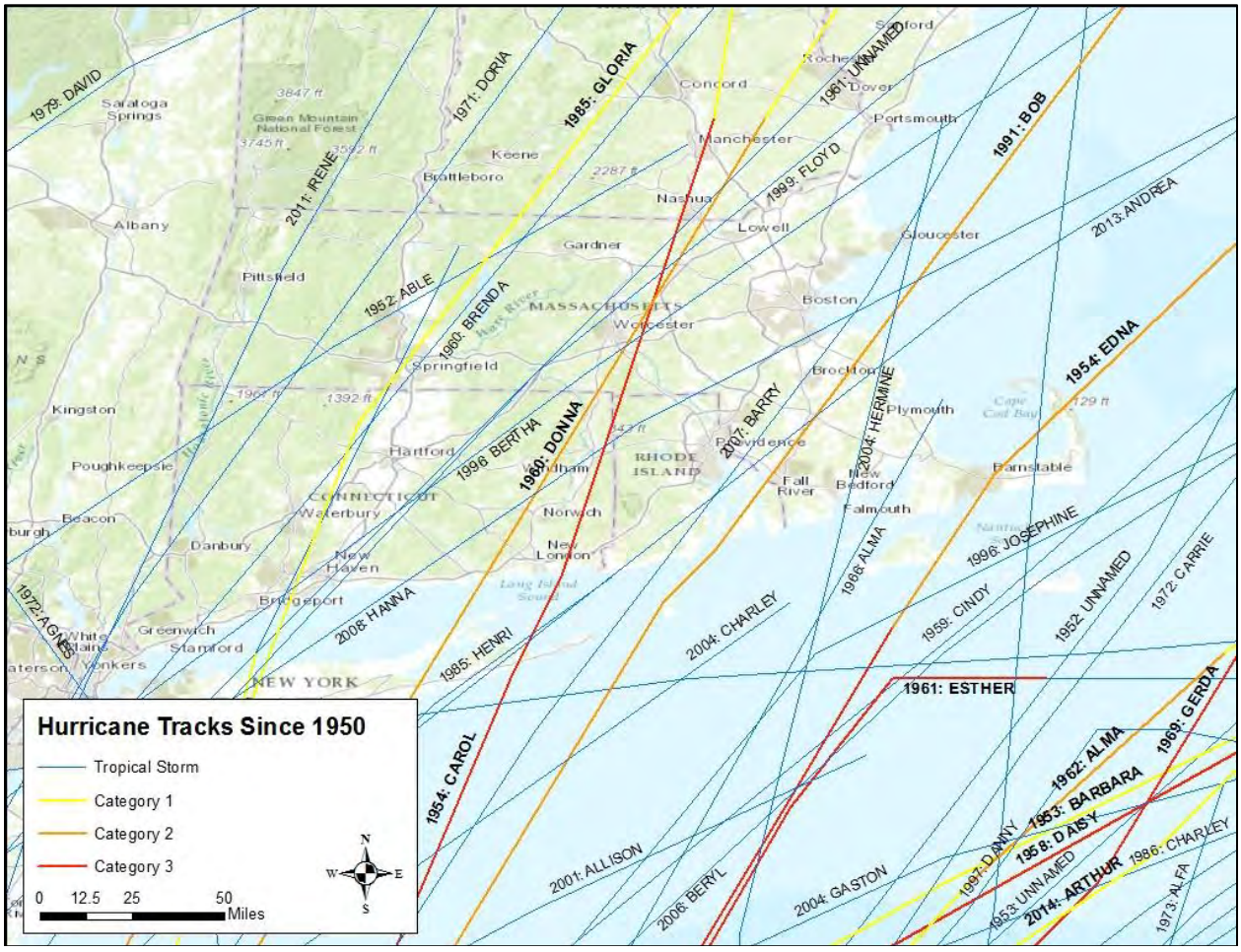


Figure 3-13. Hurricane and tropical storm tracks in the vicinity of Massachusetts between 1950 and 2016.

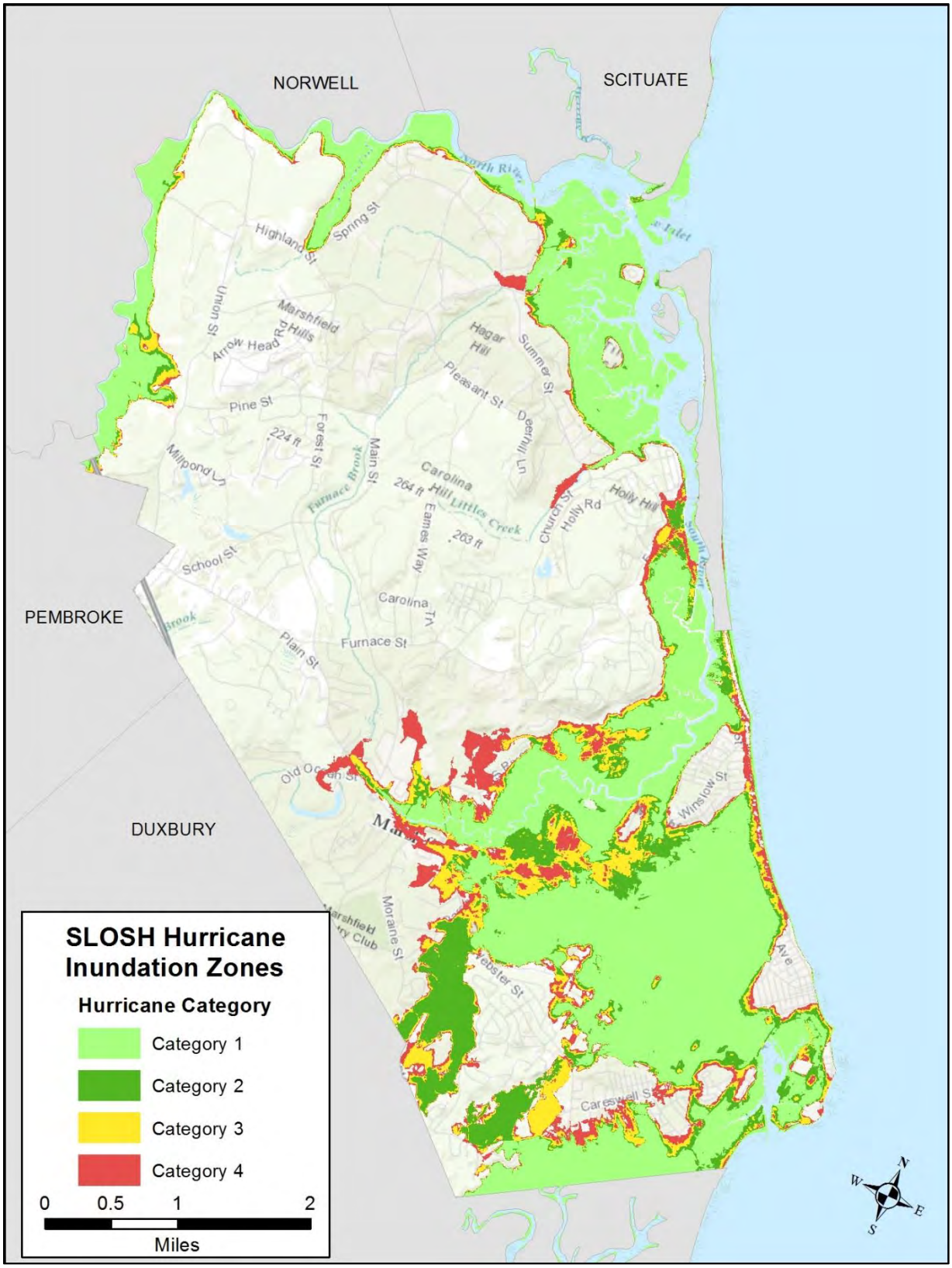


Figure 3-14. SLOSH categories for Marshfield.

The Saffir-Simpson Hurricane Wind Scale is often used to classify tropical cyclones. The Saffir-Simpson Scale, described in Table 3-5, 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 3-5. Saffir-Simpson Hurricane Wind Scale (NHC 2016b).

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	75-95 mph 64-82 kt 119-153 km/h	**Very dangerous winds will produce some damage:** 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 in the next year) that a hurricane or tropical storm will impact Marshfield.

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, or emergency response is blocked by flooded roadways.

- **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.

- **Infrastructure:** High winds, heavy rains and coastal storm surge can cause widespread power outages, limited access to other utilities such as drinking water and communications, and limited transportation.

- **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.

3.5 NOR'EASTERS

OVERVIEW

Snow storms and blizzards are common events in New England. 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

HAZARD LOCATION

Coastal areas of Marshfield are particularly susceptible to damages from wind, snow and storm surge during a nor'easter. However, it is also important to note that nor'easters can also bring heavy snow and flooding to the entire Town.

B1.c
B2.a
B2.c

PREVIOUS OCCURRENCES & EXTENT

Nor'easters have the potential to inflict more damage than many hurricanes because the high storm surge and high winds can last anywhere from 12 hours to 3 days, while hurricanes usually last for a much shorter period of time. 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, including Plymouth county (FEMA DR-546). A large nor'easter occurring in late October/early November in 1991 became known as the "Perfect Storm" after joining with Hurricane Grace and strengthening in intensity. During that nor'easter, winds measured over 80 mph with offshore waves over 30 feet high. The 1991 nor'easter resulted in a federal disaster declaration for many counties in Massachusetts, including Plymouth county (FEMA DR-920). 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).

B2.b PROBABILITY

New England generally experiences at least one or two nor'easters each year with varying degrees of intensity. Therefore, it is highly likely (near 100% probability in the next year) that a nor'easter will occur in Marshfield.

B3.a IMPACT

- **People:** Nor'easters often produce a significant amount of flooding, and the impacts are similar to that of the flooding impacts.
- **Emergency Response:** Snow and trees felled by high winds can reduce emergency vehicle response time.
- **Infrastructure:** Water infrastructure can be damaged (i.e. frozen and burst pipes). Utility outages can result from nor'easters.
- **Buildings:** Wind and flooding from storm surge can damage buildings. Also, because nor'easters often produce a significant amount of flooding, and the impacts are similar to that of the flooding impacts.
- **Economy:** Utility outages and damaged buildings can result in loss of business function. Roads blocked by snow and trees downed by high winds can reduce the potential customer base.
- **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 impassable from storm surge, debris, and accumulated snow.

Figure 3-16. Flooding on Charlotte St. caused by the January 4, 2018 Nor'easter.

3.6 Severe Winter Event

Overview

Snow storms 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 which is a true disaster, and necessitates intense large-scale emergency response. On average Marshfield receives 41 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.

B1.c

Hazard Location

The entire Town of Marshfield is at risk from snow, blizzards and ice. The Northeast Regional Climate Center has compiled 30-year annual snow totals in New England and the eastern United States. Figure 3-17 shows that the Marshfield area averaged 20 to 50 inches of snowfall annually between 1981 and 2010.

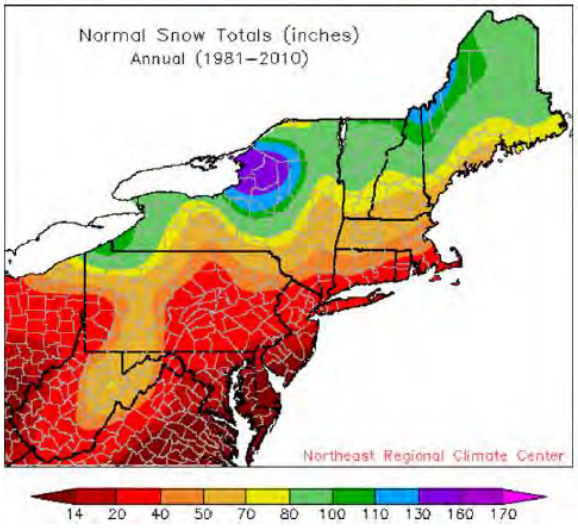


Figure 3-17. Normal annual snowfall from 1981 to 2010 (from 2013 MA State Hazard Plan).

Previous Occurrences & Extent

B1.c
B2.a
B2.c

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. Table 3-6 below provides a list of major winter storms from 2006 to 2016.

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.

Table 3-6. Major winter storms in New England (2006-2016).

Date	NESIS	Cat	Description
Feb 12-13, 2006	4.1	3	Major
Feb 12-15, 2007	5.63	3	Major
Mar 15-18, 2007	2.54	2	Significant
Mar 1-3, 2009	1.59	1	Notable
Dec 18-21, 2009	3.99	2	Significant
Feb 4-7, 2010	4.38	3	Major
Feb 9-11, 2010	4.1	3	Major
Feb 23-28, 2010	5.46	3	Major
Dec 24-28, 2010	4.92	3	Major
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

The NESIS has five categories: Notable, Significant, Major, Crippling, and Extreme (Table 3-7). This index differs from other meteorological indices, however, because it uses population information in additional 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 2016c).

Table 3-7. 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

PROBABILITY

B2.b

Based on the snow frequency of occurrence recorded from past events, it is highly likely (near 100% probability in the next year) that snow will occur in Marshfield.

B3.a

IMPACT

- **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.

- **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.

- **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.

3.7 Severe Weather

3.7.1 Thunderstorms & Lightning

Overview

While less severe than the other types of hazards discussed, thunderstorms can lead to localized damage for communities. 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 are required for a thunderstorm to form: 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.

Hazard Location

B1.c

The entire Town of Marshfield is at risk from thunderstorms. NOAA has compiled data about the annual number of thunderstorms across the United States. Figure 3-18 shows the annual number of thunderstorms in the northeastern United States. The arrow shows that all of eastern Massachusetts, including Marshfield, falls in the darker blue area, which receives, on average, 10-20 thunderstorms per year.

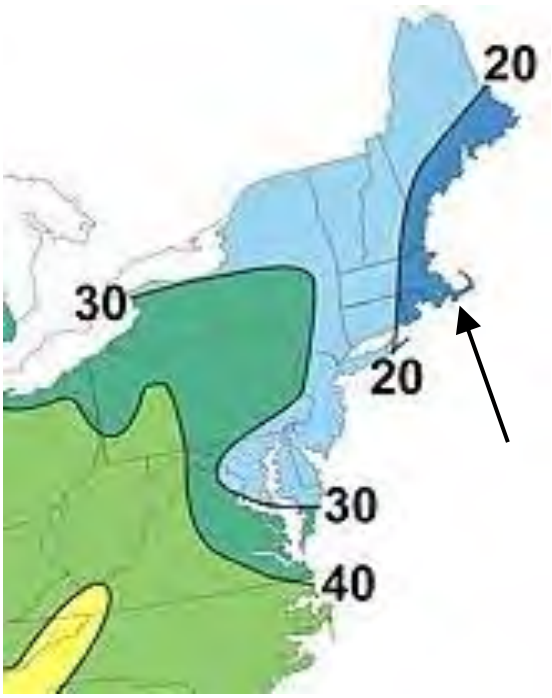


Figure 3-18. Annual number of thunderstorms.

B1.c B2.a B2.c

Previous Occurrences & Extent

NOAA's National Center for Environmental Information maintains a Storm Events Database. In the last 10 years, 91 lightning and/or thunderstorm wind events were reported for Plymouth County (NOAA 2017a). None of the recorded events were listed with Marshfield as their specific location, but may simply mean that these events went unrecorded.

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.

B2.b

Probability

Based on the annual number of thunderstorm occurrences in Figure 3-10, it is highly likely (near 100% probability in the next year) that thunderstorms will occur in Marshfield.

B3.c

Impact

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

- **People:** Thunderstorms 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.
- **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. 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. 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

3.7.2 High Wind

Overview

Major wind events in coastal Massachusetts are hurricanes and nor'easters. Tornadoes are extremely rare in Massachusetts, although they do occur. Water spouts have been seen in Cape Cod 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.

B1.c
B2.a

Hazard Location

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 Marshfield in Figure 3-21.

The hatched area in Figure 3-21 shows the Wind Born Debris Region. This region encompasses all areas within one mile of the coastal mean high water line where the basic wind speed can be 110 miles per hour or greater. Basic wind speed measures a 3 second gust 10m above the surface. The magnitude of gust speeds (i.e. exceeding 100 mph) can far exceed the averages presented in Figure 3-21. Within this Wind District, specific building code regulations apply to mitigate for the potential impacts of high winds. It is clear from Figure 3-21 that high winds are a significant hazard along and near the coastline of Marshfield.

Figure 3-20. Trees, downed by heavy winds, block residential street.

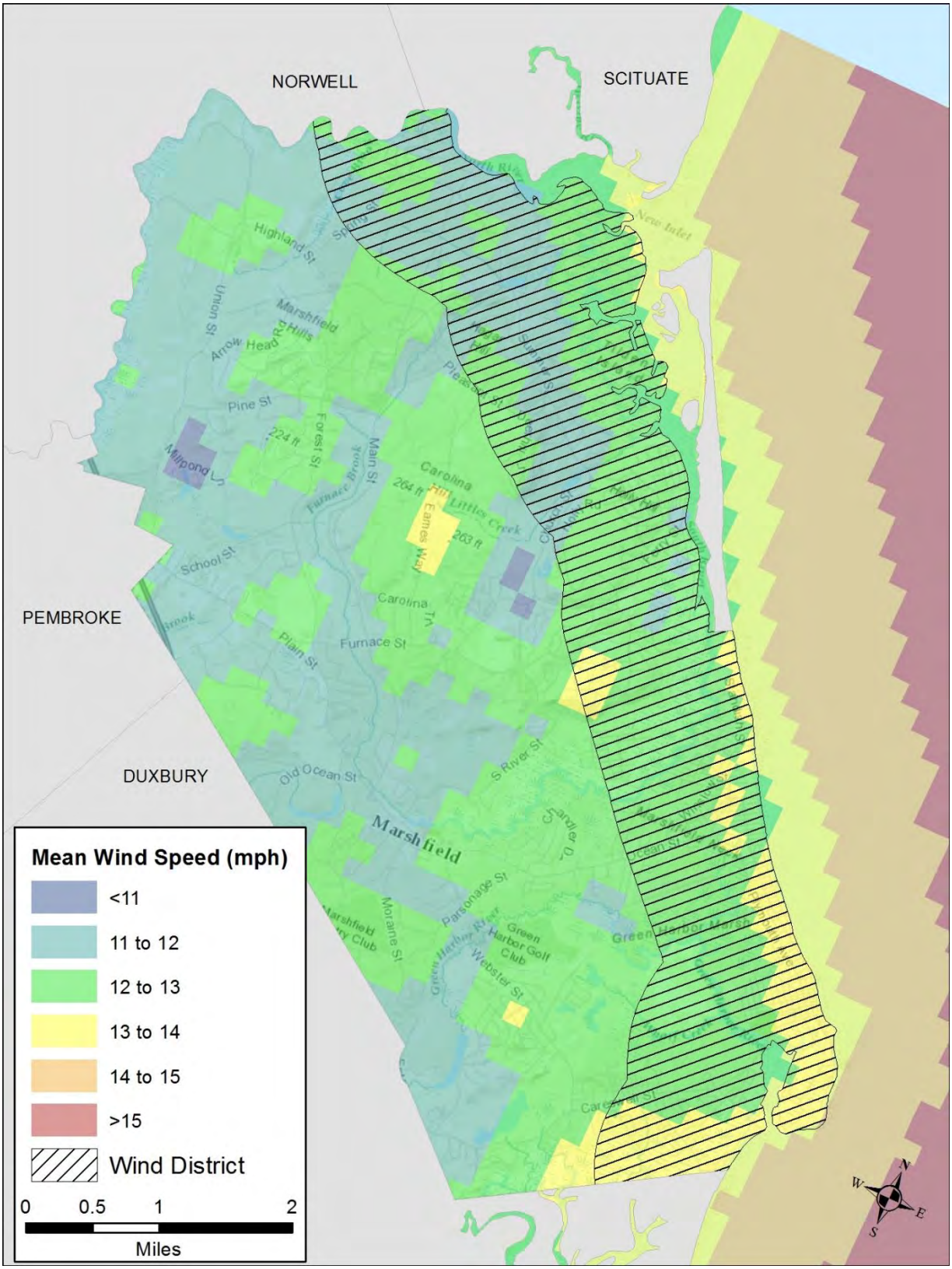


Figure 3-21. Mean wind speed (mph) at 30 meters above the surface.

B1.c
B2.a
B2.c

Previous Occurrences and Extent

Wind speeds are recorded continuously at the Marshfield Airport. From January 1st, 2007 to January 1st, 2017 the average wind speed was reported at 15 minute intervals (Figure 3-22). The average wind speed between 2007 and 2017 was 7.1 mph. Maximum wind speeds are also reported during each 15 minute interval (Figure 3-22). The average maximum wind speed during this same time period was 21.2 mph.

The graphs below, however, only represent daily averages, but each day may have winds of much higher or lower velocity. For example, the highest reported wind gust was recorded on January 8, 2008 at 96.7 mph.

In general, the average wind speed begins decreasing around March reaching its lowest points in July and August. The average speed then picks up with the onset of fall, peaking in the winter. The maximum wind speeds follow the same trend.

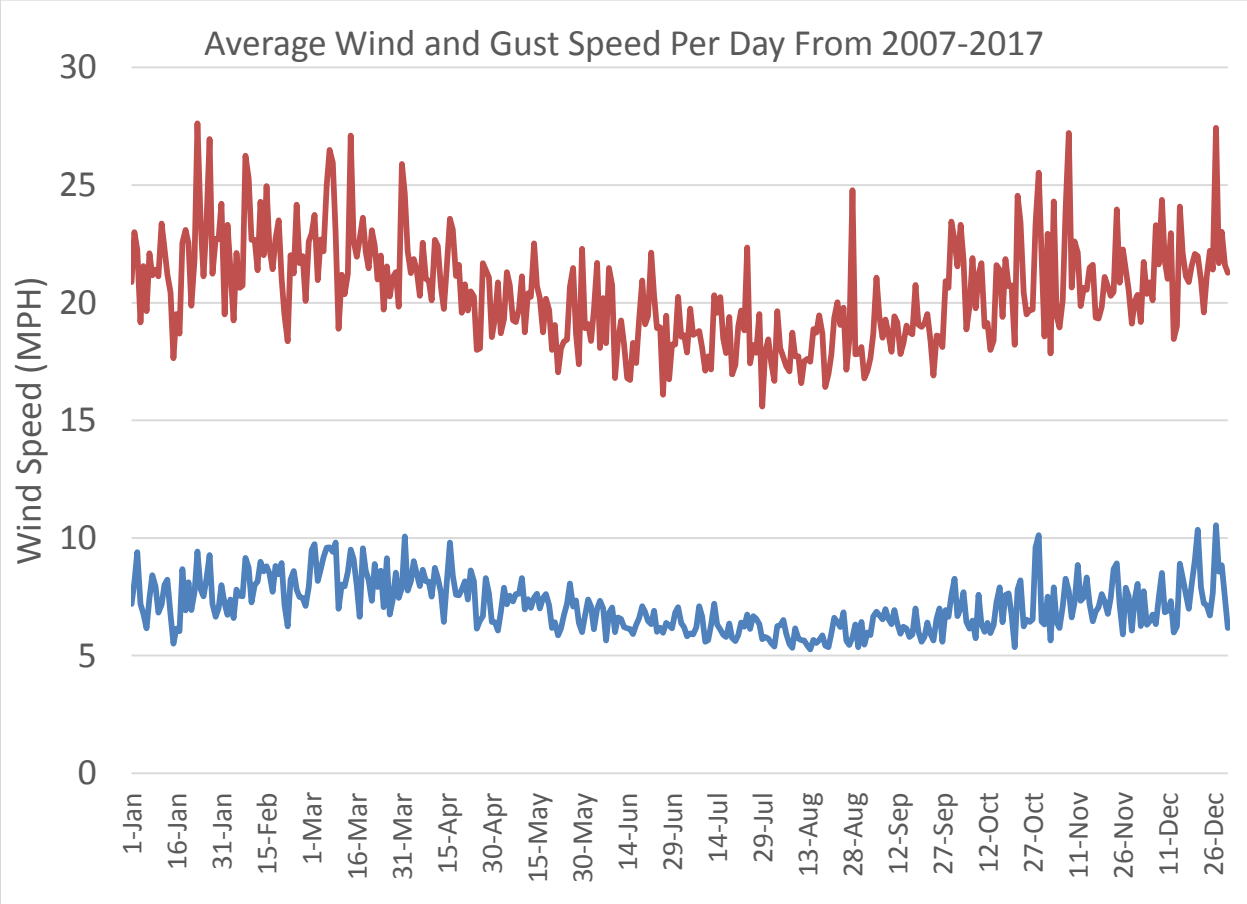


Figure 3-22. Average (blue) and average maximum (red) wind speed per day from 2007-2017 from the Marshfield Airport Weather Station.

A summary of the high wind incidences at the Marshfield Airport meteorological station is provided in Table 3-9. Note that each "incidence" represents a data point from each 15-minute interval within the 10-year dataset.

Table 3-9. Summary of high wind incidences from Marshfield Airport Weather Station between 2007 and 2017.

Wind Speed (mph)	Number of Incidences the Average Wind Speed Was:	Number of Incidences the Maximum Wind Speed Was:
≥ 20.0	1,917	31,020
≥ 25.0	470	12,900
≥ 30.0	62	3,912
≥ 35.0	15	1,395
≥ 40.0	2	516
≥ 45.0	0	114
≥ 50.0	0	36

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.

B2.b

PROBABILITY

Based on the frequency of occurrence seen in the Marshfield Airport wind dataset, it is highly likely (near 100% probability in the next year) that wind hazards will occur in Marshfield.

B3.a

IMPACT

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

- **People:** High wind events can result in power outages, leaving people without heat or other utilities.
- **Emergency Response:** Trees and power lines felled by high winds 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.
- **Buildings:** Wind and wind-born debris can damage roofs, windows and other portions of houses and buildings.
- **Economy:** Power outages can force businesses to close temporarily.
- **Natural Systems:** Heavy winds can bring down trees and branches.

3.7.3 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

Hazard Location

The entire Town of Marshfield is equally vulnerable to drought.

B1.c
B2.a
B2.c

Previous Occurrences & Extent

Significant periods of drought have occurred in Plymouth County, and Marshfield specifically, in the past. The Massachusetts Department of Conservation and Recreation (DCR) compiles monthly water conditions reports, summarizing the rainfall and its diversion 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 the last twelve (12) months is summarized in Table 3-11.

The data in Table 3-11 show that while a significant drought is relatively uncommon in Marshfield (only one other drought, in 2012, has been declared in Plymouth Country in the last 30 years), and the total rainfall from the last twelve (12) months is within -0.02 inches of average, droughts do occur and they have occurred in Marshfield. In fact, from August 2016 through April 2017 Marshfield, as well as much of Massachusetts was in a state of drought.

Table 3-11. Summary of the Southeast Region rainfall from DCR Water Resources Data Collection Analysis Program (2016-2017)

Month-Year	Total Rainfall (inches)	Departure from normal (inches)
Jul-16	1.72	-1.63
Aug-16	1.85	-2.07
Sep-16	1.9	-1.84
Oct-16	6.1	2.3
Nov-16	2.36	-1.73
Dec-16	3.11	-1.01
Jan-17	5.3	1.4
Feb-17	3.55	-0.75
Mar-17	3.74	-0.49
Apr-17	7.17	3.27
May-17	4.91	1.53
Jun-17	4.36	1
Total	46.07	-0.02

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

1) Normal
2) Advisory
3) Watch
4) Warning
5) Emergency

These levels are based on the regional conditions and are designed to provide information about the current status of water resources. A drought advisory calls for a heightened level of vigilance and increased data collection as conditions begin to deviate from normal. During a drought watch, 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 drought warning 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 2013). These categories and their associated characteristics are summarized in Table 3-12.

Based on the categories outlined in Table 3-12, the Massachusetts Executive Office of Energy and Environmental Affairs has compiled information about past drought declarations at a regional level. Drought declarations from 2010 to 2017 for the Southeast Region are detailed in Table 3-13. There was a relatively long drought from July 2016 to April 2017, ranging in severity from an Advisory to a Warning (Table 3-13).

Table 3-12. Drought indices from the Massachusetts Drought Management Plan.

Drought Level	Precipitation	Groundwater	Streamflow	Reservoir
Normal	1 month below normal	2 consecutive months below normal**	1 month below normal**	Reservoir levels at or near normal for time of year
Advisory	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
Watch	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
Warning	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	Same Warning **and** previous month was Warning or Emergency	>8 months below normal**	>7 months below normal**	Continuation of previous month's conditions

PROBABILITY

B2.b

Based on the data summarized above about past drought conditions in Marshfield, the probability that a drought will occur in Marshfield in the future is possible (between 1% and 10% probability in the next year, or at least one chance in the next 100 years).

IMPACT

B3.a

- **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.

- **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 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.

Table 3-13. Drought dates and levels from Massachusetts DCR for the Southeast Region.

Year	Begin Date	End Date	Cape & Islands Drought Status
2014	10/1/2014	11/30/2014	Advisory
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	4/30/2017	Advisory

3.7.4 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 Plan, 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 winter temperature (Dec-Feb) for Massachusetts is 27.5°F, while the average summer temperature (Jun-Aug) is 68.2°F.

B1.c

Hazard Location

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

B1.c B2.a B2.c

Previous Occurrences & Extent

NOAA's National Centers for Environmental Information houses a Storm Events Database, 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 6, 2010: Temperatures neared 100°F with a high percent of relative humidity. Heat index values ranged from 100 to 106 for most of Southern New England.

2) July 22, 2011: High temperatures and high humidity levels brought the heat index above 105 to 108 over a seven hour period as measured at the Automated Surface Observing System at Plymouth Municipal Airport.

3) February 16, 2015: Near blizzard conditions brought large amounts of snow and frigid temperatures. The Automated Surface Observing Station at Plymouth Municipal Airport recorded wind chills as low as -28°F.

4) 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 County.

Temperature is recorded continuously at the Marshfield Airport. From January 1st, 2007 to January 1st, 2017 the temperature was reported at 20 minute intervals. The average wind speed between 2007 and 2017 was 7.1 mph. A summary of the extreme temperature incidences at the Marshfield Airport meteorological station is provided in Table 3-14. Note that each "incidence" represents a data point from each 20-minute interval within the 10-year dataset.

Table 3-14. Number of extreme temperature incidences recorded at the Marshfield Airport.

Temp Degrees (F)	Number of Incidences the Temperature Was:
≤ -10	0
≤ 0	45
≤ 10	901
≥ 95.0	113
≥ 100.0	15
≥ 105.0	0

NOAA's National Weather Service (NWS) has developed a Heat Index, which measures how hot it feels when relative humidity is considered along with the actual air temperature (Figure 3-23). 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. Windchill 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 Windchill Temperature Index 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 3-24). According to the chart in Figure 3-24, if it is 0°F with a 15 mph, the windchill 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.

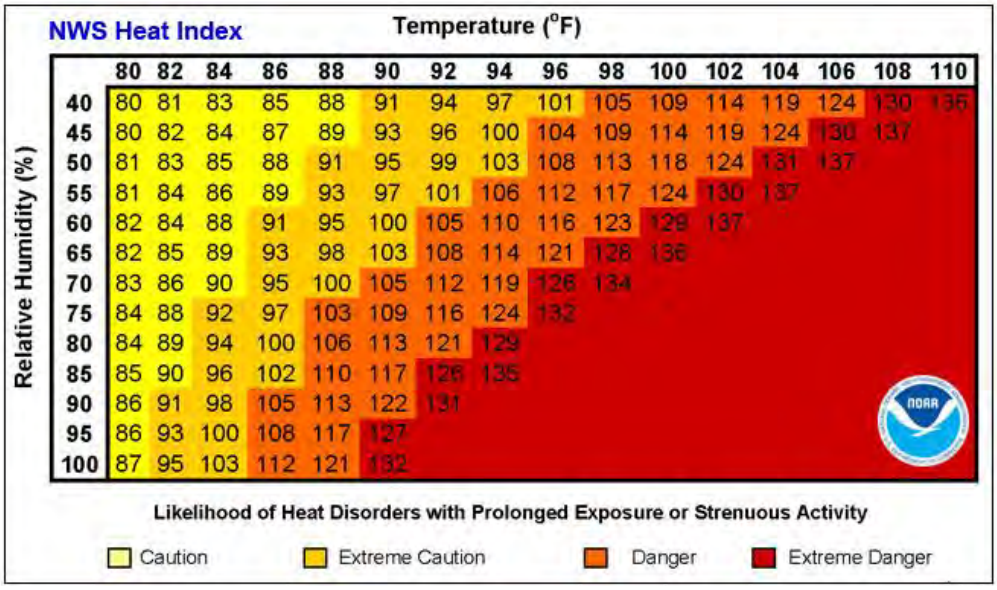


Figure 3-23. NWS's Heat Index.

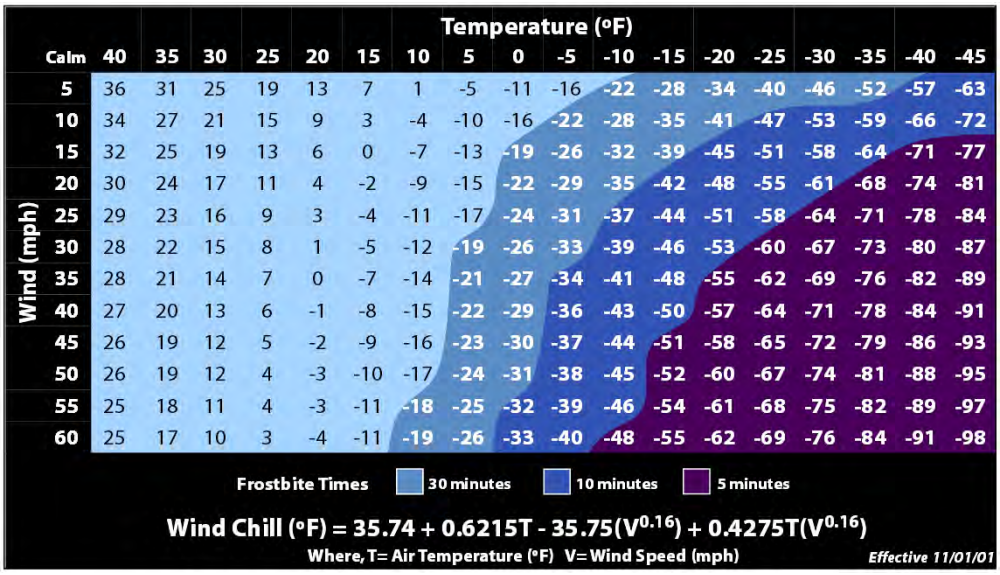


Figure 3-24. NOAA's Wind Chill Chart.

B2.b PROBABILITY

Based on the data summarized above about past extreme temperature conditions on in Plymouth County, the probability that extreme temperatures will occur in Marshfield in the future is likely (between 10% and 100% probability in the next year, or at least one chance in the next 10 years).

B3.a IMPACT

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

- **People:** Excessive heat 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.
- **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.

3.7.5 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, tornadoes have occurred in every state of the U.S. In Massachusetts, tornadoes occur most frequently in and around Worcester County, however may occur wherever conditions are right. According to NOAA, Barnstable County is located in an area of very low probability of occurrence, with less than one tornado expected to occur every five years.

HAZARD LOCATION

B1.c

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 164 tornadoes documented in Massachusetts since 1951 (Figure 3-25); of these, only 1 has occurred in Marshfield (in 1964); with 8 others occurring within all of Plymouth County.

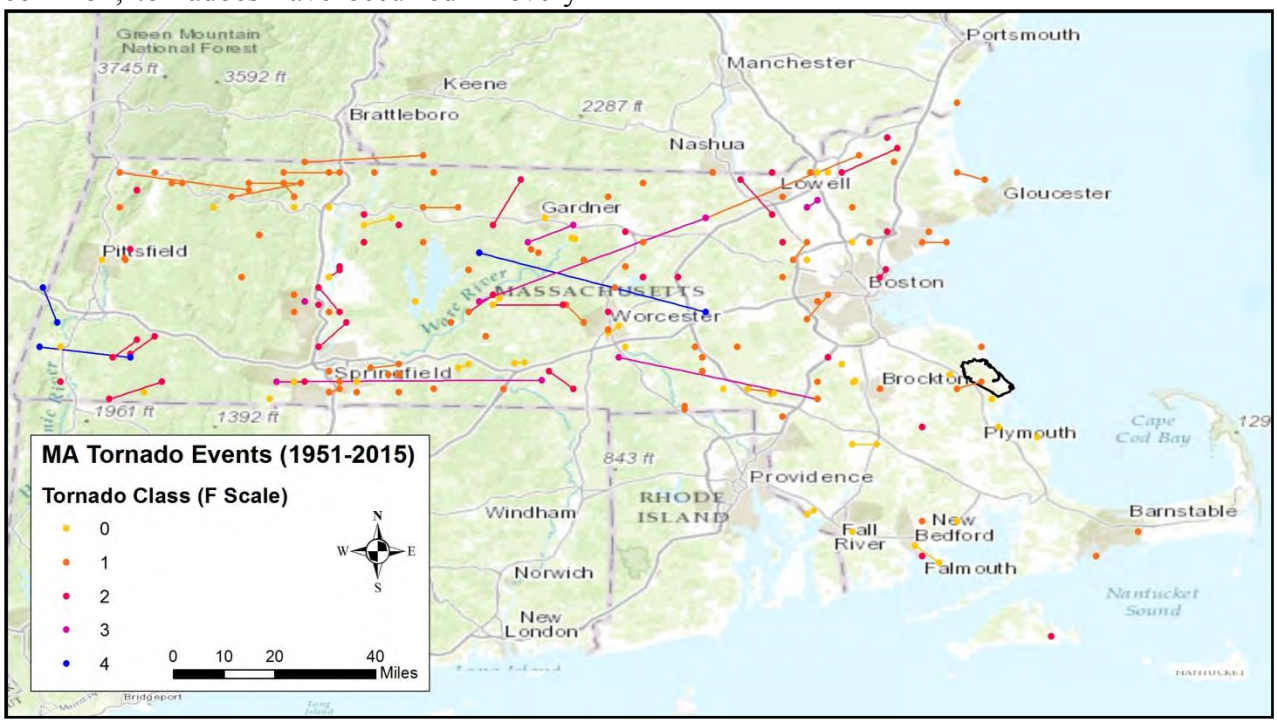


Figure 3-25. Recorded tornado events in Massachusetts between 1951 and 2015.

B1.c
B2.a
B2.c

Previous Occurrences and Extent

Although only one tornado has touched down within Marshfield itself, as noted above, a total of 9 tornadoes have occurred within Plymouth County since 1951. Table 3-15 documents the characteristics of the 9 Plymouth County tornadoes; this table documents the F-scale (see description of the Fujita Tornado Damage Scale below) and size of Table 3-16 shows 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. the tornado, as well as the number of injuries and fatalities, and the value of any property loss associated with the event.

Table 3-15. Characteristics of tornadoes occurring in Plymouth County since 1951.

Date	Town	F-scale	Injuries	Fatalities	Length (miles)	Width (yards)
9/7/1958	Duxbury	0	1	1	0.1	10
7/4/1964	Pembroke/ Marshfield	1	0	0	2.3	10
6/9/1965	Marion	0	0	0	0.1	10
11/18/1967	Halifax	2	0	0	0.1	17
9/16/1986	Scituate	1	0	0	0.1	50
7/10/1989	Brockton	1	1	0	0.1	23
7/10/1989	Hanover	0	0	0	0.1	23
8/20/2012	Plymouth	0	0	0	0.1	10
7/24/2012	Plymouth	0	0	0	0.03	15

Table 3-16. 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.

B2.b

PROBABILITY

Although only 1 tornado has been recorded in Marshfield since NOAA's records began in 1951, relatively small scale tornadoes do occur in Massachusetts on a regular basis. As such, is it possible (between 1 and 10% probability in the next year) that a tornado will occur in Marshfield.

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 and other utility infrastructure, and can damage roads. Downed power lines can also cause electrical hazards.
- **Buildings:** Tornadoes that pass through highly developed areas can cause significant property damage, breaking windows, 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.

3.8 FIRE

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 occur 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.

HAZARD LOCATION

B1.c

Wildfire has played a role in shaping the Plymouth County landscape for thousands of years. As a result, there is an abundance of fire-adapted ecosystems in the region. Marshfield's forests are primarily composed of pitch pine, mixed conifer, oak, and oak mixed, which are considered by the State fire officials to be the forest types at highest risk for wildfires. The Marshfield Fire Department responds to very few wood, brush, and grass fires of varying sizes annually.

Within the past year there were no wildfires that resulted in significant property damage. Marshfield's wildfires tend to be in the more remote wooded areas. The following areas of Town were identified as having the highest potential for brush fires (Figure 3-26):

- Cherry Hill
- Cedar Hill
- Sweets Hill
- Mill Pond Area
- Forest & Pine Streets
- Carolina Hill

Figure 3-26. Areas in the Town of Marshfield with the highest potential for brush fires.

B1.c
B2.a
B2.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.

The largest fire reported for Marshfield occurred in 1941. On April 24, 1941 a disastrous fire leveled the entire seaside community of Ocean Bluff, destroying approximately 500 buildings. The fire began in the marshland behind the beach, and was carried to the nearby dwellings by high wind. The neighborhood was extremely congested, with many of the lots being under 2,000 square feet, and cottages were generally of flimsy construction without substantial foundations or fire resistant roofs. Changes were made in the zoning rules following the fire to prevent a repeat event.

Smaller fires are more common and are generally addressed quickly by the Marshfield Fire Department. The Fire Department classifies incidents by type. Between January 2012 and December 2017 there were 218 brush fire incidents. Below is a list of incident types and the number of each that occurred within that time frame:

- Natural vegetation fire (other): 23
- Spread decorative mulch: 59
- Forest, woods or wildland fire: 40
- Brush or brush/grass mixture fire: 76
- Grass fire: 9
- Marsh grass fire: 11

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 3-17). 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.

Figure 3-27. Damage from the 1941 fire.

Probability

B2.b

The 2013 Massachusetts Hazard Mitigation Plan identifies Plymouth County 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 Marshfield.

Table 3-17. Forest fire 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

IMPACT

B3.a

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

- **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. 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.

3.9 Dam/Culvert Failure

Overview

A dam is any artificial barrier and/or any controlling structure that can or does impound or divert water. There are 2,901 public and privately owned dams in Massachusetts. Fifteen (15) of these are located in Marshfield (Figure 3-28).

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.

B1.c

Hazard Location

Hazards associated with dam failure are confined to the areas around existing dams. There are no High Hazard Dams located within Marshfield. However, there are 15 dams located in Marshfield, and two of them are classified by the Office of Dam Safety as having the potential for Significant Hazard. Of the Significant Hazard Potential Dams, Oakman Pond Dam is privately owned, while Magoun Pond Dam is publically owned (Figure 3-28). Of the other 13 dams in Marshfield, four (4) have been classified as Low Hazard, while nine (9) have not given a hazard code by the Office of Dam Safety.

There are 5 dams owned by the Town that fall under the jurisdiction of Massachusetts DCR and DEM: Little Pond Dam, Bares Brook Dam (Lewis Pond), Magoun Pond Dam, Cove Brook Dam, and Damon's Point Road Dam (Figure 3-28). Amory Engineers has performed Phase I inspection reports on these five dams. The Magoun Pond Dam is listed as Significant Hazard and requires inspection every 5 years. To address this issue, the Town has appropriated funds to develop repair plans to address the deficiencies at the Magoun Pond Dam. The Damon's Point Dam requires repair to the outlet structure and tree removal around the dam. Funds have been appropriated through CH90 to initiate the design and permitting process to implement repairs to the Damon's Point Dam outlet structure (Figure 3-27).

Figure 3-27. Damon's Point Dam downstream spillway.

There are also a number of dams over the Town line in Duxbury that could cause damage in Marshfield if they were to fail.

While all culverts could cause some damage if they failed, there is one culvert of particular concern in Marshfield: Pudding Hill Lane Culvert. This location is indicated by the green star in Figure 3-29.

Although technically not a dam or culvert, bridges, and specifically bridge failures can cause significant hazards through loss of transportation and flooding. The Town has identified 3 bridge locations that are critical as evacuation routes that could be vulnerable to damaging forces similar to those impacting culverts and dams. These locations include:

1. Willow Street Bridge;
2. Canal Street Bridge; and
3. Beach Street Bridge.

These locations are individually labeled and displayed in yellow stars in Figure 3-29. These bridges are specifically addressed by mitigation actions proposed in Section 5.

Previous Occurrences & Extent

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

B1.c B2.a B2.c

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:

High Hazard Potential Dam: A dam located where failure will likely cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways, or railroads.

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.

Low Hazard Potential Dam: A dam located where failure may cause minimal property damage to others, and loss of life is not expected.

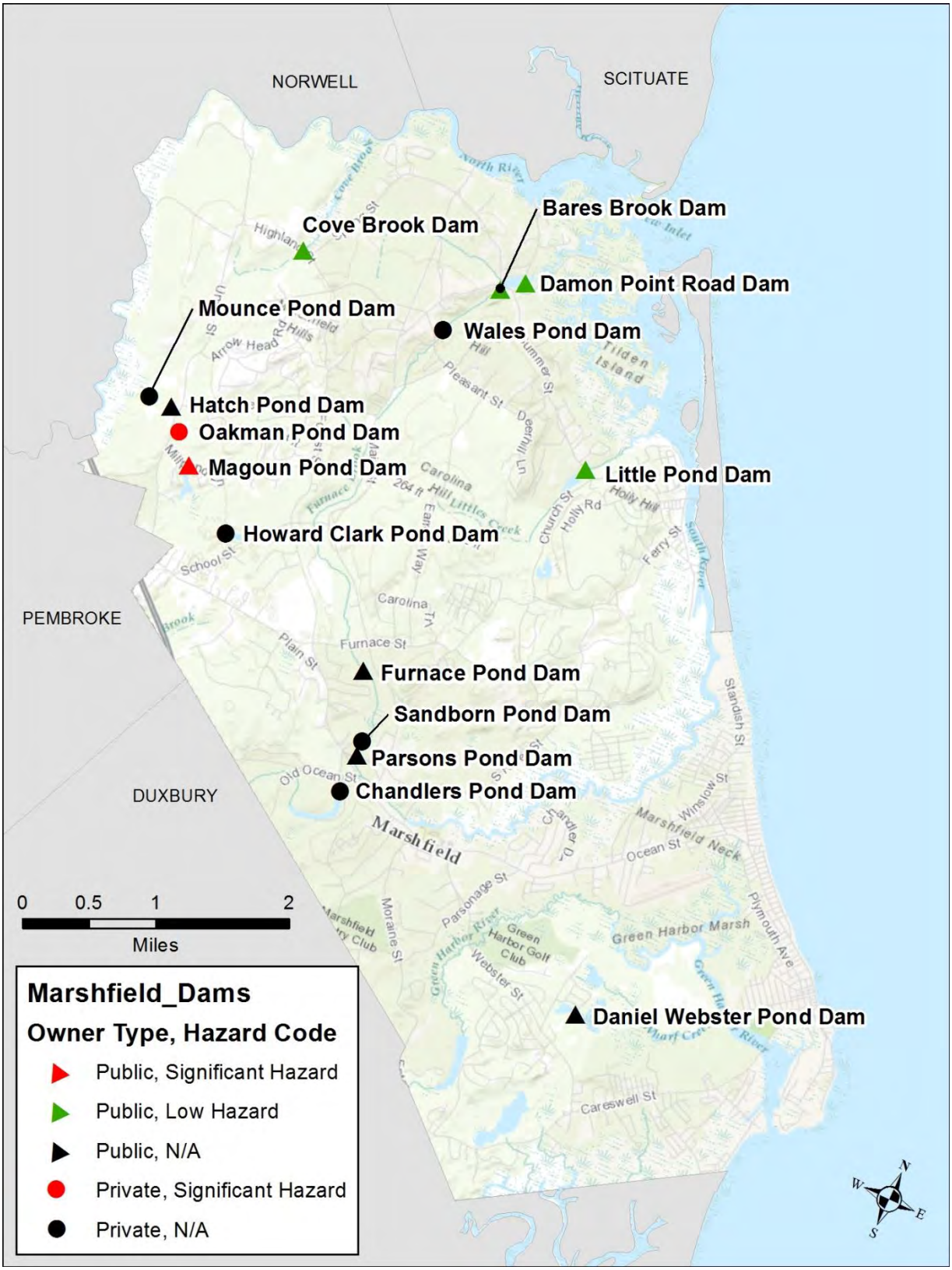


Figure 3-28. Locations of private and publically owned dams in Marshfield and their hazard rating as defined by the Office of Dam Safety.

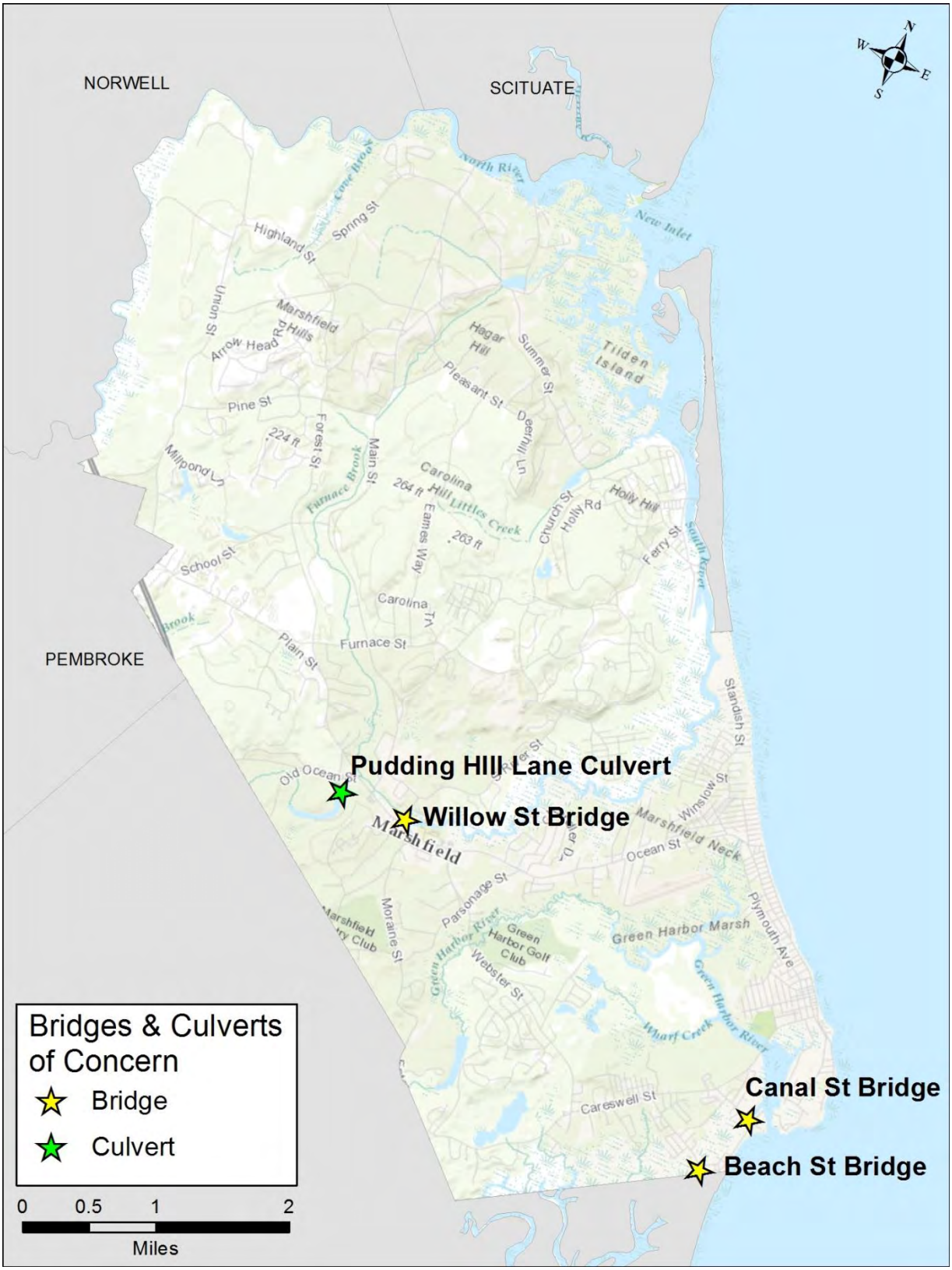


Figure 3-29. Locations of culverts and bridges of concern in Marshfield.

B2.b

PROBABILITY

The 2013 Massachusetts Hazard Mitigation Plan identifies dam failure in Massachusetts as having a very low frequency of occurrence. Although that statement did not account for the possibility of culvert failure, this event likely has a similar probability. Therefore, dam or culvert failure in Marshfield is possible (1-10% probability in the next year).

B3.a

IMPACT

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

- **People:** People could become trapped by blocked or flooded roads.
- **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.

3.10 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.

Earthquakes can occur at focal depths. 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.

HAZARD LOCATION

B1.c

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 3-30 shows earthquakes within 100 miles of the Town of Marshfield since the 1970s as reported by USGS. This data set only includes events with magnitudes 2.5 or greater.

PREVIOUS OCCURRENCES & EXTENT

B1.c
B2.a
B2.c

Although there are no recorded earthquakes within Marshfield itself, there have been 37 occurrences of earthquakes since 1982 within 100 miles of Marshfield. The epicenter locations of these earthquakes are shown in Figure 3-30, and the date and magnitude of each event is detailed in Table 3-19. The Richter magnitude of these 37 events ranged from 2.5 to 3.9, which as described below, can often be felt, but only cause minor damage.

The Richter Scale (Table 3-18) 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.

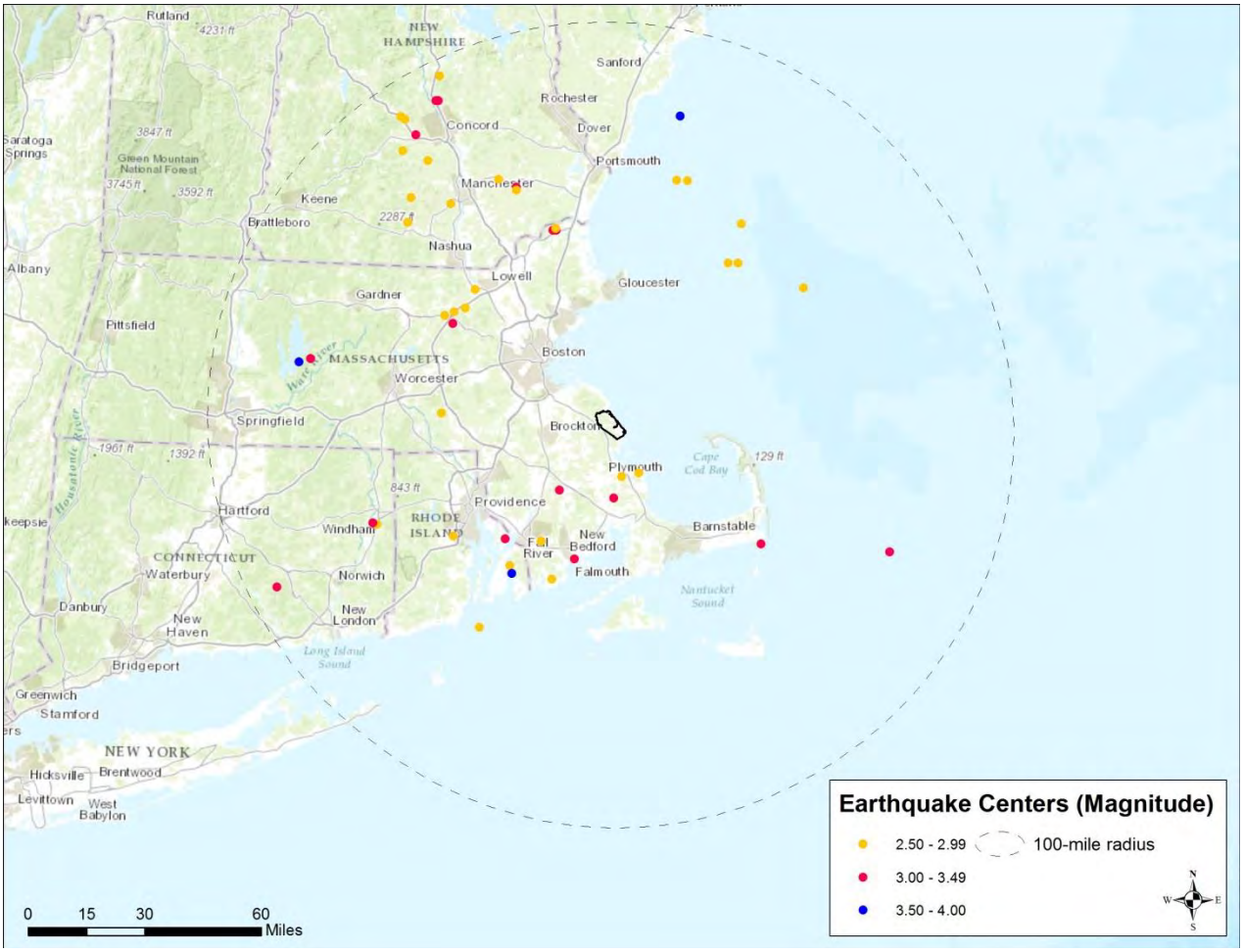


Figure 3-30. Earthquake occurrences within 100 miles of Marshfield.

Table 3-18. Richter Scale.

Richter Magnitude	Earthquake Effects
2.5 or less	Not felt or felt mildly near the epicenter, but 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

Table 3-19. Earthquake occurrences within 100 miles of Marshfield, as reported by the USGS.

Date	Mag.	Town, State
01/27/1982	3	LAKEVILLE, MA
06/17/1982	3	MOODUS, CT
10/27/1982	2.8	ATLANTIC OCEAN
11/01/1982	2.6	ATLANTIC OCEAN
03/24/1983	2.9	NEW BOSTON, NH
10/15/1985	3	BOXBOROUGH, MA
04/16/1986	2.6	AMESBURY, MA
10/25/1986	2.6	NORTHFIELD, NH
10/25/1986	3.9	NORTHFIELD, NH
02/09/1988	2.6	HENNIKER, NH
08/24/1989	3	NEW BEDFORD, MA
01/23/1990	2.5	HARVARD, MA
10/11/1990	2.7	PLYMOUTH, MA
09/30/1991	2.7	EAST MERRIMACK, NH
10/02/1994	3.3	HARDWICK, MA
10/02/1994	3.7	HARDWICK, MA
03/22/1996	3.1	BRISTOL, RI
04/22/1996	2.6	DARTMOUTH, MA
01/08/1998	2.9	ATLANTIC OCEAN
01/10/1999	3	MERRIMAC, MA
01/10/1999	3.1	MERRIMAC, MA
10/13/1999	2.7	WESTFORD, MA
01/21/2000	2.5	RAYMOND, NH
01/27/2000	3	RAYMOND, NH
03/12/2002	3	ATLANTIC OCEAN
06/07/2002	2.5	MILFORD, MA
09/28/2002	2.8	LYNDEBOROUGH, NH
07/22/2003	2.98	ATLANTIC OCEAN
11/17/2005	2.5	PLYMOUTH, MA
10/19/2007	2.5	LITTLETON, MA
03/09/2008	2.8	ATLANTIC OCEAN
06/07/2010	2.9	ATLANTIC OCEAN
09/26/2010	3.15	CANTERBURY, NH
10/11/2013	2.61	WARNER, NH
01/12/2015	3.3	WAUREGAN, CT
01/13/2015	2.6	WAUREGAN, CT
03/21/2016	2.8	WARNER, NH

PROBABILITY

B2.b

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 Marshfield.

IMPACT

B3.a

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 and cause the release of flammable substances.
- **Buildings:** 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.

3.11 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 (< 30km) 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

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 as well.

B1.c
B2.a
B2.c

PREVIOUS OCCURRENCES & EXTENT

Although there are no records of a tsunami occurring in Marshfield, there are six (6) reported tsunamis for the United States Atlantic coast and Gulf coast states in the last 200 years.

B3.a

PROBABILITY

There is no record of tsunamis ever occurring in Marshfield, and only six occurring along the Atlantic and Gulf coasts of the United States. Therefore, it is unlikely (less than a 1% probability over the next 100 years) that a tsunami hazard will occur in Marshfield.

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, breakwaters 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 can be blocked, which can adversely impact economic activities. Coastal systems impacted by tsunamis can also adversely affect the fishing industry.
- **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.

3.12 SUMMARY OF HAZARDS

As suggested by the FEMA planning guidance, the Local Hazard Mitigation Planning Committee (LHMPC) reviewed the full range of natural hazards identified in the 2013 Massachusetts State Hazards Plan and identified natural hazards that could impact Marshfield in the future, or that have impacted the Town in the past (Chapter 3). The 15 individual hazards discussed in Chapter 3 are evaluated below in Table 3-20 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 3-20 to indicate the most likely severity, while a "P" indicates the anticipated severity of a worst case 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 LHMPC members, data from the 2013 Massachusetts State Hazards Plan and other resources.

The LHMPC selected only a subset of hazards from Table 3-20 to consider during the location-specific 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 and tornado.
- 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 unnecessary. An example of this is the tsunami hazard.

The hazards that were selected for site-specific vulnerability assessments are indicated in Table 3-20 in bold font with asterisks. Additional detail as to what data will be used to evaluate these selected hazards in the vulnerability assessment is provided in Section 4.1.

Table 3-20. Relative Risk of Hazards in Marshfield

	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)	
Nor'easter				X		X		P		X	16
Severe Winter Weather				X		X	P			X	16
Flooding*				X			X		X		12
Sea-Level Rise*				X			X	P	X		12
High Wind*				X			X	P	X	P	12
Coastal Erosion				X		X	P		X		8
Earthquake		X				X		P		X	8
Hurricane & Tropical Storm*			X			X	P		X	P	6
Extreme Temperature			X		X					X	6
Thunderstorm				X	X				X	P	4
Drought		X			X					X	4
Tornado		X			X				X		2
Fire*		X				X	P		X		4
Dam/Culvert Failure		X				X			X		4
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.

Chapter 4
Vulnerability Assessment

Risk analyses involve evaluating vulnerable assets, describing potential impacts, and estimating the loss from each hazard. Chapter 2 of the Marshfield Multi-Hazard Mitigation Plan profiled the local assets and amenities, such as the 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 three separate vulnerability assessments:

1) Vulnerability assessment of parcels and buildings;
2) Exposure assessment of critical facilities; and
3) Evaluation of evacuation routes

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 Marshfield (2017). The dataset provides information about parcel size, land use type, assessed value, and building characteristics.

This large dataset was first classified into various land use types based on the Massachusetts Property Type Classification Codes. 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 Massachusetts Property Type Classification Codes that are encompassed by each land use type used in this report. Examples of the types of properties included within each Land Use classification are also shown in Table 4-1.

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 if available (see also Table 3-20):

1) **Flooding**: FEMA Flood Hazard Maps (Effective 2016) (see Figure 3-2).

2) **Coastal Erosion**: Although rates of erosion are available from MassCZM for the ocean facing shorelines, the LHMPC chose not to perform a detailed vulnerability assessment for this hazard since much of the Town is already armored, and there was no data available for riverfront properties. Additionally, it is assumed that any waterfront parcel has a risk of erosion.

3) **Sea-level Rise**: A bathtub model developed by Woods Hole Group was used to estimate potential impacts to the Town from future sea-level rise (Figure 3-8). This assessment takes into account sea-level rise impacts only, and does not account for the combined flooding effects of future sea-level rise combined with storm surge.

4) **Hurricanes and Tropical Storms**: The extent of storm surge and flooding during a hurricane was estimated using the SLOSH model (Figure 3-14).

5) **Severe Nor'easters**: Location specific data within Marshfield is not available for this hazard. Therefore, a detailed vulnerability assessment could not be completed at this time.

6) **Severe Winter Weather**: Location specific data is not available for this hazard. A detailed vulnerability assessment could not be completed at this time.

7) **Severe Weather (including thunderstorms, high wind, drought, extreme temperatures, and tornadoes)**: The Wind District overlay was used for a high wind vulnerability analysis (Figure 3-20). Location specific data within Marshfield is not available for the other severe weather hazards. Therefore, a detailed vulnerability assessment could not be completed for thunderstorms, drought, extreme temperatures or tornadoes at this time.

8) **Wildfire**: Areas mapped as high risk for wild fire (Figure 3-26) were used for a wildfire vulnerability analysis.

9) **Dam/Culvert Failure**: Location specific data for areas that would be impacted by a failure of one of these structures is not available. Therefore, a detailed vulnerability assessment could not be completed at this time.

Table 4-1. Marshfield Land Use Classification Based on Massachusetts Codes

Land Use Type	Land Use Codes	Description
Residential - Single Family	101, 106	Residential single family lots
Residential - Multi-Family	013, 102, 103, 104, 105, 109, 111, 112, 121, 125	Multi-Family units, apartments, condos, mobile home park, etc.
Commercial - Retail/Offices/Services	031, 037, 321, 322, 323, 324, 325, 326, 327, 330, 331, 332, 335, 337, 338, 340, 343, 374, 423, 900	Retail stores and shops, offices, restaurants, automotive services, commercial parking lots, greenhouses, etc.
Commercial - Manufacturing/Distribution	310, 313, 316, 333, 334, 400, 401, 402, 410, 427, 444	Oil and gas storage, gas stations, lumberyards, and other storage and warehouse facilities
Public Services	140, 305, 341, 342, 350, 352, 384, 424, 430, 431, 432, 433, 901, 903, 906, 908, 931, 934, 935	Banks, hospitals, medical offices, childcare services, schools, fire stations, marinas, utilities, town offices, post offices, churches, courthouses, libraries, etc.
Temporary Lodging	301, 303	Hotels, inns, resorts, nursing homes
Agricultural	016, 017, 018, 601, 710, 717, 718	Agricultural land, woodlots, etc.
Open Space	385, 601, 720, 905, 911, 932	beaches, forested land, conservation land, etc.
Vacant	130, 131, 132, 390, 391, 392, 440, 441, 442,444, 930, 933	Vacant developable, potentially developable, and undevelopable land
Recreation	038, 805	Recreation lands, golf courses, etc.

10) **Earthquake**: Location specific data is not available for this hazard. A detailed vulnerability assessment could not be completed at this time.

11) **Tsunami**: Location specific data is not available for this hazard. A detailed vulnerability assessment could not be completed at this time.

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 type of hazard was quantified. These results are summarized in Tables 4-2 to 4-17.

To assess the vulnerabilities of Marshfield's critical infrastructure, as discussed in Chapter 2, the planning team first developed a list of the critical facilities and structures. Each location was mapped in GIS as a polygon representing the important structure(s) on that property (Figure 2-4).

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, coastal erosion, sea-level rise, hurricanes, wind, wildfire and dam/culvert failure). 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, potential impacts from other hazards, such as landslides, earthquakes and tsunamis were not directly evaluated.

Results from the vulnerability analysis for critical facilities are summarized at the bottom of each of the hazard table (Tables 4-2 to 4-17), as well as in Appendix C.

An evaluation of the Town's evacuation routes was conducted to determine whether any of the current evacuation pathways was susceptible to inundation due to flooding or sea-level rise. Although other hazards may impact these areas, the Local Hazard Mitigation Planning Committee determined that inundated roadways posed the largest threat to the safe and effective utilization of emergency evacuation routes. To address this, the extents of these hazard areas were overlain on the existing evacuation routes, and vulnerable areas were identified. Impacts to evacuation routes are shown in Figures 4-1 and 4-2.

4.2 RESULTS

Table 4-2. Parcels and Buildings Vulnerable to Flooding in the VE Zone.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	403	4%	$1,670,578,600	$69,159,300	4%	$3,739,090,100	$222,667,800	6%
Residential (Multi-Family)	230	24	10%	$129,209,300	$5,639,900	4%	$203,765,800	$17,026,100	8%
Commercial (Retail/Office/ Services)	176	2	1%	$80,554,025	$331,025	0%	$156,925,790	$2,662,625	2%
Commercial (Man./Dist.)	53	0	0%	$24,990,700	$-	0%	$51,507,400	$-	0%
Public Services	176	14	8%	$200,181,904	$7,750,400	4%	$282,963,804	$15,696,100	6%
Temporary Lodging	2	0	0%	$524,700	$-	0%	$867,300	$-	0%
Agriculture	41	0	0%	$12,075,700	$-	0%	$25,257,365	$-	0%
Open Space	620	47	8%	$13,867,700	$484,400	3%	$101,010,336	$3,522,300	3%
Vacant	1,338	32	2%	$740,900	$-	0%	$111,789,500	$4,229,600	4%
Recreation	5	0	0%	$2,109,600	$-	0%	$6,598,317	$-	0%
Total	**11,787**	**522**	**4%**	**$2,134,833,129**	**$83,365,025**	**4%**	**$4,679,775,712**	**$265,804,525**	**6%**

Critical facilities that are vulnerable to flooding in the VE flood zone include only water-based facilities and structures, such as the Green Harbor Marina, the Harbor Master Building, and almost all coastal infrastructure.

Table 4-3. Parcels and Buildings Vulnerable to Flooding in the AE Zone.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	3,057	33%	$1,670,578,600	$439,878,600	26%	$3,739,090,100	$1,157,812,200	31%
Residential (Multi-Family)	230	92	40%	$129,209,300	$34,216,900	26%	$203,765,800	$66,522,300	33%
Commercial (Retail/Office/ Services)	176	85	48%	$80,554,025	$36,300,425	45%	$156,925,790	$70,088,690	45%
Commercial (Man./Dist.)	53	16	30%	$24,990,700	$3,023,300	12%	$51,507,400	$7,819,300	15%
Public Services	176	53	30%	$200,181,904	$31,842,200	16%	$282,963,804	$65,818,100	23%
Temporary Lodging	2	1	50%	$524,700	$-	0%	$867,300	$96,000	11%
Agriculture	41	11	27%	$12,075,700	$6,490,400	54%	$25,257,365	$14,383,706	57%
Open Space	620	301	49%	$13,867,700	$6,162,600	44%	$101,010,336	$44,732,500	44%
Vacant	1,338	446	33%	$740,900	$110,200	15%	$111,789,500	$30,460,500	27%
Recreation	5	2	40%	$2,109,600	$1,500	0%	$6,598,317	$1,728,189	26%
Total	**11,787**	**4,064**	**34%**	**$2,134,833,129**	**$558,026,125**	**26%**	**$4,679,775,712**	**$1,459,461,485**	**31%**

Critical facilities that are vulnerable to flooding in the AE flood zone include the Town Airport, Union Chapel, St. Anne's Church, a number of dams (Damons Point Pond Dam, Mounce Pound Dam, Daniel Webster Pond Dam, Dyke Road Dam, and Bares Brook Dam), Ocean Bluff Auto, Rand Handy Oil Co., Roht Marine, Taylor Marine, Town of Marshfield Fuel Station, Bridge Way Inn, Prence Grant Apt #2, the DPW Barn, Ventress Public Library, Ridge Road Public Launch Ramp, South River School, NSTAR Sub-Station off Webster St., Monopole, and waste water infrastructure, including the Avon St., Plymouth Ave., Macker Terrace, Anderson Dr., and Central St. Waste Water Pump Stations, Waste Water Treatment Plant, and Main Lift Pump Station.

Table 4-4. Parcels and Buildings Vulnerable to Flooding in Other Flood Zones (AO; A; 0.2% Chance Flood).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	98	1%	$1,670,578,600	$21,141,000	1%	$3,739,090,100	$50,130,600	1%
Residential (Multi-Family)	230	2	1%	$129,209,300	$784,100	1%	$203,765,800	$1,595,100	1%
Commercial (Retail/Office/ Services)	176	0	0%	$80,554,025	$-	0%	$156,925,790	$-	0%
Commercial (Man./Dist.)	53	0	0%	$24,990,700	$-	0%	$51,507,400	$-	0%
Public Services	176	6	3%	$200,181,904	$1,719,100	1%	$282,963,804	$6,154,800	2%
Temporary Lodging	2	0	0%	$524,700	$-	0%	$867,300	$-	0%
Agriculture	41	4	10%	$12,075,700	$434,900	4%	$25,257,365	$1,197,691	5%
Open Space	620	9	1%	$13,867,700	$253,000	2%	$101,010,336	$10,184,800	10%
Vacant	1,338	20	1%	$740,900	$-	0%	$111,789,500	$883,100	1%
Recreation	5	0	0%	$2,109,600	$-	0%	$6,598,317	$-	0%
Total	**11,787**	**139**	**1%**	**$2,134,833,129**	**$24,332,100**	**1%**	**$4,679,775,712**	**$70,146,091**	**1%**

Critical facilities that are vulnerable to flooding in the AO and 0.2% chance flood zones include a number of dams (Hatch Pond Dam, Little Pond Dam, Wales Pond Dam, and Furnace Pond Dam), and the Furnace Brook Water Pumping Station #1.

Table 4-5. Parcels and Buildings Vulnerable to Localized Flooding (Not Coincident with 100-Year Storms).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	473	5%	$1,670,578,600	$52,666,800	3%	$3,739,090,100	$152,538,000	4%
Residential (Multi-Family)	230	14	6%	$129,209,300	$2,857,700	2%	$203,765,800	$9,178,900	5%
Commercial (Retail/Office/ Services)	176	14	8%	$80,554,025	$4,637,800	6%	$156,925,790	$7,707,100	5%
Commercial (Man./Dist.)	53	3	6%	$24,990,700	$233,000	1%	$51,507,400	$618,600	1%
Public Services	176	13	7%	$200,181,904	$2,567,000	1%	$282,963,804	$18,239,300	6%
Temporary Lodging	2	1	50%	$524,700	$-	0%	$867,300	$96,000	11%
Agriculture	41	0	0%	$12,075,700	$-	0%	$25,257,365	$-	0%
Open Space	620	51	8%	$13,867,700	$1,010,100	7%	$101,010,336	$5,338,100	5%
Vacant	1,338	103	8%	$740,900	$110,200	15%	$111,789,500	$6,974,500	6%
Recreation	5	0	0%	$2,109,600	$-	0%	$6,598,317	$-	0%
Total	**11,787**	**672**	**6%**	**$2,134,833,129**	**$64,082,600**	**3%**	**$4,679,775,712**	**$200,690,500**	**4%**

Critical facilities that are vulnerable to flooding to localized flooding (not coincident with 100-rear storms).include Dyke Road Dam, Green Harbor Marina, the Harbor Master Building, the Ridge Road Public Boat Launch, Plymouth Avenue and Central Street Wastewater Pump Stations, and various coastal infrastructure locations.

Table 4-6. Parcels and Buildings Vulnerable to a Sea-Level Rise of 1 Foot.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	626	7%	$1,670,578,600	$118,409,800	7%	$3,739,090,100	$311,927,000	8%
Residential (Multi-Family)	230	23	10%	$129,209,300	$7,912,900	6%	$203,765,800	$19,983,600	10%
Commercial (Retail/Office/ Services)	176	27	15%	$80,554,025	$9,840,425	12%	$156,925,790	$22,157,990	14%
Commercial (Man./Dist.)	53	2	4%	$24,990,700	$69,700	0%	$51,507,400	$900,200	2%
Public Services	176	28	16%	$200,181,904	$19,831,200	10%	$282,963,804	$44,029,500	16%
Temporary Lodging	2	0	0%	$524,700	$-	0%	$867,300	$-	0%
Agriculture	41	11	27%	$12,075,700	$6,490,400	54%	$25,257,365	$14,383,706	57%
Open Space	620	205	33%	$13,867,700	$732,600	5%	$101,010,336	$29,387,900	29%
Vacant	1,338	184	14%	$740,900	$-	0%	$111,789,500	$12,563,000	11%
Recreation	5	2	40%	$2,109,600	$1,500	0%	$6,598,317	$1,728,189	26%
Total	**11,787**	**1108**	**9%**	**$2,134,833,129**	**$163,288,525**	**8%**	**$4,679,775,712**	**$457,061,085**	**10%**

Critical facilities that are vulnerable to inundation due to a 1-foot rise in sea level include the Town Airport, almost all coastal infrastructure locations, a number of dams (Damons Point Pond Dam, Mounce Pond Dam, and Dyke Road Dam), Green Harbor Marina, Harbor Master Building, Ridge Road Public Launch Ramp, Roht Marine, and Taylor Marine.

Table 4-7. Parcels and Buildings Vulnerable to a Sea-Level Rise of 2 Feet.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	813	9%	$1,670,578,600	$146,835,500	9%	$3,739,090,100	$384,865,100	10%
Residential (Multi-Family)	230	27	12%	$129,209,300	$8,495,600	7%	$203,765,800	$21,333,100	10%
Commercial (Retail/Office/ Services)	176	27	15%	$80,554,025	$9,840,425	12%	$156,925,790	$22,157,990	14%
Commercial (Man./Dist.)	53	3	6%	$24,990,700	$295,500	1%	$51,507,400	$1,305,800	3%
Public Services	176	31	18%	$200,181,904	$19,941,700	10%	$282,963,804	$44,583,200	16%
Temporary Lodging	2	0	0%	$524,700	$-	0%	$867,300	$-	0%
Agriculture	41	11	27%	$12,075,700	$6,490,400	54%	$25,257,365	$14,383,706	57%
Open Space	620	217	35%	$13,867,700	$732,600	5%	$101,010,336	$29,762,500	29%
Vacant	1,338	210	16%	$740,900	$-	0%	$111,789,500	$15,070,100	13%
Recreation	5	2	40%	$2,109,600	$1,500	0%	$6,598,317	$1,728,189	26%
Total	**11,787**	**1,341**	**11%**	**$2,134,833,129**	**$192,633,225**	**9%**	**$4,679,775,712**	**$535,189,685**	**11%**

Critical facilities that are vulnerable to a sea-level rise of 2 feet include all critical facilities listed as vulnerable to a sea-level rise of 1 foot, but no additional critical facilities.

Table 4-8. Parcels and Buildings Vulnerable to a Sea-Level Rise of 3 Feet.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	1,707	19%	$1,670,578,600	$254,890,800	15%	$3,739,090,100	$670,098,700	18%
Residential (Multi-Family)	230	54	23%	$129,209,300	$23,952,100	19%	$203,765,800	$46,972,200	23%
Commercial (Retail/Office/ Services)	176	48	27%	$80,554,025	$13,787,125	17%	$156,925,790	$31,344,390	20%
Commercial (Man./Dist.)	53	11	21%	$24,990,700	$2,114,700	8%	$51,507,400	$5,311,800	10%
Public Services	176	44	25%	$200,181,904	$24,935,500	12%	$282,963,804	$55,241,300	20%
Temporary Lodging	2	1	50%	$524,700	$-	0%	$867,300	$96,000	11%
Agriculture	41	11	27%	$12,075,700	$6,490,400	54%	$25,257,365	$14,383,706	57%
Open Space	620	283	46%	$13,867,700	$4,447,200	32%	$101,010,336	$38,445,600	38%
Vacant	1338	350	26%	$740,900	$110,200	15%	$111,789,500	$23,300,800	21%
Recreation	5	2	40%	$2,109,600	$1,500	0%	$6,598,317	$1,728,189	26%
Total	**11,787**	**2,511**	**21%**	**$2,134,833,129**	**$330,729,525**	**15%**	**$4,679,775,712**	**$886,922,685**	**19%**

Critical facilities that are vulnerable to a sea-level rise of 3 feet include all critical facilities listed as vulnerable to a sea-level rise of 1 to 2 feet, as well as Daniel Webster Pond Dam, Ocean Bluff Auto, Ventress Public Library, Brant Rock Food Market, the NSTAR Substation off Webster Street, and the Plymouth Avenue, Macker Terrace, and Central Street Wastewater Pump Stations.

Table 4-9. Parcels and Buildings Vulnerable to a Sea-Level Rise of 4 Feet.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	2,130	23%	$1,670,578,600	$315,739,000	19%	$3,739,090,100	$824,648,900	22%
Residential (Multi-Family)	230	66	29%	$129,209,300	$26,285,500	20%	$203,765,800	$53,047,700	26%
Commercial (Retail/Office/ Services)	176	59	34%	$80,554,025	$16,267,325	20%	$156,925,790	$36,436,190	23%
Commercial (Man./Dist.)	53	11	21%	$24,990,700	$2,114,700	8%	$51,507,400	$5,311,800	10%
Public Services	176	48	27%	$200,181,904	$25,114,700	13%	$282,963,804	$56,815,200	20%
Temporary Lodging	2	1	50%	$524,700	$-	0%	$867,300	$96,000	11%
Agriculture	41	11	27%	$12,075,700	$6,490,400	54%	$25,257,365	$14,383,706	57%
Open Space	620	293	47%	$13,867,700	$4,447,200	32%	$101,010,336	$39,678,700	39%
Vacant	1,338	383	29%	$740,900	$110,200	15%	$111,789,500	$25,545,400	23%
Recreation	5	2	40%	$2,109,600	$1,500	0%	$6,598,317	$1,728,189	26%
Total	**11,787**	**3,004**	**25%**	**$2,134,833,129**	**$396,570,525**	**19%**	**$4,679,775,712**	**$1,057,691,785**	**23%**

Critical facilities that are vulnerable to a sea-level rise of 4 feet include all critical facilities listed as vulnerable to a sea-level rise of 1 to 3 feet, as well as Little Pond Dam, Bridge Way Inn, South River School, and the Anderson Drive Wastewater Pump Station.

Table 4-10. Parcels and Buildings Vulnerable to a Sea-Level Rise of 5 Feet.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	2,434	27%	$1,670,578,600	$358,972,100	21%	$3,739,090,100	$938,150,700	25%
Residential (Multi-Family)	230	78	34%	$129,209,300	$29,249,800	23%	$203,765,800	$58,870,400	29%
Commercial (Retail/Office/ Services)	176	61	35%	$80,554,025	$16,665,125	21%	$156,925,790	$37,273,090	24%
Commercial (Man./Dist.)	53	11	21%	$24,990,700	$2,114,700	8%	$51,507,400	$5,311,800	10%
Public Services	176	54	31%	$200,181,904	$28,329,800	14%	$282,963,804	$61,579,000	22%
Temporary Lodging	2	1	50%	$524,700	$-	0%	$867,300	$96,000	11%
Agriculture	41	11	27%	$12,075,700	$6,490,400	54%	$25,257,365	$14,383,706	57%
Open Space	620	313	50%	$13,867,700	$5,298,100	38%	$101,010,336	$45,398,600	45%
Vacant	1,338	419	31%	$740,900	$110,200	15%	$111,789,500	$27,637,800	25%
Recreation	5	2	40%	$2,109,600	$1,500	0%	$6,598,317	$1,728,189	26%
Total	**11,787**	**3,384**	**29%**	**$2,134,833,129**	**$447,231,725**	**21%**	**$4,679,775,712**	**$1,190,429,285**	**25%**

Critical facilities that are vulnerable to a sea-level rise of 5 feet include all critical facilities listed as vulnerable to a sea-level rise of 1 to 4 feet, as well as Town of Marshfield Fuel Station, Monopole, Avon Street Wastewater Pump Station, and Main Lift Pump Station.

Table 4-11. Parcels and Buildings Vulnerable to a Sea-Level Rise of 6 Feet.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	2,705	30%	$1,670,578,600	$400,205,300	24%	$3,739,090,100	$1,045,962,600	28%
Residential (Multi-Family)	230	87	38%	$129,209,300	$32,187,300	25%	$203,765,800	$64,484,800	32%
Commercial (Retail/Office/ Services)	176	67	38%	$80,554,025	$29,106,225	36%	$156,925,790	$57,916,390	37%
Commercial (Man./Dist.)	53	13	25%	$24,990,700	$2,384,500	10%	$51,507,400	$6,364,800	12%
Public Services	176	59	34%	$200,181,904	$28,904,500	14%	$282,963,804	$63,464,600	22%
Temporary Lodging	2	1	50%	$524,700	$-	0%	$867,300	$96,000	11%
Agriculture	41	14	34%	$12,075,700	$7,186,900	60%	$25,257,365	$15,773,960	62%
Open Space	620	316	51%	$13,867,700	$5,464,300	39%	$101,010,336	$45,945,700	45%
Vacant	1,338	440	33%	$740,900	$110,200	15%	$111,789,500	$29,732,800	27%
Recreation	5	2	40%	$2,109,600	$1,500	0%	$6,598,317	$1,728,189	26%
Total	**11,787**	**3,704**	**31%**	**$2,134,833,129**	**$505,550,725**	**24%**	**$4,679,775,712**	**$1,331,469,839**	**28%**

Critical facilities that are vulnerable to a sea-level rise of 6 feet include all critical facilities listed as vulnerable to a sea-level rise of 1 to 5 feet, as well as Rand Handy Oil Co., Winslow Village #1, and the Wastewater Treatment Plant.

Table 4-12. Parcels and Buildings Vulnerable to a Category 1 Hurricane (SLOSH 1).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	1,620	18%	$1,670,578,600	$242,799,400	15%	$3,739,090,100	$641,607,200	17%
Residential (Multi-Family)	230	50	22%	$129,209,300	$23,332,900	18%	$203,765,800	$44,118,500	22%
Commercial (Retail/Office/ Services)	176	44	25%	$80,554,025	$13,434,125	17%	$156,925,790	$29,764,290	19%
Commercial (Man./Dist.)	53	11	21%	$24,990,700	$2,114,700	8%	$51,507,400	$5,311,800	10%
Public Services	176	42	24%	$200,181,904	$24,921,200	12%	$282,963,804	$55,045,100	19%
Temporary Lodging	2	1	50%	$524,700	$-	0%	$867,300	$96,000	11%
Agriculture	41	11	27%	$12,075,700	$6,490,400	54%	$25,257,365	$14,383,706	57%
Open Space	620	278	45%	$13,867,700	$4,447,200	32%	$101,010,336	$37,927,700	38%
Vacant	1,338	326	24%	$740,900	$110,200	15%	$111,789,500	$21,384,200	19%
Recreation	5	2	40%	$2,109,600	$1,500	0%	$6,598,317	$1,728,189	26%
Total	**11,787**	**2,385**	**20%**	**$2,134,833,129**	**$317,651,625**	**15%**	**$4,679,775,712**	**$851,366,685**	**18%**

Critical facilities that are vulnerable to flooding during a Category 1 hurricane include Town Airport, almost all coastal infrastructure, numerous dams (Damons Point Pond Dam, Mounce Pond Dam, Daniel Webster Pond Dam, and Dyke Road Dam), Ocean Bluff Auto, Ventress Memorial Library, Green Harbor Marina, Harbor Master Building, Ridge Road Public Launch Ramp, Roht Marine, Taylor Marine, NSTAR Substation off Webster Street, Plymouth Avenue, Macker Terrace, and Central Street Wastewater Pump Stations.

Table 4-13. Parcels and Buildings Vulnerable to a Category 2 Hurricane (SLOSH 2).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	2,662	29%	$1,670,578,600	$391,457,000	23%	$3,739,090,100	$1,025,079,300	27%
Residential (Multi-Family)	230	86	37%	$129,209,300	$32,230,300	25%	$203,765,800	$63,700,000	31%
Commercial (Retail/Office/ Services)	176	65	37%	$80,554,025	$28,790,225	36%	$156,925,790	$57,201,090	36%
Commercial (Man./Dist.)	53	12	23%	$24,990,700	$2,384,500	10%	$51,507,400	$5,982,200	12%
Public Services	176	61	35%	$200,181,904	$31,842,800	16%	$282,963,804	$67,016,200	24%
Temporary Lodging	2	1	50%	$524,700	$-	0%	$867,300	$96,000	11%
Agriculture	41	12	29%	$12,075,700	$6,866,100	57%	$25,257,365	$15,012,156	59%
Open Space	620	314	51%	$13,867,700	$5,464,300	39%	$101,010,336	$45,765,100	45%
Vacant	1,338	431	32%	$740,900	$110,200	15%	$111,789,500	$29,152,800	26%
Recreation	5	2	40%	$2,109,600	$1,500	0%	$6,598,317	$1,728,189	26%
Total	**11,787**	**3,646**	**31%**	**$2,134,833,129**	**$499,146,925**	**23%**	**$4,679,775,712**	**$1,310,733,035**	**28%**

Critical facilities that are vulnerable to flooding during a Category 2 hurricane include all critical facilities listed as vulnerable to a Category 1 hurricane, as well as Rand Handy Oil Co., Town of Marshfield Fuel Station, Winslow Village #1, Brant Rock Food Market, South River School, Avon Street and Anderson Drive Wastewater Pump Stations, Wastewater Treatment Plant, and Main Lift Pump Station.

Table 4-14. Parcels and Buildings Vulnerable to a Category 3 Hurricane (SLOSH 3).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	3,384	37%	$1,670,578,600	$498,704,400	30%	$3,739,090,100	$1,299,750,400	35%
Residential (Multi-Family)	230	99	43%	$129,209,300	$36,177,200	28%	$203,765,800	$70,580,400	35%
Commercial (Retail/Office/ Services)	176	96	55%	$80,554,025	$38,826,325	48%	$156,925,790	$76,281,790	49%
Commercial (Man./Dist.)	53	18	34%	$24,990,700	$3,267,300	13%	$51,507,400	$8,794,300	17%
Public Services	176	66	38%	$200,181,904	$34,568,000	17%	$282,963,804	$70,841,800	25%
Temporary Lodging	2	1	50%	$524,700	$-	0%	$867,300	$96,000	11%
Agriculture	41	12	29%	$12,075,700	$6,866,100	57%	$25,257,365	$15,012,156	59%
Open Space	620	348	56%	$13,867,700	$7,837,300	57%	$101,010,336	$50,346,480	50%
Vacant	1,338	498	37%	$740,900	$603,300	81%	$111,789,500	$34,665,300	31%
Recreation	5	2	40%	$2,109,600	$1,500	0%	$6,598,317	$1,728,189	26%
Total	**11,787**	**4,524**	**38%**	**$2,134,833,129**	**$626,851,425**	**29%**	**$4,679,775,712**	**$1,628,096,815**	**35%**

Critical facilities that are vulnerable to flooding during a Category 3 hurricane include all critical facilities listed as vulnerable to a Category 1 or 2 hurricane, as well as Union Chapel, St. Anne's Church, Little Pond Dam, Parsons Pond Dam, Marshfield Fair, Bill's Sunco, Bridge Way Inn, DPW Barn, Daniel Webster School, NSTAR Substation #1, Monopole, Webster Street Pumping Station #2, and Homestead Ave. Wastewater Pump Station.

Table 4-15. Parcels and Buildings Vulnerable to a Category 4 Hurricane (SLOSH 4).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	3,913	43%	$1,670,578,600	$586,872,600	35%	$3,739,090,100	$1,511,467,400	40%
Residential (Multi-Family)	230	111	48%	$129,209,300	$39,129,700	30%	$203,765,800	$77,806,200	38%
Commercial (Retail/Office/ Services)	176	104	59%	$80,554,025	$41,546,025	52%	$156,925,790	$81,687,290	52%
Commercial (Man./Dist.)	53	19	36%	$24,990,700	$4,021,700	16%	$51,507,400	$10,977,300	21%
Public Services	176	76	43%	$200,181,904	$41,344,800	21%	$282,963,804	$81,807,500	29%
Temporary Lodging	2	1	50%	$524,700	$-	0%	$867,300	$96,000	11%
Agriculture	41	17	41%	$12,075,700	$7,398,900	61%	$25,257,365	$16,297,605	65%
Open Space	620	371	60%	$13,867,700	$9,081,200	65%	$101,010,336	$53,915,780	53%
Vacant	1,338	554	41%	$740,900	$603,300	81%	$111,789,500	$38,964,500	35%
Recreation	5	2	40%	$2,109,600	$1,500	0%	$6,598,317	$1,728,189	26%
Total	**11,787**	**5,168**	**44%**	**$2,134,833,129**	**$729,999,725**	**34%**	**$4,679,775,712**	**$1,874,747,764**	**40%**

Critical facilities that are vulnerable to flooding during a Category 4 hurricane include all critical facilities listed as vulnerable to a Category 1, 2 or 3 hurricane, as well as Assumption Church, Hatch Pond Dam, Taylor Lumber Propane, Public Petro, Rand Handy Propane, Prence Grant Apt #1 & #2, Winslow Village #2, CVS on Ocean Street, and Gov Edward Winslow School.

Table 4-16. Parcels and Buildings Vulnerable to High Winds (within Wind District).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	5,371	59%	$1,670,578,600	$850,786,800	51%	$3,739,090,100	$2,072,923,100	55%
Residential (Multi-Family)	230	119	52%	$129,209,300	$39,489,600	31%	$203,765,800	$76,990,700	38%
Commercial (Retail/Office/ Services)	176	50	28%	$80,554,025	$13,236,525	16%	$156,925,790	$27,125,590	17%
Commercial (Man./Dist.)	53	7	13%	$24,990,700	$1,159,200	5%	$51,507,400	$3,415,000	7%
Public Services	176	55	31%	$200,181,904	$16,486,200	8%	$282,963,804	$44,215,600	16%
Temporary Lodging	2	1	50%	$524,700	$-	0%	$867,300	$96,000	11%
Agriculture	41	9	22%	$12,075,700	$1,843,500	15%	$25,257,365	$3,946,156	16%
Open Space	620	307	50%	$13,867,700	$2,697,900	19%	$101,010,336	$31,445,956	31%
Vacant	1,338	692	52%	$740,900	$125,800	17%	$111,789,500	$46,863,100	42%
Recreation	5	1	20%	$2,109,600	$1,500	0%	$6,598,317	$731,500	11%
Total	**11,787**	**6,612**	**56%**	**$2,134,833,129**	**$925,827,025**	**43%**	**$4,679,775,712**	**$2,307,752,702**	**49%**

Critical facilities that are vulnerable to high winds include Town Airport, Union Chapel, St. Anne's Church, St. Teresa's Church, Assumption Church, almost all coastal infrastructure, Damon's Point Pond Dam, Little Pond Dam, Dyke Road Dam, Bares Brook Dam, Fire Stations #1 and #2, Ocean Bluff Auto, Cedar View Filling Station, Bridge Way Inn, Fairview Inn, Green Harbor Marina, Harbor Master Building, Ridge Road Public Lunch Ramp, Roht Marine, Brant Rock Food Market, Taylor Marine, Coastguard Relay Antenna, NSTAR Substations #2 and off Webster Street, Monopole, Avon St, Homestead Ave, Plymouth Ave and Central St Wastewater Pump Station, Wastewater Treatment Plant, Main Lift Pump Station, and Telegraph Hill Water Tank.

Table 4-17. Parcels and Buildings Vulnerable to Wild Fire.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	9,146	851	9%	$1,670,578,600	$195,501,400	12%	$3,739,090,100	$384,540,200	10%
Residential (Multi-Family)	230	9	4%	$129,209,300	$2,866,400	2%	$203,765,800	$4,808,000	2%
Commercial (Retail/Office/ Services)	176	3	2%	$80,554,025	$716,400	1%	$156,925,790	$1,636,300	1%
Commercial (Man./Dist.)	53	0	0%	$24,990,700	$-	0%	$51,507,400	$-	0%
Public Services	176	35	20%	$200,181,904	$4,871,400	2%	$282,963,804	$15,734,500	6%
Temporary Lodging	2	0	0%	$524,700	$-	0%	$867,300	$-	0%
Agriculture	41	2	5%	$12,075,700	$212,000	2%	$25,257,365	$514,433	2%
Open Space	620	88	14%	$13,867,700	$2,414,400	17%	$101,010,336	$26,344,756	26%
Vacant	1,338	140	10%	$740,900	$-	0%	$111,789,500	$9,553,400	9%
Recreation	5	0	0%	$2,109,600	$-	0%	$6,598,317	$-	0%
Total	**11,787**	**1,128**	**10%**	**$2,134,833,129**	**$206,582,000**	**10%**	**$4,679,775,712**	**$443,131,589**	**9%**

Critical facilities that have a risk of wildfire include St. Christeen's Parish, Magoun Pond Dam, Oakman Pond Dam, Marcia Thomas House, Winslow House, Eames Way Elementary School, Carolina Hill Radio Tower, Webster Street Pumping Station #2, Union Street Water Pumping Station #1, Ferry Street Water Pumping Station #2, Union Street Water Pumping Station #2, Ferry Street Water Pumping Station #1, and the Carolina Hill Water Tank.

The results of the evacuation route evaluation identified large sections of Route 139, the only designated evacuation route, where inundation from flooding or hurricane storm surge could impede traffic and access. For reference, Figure 2-2, in Section 2.6 shows the location of the evacuation routes. Below, Figure 4-1 has black arrows bookending the portions of the evacuation routes that would likely be inundated during a 100-year storm as predicted by FEMA. These areas likely to be flooded include the sections of Route 139 from Winslow Street to Satucket Avenue, and from Hancock Street to Canal Street.

Figure 4-2 shows a similar evaluation for the areas of Marshfield's evacuation routes that would be potentially inundated by storm surge during hurricanes of various categories as predicted by the USACE SLOSH modeling. Storm surge produced by a hurricane is projected to impact similar areas as identified through the flood zone analysis, however, there are additional sections of the evacuation routes potentially impacted by hurricanes. This is particularly true for the areas that would be impacted by the storm surge from a Category 3 or 4 hurricane. The vulnerable areas identified in Figure 4-2 are the same as those identified in Figure 4-1, except the amount of the evacuation route potentially impacted is greater. Almost 8 miles of Route 139 between the two black arrows in Figure 4-2 could be impacted by a Category 3 or 4 hurricane.

This assessment indicates that the evacuation routes in Town should be re-evaluated. Elevations of bridges could be checked and confirmed to determine whether the threat of flooding projected along Route 139 is real. Because this is a state road, the Town should consider discussing future mitigation options with the Massachusetts Highway Department. Additional evacuation routes could be designated to direct traffic away from potentially inundated areas. Finally, if alternatives cannot be found, some roads may need to be raised or fortified to ensure safe passage if necessary, and evacuation orders would need to be given in advance of a flood event to ensure residents are not trapped in the southeastern part of town.

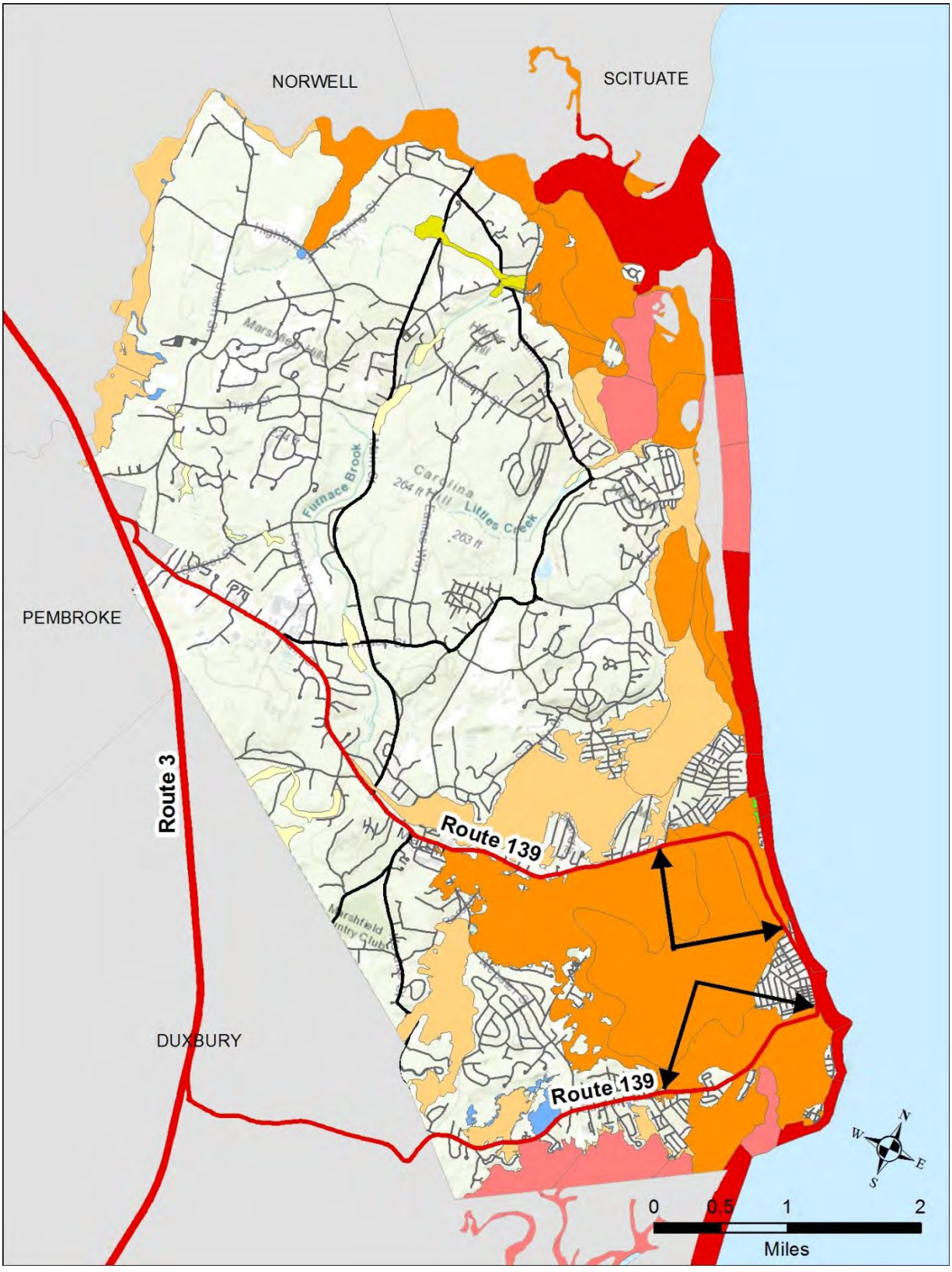


Figure 4-1. Potentially inundated evacuation routes due to the 100-year storm.

Figure 4-2. Potentially inundated evacuation routes due to hurricane storm surge.

B3.b

4.3 Vulnerable Properties & 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 findings from this analysis. The findings include 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 will also be used to direct the development of mitigation actions.

When looked at individually, based on the risk area maps utilized for this analysis, flooding and hurricanes have the potential to cause the most damage, in terms of the total value of all properties and buildings affected.

Tables 4-2, 4-3, and 4-4 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 4-2, 4-3, and 4-4 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 $1.8 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 Marshfield is approximately $166 million. At a similar magnitude of financial impact, the surge inundation (i.e. flooding) that would result from a Category 2 hurricane would impact properties valuing approximately $1.3 billion, with the structures and buildings on those properties valuing $500 million (Table 4-13). Finally, although based on the mapping criteria alone, it appears that flooding can cause more damage than 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.

Of the critical facilities impacted by flooding, Green Harbor Marina and the Harbor Master Building are located within a VE flood zone, while the airport, the DPW Barn and the Wastewater Treatment Plant are located within an AE flood zone. The Harbor Master Building has recently been upgraded to be at a higher elevation to reduce flood impacts to the building itself.

It is also worth acknowledging the breakdown of land use types impacted by these hazards. The inundation projected from a Category 2 hurricane will impact primarily single-family residential properties (2,662 parcels out of a total of 1,787 total parcels in Marshfield), which represents 29% of that land-use category. However, although only 65 commercial (retail/office/ services) parcels are projected to be inundated, this number represents 37% of that land use category. The implications of this are that hurricane damage could have substantial impacts on the economy.

Sea-level rise was considered as potential increases above current day MHHW. Depending on which sea-level rise scenario the Town considers for future planning purposes, these increases can be roughly correlated to dates based on Figure 3-10. For example, 1 foot of sea-level rise is projected to occur by approximately 2030 according to a High sea-level rise scenario,

but not until approximately 2075 under an Intermediate-Low scenario. Similarly, 3 feet of sea-level rise is projected to occur by approximately 2065 under a High sea-level rise scenario, but not until approximately 2080 under an Intermediate-High scenario. Additionally, 6 feet of sea-level rise is only projected to occur by 2100 under the High scenario.

For this discussion, impacts from 3 feet and 6 feet of sea-level rise were considered. With 3 feet of sea-level rise above today's MHHW, 2,511 parcels (21% of the total parcels in Marshfield) with total property values totaling more than $887 million would experience some additional inundation, particularly during high tide. The majority of these parcels are single-family residential (1,707). As mentioned above, this would be expected to occur by approximately 2065 under a High sea-level rise scenario, but not until approximately 2080 under an Intermediate-High scenario. With 6 feet of sea-level rise, these numbers increase to 3,704 total parcels (31% of all the parcels in Marshfield) with property values totaling approximately $1.3 billion.

The real hazard lies in the combination of sea-level rise and all of the hazards discussed so far (i.e. flooding, hurricanes and coastal erosion); these hazards will all be exacerbated by sea-level rise as time goes on.

As shown in Figure 3-20, high winds are most likely within 1-mile of the coast (i.e. Wind District). This area encompasses 6,612 parcels; 56% of all parcels in Marshfield. This number includes 5,371 single-family residential parcels, representing 59% of that land use type, but also 55 parcels classified as public services and 119 parcels classified as multi-family residential (31% and 52% of those land use types, respectively) (Table 4-16). It is important to note the simplification of this analysis: all parcels within 1 mile of the coast are included, but not all properties and structures in that zone are equally vulnerable to wind. Some properties will be sheltered by hills and other variations in topography, and there is a wide range of building construction and maintenance practices that might make certain buildings more resilient to high wind. There are a significant number of critical facilities within Marshfield's Wind District; these facilities should be assessed for adequate construction to mitigate any impacts from high winds, specifically tall structures like the monopole.

In terms of risk from wildfire, it is worth noting that based on Figure 3-26, which shows the areas within the Town of Marshfield with the highest potential for brush fires, the entire Town is at some risk to wildfire. However, this discussion will focus on the parts of Town within these areas of higher risk. There are 1,128 parcels within these high risk areas, with a combined total value of approximately $443 million. Although the majority of parcels within the High Fire Risk area are classified as single-family residential parcels, these 851 parcels only represent 9% of that category. There are only 35 parcels classified as public services in the high brush fire risk area, but these parcels represent 20% of public service parcels (Table 4-17). Critical facilities in high fire risk area include the Carolina Hill radio tower, as well as various historic properties and water and wastewater infrastructure.

B3.b

4.4 Vulnerable Populations

Marshfield has a number of vulnerable populations, including (ex: residents of isolated coastal communities, areas with a high concentration of elderly residents, and centers of tourism and visitor lodging).

Isolated Coastal Communities

As an oceanfront community, Marshfield is an attractive place to live for both year-round and summer residents. For many, their enjoyment of the coastline is contingent on their proximity to the shore. However, due to Marshfield's unique topography, and extensive network of tidal creeks, many of these coastal neighborhoods become "isolated" during a storm event or similar flood occurrence. During flood events, numerous roads can become submerged, leaving no means of access to particular neighborhoods. Table 4-18 lists 48 roads that can become isolated during a flood event, as well as the number of residences and businesses that would be affected during an event and the length of roadway involved. These areas range in size from the Esplanade/Blue Fish Cove area, with 278 residences, to the island access roads in the northern part of Town, with 39 residences. Roads within communities that are isolated during flood events are shown in Figure 4-6 in red. Note, not all areas shown in red will actually flood. Some roads and neighborhoods may be dry, but inaccessible due to flooding of surrounding access ways.

Concentrations of Elderly or Disabled People

Marshfield has a number of age restricted communities. These places, in addition to senior care and nursing facilities, would need special attention during emergencies or if evacuations become necessary. Table 4-19 lists age restricted communities, which represent concentrated areas of elderly populations. These locations are also shown in Figure 4-6 in green.

There are also disabled individuals who live in Marshfield. While some of these individuals may reside in age restricted communities, or senior care and nursing facilities, it is likely that there are also many disabled residents residing in single- or multi-family homes throughout Town. Disabled residents may need additional help to exit buildings during an emergency, particularly those in wheel chairs and on a floor above the ground level.

Visitor/Tourist Centers

Marshfield contains two hotels: the Fairview Inn on the corner of Bradford and Ocean Streets, and the Marshfield Inn on Old Plain St. Although neither of these facilities is located in a flood zone, one of them (the Fairview Inn) has the potential to be isolated during flood related hazards. Table 4-19 lists the addresses of the two hotels. These locations are also shown in Figure 4-6 in pink.

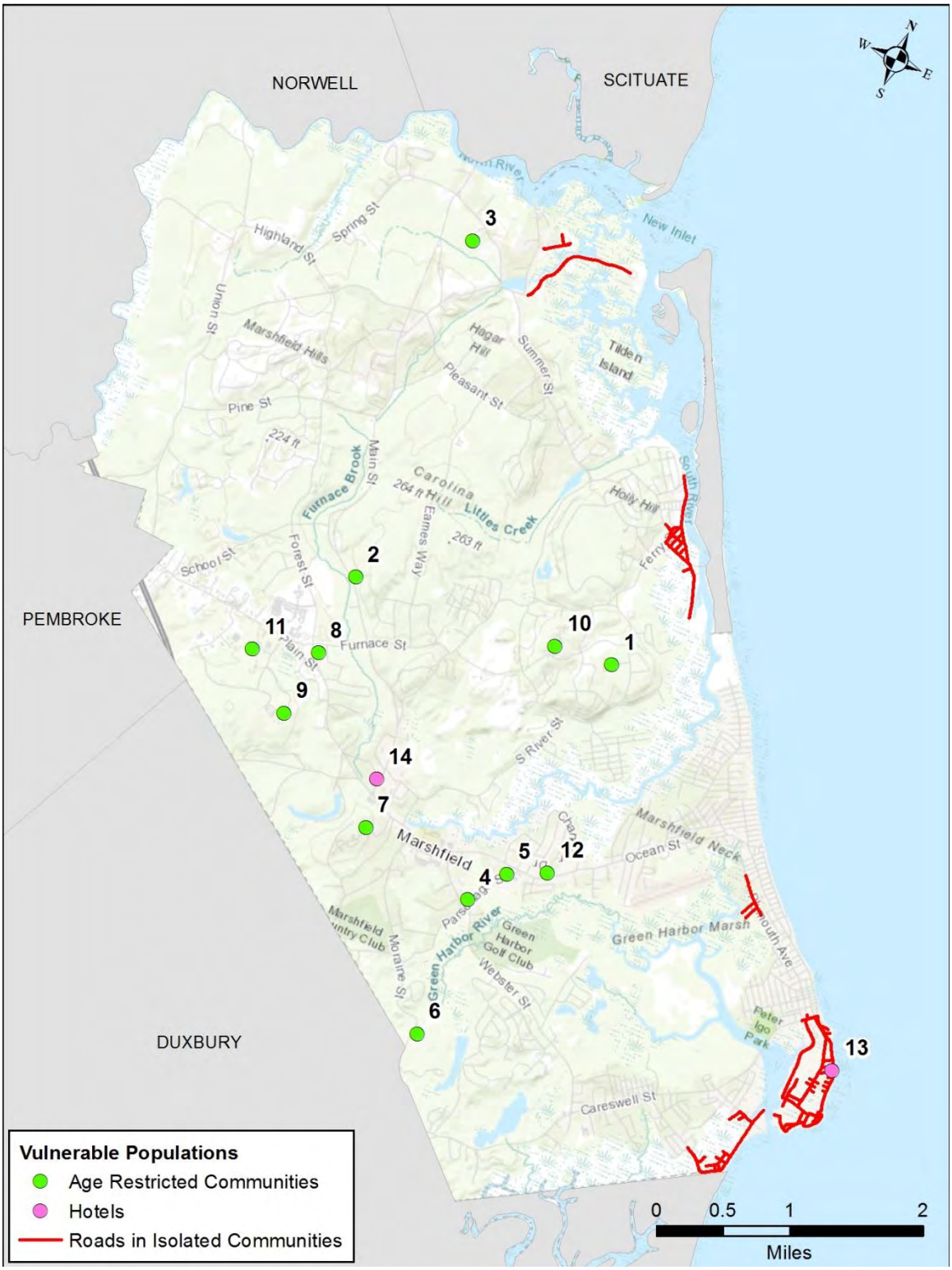


Figure 4-6. Locations of vulnerable populations in Marshfield. (Numbers correspond with Table 4-19)

Table 4-18. List of roads in isolated coastal communities.

Area	Street Name	Length (LF)	# of Homes	# Businesses
Bay Ave Area	Marion St.	515	13	n/a
	Naomi St.	250	6	n/a
	Beach St.	675	2	1
	Bay Ave.	2,975	102	n/a
	Brighton St.	460	15	n/a
	Bay St.	800	19	n/a
	Creek St.	380	5	n/a
	Canal St.	1,040	15	1
	Avon St.	1,005	23	n/a
	Pearl St.	350	6	n/a
	Stage Lane	435	6	n/a
Esplanade Area to Blue Fish Cove	Central St.	970	15	n/a
	A St. (Blue Fish Cove)	500	5	n/a
	Cove St. (Blue Fish Cove)	1,315	18	n/a
	Island St.	3,005	68	1
	Cherry St.	1,225	16	3
	Ocean St.	3,095	80	7
	Dyke Rd./ Town Pier Rd./Plymouth Ave.	1,210	1	3
	Branch St.	580	11	n/a
	South St.	200	10	n/a
	Middle St.	305	10	n/a
	Town Pier Rd.	3,400	n/a	2
	Reed St.	390	4	n/a
	Thomas St.	470	7	n/a
	Bradford St.	605	9	n/a
	Jersey St.	185	3	n/a
	Iowa St.	190	2	n/a
	Dana St.	200	3	n/a
	Linden St.	140	1	n/a
	Lindwood St.	375	5	n/a
	Bancroft St.	360	8	n/a
	Laurel St.	220	2	n/a
Plymouth Ave	Plymouth Ave. (Hutchinson Rd. to 2nd Rd.)	1,680	13	n/a
	Johnson Ter.	610	22	n/a
	MacArthur Ln.	675	21	n/a
Island Access Routes	Macombers Way (includes Trouant Island)	4,800	25	n/a
	Bartletts Isle Way	1,800	14	n/a

Table 4-18. (Continued) List of roads in isolated coastal communities.

Area	Street Name	Length (LF)	# of Homes	# Businesses
Ridge Road Area	Ridge Rd.	3,705	71	n/a
	Bayberry Rd.	1,245	7	n/a
	Shipyard Rd.	550	10	n/a
	Shady Ln.	335	6	n/a
	Old Ferry St.	450	6	n/a
	Ferry St. (South of Sea St.)	1,895	20	3
	Ferry St. (North of Sea St.)	1,070	8	1
	Keene Rd.	665	5	n/a
	Meadow Ln.	375	5	n/a
	Mallard Rd.	720	13	n/a
	Newtown Rd.	480	0	n/a

Table 4-19. Vulnerable populations (age restricted communities and hotels).

#	Age Restricted Communities	Address
1	Autumn Farm	1070 South River St.
2	Carolina Hill Shelter	728 Main St.
3	Hannah Brook Waye	919 Summer St.
4	Independent Living I	780 Webster St.
5	Independent Living II	40 Parsonage St.
6	Maples	20 Moraine St.
7	Mariner's Hill	2093 Ocean St.
8	Samuel Curtis Way	50 Forest St.
9	Seasons	Seth Sprague Drive
10	Spyglass	Stonybrook Rd.
11	Village at Proprietors Green	Proprietors Way
12	Winslow Village I and II	1554 Ocean St.

#	Hotels	Address
13	Fairview Inn	Bradford and Ocean Street
14	Marshfield Inn	7 Old Plain St.

Chapter 5 Mitigation Measures

The first sections of this plan discuss the potential hazards that could occur in Marshfield 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 Marshfield will accomplish their mitigation goals.

This chapter documents Marshfield's mitigation goals and existing and ongoing mitigation actions, as well as its proposed mitigation actions. The purpose, responsibility, priority and timeline is 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.

C3.a
C3.b
D3.a

5.1 Mitigation Goals and Objectives

During planning team meetings for this update of the plan, the Local Hazard Mitigation Planning Committee (LHMPC) reviewed the 2010 hazard mitigation goals. No changes were made to the goals. These goals are meant to reduce impacts and losses due to hazards associated with natural disasters, and to minimize the impacts of natural disasters on residents, businesses and infrastructure. The following 10 goals were endorsed by the LHMPC to remain in this version of the Multi-Hazard Mitigation Plan:

1) Ensure that critical infrastructure sites are protected from natural hazards;
2) Protect existing residential and business areas from flooding;
3) Maintain existing mitigation infrastructure in good condition;
4) Continue to enforce existing zoning and building regulations;
5) Educate the public about zoning and building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction;
6) Work with surrounding communities to ensure regional cooperation and solutions for hazards affecting multiple communities, such as coastal erosion;
7) Encourage future development in areas that are not prone to natural hazards;
8) Educate the public about natural hazards and mitigation measures;
9) Make efficient use of public funds for hazard mitigation; and
10) Protect the Town's ability to respond to various natural hazard events.

5.2 Existing Capabilities

C1.a
C6

Marshfield has a unique set of capabilities, including Town plans, policies, staff, funding, and other resources available to accomplish mitigation and reduce short- and long-term vulnerability. These capabilities are summarized here.

Town Plans and Policies

Marshfield 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, Marshfield can guide and manage growth and development within the Town, with the goal of reducing hazard vulnerability. These plans include:

1. Master Plan (updated 2015); with includes topics such as economic development, transportation and climate change planning.

2. Marshfield Harbor, Rivers, and Waterways Management Plan (2014)
3. Sea Level Rise Study – Towns of Marshfield, Duxbury, and Scituate (2013)
4. Beach Management Plan (2017)

Many of the existing Town policies and ordinances also provide an effective means of mitigating hazards. Marshfield has Zoning, Subdivision, and Floodplain ordinances.

Town Staff

The Town of Marshfield has a very capable staff that includes an Emergency Manager, a Town Planner, and a Chief Engineer. Together these staff allow the Town to effectively plan for and implement specific mitigation actions. In addition, the Town has a Local Emergency Management Agency and a Local Planning Board, which are instrumental in developing and coordinating mitigation actions.

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 assessment or outreach efforts, which require little to no costs other than staff time and existing operating budgets. Alternatively, higher cost actions, such as the acquisition of flood-prone properties, could require a substantial monetary commitment from local, state, and federal funding sources.

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.

Existing Mitigation Measures

D2.a

The following are existing and ongoing mitigation measure performed by the Town of Marshfield:

1. **Comprehensive Emergency Management Plan (CEMP):** Every community in Massachusetts is required to have a Comprehensive Emergency Management Plan. These plans address mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies. These plans contain important information regarding flooding, hurricanes, tornadoes, dam failures, earthquakes, and winter storms. Therefore, the CEMP is relevant to all of the hazards discussed in this plan.
2. **Communications System:** The Town has an array of communications equipment that would assist public safety efforts during a natural hazard event. The Town has recently upgraded this system, which multiple communications towers. Marshfield also participates in the CodeRED emergency alert system.
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 serve the operation of emergency shelters. Locations include: Town Hall, Police/EOC, Central Fire Station, Council on Aging Building, DPW Building, Governor Winslow School, Furnace Brook School, South River School, Daniel Webster School, High School, Martinson School,

Eames Way School, and the School Administration Building.

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. **Regional Emergency Management Planning Committee (REPC):** Marshfield is a member of a regional emergency planning committee together with Kingston, Duxbury, and Plymouth.
6. **Public Information & Outreach**: The Town provides information to residents and business owners relating to a range of potential natural hazards, most especially with regard to flooding, hurricanes, and northeasters.
7. **Public Works Operations/ Maintenance Activities**: The Public Works Department actively maintains the Town's storm drain system. The following specific activities serve to maintain the capability of the drainage system through the reduction of sediment and litter build up and proper maintenance and repair:
    a. **Street Sweeping**: Conducted twice annually.
    b. **Catch Basin Cleaning**: 3013 catch basins cleaned annually (some biannually as needed).
    c. **Roadway Treatments**: Calcium chloride is used for snow/ice treatment.
8. **Tree Trimming Program**: The electric and telephone utilities trim branches near the electric lines while Town staff maintain trees in other areas.
9. **Snow Disposal**: The town conducts general snow removal operations with its own equipment and has adequate space for snow storage as needed.
10. **Water Restrictions**: During a drought, or other periods of high demand (typically occurring in the summer months), restrictions are placed on those connected to the Town's public water system and include odd/even day outdoor watering, limited outdoor watering hours, outdoor watering bans, prohibitions on filling swimming pools, and the use of automatic irrigation sprinkler systems (Town Article 82).
11. **Floodplain Zoning District**: Zoning is intended to protect the public health and safety through the regulation of land use. The Marshfield Zoning Bylaw includes a Floodplain District (Article XV). The purposes of this district are:
    a. Protect human life and health and minimize danger to emergency response officials in the event of flooding;
    b. Minimize expenditure of public money for flood control projects and emergency response and clean up;
    c. Reduce damage to public and private property and utilities resulting from flooding waters and debris; and
    d. Ensure that the Town of Marshfield qualifies for

participation in the National Flood Insurance Program.

The Floodplain District is an overlay district, defined by the 100-year floodplain as designated by FEMA.

12. **Subdivision Rules and Regulations**: The Marshfield Subdivision Rules and Regulations contain provisions intended to reduce the impacts of floods and erosion. Through its design and layout standards, the bylaws contribute to the Town's overall efforts to mitigate the risks for damage through flooding.
13. **Wetlands Protection Bylaw**: The purpose of the Wetlands Protection By-Law (Article 37) is to further protect the Town's shores, ponds, rivers, and wetlands for, among other reasons, flood control, erosion and sedimentation control, and public safety. The by-law builds on the State Wetlands Protection Act offering more stringent controls over dredging and filling activities. Any activity that might fill or otherwise alter these resource areas requires a permit from the Marshfield Conservation Commission.
14. **Coastal Wetlands Zoning District**: The Coastal Wetlands District (section 13.02) is an overlay district established for the following purposes: protecting the health and safety of residents whose lands are subject to seasonal or periodic tidal flooding; preservation of salt marshes and tidal flats (thereby maintaining their functions of drainage and flood control, as well as filtration of contaminants); and, maintaining the purity of water and the safe operation of utilities subject to damage in floods.
15. **Inland Wetlands Zoning District**: In terms of general purpose and intent, The Inland Wetlands District (section 13.01) is similar to the Coastal Wetlands District. In addition to its goals of preserving streams and rivers and conserving sensitive watershed areas, this wetlands district overlay is intended to "protect the health and safety of persons and property against the hazards of flooding and contamination." The district includes principally areas containing soils that drain poorly. The district regulations are less restrictive than those in the coastal areas are. Key development requirements are as follows: special permit for structures intended for human occupancy or use on a permanent basis, and having water and sewage facilities; special permit for dumping, filling, and excavating of earth material; and, special permit for creation of ponds or pools and for changes to watercourses.
16. **Stormwater Management Overlay District**: The Stormwater Management Overlay District is intended to limit impervious surfaces and stormwater run-off in a designated area north of the South River. By promoting infiltration of storm water where it lands, the potential for flooding can be reduced.
17. **DCR Dam Safety Regulations**: The state has enacted dam safety regulations mandating inspections and emergency action plans. All new dams are subject to state permitting.
18. **Seawalls, Jetties and Dikes**: The Town of Marshfield coastline is protected by a series of seawalls, jetties and dikes. Repairs have

recently been made following a study of this protection system that indicated repairs were necessary.

19. **Plymouth County Mutual Aid System**: The Marshfield Fire Department is part of the Plymouth County mutual aid system. This system is run by the Plymouth County Control, which can supply as little as a single ambulance to as much as an entire taskforce.

C2.a

Participation in the National Flood Insurance Program (NFIP)

Marshfield currently participates in FEMA's 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 November 4, 2016.

Loss statistics for January 1, 1978 through November 30, 2017 include 1,582 total losses. 1,316 cases were closed and 1 remains open, however, 265 cases were closed without payment. Of the 1,316 cases that did receive payment, the total payments amounted to $18,479,963.44.

As part of ongoing NFIP requirements, Marshfield 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.

Marshfield also works with nearby communities to establish mutual aid agreements to address administration of the NFIP following a major storm.

The NFIP also has a Community Rating System (CRS), which recognizes community efforts beyond those minimum standards by reducing flood insurance premiums for the community's property owners. CRS discounts on flood insurance premiums range from 5% (for a rate class of 9) up to 45% (for a rate class of 1) (FEMA 2015). The Town of Marshfield is currently part of the CRS program, and has a rate class of 9, which affords a 5% insurance discount.

D2.a

5.3 Existing/Ongoing Mitigation Measures

Recent natural disaster response has been adequate, with generally good communi-cation and cooperation between various Town departments. Communication efforts have been improved over the years to better prioritize problem areas and expedite responses. Marshfield has implemented almost all of the mitigation actions proposed in previous versions of the Hazard Mitigation Plan. This section will discuss the existing mitigation measures.

Table 5-1. Existing/ongoing mitigation measures.

Mitigation Measures	Status	Effectiveness	Improvements/ Changes Needed
ACTIONS FOR MULTIPLE HAZARDS			
Comprehensive Emergency Management Plan (CEMP)	Developed	Emphasis is on emergency response	None
Communications equipment	Recently updated the phone system, antenna tower, etc.	Effective	None
Massachusetts State Building Code	In place	Effective for new construction	Will need to update to January 2018 code
Emergency power generators	Furnace Brook School (Evacuation center) has one; 3 new generators at wastewater treat-ment plant; fuel station has auxiliary power.	Effective	Other schools would benefit from a generator
Regional Emergency Planning Committee (REPC)	Ongoing	Effective	None
Public information and outreach	Ongoing; tabling at fairs; website	Effective	None
ACTIONS FOR FLOOD HAZARDS			
Participation in the National Flood Insurance Program (NFIP)	Ongoing	Effective	Encourage all eligible homeowners to obtain insurance
CRS Program Participation	Ongoing	Marshfield is currently a Class 9	Seek more CRS points
Floodplain Management Plan	Ongoing; establishing detours for flooded roads, cleaning catch basins, and culvert repair as necessary	Effective	None
Master Plan (2015)	In place; includes Harbor Plan update	Effective	Updated to include Open Space and Beach Man. Plan

Table 5-1 (continued). Existing/ongoing mitigation measures.

Mitigation Measures	Status	Effectiveness	Improvements/ Changes Needed
ACTIONS FOR FLOOD HAZARDS (continued)			
Open Space Plan	In place	Effective	None
Zoning – Floodplain District	In place	Effective for new construction	None
Subdivision Rules and Regulations	In place; updated in 2014	Effective	None
Wetlands Protection By-Law	In place	Effective	Guidance on elevation min. for buildings once FEMA maps finalized; vertical datum issue
Coastal Wetlands Zoning District	In place	Effective	None
Inland Wetlands Zoning District	In place	Effective	None
Stormwater Management Overlay District	In place	Effective	None
DCR Dam Safety Regulations	In place	Effective	Magoun Pond dam is currently under administrative orders to be repaired
Elevating Repetitive Loss Properties	Program has lapsed; some properties have qualified for grant funding in the past	Effective	Apply for funding to reinstate this program
Coastal protection structures (seawalls, jetties, dikes)	In place; repairs completed as necessary (Fieldston and Brant Rock area recently repaired)	Effective	Major improvements needed to seawall south of Green Harbor; apply annually for dams and seawall grants
ACTIONS FOR WIND HAZARDS			
Wind Code supplement to MA Building Code	In place	Effective for new construction	None
Tree trimming program	Ongoing	Effective	None

D1.a
D2.a

5.4 PROGRESS DETERMINATION ON MITIGATION ACTIONS SINCE 2013

Before identifying new Mitigation Actions for the 2018 Hazard Plan, the LHMPC discussed the status of the mitigation actions identified in the 2013 Marshfield Hazard Mitigation Plan. One of the following status determinations was given to each mitigation action identified from the 2013 plan:

- **Complete**: The project was implemented and completed in 2013-2018
- **Existing Capability**: The project was implemented and completed in 2013-2018, and it will continue to be implemented on an annual basis (these action items are also identified in Section 5.3).
- **In Progress**: the project was started in the 2013-2018 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.

In 2013, the LHMPC identified 17 new actions. During this plan update, the LHMPC assessed the Town's progress on all 17 actions.

Table 5-2. Status of 2013 Proposed Mitigation activities.

Hazard(s) to Mitigate	Action Item and Description	Status (Explanation)
Flooding	**A. Sea Wall Repair, Maintenance & Upgrade**: Create a strategy for annual predictable funding for on-going sea wall repair and maintenance. Establish a documentation system for repair and maintenance activities. Seek opportunities to fund individual sea wall upgrades that will address potential for rising sea levels and increased storm intensity. The Board of Selectmen is forming a Shore Front Protection Committee to guide this process.	In Progress. The seawall between lower Rexhame and Ocean Bluff has recently been repaired, and raised an additional 2 feet in elevation. Additional sections of the seawall, specifically in the Brant Rock area, still need to be repaired and upgraded.
Flooding	**B. Elevate Repetitive Loss Structures**: Re-constitute the grant program to assist property owners with repetitive loss structures in elevating their homes. In the previous program the homeowner was responsible for 25% of the cost of the work. Consider applying this program to commercial structures as well.	In Progress.
Flooding	**C. Dyke Road Bridge**: Serves both to connect the villages of Brant Rock and Green Harbor and as a flood control structure, protecting the Green Harbor marsh from tide driven flooding. The bridge also serves as an important emergency evacuation route for Brant Rock residents. Tides and flooding are undermining the bridge, which is 70 to 80 years old. This mitigation measure would include both an engineering study of the bridge and steps necessary to structurally enhance the bridge and its flood control capabilities.	In Progress. The engineering study of the bridge was completed. The plan included recommendations to pursue feasibility studies and preliminary plans to replace and/or add a separate structure. The Town is also considering appropriate elevations for the dike but is waiting for FEMA flood zones to be finalized.
Flooding	**D. Stormwater Drainage System – Cleaning and Repairs**: Continue to clean all catch basins, manholes, and drop-inlets; clean/snake all clogged lines; rebuild defective and broken drainage structures.	Existing Capability. These activities are performed regularly.

Table 5-3 (continued). Status of 2013 Proposed Mitigation activities.

Hazard(s) to Mitigate	Action Item and Description	Status (Explanation)
Flooding	**E. Stormwater Drainage System Improvements**: Continue to implement improvements in targeted areas prone to flooding such as the Rexhame area, Brant Rock, Peregrine, White Drive, Rugani Avenue, Forest Street, South River Street, Snow Road, and other areas identified as local areas of concern for flooding. Install new catch basins as needed.	Existing Capability. Improvements were implemented at all areas listed to the left, except the Esplande area of Brant Rock, which still needs to be improved. Forest Street had some improvements implemented, but there are still some ongoing stormwater drainage system improvements in that location.
Flooding	**F. Bass Creek Drainage Area**: Continue to implement drainage system improvements to more effectively move drainage into Bass Creek from the Fieldston Area. Increase the capacity of drain pipes and catch basins in the area.	Complete. Drainage system improvements were implemented in the Bass Creek area.
Flooding	**G. Saltmarsh Restoration**: Continue to restore salt marshes in the Polder area to their original condition by addressing the *Phragmites* invasion and creating additional natural flood storage areas. This work is primarily carried out as part of mitigation for other projects impacting wetland in the area. The Town will continue to look for opportunities to advance wetland restoration in this area.	In Progress. The Town is currently addressing the *Phragmites* in from of the dike in the Harbor Park area.
Flooding	**H. Well Head Protection**: Install new stormwater management infrastructure to protect against storm water pollution of the wellheads of the town's public water supply in the Forest Street and Ferry Street area.	In Progress. New stormwater management infrastructure was installed in the Forest Street Area. Ferry Street received a new detention basin and is currently a proposed 40B project.
Flooding	**I. Acquisition of Repetitive Loss Properties**: Consider acquisition of repetitive loss properties.	Complete. The Town purchased one repetitive loss property.
Flooding	**J. Master Plan Update:** Include a section on Climate Change and its potential impacts on Marshfield in the next update of the Master Plan.	Complete. The Master Plan now includes a section on Climate Change.

Table 5-4 (continued). Status of 2013 Proposed Mitigation activities.

Hazard(s) to Mitigate	Action Item and Description	Status (Explanation)
Flooding	**K. Update WWTF Procedures / I&I:** Continue updating operating procedures of the wastewater treatment facility to address and mitigate Inflow and Infiltration.	Existing Capability. There is an I&I article that is included annually for funding.
Compliance with NFIP	**L. Floodplain Management:** Continue to enforce the Floodplain District (Article XV) and associated building regulations for floodplain areas. Update this district to remain consistent with FEMA guidelines and floodplain mapping.	Existing Capability.
Compliance with NFIP	**M. Floodplain Mapping**: Maintain up to date maps of local FEMA identified floodplains.	Existing Capability.
Compliance with NFIP	**N. Acquisition of Vacant Flood Prone Lands:** Acquire priority open space parcels in floodplain areas in order to maintain flood storage and water infiltration capacity. These parcels may also be used for general conservation and recreation purposes.	Deferred. Town is currently looking at Ranch House.
Geologic Hazards	**O. Public Building Assessments:** Assess the earthquake vulnerability of all public buildings.	Complete. Conducted a Town-wide building study.
Multi-Hazard	**P. Emergency Power Generators:** Upgrade all emergency power generators in emergency shelters and critical facilities as needed; provide alternative fuel sources and generator power source flexibility.	Complete. Emergency power generators were upgraded. Four additional generators were added to the wastewater treatment facility.
Multi-Hazard	**Q. Public Education:** Continue efforts at public education on natural hazards. Leverage existing State and Federal public information materials. Continue to reach out to residents and businesses in flood prone areas and provide them with information on steps they can take to reduce their vulnerabilities. Use public education to build support for implementation of hazard mitigation measures.	Existing Capability.

5.4 Proposed Mitigation

C4.a
C5.a
C5.b

5.4.1 Planning Process

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

- **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 Section 5.4.2 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, please see Appendix C.

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

5.4.2 Proposed Mitigation Actions

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

The final proposed mitigation actions developed during the planning process are summarized in this section. A total of 42 actions were developed. These actions address risks due to flooding, coastal erosion, sea-level rise, wind, nor'easters and other winter weather, fire, and dam and culvert failure, as well as more general public outreach actions. Specific actions range from Town administrative or regulatory actions that influence the way land and buildings are developed and built, to actions that involve the modifications of existing buildings or infrastructure to protect them from a hazard or removal from the hazard area, to actions developed to increase public education and awareness.

For each action identified below, a brief description is provided, as well as the responsible department(s), potential funding sources, priority, and anticipated timeline. Finally, to help tie the recommended actions to the Town's hazard mitigation goals listed in Section 5.1, the numbers associated with the goal(s) each action addresses are also listed.

Mitigation Action #1: Evaluate the creation of a dike around the WWTP	
PURPOSE	To protect the waste-water treatment plant from flooding, ensure uninterrupted operation of the plant, and avoid contamination to the surrounding salt marsh.
RESPONSIBILITY	DPW
POTENTIAL FUNDING SOURCES	DPW Budget; Town Meeting Article
PRIORITY	Medium
TIMELINE	Start within 2 yrs.
MITIGATION GOAL(S) ADDRESSED	1,9

Mitigation Action #2: Review WWTP operations and maintenance plan	
PURPOSE	To ensure plan is up-to-date, and has protocols for how to keep the plant safely operational during storm events (which may include contingencies for staff to remain on site).
RESPONSIBILITY	DPW
POTENTIAL FUNDING SOURCES	DPW Budget; Town Meeting Article
PRIORITY	Medium
TIMELINE	Start within 2 yrs.
MITIGATION GOAL(S) ADDRESSED	1,3,10

Mitigation Action #3: Add batter boards at Old Rexhame Road to close opening	
PURPOSE	The seaward end of Old Rexhame Road is in a low lying area, located between two seawalls. Adding batter boards would reduce the amount of flooding that affects the properties in that area.
RESPONSIBILITY	DPW
POTENTIAL FUNDING SOURCES	DPW Budget; Town Meeting Article
PRIORITY	High
TIMELINE	Start within 4 yrs.
MITIGATION GOAL(S) ADDRESSED	2,9

Mitigation Action #4: Continue to restrict additional uses at the airport due to flood prone elevations	
PURPOSE	The business community has proposed additional uses (e.g., restaurants) on the airport property, but the Town will continue to restrict uses in this area due to its low lying elevations and position in the flood plain.
RESPONSIBILITY	Planning Board
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Medium
TIMELINE	Ongoing
MITIGATION GOAL(S) ADDRESSED	4,5,7

Mitigation Action #5: Ditch cleaning and maintenance of the Bass Creek headwaters	
PURPOSE	Cleaning out the ditches and maintaining adequate flow in the Bass Creek Headwaters north of Monitor Road will reduce the flood risk to the surrounding areas but facilitating drainage in the event of a flood.
RESPONSIBILITY	DPW, Conservation Commission
POTENTIAL FUNDING SOURCES	DPW Budget; Town Meeting Article
PRIORITY	Medium
TIMELINE	Start within 4 yrs.
MITIGATION GOAL(S) ADDRESSED	2,9

Mitigation Action #6: Raise the elevation of the Dyke Road bridge and its approaches	
PURPOSE	Raising the bridge out of the flood plain would improve evacuation routes and emergency access during flood hazard events.
RESPONSIBILITY	DPW, Conservation Commission
POTENTIAL FUNDING SOURCES	Town Meeting Article; Grants
PRIORITY	Low
TIMELINE	Start within 4 yrs.
MITIGATION GOAL(S) ADDRESSED	1,2,9,10

Mitigation Action #7: Implement recommended tide gate upgrades at Dyke Road	
PURPOSE	The Green Harbor Tide Gate Study recommend-ed installing an upgraded tide gate system to control flooding and improve the tidal wetland habitat upstream of the Dyke Road bridge.
RESPONSIBILITY	DPW, Harbormaster
POTENTIAL FUNDING SOURCES	Town Meeting Article; Grants
PRIORITY	Medium
TIMELINE	Start within 4 yrs.
MITIGATION GOAL(S) ADDRESSED	1,2,9,10

Mitigation Action #8: Raise elevation of the Brant Rock seawall	
PURPOSE	Increasing the elevation of the Brant Rock seawall would reduce the risk from waves and storm surge associated with coastal flooding in that area.
RESPONSIBILITY	DPR
POTENTIAL FUNDING SOURCES	Town Meeting Article; Grants
PRIORITY	Medium
TIMELINE	Start within 1 yr; entire project will be phased over time
MITIGATION GOAL(S) ADDRESSED	1,2,3,10

Mitigation Action #9: Develop an evacuation plan for Housing Authority units	
PURPOSE	No evacuation plan currently exists. At least one Housing Authority Unit (the Pence Grant apartments) can become inaccessible during a flood event. Development of an evacuation plan would improve public safety.
RESPONSIBILITY	Emergency Operations Center
POTENTIAL FUNDING SOURCES	EOC Budget
PRIORITY	High
TIMELINE	Start within 2 yrs.
MITIGATION GOAL(S) ADDRESSED	8,10

Mitigation Action #10: Move and rebuild the DPW Barn in a less vulnerable location	
PURPOSE	The current DPW Barn is located in the flood zone, which prohibits access and hinders emergency response during a flood event.
RESPONSIBILITY	DPW
POTENTIAL FUNDING SOURCES	Town Meeting Article; Grants
PRIORITY	Low
TIMELINE	Start within 3 yrs.; then 1 year to design; 1 year to build
MITIGATION GOAL(S) ADDRESSED	1,3,7,10

Mitigation Action #11: Purchase wetlands and other flood prone lands for conservation	
PURPOSE	Purchasing wetland and other flood prone lands for conservation not only protects and enhances the environ-ment, but also improves flood retention and coastal resiliency.
RESPONSIBILITY	Conservation Commission
POTENTIAL FUNDING SOURCES	Town Meeting Article; CPC; Grants
PRIORITY	Low
TIMELINE	Start within 2 yrs.
MITIGATION GOAL(S) ADDRESSED	2,7

Mitigation Action #12: Evaluate the need for enhanced drainage for Mt. Skirgo wellhead protection	
PURPOSE	Enhancing drainage could reducing flooding and ponding at the Mt. Skirgo wellhead site, and would help protect the public drinking water supply.
RESPONSIBILITY	DPW; Conservation Commission
POTENTIAL FUNDING SOURCES	Town Meeting Article; CPC; Grants
PRIORITY	High
TIMELINE	Start within 3 yrs.
MITIGATION GOAL(S) ADDRESSED	1,3

Mitigation Action #13: Confirm the properties on the Repetitive Loss list and refine if necessary	
PURPOSE	Some properties are misidentified, or have been mitigated and should be removed from the list.
RESPONSIBILITY	CRS Coordinator, PPI, Planning Department
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Medium
TIMELINE	Ongoing
MITIGATION GOAL(S) ADDRESSED	5,7,8

Mitigation Action #14: Develop specific recommendations for each Repetitive Loss Area	
PURPOSE	13 Repetitive Loss Areas were identified in Town. Each may have a slightly different reason for flooding. Developing targeted mitigation actions for each area can help reduce the flood risk.
RESPONSIBILITY	CRS Coordinator, PPI, Planning Department
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Medium
TIMELINE	Ongoing
MITIGATION GOAL(S) ADDRESSED	2,4,5,7,8

Mitigation Action #15: Inform Repetitive Loss property owners annually about financial assistance options	
PURPOSE	Conducting outreach activities to Repetitive Loss property owners to inform them about available financial assistance to mitigation their flood risk could reduce the number of Repetitive Loss properties in Town.
RESPONSIBILITY	CRS Coordinator, PPI, Planning Department
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Medium
TIMELINE	Ongoing
MITIGATION GOAL(S) ADDRESSED	2,5

Mitigation Action #16: Hire a Community Rating System (CRS) Coordinator	
PURPOSE	A dedicated CRS coordinator could work towards improving the Town's CRS score, improve public awareness about flood risks, and support the PPI.
RESPONSIBILITY	Board of Selectmen
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Medium
TIMELINE	Start within 1 yr
MITIGATION GOAL(S) ADDRESSED	2,4,5,6,8

Mitigation Action #17: Discuss the possibility of elevating flood prone NSTAR substation	
PURPOSE	Open communication with NSTAR about the flood risk to its sub-stations and other utilities will help ensure continued power generation during flood events.
RESPONSIBILITY	Board of Selectmen
POTENTIAL FUNDING SOURCES	NA
PRIORITY	High
TIMELINE	Within 1 yr
MITIGATION GOAL(S) ADDRESSED	1,10

Mitigation Action #18: Develop a pre-storm checklist for the installation of seawall batter boards	
PURPOSE	Developing a pre-storm checklist will ensure that adequate steps are taken to install the batter boards in a timely fashion.
RESPONSIBILITY	DPW
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	High
TIMELINE	Within 1 yr
MITIGATION GOAL(S) ADDRESSED	2,3,9,10

Mitigation Action #19: Rebuild Willow Street bridge (to a higher elevation)	
PURPOSE	Rebuilding the Willow Street bridge could raise its elevation, reducing interruptions to vehicle access during flood events and increasing the flow capacity beneath the bridge.
RESPONSIBILITY	DPW, Conservation Commission
POTENTIAL FUNDING SOURCES	Town Meeting Article (as a match to state funding)
PRIORITY	Medium
TIMELINE	Within 5 yrs
MITIGATION GOAL(S) ADDRESSED	1,3,9,10

Mitigation Action #20: Rebuild the Canal and Beach Street bridges (to a higher elevation)	
PURPOSE	Rebuilding the Canal and Beach Street bridges could raise their elevations, reducing interruptions to vehicle access during flood events and increasing the flow capacity beneath the bridges.
RESPONSIBILITY	DPW, Conservation Commission
POTENTIAL FUNDING SOURCES	Town Meeting Article (as a match to state funding)
PRIORITY	Medium
TIMELINE	Within 5 yrs
MITIGATION GOAL(S) ADDRESSED	1,3,9,10

Mitigation Action #21: Raise intersection of Town Pier Road and Route 139	
PURPOSE	Raising the intersection of Town Pier Road and Route 139 would reduce interruptions to vehicle access during flood events
RESPONSIBILITY	DPW
POTENTIAL FUNDING SOURCES	Town Meeting Article (as a match to state funding)
PRIORITY	Medium
TIMELINE	Within 5 yrs
MITIGATION GOAL(S) ADDRESSED	1,3,9,10

Mitigation Action #22: Conduct an analysis of engineering alternatives to reduce flooding and improve drainage in the Esplanade	
PURPOSE	The Esplanade is an important business center, but regularly floods inhibiting traffic and damaging buildings. Developing solutions to mitigate this would reduce flood risk to this area and improve the economic potential of the area.
RESPONSIBILITY	DPW, Planning Dept., Conservation Com.
POTENTIAL FUNDING SOURCES	Town Meeting Article (as a match to state funding)
PRIORITY	Low
TIMELINE	Within 5 yrs
MITIGATION GOAL(S) ADDRESSED	1,2,10

Mitigation Action #23: Review and upgrade the Master Plan for Seawalls	
PURPOSE	The existing Master Plan for Seawalls was last updated in 2006. The plan should be reviewed and updated to ensure it covers repair, monitoring, and maintenance.
RESPONSIBILITY	DPW
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Low
TIMELINE	Within 2 yrs
MITIGATION GOAL(S) ADDRESSED	3,10

Mitigation Action #24: Complete the Green Harbor beneficial reuse study	
PURPOSE	Green Harbor is dredged almost every year. Dredged material has traditionally been placed in a nearshore area. A beneficial reuse study will evaluate the economics and potential shore protection benefits of alternative placement options.
RESPONSIBILITY	Beach Administrator, DPW, Conservation Com
POTENTIAL FUNDING SOURCES	Town Budget, CZM Grant
PRIORITY	Medium
TIMELINE	Within 1 yr
MITIGATION GOAL(S) ADDRESSED	3,6,9

Mitigation Action #25: Maintain Rexhame dunes	
PURPOSE	Begin an annual program of beach grass planting. Focus on fencing and pedestrian management. Consider using volunteers and/or starting a beach grass nursery to support the project.
RESPONSIBILITY	Beach Administrator, DPW, Conservation Com
POTENTIAL FUNDING SOURCES	Town Budget, Grant
PRIORITY	Low
TIMELINE	Within 3 yrs
MITIGATION GOAL(S) ADDRESSED	3

Mitigation Action #26: Develop a large-scale town-wide beach nourishment program	
PURPOSE	Many of Marshfield's beaches are eroding, or have already eroded to the point where there is no dry high tide beach fronting the seawalls. To improve the beaches' recreational value, as well as protect the base of the seawalls, a large beach nourishment project would be required.
RESPONSIBILITY	Beach Administrator, DPW, Conservation Com
POTENTIAL FUNDING SOURCES	Town Budget, Grant
PRIORITY	Medium
TIMELINE	Within 3 yrs
MITIGATION GOAL(S) ADDRESSED	3,6,9

Mitigation Action #27: Create special conditions for Orders of Conditions to require beneficial reuse	
PURPOSE	Pre-set special conditions could be developed for the Conservation Commission to apply to Orders of Conditions requiring any dredging project in town to employ a beneficial re-use strategy for material placement and disposal.
RESPONSIBILITY	Conservation Com
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Medium
TIMELINE	Within 1 yrs
MITIGATION GOAL(S) ADDRESSED	3,8

Mitigation Action #28: Evaluate the potential risk to the Webster Wells from sea-level rise	
PURPOSE	The Webster Wells supply drinking water to part of Town, but because they are located at a low elevation they may be vulnerable to sea-level rise, flooding and salt water intrusion.
RESPONSIBILITY	DPW, Planning Dept, Conservation Com
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Low
TIMELINE	Within 2 yrs
MITIGATION GOAL(S) ADDRESSED	1

Mitigation Action #29: Evaluate the vulnerability of the radio antenna to wind hazards	
PURPOSE	The radio antenna is vital for communication before, during, and after a hazard, but it is located in a high wind area. Evaluating its vulnerability and implementing necessary actions to protect this structure are vital to emergency response.
RESPONSIBILITY	Fire, Police, EOC
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Low
TIMELINE	Within 1 yr
MITIGATION GOAL(S) ADDRESSED	1,10

Mitigation Action #30: Consider acquiring larger snow removal machinery	
PURPOSE	Consider whether acquiring a larger double-blade truck, front end loaders, or other similar equipment is necessary for efficient removal of snow. Consider sharing this equipment with neigh-boring town to reduce cost.
RESPONSIBILITY	DPW
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Low
TIMELINE	Within 5 yrs
MITIGATION GOAL(S) ADDRESSED	3,6,10

Mitigation Action #31: Evaluate additional snow storage needs within the Town	
PURPOSE	In the past, large accumulations of snow were disposed of in the ocean. Currently, snow is stored behind the DPW and in the Rexhame lot. Evaluate whether this is adequate, or if additional locations are required.
RESPONSIBILITY	DPW
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	High
TIMELINE	Ongoing
MITIGATION GOAL(S) ADDRESSED	10

Mitigation Action #32: Consider fire prevention vegetation clearing at Marcia Thomas house	
PURPOSE	Marcia Thomas house, a historical property, is located in one of the high risk wildfire areas. Preemptively pruning and clearing vegetation around the building would reduce its vulnerability in the event of a nearby fire.
RESPONSIBILITY	Fire Dept, Historical Commission
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	High
TIMELINE	Within 2 yrs
MITIGATION GOAL(S) ADDRESSED	1,10

Mitigation Action #33: Develop a fire/forest management plan for select properties and woodlots	
PURPOSE	Developing a plan for regularly management, as well as emergency response for specific properties and woodlots in Town could reduce fire risk and improve fire response.
RESPONSIBILITY	Fire Department
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Medium
TIMELINE	Within 2 yrs
MITIGATION GOAL(S) ADDRESSED	1,8,10

Mitigation Action #34: Repair emergency spillway at Mill Pond (Magoun) Dam	
PURPOSE	The dam is currently designated as "non-compliant" and must be repaired. The road crossing the dam is also the only access to Mill Pond Lane. Additional maintenance, such as tree removal on the embankment is also required.
RESPONSIBILITY	DPW, Conservation Commission
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Low
TIMELINE	Within 3 yrs
MITIGATION GOAL(S) ADDRESSED	2,9,10

Mitigation Action #35: Evaluate potential alternatives to improve the Veterans Park Dam	
PURPOSE	The spillway is currently undersized and regularly overtops. Renovations could improve fish passage. Mass Highway may provide financial assistance if/when they widen the road.
RESPONSIBILITY	DPW, Conservation Commission, Veterans Park
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Low
TIMELINE	Within 2 yrs
MITIGATION GOAL(S) ADDRESSED	2,3,9,10

Mitigation Action #36 Discuss potential repairs to Duxbury dams with the Town of Duxbury	
PURPOSE	There are dams located in Duxbury, but near enough to the town line that their failure would impact properties in Marshfield. Identifying and discussing options to address this issue is an important first step in mitigating the risk from dam failure.
RESPONSIBILITY	Planning Department
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Medium
TIMELINE	Within 1 yr
MITIGATION GOAL(S) ADDRESSED	6,10

Mitigation Action #37: Conduct outreach to owners/managers of privately held critical facilities	
PURPOSE	Many critical facilities identified by the Town are privately owned, but have known risks from particular hazards. Informing these owners of these risks may encourage them to conduct mitigation actions of their own.
RESPONSIBILITY	CRS Coordinator, PPI, Planning Department
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Medium
TIMELINE	Start within 1 yr, Ongoing
MITIGATION GOAL(S) ADDRESSED	1,8,10

Mitigation Action #38: Develop cable TV programming to increase public outreach	
PURPOSE	A regular program could be developed for MCTV to help increase public awareness about certain hazards, hazard mitigation and emergency response procedures.
RESPONSIBILITY	CRS Coordinator, PPI, Planning Department, Town Administrator
POTENTIAL FUNDING SOURCES	MCTV
PRIORITY	Low
TIMELINE	Start within 1 yr, Ongoing
MITIGATION GOAL(S) ADDRESSED	8

Mitigation Action #39: Develop a Public Plan for Information (PPI) website	
PURPOSE	PPI websites traditionally focus on flood risk and flood hazard mitigation, but the Town could develop a PPI website that also incorporates infor-mation about all hazards covered in this plan.
RESPONSIBILITY	CRS Coordinator, PPI
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Low
TIMELINE	Start within 1 yr, Ongoing
MITIGATION GOAL(S) ADDRESSED	8

Mitigation Action #40: Develop a summary brochure with this Multi-Hazard Mitigation Plan is complete	
PURPOSE	A summary brochure could provide a more accessible summary of the important parts of this plan for residents and visitors.
RESPONSIBILITY	PPI
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Medium
TIMELINE	Start within 1 yr
MITIGATION GOAL(S) ADDRESSED	8

Mitigation Action #41: Apply to be a Municipal Vulnerability Preparedness (MVP) Community	
PURPOSE	The state-run MVP program provides support for cities and towns to begin the planning for resiliency. Communities who complete the MVP program become eligible for follow-up grant funding and other opportunities.
RESPONSIBILITY	Planning Department
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	Medium
TIMELINE	Within 1 yr
MITIGATION GOAL(S) ADDRESSED	9,10

Mitigation Action #42: Conduct community outreach about the Code Red program	
PURPOSE	Conduct community outreach to let residents of Marshfield know they need to sign up for the Code Red program. Enrollment is not automatic for cell phone numbers.
RESPONSIBILITY	EOC
POTENTIAL FUNDING SOURCES	Town Budget
PRIORITY	High
TIMELINE	Within 1 yr
MITIGATION GOAL(S) ADDRESSED	8,10

Chapter 6
Plan Maintenance Process

The Marshfield 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 Marshfield will meet these Plan maintenance requirements.

A6

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 LHMPC will conduct bi-annual reviews to track implementation progress 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, LHMPC members and/or departments may be added or removed from the LHMPC 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 LHMPC, review of goals and objectives, updating the community profile, review and modification of potential hazards, 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.

Upon approval of this plan, the LHMPC 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:

- Fire / Emergency Management
- Police
- Public Works / Highway
- Engineering
- Planning
- Conservation
- Health
- Building

A5

6.3 Continued Public Involvement

During the periodic five year update process, the LHMPC 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 Hall and/or Public Libraries. The Plan will also be made available to the general public via the Town's website.

Chapter 7 Plan Adoption

Once the draft of the Marshfield Multi-Hazard Mitigation Plan was reviewed by the Local Hazard Mitigation Planning Committee, stakeholders and the general public, the plan was approved by the Marshfield Board of Selectmen. Following adoption, the Town will submit the plan for reviewed by the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency (FEMA). If approved by MEMA and FEMA, the Plan will then enter into the five year "maintenance" phase. This chapter describes the process of plan adoption and includes documentation for plan adoption by the Marshfield Board of Selectmen.

E1.a

At the conclusion of planning efforts conducted by the Local Hazard Mitigation Planning Committee, the final Local Multi-Hazard Mitigation Plan was reviewed and informally approved by all applicable Town departments, boards, and other agencies identified as members of the LHMPC. The plan was the adopted by the Marshfield Board of Selectmen. Proof of plan adoption is included in Appendix D. The Plan was then sent to the State Hazard Mitigation Officer (SHMO) of the Massachusetts Department of Resource Conservation, the Massachusetts Emergency Management Agency (MEMA) and the FEMA for review and approval.

Upon receiving final approval from MEMA and FEMA, the Plan will the Plan will then enter into the five year "maintenance" phase.

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Appendix A: Local Mitigation Plan Review Guide

Local Mitigation Plan Review Guide

October 1, 2011

FEMA

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.

ELEMENT	REQUIREMENTS
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)*** ***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.*	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. ***Document*** *means provide the factual evidence for how the jurisdictions developed the plan.* b. The plan **must** list the jurisdiction(s) participating in the plan that seek approval. 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. 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. ***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. e. Plan updates **must** include documentation of the current planning process undertaken to update the plan.
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)***	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: 1) Local and regional agencies involved in hazard mitigation activities; 2) Agencies that have the authority to regulate development; and 3) Neighboring communities. *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.*

ELEMENT	REQUIREMENTS
***Intent**: 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.*	b. The Plan **must** provide the agency or organization represented and the person's position or title within the agency. c. The plan **must** identify how the stakeholders were invited to participate in the process. Examples of stakeholders include, but are not limited to: • 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.
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)*** ***Intent**: 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.*	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. 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.

ELEMENT	REQUIREMENTS
A4. Does the Plan document the review and incorporation of existing plans, studies, reports, and technical information? *44 CFR 201.6(b)(3)* ***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.*	a. The plan **must** document *what* 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. b. The plan **must** document *how* relevant information was incorporated into the mitigation plan. ***Incorporate** means to reference or include information from other existing sources to form the content of the mitigation plan*.
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)* ***Intent**: To identify how the public will continue to have an opportunity to participate in the plan's maintenance and implementation over time.*	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. ***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.
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)* ***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.*	*a.* The plan **must** identify how, when, and by whom the plan will be monitored. ***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.* *b.* The plan **must** identify how, when, and by whom the plan will be evaluated. ***Evaluating** means assessing the effectiveness of the plan at achieving its stated purpose and goals.* *c.* The plan **must** identify how, when, and by whom the plan will be updated. ***Updating** means reviewing and revising the plan at least once every five years.* d. The plan **must** include the title of the individual or name of the department/ agency responsible for leading each of these efforts.

4.2 ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT

Requirement §201.6(c)(2)(i)	[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)(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.

ELEMENT	REQUIREMENTS
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)* ***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.*	a. The plan **must** include a description of the natural hazards that can affect the jurisdiction(s) in the planning area. *A **natural hazard** is a source of harm or difficulty created by a meteorological, environmental, or geological event*[3]*.* 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. 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. 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. 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. ***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. ***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.

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

ELEMENT	REQUIREMENTS
	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.
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)* ***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.*	a. The plan **must** include the history of previous hazard events for each of the identified hazards. b. The plan **must** include the probability of future events for each identified hazard. ***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. c. Plan updates **must** include hazard events that have occurred since the last plan was developed.
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)* ***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.*	a. For each participating jurisdiction, the plan **must** describe the potential impacts of each of the identified hazards on the community. ***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). 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). 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.

ELEMENT	REQUIREMENTS
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)* ***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.*	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. ***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.* ***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.* 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.

4.3 ELEMENT C. MITIGATION STRATEGY

Requirement §201.6(c)(3)	[The plan shall include the following:] A *mitigation strategy* 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.

ELEMENT	REQUIREMENTS
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)* ***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.*	a. The plan **must** describe each jurisdiction's existing authorities, policies, programs and resources available to accomplish hazard mitigation. 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.
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)* ***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.*	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 not meet this requirement. The description could include, but is not limited to: • 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. 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.

ELEMENT	REQUIREMENTS
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? *44 CFR 201.6(c)(3)(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.*	a. The plan **must** include general hazard mitigation goals that represent what the jurisdiction(s) seeks to accomplish through mitigation plan implementation. ***Goals** are broad policy statements that explain what is to be achieved.* b. The goals **must** be consistent with the hazards identified in the plan.
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)* ***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.*	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. ***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. 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. *A **comprehensive range** consists of different hazard mitigation alternatives that address the vulnerabilities to the hazards that the jurisdiction(s) determine are most important.* 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. c. The action plan **must** reduce risk to existing buildings and infrastructure as well as limit any risk to new development and redevelopment. ***With emphasis on new and existing building and infrastructure** means that the action plan includes a consideration of actions that address the built environment.*

ELEMENT	REQUIREMENTS
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)* ***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.*	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 benefic-cost analysis is not required. Qualitative benefits (*for example*, 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.
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)* ***Intent**: To assist communities in capitalizing on all available mechanisms that they have at their disposal to accomplish hazard mitigation and reduce risk.*	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. ***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.* 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.

ELEMENT	REQUIREMENTS
D1. Was the plan revised to reflect changes in development? ***44 CFR 201.6(d)(3)*** ***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.*	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. ***Changes in development*** means recent development (*for example*, construction completed since the last plan was approved), potential development (*for example*, development planned or under consideration by the jurisdiction), or conditions that may affect the risks and vulnerabilities of the jurisdictions (*for example*, climate variability, declining populations or projected increases in population, or foreclosures). Not all development will affect a jurisdiction's vulnerability.

ELEMENT	REQUIREMENTS
D2. Was the plan revised to reflect progress in local mitigation efforts? *44 CFR 201.6(d)(3)* ***Intent**: To evaluate and demonstrate progress made in the past five years in achieving goals and implementing actions outlined in their mitigation strategy.*	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.
D3. Was the plan revised to reflect changes in priorities? *44 CFR 201.6(d)(3)* ***Intent**: To ensure the plan reflects current conditions, including financial, legal, and political realities as well as post-disaster conditions.*	a. The plan **must** describe if and how any priorities changed since the plan was previously approved. If no changes in priorities are necessary, plan updates may validate the information in the previously approved plan.

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.

ELEMENT	REQUIREMENTS
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)*** ***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.*	a. The plan **must** include documentation of plan adoption, usually a resolution by the governing body or other authority. 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. 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. If adopted after FEMA review, adoption **must** take place within one calendar year of receipt of FEMA's "Approval Pending Adoption." See Section 5, *Plan Review Procedure* for more information on "Approvable Pending Adoption."

ELEMENT	REQUIREMENTS
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? *44 CFR 201.6(c)(5)* ***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.*	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. 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, *Plan Review Procedure* for more information on "Approvable Pending Adoption."

Appendix B: Planning Process and Public Outreach

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

Town of Marshfield
Local Hazard Mitigtation Planning Committee (LHMPC)
Master List

	Name	Department/Affiliation	Email
1	Rod Procaccino	DPW	RProcaccino@townofmarshfield.org
2	Greg Guimond	Town Planner	GGuimond@townofmarshfield.org
3	Paul Taber	Retired (EOC)	ptaber@marshfieldpolice.org
4	Shawn Patterson	DPW	spatterson@townofmarshfield.org
5	Louis Cipullo	Deputy Fire Chief	lcipullo@marshfieldfire.org
6	Arthur Shaw	EOC Director	ashaw@marshfieldpolice.org
7	Michael Dimeo	Harbor Master	mdimeo@marshfieldpolice.org
8	Paul Tomkavage	DPW	ptomkavage@townofmarshfield.org
9	Tom Reynolds	DPW	treynolds@townofmarshfield.org
10	Jack Sullivan	Coastal Advisory Committee	jsulliv532@gmail.com
11	Timothy Williams	Marshfield Coastal Coalition	twilliams@marshfieldcoastalcoalition.org
12	Joe Rossi	Marshfield Coastal Coalition	jrossi@marshfieldcoastalcoalition.org
13	Doris Crary	Marshfield Coastal Coalition	dcrary@marshfieldcoastalcoalition.org
14	Liam Rooney	Police Department	lrooney@marshfieldpolice.org
15	Bill Grafton	Conservation Commission	bgrafton@townofmarshfield.org
16	Michael Maresco	Town Administrator	mmaresco@townofmarshfield.org
17	Nanci Porreca	ZBA	nporreca@townofmarshfield.org
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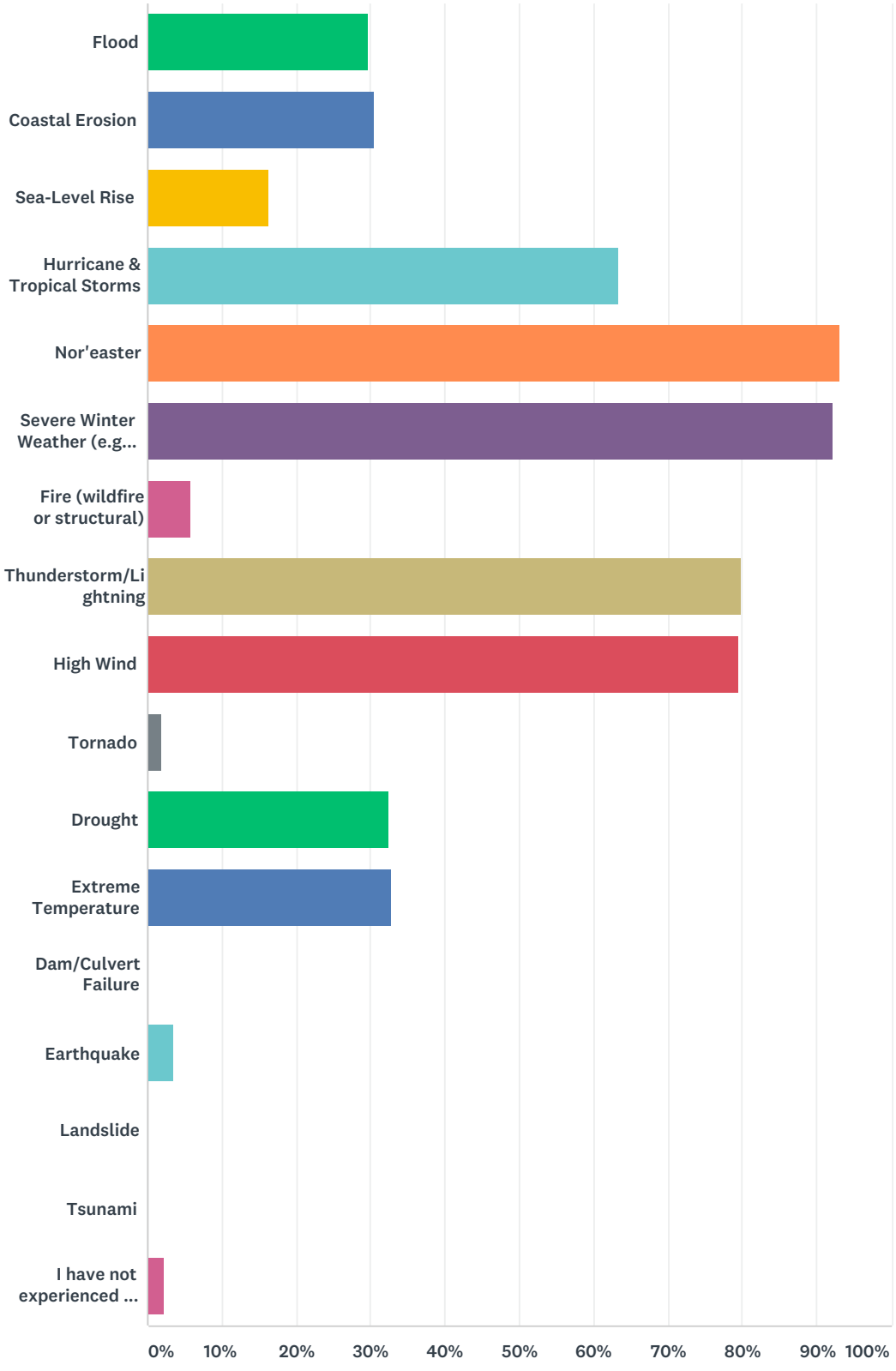
Q1 Which of the following natural hazards have you experienced while in Marshfield?(You can select more than 1 answer)

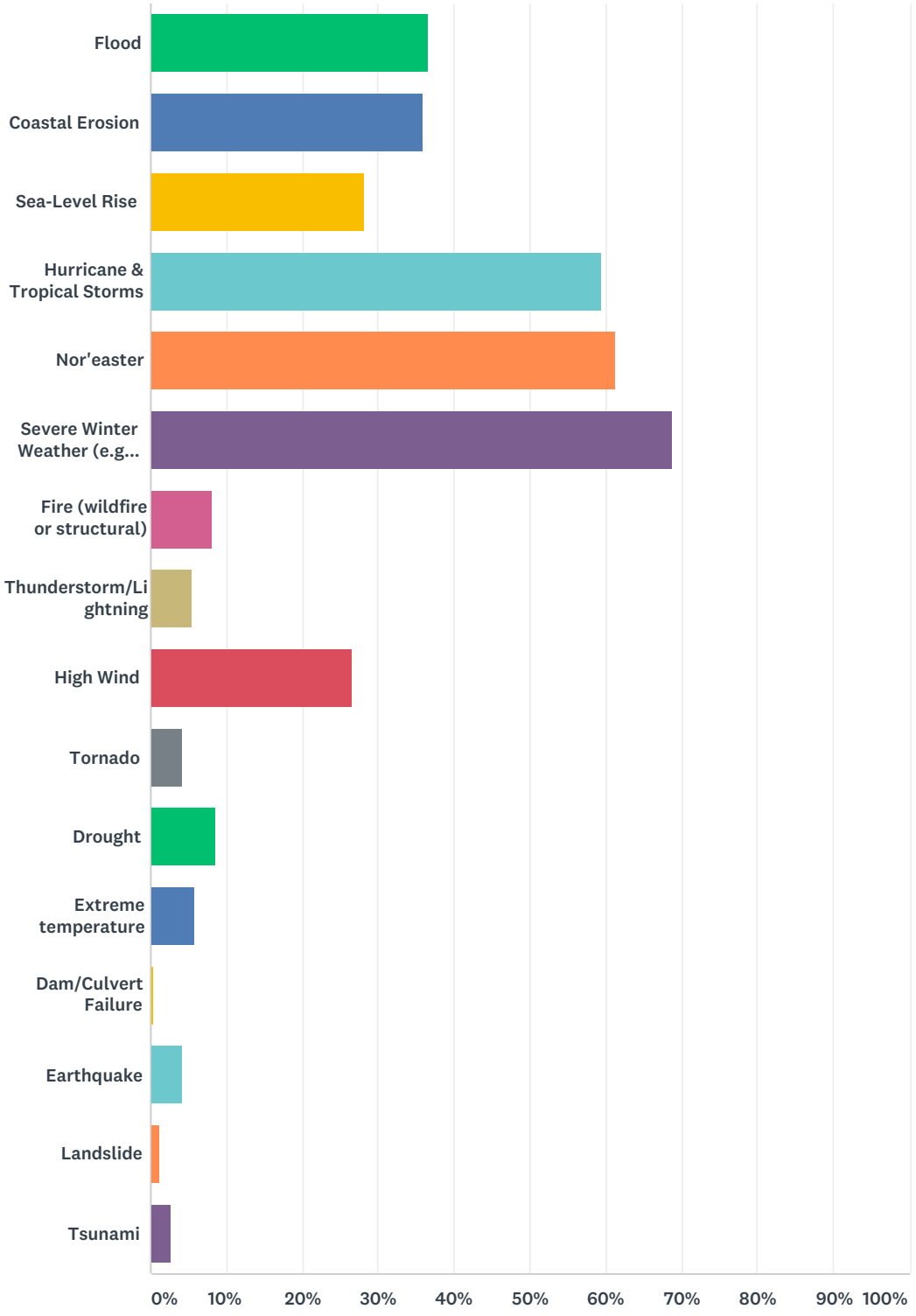
Answered: 259 Skipped: 0



ANSWER CHOICES	RESPONSES	
Flood	29.73%	77
Coastal Erosion	30.50%	79
Sea-Level Rise	16.22%	42
Hurricane & Tropical Storms	63.32%	164
Nor'easter	93.05%	241
Severe Winter Weather (e.g., Snow, Blizzard, Ice Storm)	92.28%	239
Fire (wildfire or structural)	5.79%	15
Thunderstorm/Lightning	79.92%	207
High Wind	79.54%	206
Tornado	1.93%	5
Drought	32.43%	84
Extreme Temperature	32.82%	85
Dam/Culvert Failure	0.00%	0
Earthquake	3.47%	9
Landslide	0.00%	0
Tsunami	0.00%	0
I have not experienced a weather-related disaster while living, working, or visiting Marshfield	2.32%	6
Total Respondents: 259		

Q2 In your opinion, which of the following natural hazards are you most concerned about?(You can select more than 1 answer)

Answered: 259 Skipped: 0

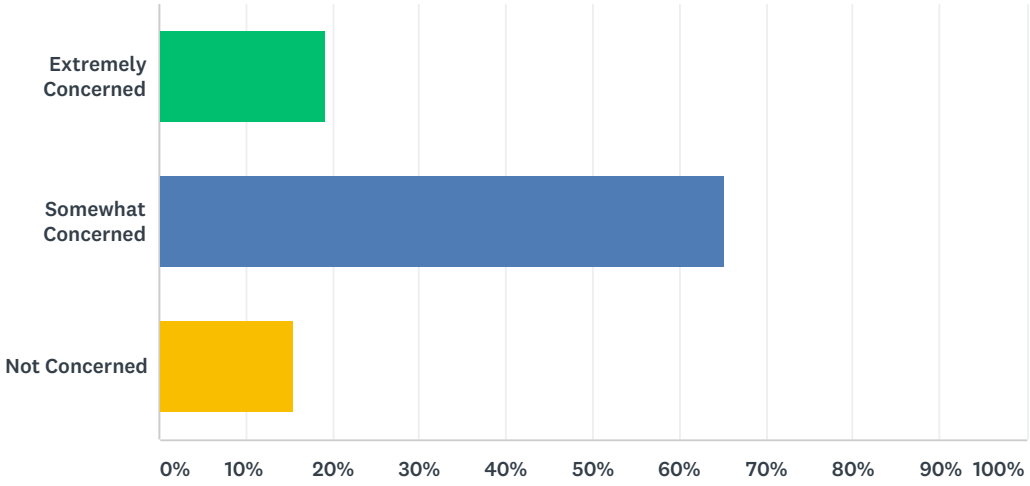


ANSWER CHOICES	RESPONSES

Flood	36.68%	95
Coastal Erosion	35.91%	93
Sea-Level Rise	28.19%	73
Hurricane & Tropical Storms	59.46%	154
Nor'easter	61.39%	159
Severe Winter Weather (e.g., Snow, Blizzard, Ice Storm)	68.73%	178
Fire (wildfire or structural)	8.11%	21
Thunderstorm/Lightning	5.41%	14
High Wind	26.64%	69
Tornado	4.25%	11
Drought	8.49%	22
Extreme temperature	5.79%	15
Dam/Culvert Failure	0.39%	1
Earthquake	4.25%	11
Landslide	1.16%	3
Tsunami	2.70%	7
Total Respondents: 259		

Q3 How concerned are you about the possibility of any natural hazards impacting Marshfield?

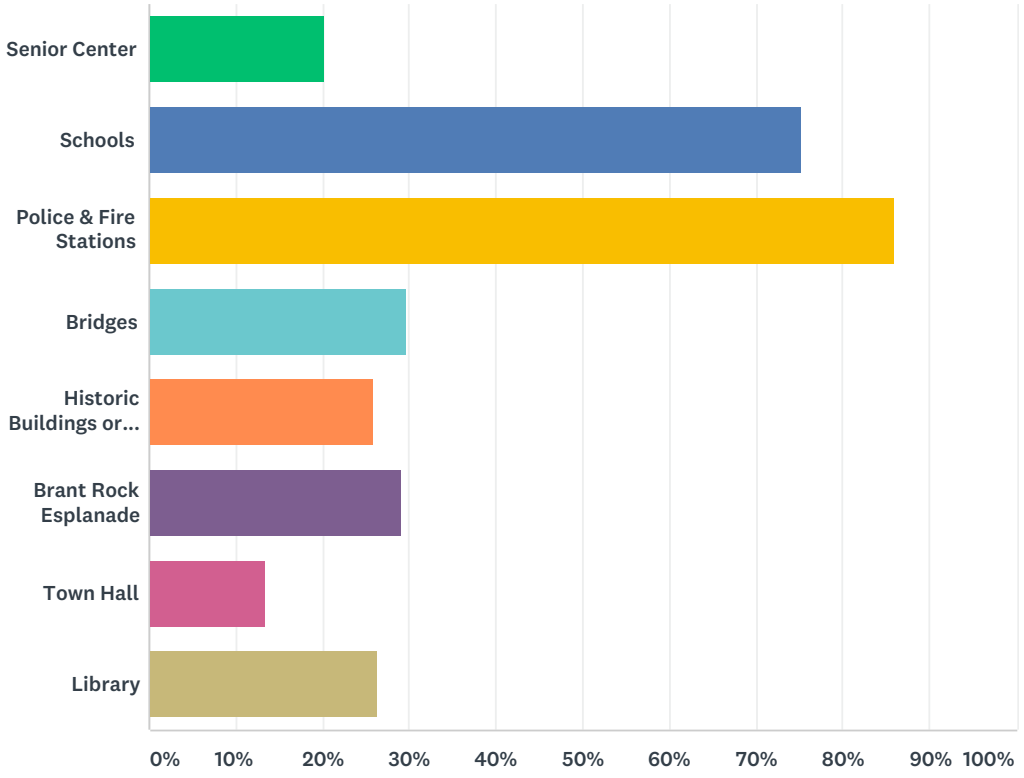
Answered: 259 Skipped: 0



ANSWER CHOICES	RESPONSES	
Extremely Concerned	19.31%	50
Somewhat Concerned	65.25%	169
Not Concerned	15.44%	40
TOTAL		259

Q4 What specific community assets are most important to you? (You can select more than 1 answer)

Answered: 255 Skipped: 4



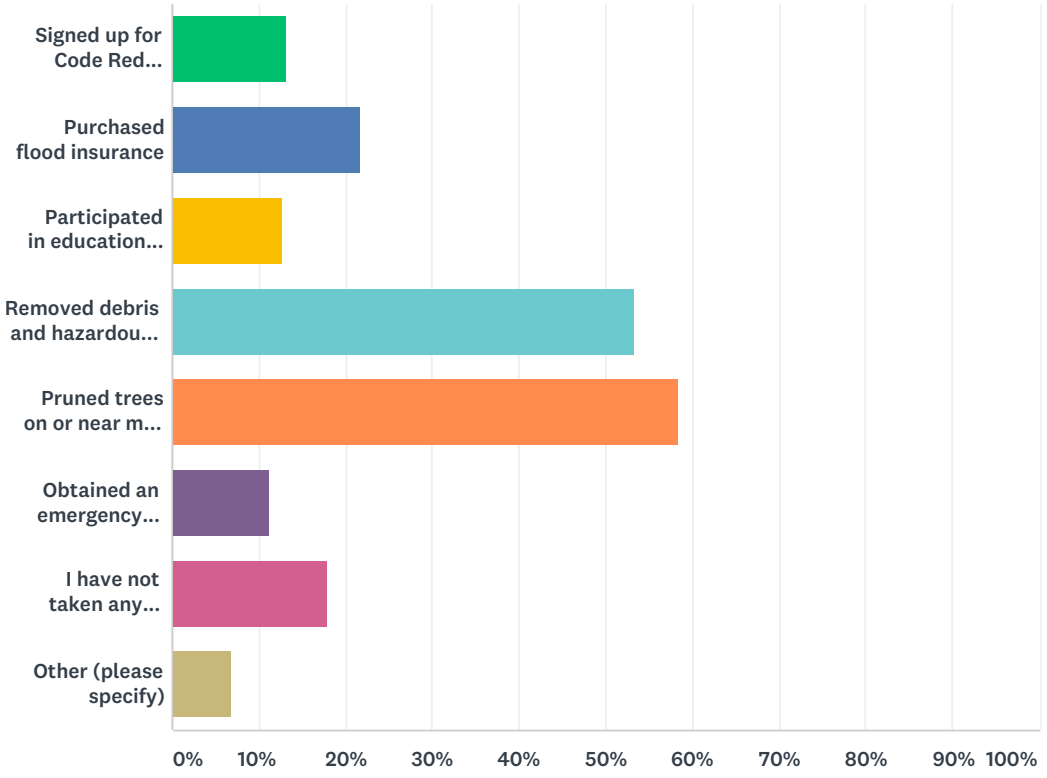
ANSWER CHOICES	RESPONSES	
Senior Center	20.39%	52
Schools	75.29%	192
Police & Fire Stations	85.88%	219
Bridges	29.80%	76
Historic Buildings or Sites	25.88%	66
Brant Rock Esplanade	29.02%	74
Town Hall	13.33%	34
Library	26.27%	67
Total Respondents: 255		

#	IF A COMMUNITY ASSET IMPORTANT TO YOU IS NOT LISTED OR YOU WOULD LIKE TO IDENTIFY A SPECIFIC LOCATION(S) (I.E. SPECIFIC BRIDGE, SCHOOL, HISTORIC BUILDING, ETC.) PLEASE ENTER THESE BELOW	DATE
1	beaches	9/21/2017 6:31 PM
2	Road /Pot holes/Patches	9/19/2017 8:27 AM
3	all of above prioritized by risk	9/18/2017 10:42 AM

4	Beaches	9/16/2017 8:39 AM
5	development that impacts others (ie. tree removal causing neighbor's flooded basement)	9/15/2017 11:28 AM
6	Marina, pier	9/15/2017 9:45 AM
7	beaches	9/15/2017 8:16 AM
8	Peter Igo Park	9/15/2017 12:24 AM
9	Transfer Station	9/14/2017 11:48 PM
10	Local businesses	9/14/2017 10:30 PM
11	Beaches and access to them for senior citizens.	9/14/2017 10:00 PM
12	Parks and woodland trails	9/14/2017 9:34 PM
13	Beaches	9/14/2017 9:23 PM
14	Beaches	9/14/2017 8:46 PM
15	Beaches	9/14/2017 8:45 PM
16	harbor	9/14/2017 8:33 PM
17	Beaches	9/14/2017 8:17 PM
18	Dpw not included?	9/14/2017 8:00 PM
19	Beaches	9/14/2017 6:55 PM
20	Animal Shelter	9/14/2017 6:55 PM
21	Athletic Fields	9/14/2017 6:52 PM
22	Beach wall. We need to hold the line! Haha	9/14/2017 6:51 PM
23	All beaches, passive recreation land	9/14/2017 6:40 PM
24	existing way of life!	9/14/2017 6:26 PM
25	Church in Marshfield center	9/14/2017 6:01 PM
26	the power station that sites low on South River Street	8/30/2017 8:17 AM
27	Beaches	8/29/2017 4:45 PM

Q5 Which of the following actions have you taken to be more hazard resistant?(You can select more than 1 answer)

Answered: 257 Skipped: 2



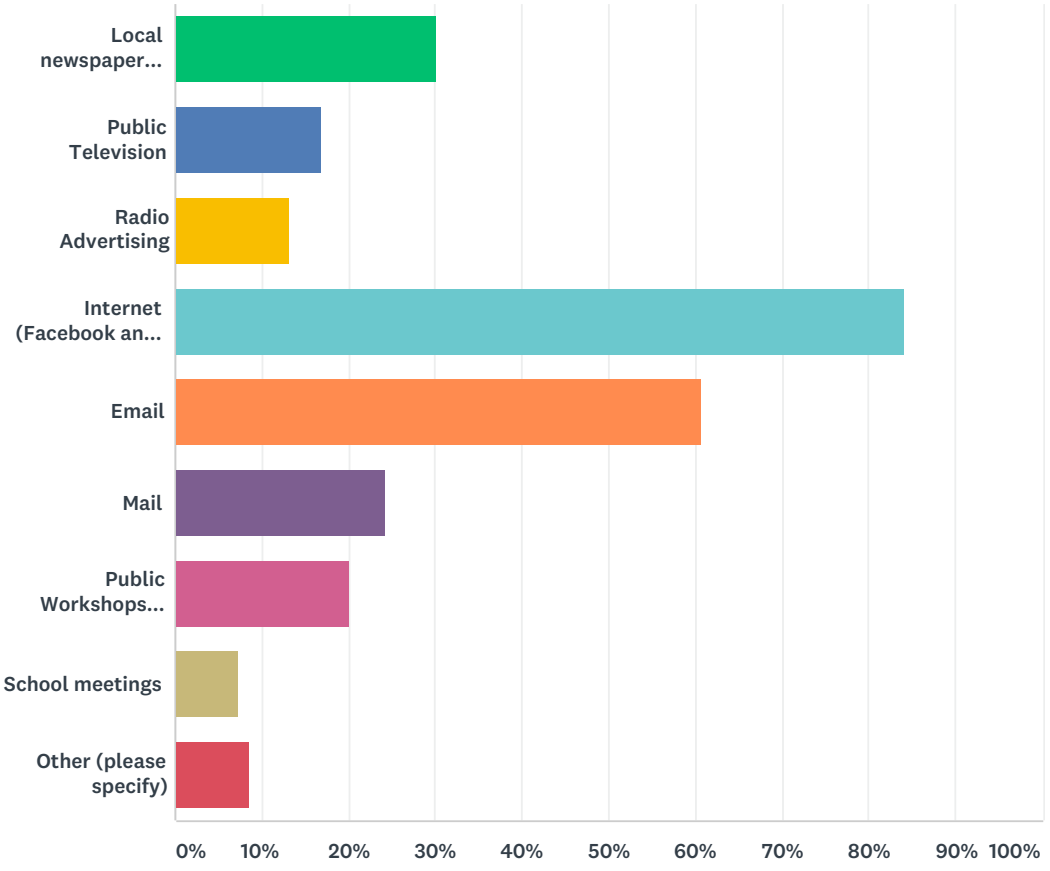
ANSWER CHOICES	RESPONSES	
Signed up for Code Red through the Plymouth County Sheriff's Department	13.23%	34
Purchased flood insurance	21.79%	56
Participated in educational activities and trainings about hazard and emergency preparedness	12.84%	33
Removed debris and hazardous materials from my property	53.31%	137
Pruned trees on or near my property	58.37%	150
Obtained an emergency response kit	11.28%	29
I have not taken any actions to be more hazard resistant	17.90%	46
Other (please specify)	7.00%	18
Total Respondents: 257		

#	OTHER (PLEASE SPECIFY)	DATE
1	i have stored water and food for an emergency.	9/21/2017 6:31 PM
2	Generator and water	9/17/2017 1:42 PM
3	Moved	9/17/2017 1:04 PM
4	Purchased generator	9/17/2017 9:38 AM

5	RN	9/16/2017 6:47 PM
6	We have a supply of water and freeze dried food.	9/16/2017 11:19 AM
7	Purchased a generator	9/16/2017 8:39 AM
8	Generator, food supplies, water supplies	9/15/2017 10:27 PM
9	generator, emergency food rations, etc	9/15/2017 9:09 AM
10	'Forced' to carry flood insurance.	9/14/2017 11:48 PM
11	At another property in Florida as a result of Hurricane Irma which could easily happen in Marshfield. Maybe a	9/14/2017 10:28 PM
12	Didn't know I had to sign up for code red. Thought it would be automatic	9/14/2017 9:13 PM
13	genrator	9/14/2017 8:33 PM
14	Supplies and go bag	9/14/2017 8:01 PM
15	have kept up in readings about situations and also preparations to be made.	9/14/2017 7:27 PM
16	Install generators	9/14/2017 7:25 PM
17	Attend flood map info meetings	9/14/2017 6:36 PM
18	Purchased a back up generator	9/14/2017 6:21 PM

Q6 What is the most effective way to engage you in hazard planning and emergency preparedness activities? (You can select more than 1 answer)

Answered: 259 Skipped: 0



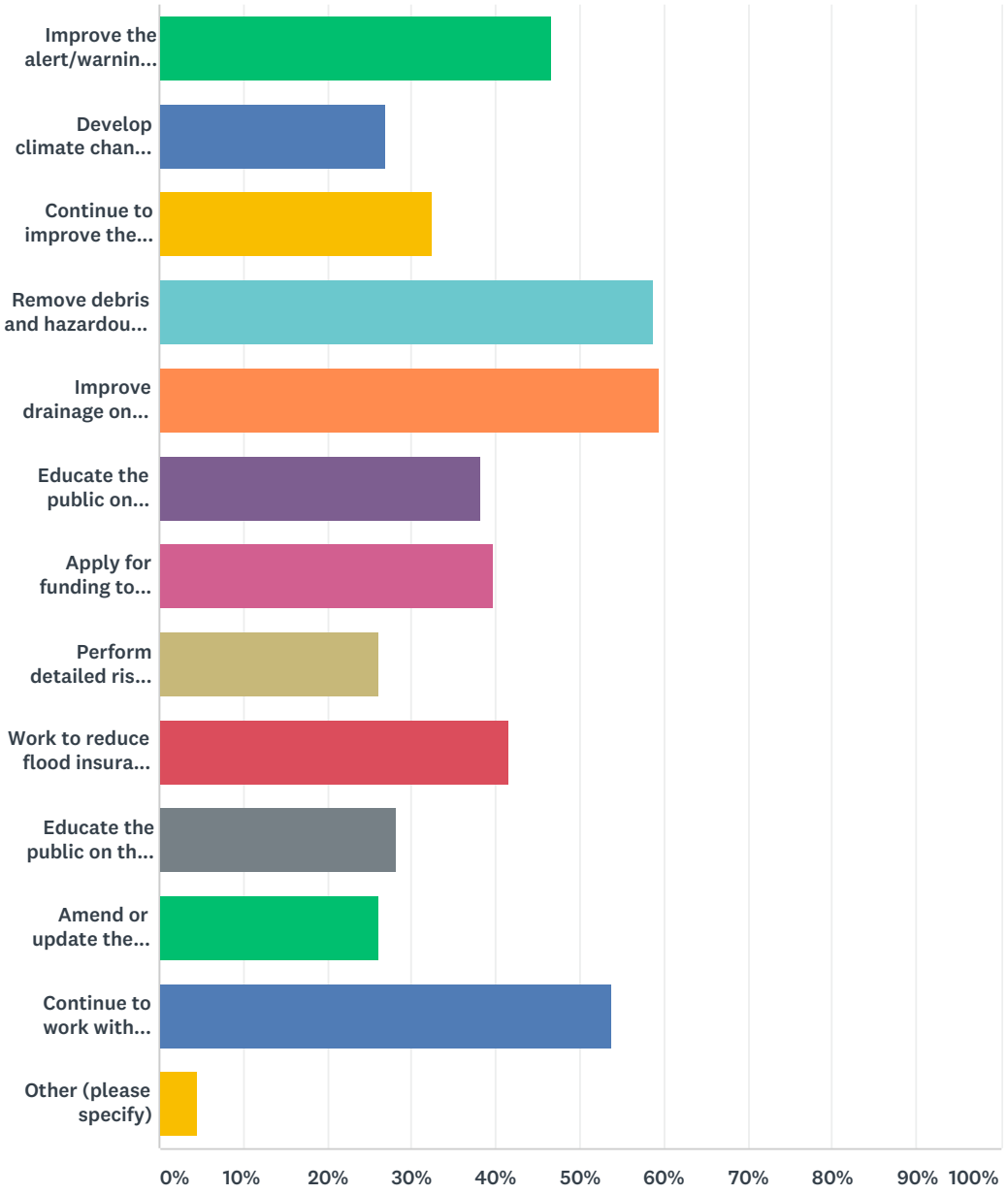
ANSWER CHOICES	RESPONSES	
Local newspaper (Marshfield Banner and/or Cape Cod Times)	30.12%	78
Public Television	16.99%	44
Radio Advertising	13.13%	34
Internet (Facebook and Town website)	84.17%	218
Email	60.62%	157
Mail	24.32%	63
Public Workshops and/or meetings	20.08%	52
School meetings	7.34%	19
Other (please specify)	8.49%	22
Total Respondents: 259		

#	OTHER (PLEASE SPECIFY)	DATE
1	twitter, robo text messaging	9/15/2017 11:50 AM

2	Twitter	9/15/2017 6:43 AM
3	phone calls from police and county about situations as they occur	9/15/2017 2:40 AM
4	Marshfield Mariner, Ledger, WATD	9/15/2017 12:24 AM
5	Town website is terrible.	9/14/2017 10:30 PM
6	Maybe a town App for residents to engage those that sign up.	9/14/2017 10:28 PM
7	Town-wide phone messages	9/14/2017 10:00 PM
8	Internet	9/14/2017 9:24 PM
9	Patriot ledger	9/14/2017 9:23 PM
10	Twitter	9/14/2017 8:51 PM
11	Twitter	9/14/2017 8:45 PM
12	Instagram	9/14/2017 8:13 PM
13	Online research	9/14/2017 7:35 PM
14	I do try to monitor local twitter accounts for these purposes	9/14/2017 7:27 PM
15	But no more government jobs!!!!	9/14/2017 7:12 PM
16	Twitter	9/14/2017 6:40 PM
17	Reverse 911	9/14/2017 6:30 PM
18	Twitter	9/14/2017 6:22 PM
19	Twitter	9/14/2017 6:14 PM
20	Twitter	9/14/2017 6:10 PM
21	Text alerts	9/14/2017 6:01 PM
22	telephone and or text messages to mobile phones	8/30/2017 8:17 AM

Q7 What steps can your local government take to reduce its risk from natural hazards and protect the buildings and people of Marshfield? (You can select more than 1 answer)

Answered: 259 Skipped: 0



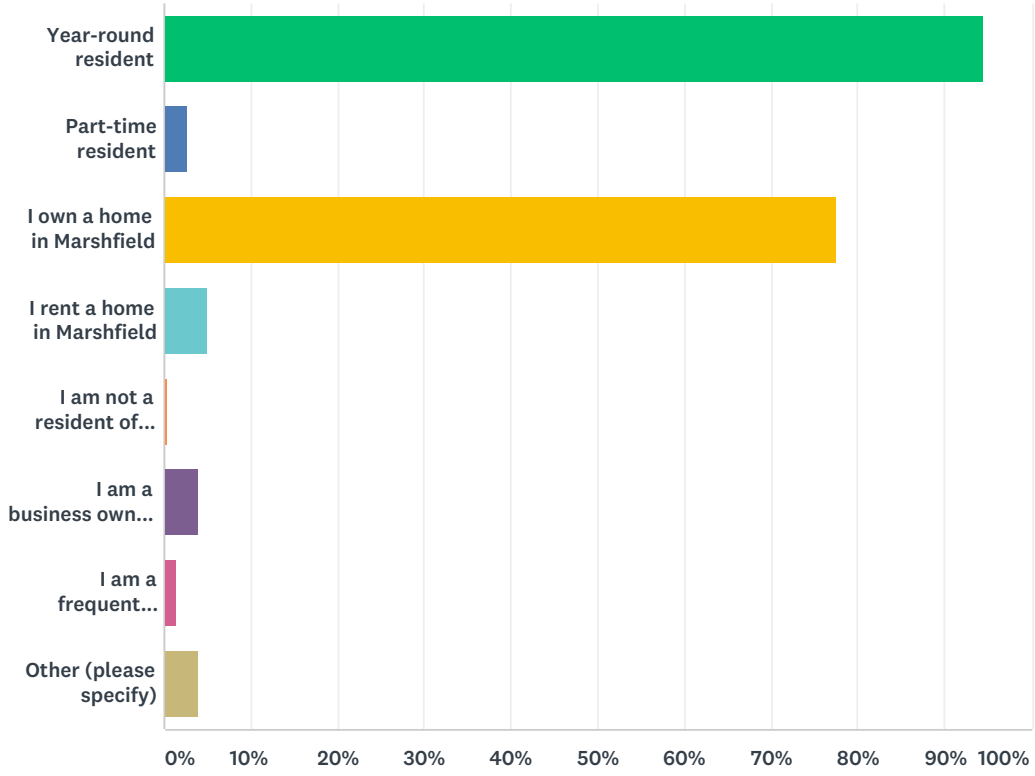
ANSWER CHOICES	RESPONSES	
Improve the alert/warning/notification system	46.72%	121
Develop climate change adaptation plans and implement them	27.03%	70
Continue to improve the emergency shelter in town	32.43%	84
Remove debris and hazardous materials as well as prune trees on town property	58.69%	152

Improve drainage on area roads	59.46%	154
Educate the public on evacuation methods	38.22%	99
Apply for funding to reduce Marshfield's risk to natural hazards	39.77%	103
Perform detailed risk assessments	26.25%	68
Work to reduce flood insurance for residents through the Community Rating System	41.70%	108
Educate the public on the science of natural hazards and emergency preparedness	28.19%	73
Amend or update the Marshfield Zoning Bylaws as they relate to Flooding	26.25%	68
Continue to work with regional partners to prepare for and recover from natural hazards	53.67%	139
Other (please specify)	4.63%	12
Total Respondents: 259		

#	OTHER (PLEASE SPECIFY)	DATE
1	Maintain that wires and telephone poles, many of which are leaning because of the winds. Those that are leaning should be replaced so that it may ease the burden of a storm goes through and they fall as a result.	9/16/2017 8:39 AM
2	educate on how Marshfield would most likely be impacted from a variety of natural hazards so people choose appropriate responses when these things happen.	9/15/2017 10:27 PM
3	Ask to stop rebuilding homes destroyed by the ocean, create a breakwater	9/15/2017 10:19 PM
4	stop allowing homes to be built in known flood areas/zones	9/15/2017 9:09 AM
5	Bury power lines underground when possible. Specifically when doing major roadwork. Lost opportunity on 139 project	9/15/2017 6:43 AM
6	federal funding to repair seawalls as long as residents are made aware they don't own the seas walls they are public property if not let them build their own walls.	9/15/2017 2:40 AM
7	Beach replenishment, improve sea walls	9/14/2017 6:55 PM
8	SHIFT TOTAL PREVENTION EFFORTS FROM SEAWALLS THAT BENEFIT INDIVIDUAL HOMEOWNERS TO PUBLICLY FUNDED FACILITIESS LIKE SEWER PUMPING AND BRIDGE ELEVATION ESCAPE ROUTES	9/3/2017 2:44 PM
9	offer email/text link from town website for important info. Scituate offers this and friends say it is very helpful.	9/1/2017 4:33 PM
10	Provide pet friendly shelters	8/31/2017 3:32 PM
11	Install emergcey pump at the dike. to pump the RIVER AT LOW TIDE WHEN STOEM SERGIS FORCAST	8/30/2017 10:05 AM
12	Keep trimming the trees and unclogging the storm drains	8/30/2017 8:17 AM

Q8 Please tell us about yourself. (Select all that apply to you)

Answered: 258 Skipped: 1



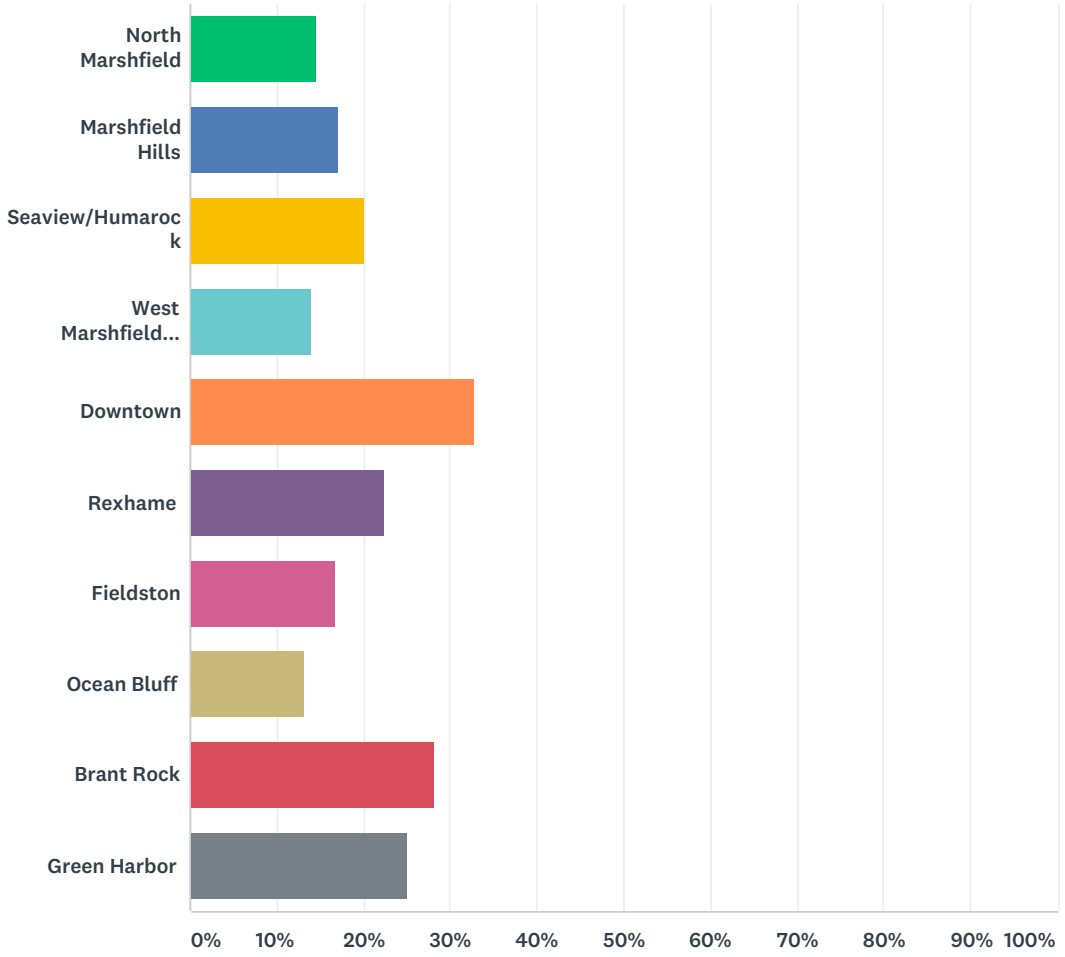
ANSWER CHOICES	RESPONSES	
Year-round resident	94.57%	244
Part-time resident	2.71%	7
I own a home in Marshfield	77.52%	200
I rent a home in Marshfield	5.04%	13
I am not a resident of Marshfield, but I am employed in Marshfield	0.39%	1
I am a business owner in Marshfield	3.88%	10
I am a frequent visitor to Marshfield	1.55%	4
Other (please specify)	3.88%	10
Total Respondents: 258		

#	OTHER (PLEASE SPECIFY)	DATE
1	we both also work from home	9/15/2017 10:27 PM
2	i live in senior housing	9/14/2017 11:46 PM
3	Own and live in an over 55 condo complex	9/14/2017 10:00 PM
4	Life long resident	9/14/2017 9:23 PM
5	Parents own the home	9/14/2017 8:46 PM
6	Used to live and owned a business in town	9/14/2017 7:39 PM

7	i own rental properties in marshfield.	9/14/2017 7:17 PM
8	I grew up my whole life in this town and plan to continue to raise my children here as along as I can	9/14/2017 6:59 PM
9	Work in marshfield	9/14/2017 6:55 PM
10	i am an involved citizen	9/3/2017 2:44 PM

Q9 Please identify the Village or Area(s) of Town in which you work, live, or visit frequently:

Answered: 258 Skipped: 1



ANSWER CHOICES	RESPONSES	
North Marshfield	14.73%	38
Marshfield Hills	17.05%	44
Seaview/Humarock	20.16%	52
West Marshfield (Plain Street)	13.95%	36
Downtown	32.95%	85
Rexhame	22.48%	58
Fieldston	16.67%	43
Ocean Bluff	13.18%	34
Brant Rock	28.29%	73
Green Harbor	25.19%	65

Town of Marshfield

Hazard Mitigation

Hazard Mitigation Plan Community Meeting

(Greg Guimond)

(From a Boston Newspaper)

We Are Looking For Your Input

There will be a presentation describing the importance of municipal hazard mitigation planning and an overview of the plan update process, followed by a discussion about hazards that have impacted Marshfield and what areas are perceived as most vulnerable. Come learn about how to keep your community, neighbors and family safe from the various natural hazards that could affect our Town and provide input on the development of the Marshfield's Hazard Mitigation Plan.

The workshop will be held at the new Ventress Memorial Library Program Room on August 29, 2017, from 6 to 8 PM

For more information contact Lt. Shaw at ashaw@marshfieldpolice.org
or Greg Guimond at gguimond@townofmarshfield.org

Town of Marshfield
Multi-Hazard Mitigation Plan Update
Public Meeting
August 29, 2017

	Name	Email (optional)
1	Greg Guimond	gguimond@TownofMarshfield.org
2	Wm. Connell	dawk217@aol.com.
3	Joe Rossi	Infomarshfield(coastal)coalition.org
4	Tom Calligan	DC@prostrong.com
5	Doris Crary	
6	David Allen	
7	Ann Pollard	apollard@shorelineaviation.net
8	Jack Sullivan	Jsullivan523@gmail.com
9	Val Massard	massard@town.duxbury.ma.us
10	Sean Robinson	spr.marshfvegas@gmail.com.
11	Bert O'Donnell	Bwad54@gmail.com
12	Louis Cipullo	lcipullo@marshfieldfire.org
13	Kathy Sullivan	Kat837@gmail.com
14	Janet McGrath	janet.mcgrath@comcast.net
15	Dana Childs (Sen. O'Connor's Office)	dana.childs@masenate.gov
16	Marlene Howard	PADUX02@AOL.COM
17	Tim Williams	williatj33@gmail.com
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Town of Marshfield

Hazard Mitigation

Hazard Mitigation Plan Community Meeting

(Greg Guimond)

(From a Boston Newspaper)

We Are Looking For Your Input

There will be a presentation by Woods Hole Group on the draft Hazard Mitigation Plan, followed by a discussion and comments. The presentation will describe the Town's progress to date, including results of the online public survey, identification of critical facilities and preliminary results from the vulnerability assessments. Come learn about how to keep your community, neighbors and family safe from the various natural hazards that could affect our Town and provide input on the draft Hazard Mitigation Plan.

The workshop will be held at the old Ventress Memorial Library Program Room on December 6, 2017, from 6 to 8 PM

For more information contact Lt. Shaw at ashaw@marshfieldpolice.org
or Greg Guimond at gguimond@townofmarshfield.org

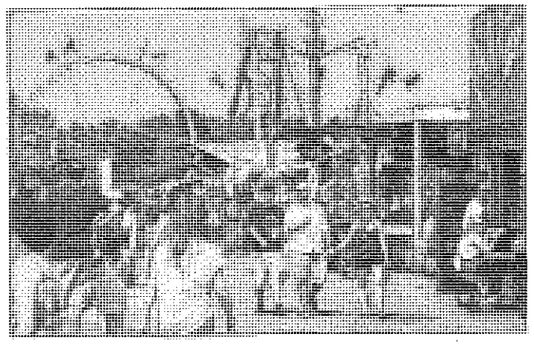
Marshfield Hazard Mitigation Plan Public Meeting 12-6-17

Valerie Massard
Greg Guimond
Arthur Shaw
Michael Mareseo
Joe Rossi
Doris Crary
Jack Sullivan
Kay Ramsey
James Kukstis

5 THINGS TO DO THIS WEEK

1 Visit the Fair. The 150th Marshfield Fair opens Friday, Aug. 18, with an enormous selection of activities and programs for people of all ages, from rides and games to demolition derby and live music to the agricultural and horticultural exhibits and competitions that tie the Fair to its roots. The Fair is held through August 27 and admission is $10, with children 6 and under entering for free. On site parking is $5 and gates are open every day from noon to 10 p.m. For more information and full schedule of events visit marshfieldfair.org.

2 Celebrate one year of Rock Steady Boxing. Rock Steady Boxing began on the South Shore one year ago, giving people with Parkinson's disease hope by improving their quality of life through a non-contact boxing based fitness curriculum. To celebrate their anniversary and raise money for their future, the non-profit is hosting an anniversary party at Haddad's Ocean Café on Thursday, Aug. 17 from 5-8 p.m. Tickets are $45 and can be purchased at eventbrite.com/e/rock-steady-boxing-south-shore-anniversary-party-tickets-34171185937?aff=efbeventtix, where you can also find more information. Haddad's is located at 291 Ocean St.



3 Sing songs and share stories of the sea. On Monday, Aug. 21 at 1 p.m. the Marshfield Council on Aging will celebrate summer and the diverse heritage of the New England Coastal Region by hosting a performance by Parents' Choice Award winning storyteller Davis Bates. The program will involve the audience in a variety of cultural traditions, including ghost ballads & sea chanteys, Native American stories, folk tales and family tales, sing-alongs and a lesson in how to play music with your kitchen spoons. A summer dessert will be served. Stop by the front desk at the senior center, 230 Webster St, or call at 781-834-5581 to register.

4 Gain a new perspective on a historic home. Throughout August, the Winslow House is hosting themed tours every Sunday. This weekend, the tour will be themed "Slaves and servants of the Winslow Family", telling the stories of Bette, Briton, Nab Nowitt and Cato, all of whom sent time working for the family. Come see this unique twist on Sunday, Aug. 20 with tours starting at 1 p.m., 2 p.m. and 3 p.m. Cost is $5 per adult and $3 per child. The Winslow House is located at 634 Careswell St.

5 Gala for a good cause. Join St. Ann's by the Sea for a benefit this Saturday, Aug. 19 from 7-10 p.m. at the Daniel Webster Estate. Proceeds from the event will benefit the Constanza Medical Mission and the St. Ann by the Sea Missionary Program. Tickets are $50 and can be purchased at the door or at stanns.net/mission-seaside-gala. The Daniel Webster Estate is located at 238 Webster St.

SCHEDULE

First Congregational Church of Marshfield announces events

The First Congregational Church of Marshfield has announced two upcoming events.

The church will hold Sunday School and Confirmation class registration at 9:30 a.m. Sept. 3 at the church, 1981 Ocean St. Sunday school is open to children in nursery school through seventh grade. Communion class is open to children in second grade. Confirmation class is open to students in eighth through 10th grades.

The church will hold a picnic on Sept. 10. A Sunday School kickoff and worship service will be held at 9:30 a.m., and the picnic will begin at 10:30 a.m. The event is free.

BRIEFS

Ventress Memorial Library to host Hazard Mitigation Plan meeting

A presentation about municipal hazard mitigation will be held from 6 to 8 p.m. Aug. 29 at the Ventress Memorial Library, 15 Library Plaza.

The meeting will detail mitigation planning and discuss hazards that have impacted Marshfield.

For more information, contact Arthur Shaw at ashaw@marshfieldpolice.org or Greg Guimond at gguimond@townofmarshfield.org.

North Community Church announces worship services

North Community Church will hold a Sunday Service of Worship at 9:30 a.m. Aug. 20 at the church, 72 Old Main St.

The Rev. Frederick Hayes will preach.

For more information, visit northcommunitychurch.org, call 781-837-3784 or email office@northcommunitychurch.org.

POLICE LOGS

The following are excerpts from the Marshfield police log for Thursday, Aug. 3, through Friday, Aug. 11. The log is public record and available for review. All persons are presumed innocent unless found guilty in a court of law.

Thursday, Aug. 3

9 a.m.: An animal complaint was reported on Main Street.
10:14 a.m.: Medical help was requested on Webster Street.
11:59 a.m.: Suspicious activity was reported on Ocean Street.
12:06 p.m.: Larceny, forgery or fraud was reported on Damons Point Road.
12:31 p.m.: A motor vehicle accident was reported on Careswell Street.
11:23 a.m.: Medical help was requested on Spring Street.
11:30 a.m.: Medical help was requested on Village Green Way.
11:49 a.m.: An animal complaint was reported on Webster Square.
3:52 p.m.: Medical help was requested on Moraine Street.
5:15 p.m.: An animal complaint was reported on Plain Street.
6:39 p.m.: Medical help was requested on Union Street.
9:05 p.m.: Medical help was requested on Royal Dane Drive.
9:17 p.m.: Suspicious activity was reported on Union Street and Hunter Drive.
10:32 a.m.: Vandalism was reported on Ocean Street.
11:33 a.m.:Medical help was requested on Village Green Way.
2:54 p.m.: Medical help was requested on Beach Street.
4:15 p.m.: An animal complaint was reported on Snow Road.
4:53 p.m.: A motor vehicle accident was reported on Ocean Street.
5:17 p.m.: Medical help was requested on Main Street.
6:22 p.m.: Medical help was requested on Main Street.
8:02 p.m.: An animal complaint was reported on Ferry Street.
8:08 p.m.: Medical help was requested on Plain Street.
10:32 p.m.: A motor vehicle accident was reported on Ocean Street.
12:18 p.m.: Larceny , forgery or fraud was reported on Main Street.
2:11 p.m.: Medical help was requested on Pilgrim Trail.
3:17 p.m.: Suspicious activity was reported on Ocean Street.
3:41 p.m.: An animal complaint was reported at Couch Cemetery on Union Street.
4:57 p.m.: Medical help was requested on Frisbie Road.
5:30 p.m.: Medical help was requested on Ocean Street.
7:11 p.m.: Medical help was requested on Ocean Street.
8:35 p.m.: Medical help was requested on Fourth Road.
9:12 p.m.: Medical help was requested on Village Green

Front page of the Town of Marshfield website announcing the August 29 public meeting and the page with the actual announcement and link to flyer

Marshfield Citizens Coastal Coalition UPDATE

Hazard Mitigation Public Meeting

The Town of Marshfield will be having a public Hazard Mitigation Plan meeting on December 6th from 6pm to 8pm at the Ventress Library Program Room. This meeting will discuss the draft hazard mitigation plan, with discussion and comments. There will be a presentation about the town progress to date, including the results of the online survey.

Hull Successful in Map Revision

Due to a Letter of Map Revision (LOMR) submitted by the Town of Hull, flood maps for the town are changing. This change will be effective December 13th. If you are a resident of Hull, the LOMR will have one of three effects on you:

- No effect- you either remain in or out of the Special Flood Hazard Area (SFHA)
- You are removed from being in the SFHA
- Your flood elevation is lowered

The MCCC Executive Board

Joe Rossi- Chair

Tim Williams- Vice Chair

Steve Amico- Treasuer

Doris Crary- Clerk

Tim Carty- Director

Sue Sullivan- Director

Contact us any time!

Info@marshfieldcoastalcoalition.org

www.marshfieldcoastalcoalition.org

Hazard Mitigation Plan Community Meeting

POSTED ON: AUGUST 11, 2017 - 10:09AM

Town of Marshfield

Hazard Mitigation Plan Community Meeting

We Are Looking For Your Input

There will be a presentation describing the importance of municipal hazard mitigation planning and an overview of the plan update process, followed by a discussion about hazards that have impacted Marshfield and what areas are perceived as most vulnerable. Come learn about how to keep your community, neighbors and family safe from the various natural hazards that could affect our Town and provide input on the development of the Marshfield's Hazard Mitigation Plan.

The workshop will be held at the new Ventress Memorial Library Program Room on August 29, 2017, from 6 to 8 PM

For more information contact Lt. Shaw at ashaw@marshfieldpolice.org

or Greg Guimond at gguimond@townofmarshfield.org

Attachment	Size
haz_mit_workshop_flyer.pdf	188.95 KB

Appendix C: Critical Facilities and Vulnerability

1. Critical Facilities List w/Vulnerabilities
2. Mitigation Actions Prioritization
3. Removed Mitigation Actions

Category	Critical Facility Name	Address	Hazards					
			FEMA Flood Zone	Within Local Flood Areas	Min SLR (ft) That Will Affect Facility	Min Hurricane Category That Will Affect Facility	Within Wind District	Within High Fire Hazard Area
Airport	Town Airport		AE	No	1	1	Yes	No
Churches	First Congregation Church	1994 Ocean St	0	No	>6ft	>4	No	No
	Union Chapel	327 Ocean St	AE	No	>6ft	3	Yes	No
	North Community Church	72 Old Main St	0	No	>6ft	>4	No	No
	New Hope Chapel	52 Main St	0	No	>6ft	>4	No	No
	St Mary & St. George Coptic Orthodox	255 Furnace St	0	No	>6ft	>4	No	No
	Pudding Hill Pre-school/Sanctuary Church	185 Plain St	0	No	>6ft	>4	No	No
	Trinity Episcopal	229 Highland St	0	No	>6ft	>4	No	No
	St Anne's Church	587 Ocean St	AE	No	>6ft	3	Yes	No
	St Teresa's Church	Across from 100 Elm St	0	No	>6ft	>4	Yes	No
	St Christeen's Parish	1295 Main St	0	No	>6ft	>4	No	Yes
	Assumption Church	40 Canal St	0	No	>6ft	4	Yes	No
	Marshfield United Methodist	185 Plain St	0	No	>6ft	>4	No	No
Coastal Infrastructure	Timber Bulk Head		VE	Yes	1	1	Yes	No
	South River Revetment (Area #2)		AE	No	1	1	Yes	No
	Fieldston Sea Wall (Area 3)		VE	No	1	1	Yes	No
	Ocean Bluff Sea Wall (Area #4)		VE	Yes	1	1	Yes	No
	Ocean Bluff Stone Revetment (Area #4)		VE	Yes	1	1	Yes	No
	Hewitt's Point Sea Wall (Area #5)		VE	No	1	1	Yes	No
	Hewit's Revetment (Area #5)		VE	No	1	1	Yes	No
	Brant Rock Seawall (Area #6) Part A		VE	No	1	1	Yes	No
	Brant Rock Seawall (Area #6) Part B		VE	Yes	3	1	Yes	No
	Brant Rock Revetment		VE	No	1	1	Yes	No
	Brant Rock Rip Rap Slope		VE	No	1	1	Yes	No
	Town Pier Sea Wall		AE	No	4	2	Yes	No
	Green Harbor Stone Jetty East		VE	No	1	1	Yes	No
	Green Harbor Stone Jetty West		VE	Yes	>6ft	1	No	No
	Bay Ave Sea Wall		VE	No	1	1	Yes	No
	Bay Ave Access Ramp		VE	No	4	2	Yes	No
Dams	Dam - Magoun Pond Dam	East of 71 Mill Pond Lane	0	No	>6ft	>4	No	Yes
	Dam - Oakman Pond Dam	West of 390 Union St	0	No	>6ft	>4	No	Yes
	Dam - Hatch Pond Dam	West of 431 Union St	A/AO	No	>6ft	4	No	No
	Dam - Damons Point Pond Dam	North of 6 Damons Point Rd	AE	No	1	1	Yes	No
	Dam - Chandlers Pond Dam	115 & 122 Cross St	0	No	>6ft	>4	No	No
	Dam - Little Pond Dam	West of 26 Summer St	A/AO	No	4	3	Yes	No
	Dam - Wales Pond Dam	506 Pleasant St	A/AO	No	>6ft	>4	No	No
	Dam - Mounce Pond Dam	South of 481 Union St	AE	No	1	1	No	No
	Dam - Daniel Webster Pond Dam	South of 74 Presidential Circle	AE	No	3	1	No	No
	Dam - Parsons Pond Dam	West of 101 Old Plain St	0	No	>6ft	3	No	No
	Dam - Furnace Pond Dam	West of 457 Main St	A/AO	No	>6ft	>4	No	No
	Dam - Dyke Rd Dam		AE	Yes	1	1	Yes	No

Category	Critical Facility Name	Address	Hazards					
			FEMA Flood Zone	Within Local Flood Areas	Min SLR (ft) That Will Affect Facility	Min Hurricane Category That Will Affect Facility	Within Wind District	Within High Fire Hazard Area
	Dam - Bares Brook Dam (Louis Pond Dam)		AE	No	>6ft	>4	Yes	No
Fairgrounds	Marshfield Fair	33 South River St	0	No	>6ft	3	No	No
Fire/Police Stations	Fire Station #2	229 Old Main St	0	No	>6ft	>4	Yes	No
	Marshfield Fire Department	60 South River Street	0	No	>6ft	>4	No	No
	Fire Station #1	21 Massasoit St	0	No	>6ft	>4	Yes	No
	Marshfield Police Station/EOC	1639 Ocean St	0	No	>6ft	4	No	No
Fuel (Gas, Oil, Propane, etc)	Ocean Bluff Auto	969 Ocean St	AE	No	3	1	Yes	No
	Taylor Lumber Propane	2075 Ocean St	0	No	>6ft	4	No	No
	Cedar View Filling Station	430 Careswell St	0	No	>6ft	>4	Yes	No
	A L Prime	2170 Ocean St	0	No	>6ft	>4	No	No
	Rand Handy Oil Co	900 Webster St	AE	No	6	2	No	No
	Public Petro	1933 Ocean St	0	No	>6ft	4	No	No
	Bill's Sunco	2054 Ocean St	0	No	>6ft	3	No	No
	Speedway Gas Station	2139 Ocean St	0	No	>6ft	>4	No	No
	Shell Gas Station	2126 Ocean St	0	No	>6ft	>4	No	No
	Williams Coal & Oil Co.	717 Plain St	0	No	>6ft	>4	No	No
	Bay State Gas	South of 180 Enterprise Dr	0	No	>6ft	>4	No	No
	Rand Handy Propane	851 Webster St	0	No	>6ft	4	No	No
	Taylor Marine	95 Central St	AE	No	1	1	Yes	No
	Roht Marine	2205 Main St	AE	No	1	1	Yes	No
	Town of Marshfield Fuel Staton		AE	No	5	2	No	No
	Maintenance Facility	86 Enterprise Dr	0	No	>6ft	>4	No	No
Historic Properties	Marcia Thomas House	65 Webster St	0	No	>6ft	>4	No	Yes
	Seth Ventress Building	Seth Ventress Building	0	No	>6ft	>4	No	No
	Winslow School House	610 Careswell St	0	No	>6ft	>4	No	No
	Winslow House	634 Careswell St	0	No	>6ft	>4	No	Yes
	Daniel Webster House	238 Webster St	0	No	>6ft	>4	No	No
Housing	Prence Grant Apt #1	780 Webster St	0	No	>6ft	4	No	No
	Prence Grant Apt #2	40 Parsonage St	AE	No	>6ft	4	No	No
	Marshfield Housing Authority - Housing	12 Tea Rock Gardens	0	No	>6ft	>4	No	No
	Proprietors Green Village (Welch Healthcare)	10 VIllage Green	0	No	>6ft	>4	No	No
	Winslow Village #1	1520 Ocean St	0	No	6	2	No	No
	Winslow Village #2	1554 Ocean St	0	No	>6ft	4	No	No
	Grace Ryder Apartments	135 Main St	0	No	>6ft	>4	No	No
	Bridge Way Inn	1265 Ferry St	AE	No	4	3	Yes	No
	Fairview Inn	133 Ocean St	0	No	>6ft	>4	Yes	No
Municipal Buildings	Main Post Office	11 Snow Rd	0	No	>6ft	>4	No	No
	Marshfield Town Hall	870 Moraine St	0	No	>6ft	>4	No	No
	Marshfield Senior Center	230 Webster St	0	No	>6ft	>4	No	No
	DPW Barn	35 Parsons St	AE	No	>6ft	3	No	No
	Road to Responsibility/Ventress Public Library	1831 Ocean St	AE	No	3	1	No	No

Category	Critical Facility Name	Address	Hazards					
			FEMA Flood Zone	Within Local Flood Areas	Min SLR (ft) That Will Affect Facility	Min Hurricane Category That Will Affect Facility	Within Wind District	Within High Fire Hazard Area
	Green Harbor Marina	239 Dyke Rd	VE	Yes	1	1	Yes	No
	Marshfield Town Pier/Harbor Master Building	100 Central St	VE	Yes	1	1	Yes	No
	Ridge Road Public Launch Ramp	9 Ridge Rd	AE	Yes	1	1	Yes	No
Retail (Grocery, Pharmacy, etc.)	Rite Aid	1914 Ocean St	0	No	>6ft	>4	No	No
	Brant Rock Food Market	72 Dyke Rd	AE	No	3	2	Yes	No
	CVS	1880 Ocean St	0	No	>6ft	4	No	No
	Walgreens Pharmacy	2177 Ocean St	0	No	>6ft	>4	No	No
	Roche Brothers	605 Plain St	0	No	>6ft	>4	No	No
	Star Market	0 Snow Rd	0	No	>6ft	>4	No	No
Schools	South River School	59 Hatch St	AE	No	4	2	No	No
	Daniel Webster School	1456 Ocean St	0	No	>6ft	3	No	No
	Furnace Brook Middle School	500 Furnace St	0	No	>6ft	>4	No	No
	Martinson Elementary School	257 Forest St	0	No	>6ft	>4	No	No
	Eames Way Elementary School	165 Eames Way	0	No	>6ft	>4	No	Yes
	Gov Edward Winslow School	60 Regis St	0	No	>6ft	4	No	No
	Marshfield High School	167 Forest St	0	No	>6ft	>4	No	No
Utilities/Communications	Coastguard Relay antenna	Across from 1299 South River St	0	No	>6ft	>4	Yes	No
	WATD media/radio station	110 Enterprise Dr	0	No	>6ft	>4	No	No
	Solid Waste Transfer Station	23 Clay Pit Rd	0	No	>6ft	>4	No	No
	Verizon Telephone Exchange	200 Main St	0	No	>6ft	>4	No	No
	NSTAR Sub Station #1	West of 260 South River St	0	No	>6ft	3	No	No
	NSTAR sub station #2	West of 53 Station St	0	No	>6ft	>4	Yes	No
	NSTAR Sub Station LAT 42.0886 Long -70.6544	Webster St.	AE	No	3	1	Yes	No
	Indust. Comm Cell/Radio Tower	40 Lone St	0	No	>6ft	>4	No	No
	Radio Tower - Carolina Hill	South of 164 Eames St	0	No	>6ft	>4	No	Yes
	WATD media/Fire Municipal radio system	Behind 125 Grove St	0	No	>6ft	>4	No	No
	Monopole		AE	No	5	3	Yes	No
	Furnace Brook Water Pumping Station #4		0	No	>6ft	>4	No	No
	Mt Skirgo Rd Water Pump		0	No	>6ft	>4	No	No
	South River Pumping Station	227 South River	0	No	>6ft	>4	No	No
	Avon Street Waste Water Pumping Station		AE	No	5	2	Yes	No
	Webster St Pumping Station #1		0	No	>6ft	>4	No	No
	Wastewater Treatment Plant	200 Joseph Dribeek Way	AE	No	6	2	Yes	No
	Marshfield HS Wastewater Treatment Facility	167 Forest St	0	No	>6ft	>4	No	No
	Church Street Water Pumping Station		0	No	>6ft	>4	No	No
	Webster St Pumping Station #2		0	No	>6ft	3	No	Yes
	Homestead Ave Wastewater Pumping Station		0	No	>6ft	3	Yes	No
	Plymouth Avenue Wastewater Pumping Station		AE	Yes	3	1	Yes	No
	Macker Terrace Wastewater Pumping Station		AE	No	3	1	No	No
	Furnace Brook Water Pumping Station #1		A/AO	No	>6ft	>4	No	No
	Union Street Water Pumping Station #1		0	No	>6ft	>4	No	Yes

Category	Critical Facility Name	Address	Hazards					
			FEMA Flood Zone	Within Local Flood Areas	Min SLR (ft) That Will Affect Facility	Min Hurricane Category That Will Affect Facility	Within Wind District	Within High Fire Hazard Area
Water/Wastewater System	Furnace Brook Water Pumping Station #3		0	No	>6ft	>4	No	No
	Ferry Street Water Pumping Station #2		0	No	>6ft	>4	No	Yes
	Main Lift Pumping Station		AE	No	5	2	Yes	No
	Furnace Brook No. 2 Water Treatment Facility		0	No	>6ft	>4	No	No
	Spring Street Water Pump		0	No	>6ft	>4	No	No
	Anderson Drive Wastewater Pumping Station		AE	No	4	2	No	No
	Union Street Water Pumping Station #2		0	No	>6ft	>4	No	Yes
	Pudding Hill Lane Water Tank		0	No	>6ft	>4	No	No
	Telegraph Hill Water Tank	97 Eagle Rd	0	No	>6ft	>4	Yes	No
	Ferry Street Water Pumping Station #1		0	No	>6ft	>4	No	Yes
	Furnace Brook Water Pumping Station #2		0	No	>6ft	>4	No	No
	School St Water Pumping Station		0	No	>6ft	>4	No	No
	Central Street Wastewater Pumping Station		AE	Yes	3	1	Yes	No
	Fairgrounds Well Site		0	No	>6ft	>4	No	No
	Water Standpipe Forest St		0	No	>6ft	>4	No	No
	Carolina Hill Water Tank	South of 164 Eames Way	0	No	>6ft	>4	No	Yes

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

		Benefits					Feasibility				Economic		Regulatory		
	Hazard Type and Potential Mitigation Actions	Protects Properties and Structures	Protects Natural Resources	Technical/Capacity Improvement (Training, Evaluations, Regulations, etc)	Improves Public Awareness	Improves Emergency Response or Public Protection Immediately after Emergency	Appropriate Staffing Available	Technically Feasible	Public Support	Town/Political Support	Cost	Funding Available / Attainable	Permitting/Regulatory Feasibility	Consistent with Local, State, & Federal Goals	Total Score
	Flooding														
1	Evaluate the creation of a dike around wastewater treatment plant	3	2	2	2	3	3	3	2	2	2	2	2	3	31
2	Review wastewater treatment plan operations and maintenance plan	2	1	3	1	3	3	3	2	2	3	3	3	3	32
3	Close opening (add batterboards) at Old Rexhame Road	3	3	2	2	3	3	3	3	3	2	3	3	3	39
4	Continue to restrict additional uses at airport due to flood prone elevations	1	1	3	3	1	3	3	2	3	3	3	3	3	32
5	Ditch cleaning and continued maintenance of brook north of Monitor Road (Bass Crk headwaters)	3	3	1	2	3	2	3	2	2	2	2	3	3	31
6	Raise elevation of Dike Road bridge and approaches to improve evacuations routes/access	3	2	2	2	3	2	2	2	2	1	2	2	2	27
7	Implement recommended tide gate upgrades at Dike Road	3	3	1	2	3	2	3	1	2	2	2	3	3	30
8	Raise Brant Rock seawall	3	2	1	2	3	3	3	3	3	1	2	3	3	32
9	Develop an evacuation plan for Housing Authority units	1	1	3	3	3	2	3	3	3	3	2	3	3	33
10	Move and rebuild DPW Barn in less vulnerable area	3	1	3	2	3	1	2	2	2	1	1	3	3	27
11	Purchase wetlands and other flood prone lands	1	3	1	1	1	3	3	2	2	2	2	3	3	27
12	Mt. Skirgo wellhead protection (Evaluate enhanced drainage)	2	3	3	1	1	2	3	3	3	3	3	3	3	33
13	Repetitive Loss: Confirm/Refine repetitive loss list	1	1	3	3	1	2	3	2	2	3	2	3	3	29
14	Repetitive Loss: Develop specific recommendations for each Repetitive Loss Area	3	2	2	3	2	1	3	2	2	2	2	3	3	30
15	Repetitive Loss: Contact Rep Loss property owners annually to inform them of $ assistance	2	1	2	3	1	2	3	2	2	3	3	3	3	30
16	Hire a CRS Coordinator w/the goal to improve CRS score	1	1	3	3	3	1	3	2	2	2	2	3	3	29
17	Discuss elevating Nstar substation(s) that's in the flood zone	3	1	3	2	3	2	2	3	3	3	3	3	3	34
18	Develop a pre-storm check-list for installation of batter boards	1	1	3	1	3	3	3	3	3	3	3	3	3	33
19	Rebuild Willow St. Bridge	3	3	1	1	3	3	3	2	2	1	3	2	2	29
20	Canal and Beach Street Bridges	3	1	1	2	3	2	3	3	3	2	2	2	2	29
21	Raise Intersection of Town Pier Road & 139	3	1	1	2	3	3	3	3	3	2	2	2	3	31
22	Conduct an alternatives analysis engineering study of flood reduction and improved drainage in the Esplanade area	2	2	3	1	2	2	2	2	2	2	1	2	2	25
	Coastal Erosion														
23	Upgrade Master Plan for Sea Walls	2	1	3	1	2	2	3	2	2	2	2	3	3	28
24	Complete Green Harbor Beneficial Reuse Study	1	1	3	1	1	3	3	3	3	2	3	3	3	30
25	Maintain Rexhame Dunes	3	3	1	3	1	2	3	2	2	1	1	2	2	26
26	Develop Large Town-Wide Beach Nourishment Program (consider sources)	3	3	3	2	3	2	3	2	2	1	1	2	3	30
27	Create Special Conditions for OOC to require the beneficial reuse of sand	1	1	3	3	1	2	3	2	2	3	3	2	3	29

		Benefits					Feasibility				Economic		Regulatory		
	Hazard Type and Potential Mitigation Actions	Protects Properties and Structures	Protects Natural Resources	Technical/Capacity Improvement (Training, Evaluations, Regulations, etc)	Improves Public Awareness	Improves Emergency Response or Public Protection Immediately after Emergency	Appropriate Staffing Available	Technically Feasible	Public Support	Town/Political Support	Cost	Funding Available / Attainable	Permitting/Regulatory Feasibility	Consistent with Local, State, & Federal Goals	Total Score
	Sea Level Rise														
28	Evaluate the potential risk to Webster Wells from SLR	1	1	3	1	1	2	3	2	2	2	2	3	3	26
	Wind														
29	Evaluate vulnerability of radio antenna	2	1	3	1	1	2	3	2	2	2	2	2	2	25
	Nor'easter/Snow/Ice (Winter Weather)														
30	Consider acquiring larger snow removal machinery	1	1	3	1	3	2	3	2	2	2	2	3	3	28
31	Evaluate needs for additional snow storage	1	1	3	1	3	3	3	3	3	3	3	3	3	33
	Fire														
32	Consider fire prevention pruning/vegetation clearing @ Marcia Thomas house	3	1	3	1	3	3	3	3	3	3	3	3	3	35
33	Develop fire management/forest management plan for select properties and woodlots	3	3	3	2	3	2	2	2	2	2	2	2	3	31
	Dam/Culvert Failure														
34	Repair Emergency Spillway and perform maintenance at Mill Pond (Magoun) Dam	3	1	1	1	3	2	3	2	2	2	2	2	3	27
35	Evaluate potential alternatives to improve Veterans Park Dam	2	2	3	1	1	2	2	2	2	2	2	2	3	26
36	Discuss potential repairs to nearby dams (that would impact Marshfield if they breached) with Duxbury	1	1	3	1	1	3	3	3	3	3	3	3	3	31
	Multi-Hazard / Non-specific														
37	Conduct outreach to owners/managers of privately held critical facilities	1	1	3	3	1	2	2	2	2	3	3	3	3	29
38	Develop a cable tv show to increase public outreach	1	1	1	3	1	2	3	2	3	2	2	3	3	27
39	Develop a PPI (Public Plan for Information) website - could include info on all hazards	1	1	1	3	1	2	3	2	3	2	2	3	3	27
40	Develop summary brochure when plan is complete	1	1	3	3	1	3	3	3	3	3	2	3	3	32
41	Apply to be an MVP (Municipal Vulnerability Preparedness) community	1	1	3	1	1	3	3	2	2	3	3	3	3	29
42	Public Outreach - let residents know they need to sign up for the Code Red program	1	1	3	3	3	3	3	3	3	3	3	3	3	35

Score	Priority	#
25-29	Low	13
30-32	Medium	21
33-39	High	8

Proposed Mitigation Actions Dismissed from the Final Plan

Mitigation Action	Reason Removed
Elevate repetitive loss properties	An action to contact repetitive loss property owners annually to inform them about finance assistance available for elevating houses on repetitive loss properties was retained. After initially proposing this action, the Town felt that actually elevating the property would be the responsibility of the private homeowner.
Coordinate with Eversource on tree removal and pole replacement	After additional discussion, it was determined that Eversource does an effective job, and additional direction from the Town was unnecessary.
Evaluate whether any dams can be removed	Only some of the dams in Town are actually owned by the Town. Further discussion determined that this action should be removed from the mitigation action plan for now, but should be considered again in the future.
Better public outreach about flood risks and travel	After further disucssion, it was determined that this action could actually be accomplished through two of the other actions listed in the mitigation action plan (1. Develop a cable TV show to increase public outreach, and 2. Develop a PPI website), so it was determined not to list this action as a separate task.

Appendix D: Plan Adoption

DOCUMENTATION OF PLAN APPROVAL AND ADOPTION WILL BE ADDED WHEN AVAILABLE