

January 2017

Town of  
**Tiverton, RI**  
Multi-Hazard Mitigation Plan  
**DRAFT**



**CDR** | MAGUIRE



## Acknowledgements

The Town of Tiverton commends the efforts of its Hazard Mitigation Committee in completing this important plan. The effort is sure to result in the protection of life and property and special thanks are extended to Committee members:

### **Town Administrator**

Matthew Wojcik

**Business Owner-** Fred Almeida

**Public Works Director-** Stephen Berlucchi (left in 2016)

**Police Chief-** Thomas Blakey

**Code Enforcement-** Neil Hall

**Fire Chief/EMA Director-** Robert Lloyd

**School Department-** Mike Mendes

**Town Planner-** Marc Rousseau

**RI Emergency Management Agency-** Jess Stimson

**Deputy EMA Director-** Bill Tavares

### **2017 Tiverton Town Council**

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## **Executive Summary**

This Hazard Mitigation Plan (HMP) is a product of the Tiverton Hazard Mitigation Committee (THMC). It has been approved by the Tiverton Town Council, the Rhode Island Emergency Management Agency, and the Federal Emergency Management Agency in accordance with the Disaster Mitigation Act of 2000.

The THMC's overview of past natural hazard occurrences verifies that the Town is vulnerable to diverse events including blizzards, floods and hurricanes. The discussion puts the likelihood of these events into historical perspective and recognizes that although the probability of thunderstorm, high wind and lightning events may be higher; the intensity and potential impacts from less likely events such as hurricanes and earthquakes can be far greater.

The risk assessment portion of the plan confirms that the Town has much to lose from these events. The four highest ranking risks identified include flood prone drainage systems, potential dam failures, damage to care facilities, and critical municipal hazard response facilities.

To address these risks the HMP put forth a clear mission, a distinct set of goals and 35 specific mitigation actions. The Town's hazard mitigation mission is to protect and enhance the quality of life, property and resources by identifying areas at risk and implementing appropriate mitigation actions. The specific goals include protecting the lives and property of the Town of Tiverton's residents, protecting the Town of Tiverton's critical facilities and infrastructure, and protect the town's cultural, historical, natural, and economic resources. Each of the subsequent mitigation actions for achieving these goals summarizes specific problems and possible solutions, details the primary tasks to be undertaken, identifies an appropriate lead and anticipated funding sources.

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## Chapter 1: Introduction

### 1.1 Plan Purpose

The purpose of The Hazard Mitigation Plan is to set forth guidelines of short-term and long-term actions, which will reduce the actual or potential loss of life or property from hazardous events such as flooding, severe winter storms/extreme cold, lightning, hurricanes/Nor'easters, drought/extreme heat, dam failure, brushfires, tornadoes, and earthquakes. This plan was constructed using input from a variety of municipal and private stakeholders and the general public involved in the planning process. This plan serves as guidance to help the Town reduce their losses and vulnerabilities relating to natural hazards.

### 1.2 Hazard Mitigation and its Benefits

Hazard mitigation planning is advance action taken to identify specific areas that are vulnerable to natural and man-made hazards within a town, and seeks to permanently reduce or eliminate the long-term risk to human life and property. It coordinates available resources and identifies community policies, actions, and tools for implementation that will reduce risk and the potential for future losses town-wide. The process of natural hazard mitigation planning sets clear goals, identifies appropriate actions, and produces an effective mitigation strategy that can be updated and revised to keep the plan current.

States and communities across the country are slowly, but increasingly, realizing that simply responding to natural disasters, without addressing ways to minimize their potential effect, is no longer an adequate role for government. Striving to prevent unnecessary damage from natural disasters through proactive planning that characterizes the hazard, assesses the community's vulnerability, and designs appropriate land-use policies and building code requirements is a more effective and fiscally sound approach to achieving public safety goals related to natural hazards.<sup>1</sup>

In the past, federal legislation has provided funding for disaster relief, recovery, and some hazard mitigation planning. The Disaster Mitigation Act of 2000 (DMA 2000) is the latest federal legislation to improve this planning process. It reinforces the importance of natural hazard mitigation planning and establishes a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP) or other annual funding opportunities. Section 322 of the Act specifically addresses mitigation planning at the state and municipal levels of government. It identifies new requirements that allow HMGP funds to be used for planning activities. As a result of this Act, states and communities must now have an approved natural hazard mitigation plan in place prior to receiving post-disaster HMGP funds. In the event of a natural disaster; municipalities that do not have an approved natural hazard mitigation plan will not be eligible to receive post-disaster HMGP funding.

The purpose of this plan is to recommend actions and policies for the Town of Tiverton to minimize the social and economic loss of hardships resulting from natural hazards. These hardships include the loss of life, destruction of property, damage to crucial infrastructure and critical facilities, loss/interruption of jobs, loss/damage to businesses, and loss/damage to significant historical structures. Hazardous events that affect Tiverton include severe weather, hurricanes, conflagration, floods, and earthquakes. To protect present and future structures, infrastructure and assets and to minimize the social and economic hardships, the Town of Tiverton implements the following general actions and policies:

- Revisions to the town's comprehensive plan
- Incorporation of hazard mitigation into the site plan review process
- State and local building code review
- Public education/outreach
- Post-disaster recovery opportunities/strategies

The Town of Tiverton also recognizes the important benefits associated with hazard mitigation, its interaction with municipal land use and infrastructure planning, and the need for a comprehensive planning approach, which accommodates these interdependencies. The Town's state-approved comprehensive community plan (2009) addresses natural and cultural resources, land use, housing, services and facilities, traffic circulation, open space, economic development, and future development trends.<sup>1</sup> While the entire hazard mitigation plan will not be formally incorporated into the Comprehensive Plan, certain, applicable mitigation actions will be incorporated during the update process. The Town recognizes coordination between the HMP and the Comprehensive Plan to be of benefit because it will ensure a unified planning approach into the future and ensure that risk reduction remains a critical element of municipal planning. This is also in alignment with current goals of Rhode Island Statewide Planning.

A second benefit of hazard mitigation allows for a careful selection of risk reduction actions through an enhanced collaborative network of stakeholders whose interests might be affected by hazard losses. Working side by side with this broad range of stakeholders can forge partnerships that pool skills, expertise, and experience to achieve a common goal. Proceeding in this manner will help the Town ensure that the most appropriate and equitable mitigation projects are undertaken.

A third benefit of hazard mitigation would be endorsing a proactive planning approach focused on sustainability, whereby the Town of Tiverton could minimize the social and economic hardships that have resulted from the occurrence of previous natural disasters. These social and economic hardships include: the loss of life, destruction of property, interruption of jobs, damage to businesses, and the loss of historically significant structures and facilities. This proactive planning approach would look for ways to combine policies, programs, and design solutions to bring about multiple objectives and seek to address and integrate social and environmental concerns. Linking sustainability and loss reduction to other goals can provide a framework within the state and local governments that will bring the comprehensive planning process full circle.

Lastly, the participation in a hazard mitigation planning process will establish funding priorities. The formal adoption and implementation of this plan will allow the Town of Tiverton and its residents to become more involved in several programs offered by the Federal Emergency Management Agency (FEMA) including: the Community Rating System Program (CRS); the Pre-Disaster Flood Mitigation Assistance Program (FMA); and the Hazard Mitigation Grant Program (HMGP). Money spent today on preventative measures can significantly reduce the cost of post-disaster cleanup tomorrow.

### **1.3 Goals**

The Town of Tiverton has established the following mission statement:

"Preserve and enhance the quality of life, property, and resources by identifying areas at risk from natural hazards and implementing priority hazard mitigation strategies designed to protect Tiverton's population, infrastructure, historical, cultural, natural and economic resources".

The Town of Tiverton has established the following mitigation goals:

- Implement actions which protect the lives and property of the Town of Tiverton's residents
- Implement actions which protect the Town of Tiverton's critical facilities and infrastructure
- Implement actions which protect the Town of Tiverton's cultural, historical, natural and economic resources

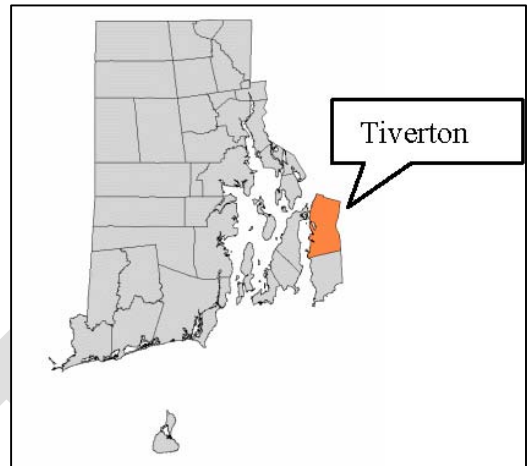
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<sup>1</sup> Town of Tiverton, RI, Comprehensive Community Plan, Amended June 22, 2009.

### 1.4 Background

The land, which comprises the present day Town of Tiverton, was acquired from Native Americans in two separate purchase activities. These were the Punkatest Purchase of 1631 and the Pocasset Purchase of 1676. Tiverton was incorporated by the Province of Massachusetts in 1694 and annexed by royal decree to Newport County in the colony of Rhode Island in February 1746.

The Town of Tiverton occupying 35.5 square miles, is located in Newport County, in the southeastern section of Rhode Island. Tiverton is bordered by the city of Fall River, Massachusetts to the north, by the town of Westport, Massachusetts to the east, by the town of Little Compton, Rhode Island to the south, and by the Sakonnet River to the west. The Town of Portsmouth, Rhode Island lies across the Sakonnet River.



More than anything else, the abundance of natural resources and the town's cultural roots in its past characterize what is special about Tiverton. Farms, broad open spaces, forests and miles of scenic roadways in the south, and the rich ethnic and architectural heritage in the north give the town its fascinating diversity. Along the west side lies the beauty of an unspoiled coastline, treed neighborhoods, while low lying heather, bogs and swamps alternate with farms and crossroads hamlets in the eastern portion of the town.

The Town of Tiverton has a population of roughly 15,813 residents (2010 Census) with a 48.5/51.5 proportion of male to female. The median age of our residents is 46.2. Approximately 8% of the population is over 65. According to the 2013 US Census Bureau the town is predominantly white 96.5%, Black or African Americans make up 1 % of the population. English is spoken in nearly 100% of the homes.

According to the 2010 U.S. Census Bureau, the town has approximately 7,446 housing units with an occupancy rate of 90%. 18% of the homes were built before 1939. Most are of wood construction. The median income for a family household is \$73,438. Six percent of the population has income in the poverty level.

In general, the majority of an evacuated population (87%) do not use public shelters.<sup>2</sup> Evacuees will likely seek shelter by making other arrangements such as staying with family or friends, particularly if the event is forecasted or predicted to occur. The same trend is anticipated in Tiverton. Currently the American Red Cross Shelter in Tiverton is the Tiverton Middle School.

The Town of Tiverton is a blended community with agricultural, residential, commercial and industrial areas. Natural disasters could have a devastating effect on the whole community or one particular neighborhood. Homes are nestled among forests, along rivers, next to businesses. The total gross assessed value of real and tangible property in the Town of Tiverton as of 2015 is \$1,920,290,000 dollars.



Properties that are agricultural, forest and brushland, and wetlands account for 70% of the total land area. Approximately 3,918 acres are designated as residential, and 756 acres are for commercial industry as well as utility/transportation/waste disposal. "A 2006 buildout analysis projected that an additional 3,681 dwelling units

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<sup>2</sup> Mileti, Dennis S., John H. Sorensen and Paul W. O'Brien. 1992. "Toward an Explanation of Mass Care Shelter Use in Evacuations." International Journal of Mass Emergencies and Disasters 10 (1): 25-42.

could be developed as-of-right in Tiverton based on the land available for development and the zoning in place as of 2005.”<sup>3</sup>

According to the 2009 Comprehensive Plan, the town has approximately 450 mobile or manufactured homes in Tiverton. The newest development, Countryview Estates is in northeastern Tiverton. Additional manufactured home developments include Dadson Mobile Estate (102 units), Four Seasons Mobile Home Association (38 units), and Heritage Home Park Co-Op (37 units). None are located in a regulatory flood zone.

The town has several group homes which provide 50 beds that also count as low and moderate income units. Staff live full time in these residences. The Tiverton Housing Authority also operates 45 housing units for low income elderly people. The Cumberland Affordable Housing Corporation has 51 apartments for very low income elderly people on Hancock Street. SK Properties owns and manages 23 units for the elderly, disabled, and handicapped near Stafford Pond. Church Community Housing Corporation is a non-profit housing organization that has nearly 20 units for low and moderate income individuals.<sup>4</sup>

#### Our Government

Tiverton is governed by an elected Town Council with seven (7) members, elected every two years. Day to day operation of the town is delegated to an appointed Town Administrator who reports to the Town Council.

#### Public Safety

Law enforcement and protection of persons and property is provided by the Police Department's 30 member enforcement team, supplemented by 12 civilian employees, including the animal control officer. The Police Department operates a twenty-four hour patrol with three officers per shift. Average response time to an emergency dispatched call is approximately four minutes throughout town.



The Fire Department is operating its three fire stations with a staff of 28 full-time firefighters, plus the Fire Chief, Fire Marshall, and a civilian secretary. The town no longer has the assistance of volunteer firefighters and is currently increasing recruitment efforts for permanent staff. The Fire Chief currently serves as the Emergency Management Director, appointed by the Town Administrator and supported by the Deputy Emergency Management Director.

#### Roads and Bridges

There are approximately 156 miles of roads in Tiverton<sup>5</sup> and 3 major bridges of concern (Pond Bridge Road Bridge, Route 24/138 Bridge, and Nanaquaket Road Bridge).

Swales and culverts are the primary historical means for stormwater control in Tiverton. More developed areas include systems with catch basins, connecting pipes, and detention posts to control stormwater runoff.

#### Utilities

Stafford pond is the primary source of the drinking water supply for Tiverton, distributed by the town's two water districts. Some of the Town's drinking water also comes from Fall River. Tiverton residents are serviced by both public water and private wells, depending on location. "Although all of south Tiverton and most sparsely populated areas in

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<sup>3</sup> Town of Tiverton, RI, Comprehensive Community Plan, Amended June 22, 2009.

<sup>4</sup> The Comprehensive Community Plan, June 2009, Tiverton, RI

<sup>5</sup> Rhode Island GIS, January 2016



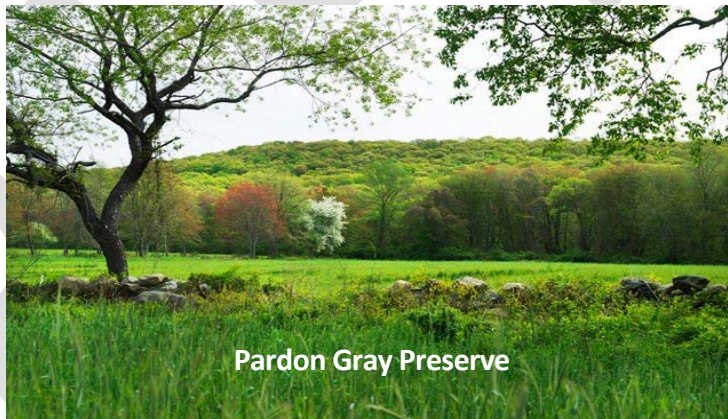
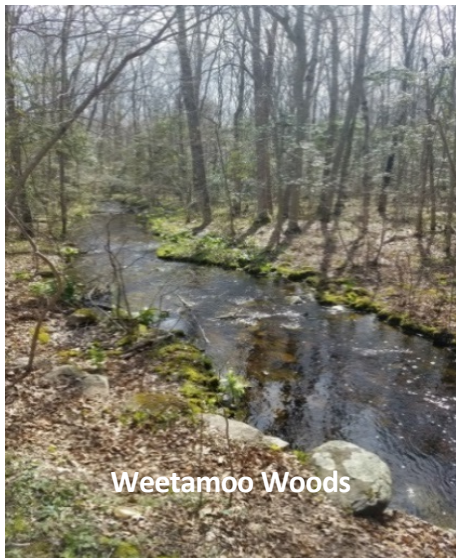
the north derive their water from wells, most homes and businesses in the more densely settled northeast portion of town are connected to public water. Two water systems serve the town, the Stone Bridge Fire District and the North Tiverton Fire District.”<sup>6</sup> Both districts maintain their own distribution system and update their management plans every five years as required by the Rhode Island Water Resources Board.

Approximately 94% of the homes and businesses in Tiverton rely on on-site sewage disposal systems, with an estimated 6,400 separate septic systems, half built before 1970, which implies outdated design concepts. Disposal of wastewater through inadequately maintained or failing on-site disposal systems can adversely affect the Town's drinking water supply. The remaining 6% of homes and businesses are connected to a wastewater collections system operated by the town which discharges to the City of Fall River, Massachusetts sewage treatment facility.<sup>7</sup> These connections are north of Bulgarmarsh Road.

#### Forest and Open Space

Tiverton is known for its rich abundance of natural areas. The town is mostly a forest community with over 50% of the land area dedicated to forests and wetlands. The Rhode Island Natural Heritage Program has identified the following areas as rare species habitats: Fogland Marsh, Seapowet Marsh, Sin and Flesh Brook, Weetamoo Woods and the Pardon Gray Preserve, Stafford Pond.<sup>8</sup>

Weetamoo Woods (541 acres) is the largest contiguous forest area in Tiverton. There are trails that traverse the southern end of Weetamoo Woods but emergency access into some of the dense interior forest is challenging.



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<sup>6</sup> The Comprehensive Community Plan, June 2009, Tiverton, RI

<sup>7</sup> The Comprehensive Community Plan, June 2009, Tiverton, RI

<sup>8</sup> The Comprehensive Community Plan, June 2009, Tiverton, RI

## Chapter 2: Planning Process

### 2.1 Overview

The Town of Tiverton initiated hazard mitigation planning in February 2015 at the recommendation of the Tiverton Emergency Management Director. A draft plan had been developed prior to 2015 but it was never approved by FEMA. The draft plan sat dormant until 2014 when the Town decided to hire a consultant to resume planning efforts. This Hazard Mitigation Plan is the result of a dedicated group of individuals working for 6 months identifying natural hazards and proposing ways to improve Tiverton's resiliency.

### 2.2 Tiverton Hazard Mitigation Committee

This Hazard Mitigation Plan (HMP) is a product of the Tiverton Hazard Mitigation Planning Committee (THMC). Committee members include:

- Town Administrator-** Matthew Wojcik
- Business Owner-** Fred Almeida\*
- Public Works Director-** Stephen Berlucchi (left in 2016)
- Police Chief-** Thomas Blakey
- Code Enforcement-** Neil Hall
- Fire Chief/EMA Director-** Robert Lloyd
- School Department-** Mike Mendes\*
- Town Planner-** Marc Rousseau
- RI Emergency Management Agency-** Jess (Stimson) Henry
- Deputy EMA Director-** Bill Tavares\*

\*denotes Tiverton resident

### 2.3 The Planning Process

This new 2017 HMP is the result of a seven step process. It was initiated in February 2015 with the establishment of the THMC by invitation from the Town Emergency Management Director. Step two started the plan development process and included the first meeting of the THMC on February 19, 2015. The Town's previous plan was dated 2005, so the first meeting focused on re-ranking hazards and discussing the process for updating the plan. The THMC met regularly at the Tiverton Fire Station on Main Road and completed individual assignments between the meetings to help further the efficacy of the times everyone was together. The resulting process is summarized below for convenience and detailed procedural methodologies are presented within the plan's respective chapters.

Step three began with the THMC meeting on March 20, 2015. After reviewing the hazards of concerns, the THMC identified critical infrastructure and community assets within the town. Twelve areas of vulnerability were identified: Flood prone drainage systems, bridges, wastewater, water, electrical facilities, dams, critical municipal hazard response facilities, populations, businesses, schools, recreational facilities, and historic resources. During this time, the Town's consultant reviewed the existing Comprehensive Plan, local ordinances, and dam safety plans, and gathered information on current infrastructure projects going on within the Town.

Step four was the review of mitigation items proposed in the existing plan that would help reduce the risk from natural hazards. Included in this step were proposing new actions, establishing action timelines, costs, and identifying responsible parties.

Step five entailed the THMC reviewing and adjusting specific mitigation goals and individual mitigation actions. Follow-up meetings of the THMC were then held to review the drafts and finalize the content of Chapters 5 and 6.

Step six focused on the prioritization of the mitigation actions and the development of the implementation, evaluation and revision schedule. This prioritization was completed through individual review of the draft actions.

Step seven furthered the public input and review process with the Tiverton Planning Board, Town Council, and the general public for review and comment. The plan was posted on the Town’s website, Facebook, and made available at Town Hall and Library for public review. The THMP was also emailed to Emergency Management Directors in the neighboring towns of Little Compton, Portsmouth, and Fall River, MA for their review and comments. [enter comments if received, summarize final revisions]. Table 1 below provides a summary of the HMPC meeting dates and the activities that they conducted:

**Table 1: Summary of THMC Activities**

Date	Meeting Summary
2/19/2016	Kick off meeting. THMC discussed the plan purpose and hazards of concern
3/4/2016	The THMC reviewed the hazards of concern and listed critical infrastructure and community assets
4/1/2016	Discussions with Fall River EM Director about risks to Tiverton as identified in their plan. Review of critical facilities and planning effort with State Hazard Mitigation Officer and Region 1 Hazard Mitigation Specialist
4/19/2016	Using the identified critical facilities as the backbone of their planning efforts, the committee began reviewing mitigation actions that would help reduce risk from natural hazards.
5/5/2016	Continued discussion about mitigation actions
5/9/2016	Finalized mitigation actions, discussed prioritization and current capabilities
6/8/2016	Draft plan sent to THMC for review
	Draft of 2017 HMP posted for public comment, public notice ran in local newspaper
	2017 HMP was emailed to neighboring Emergency Management Directors for review.
1/23/2017	2017 HMP was presented to Town Council and public
	Town’s consultant made document changes as per public comments and final edits.
	Draft reviewed by Tiverton Planning Board and approved with minor edits for submission to RIEMA
	Sent to RIEMA for review.
	Comments received from RIEMA. Edits made to draft plan by Town’s consultant under the guidance of the Emergency Management Director
	Sent to FEMA for review
	Edits made to draft plan by Town’s consultant under the guidance of the Emergency Management Director
	Plan approved and adopted by Planning Board/Town Council

## Chapter 3: Natural Hazards

This history of natural hazard events verifies that the area is vulnerable to diverse events including blizzards, floods and strong storms. This discussion puts the likelihood of these events into historical perspective and recognizes that although the probability of, thunderstorms, high wind and lightning events may be higher; the intensity and potential impacts from less likely events such as hurricanes, flooding, and winter storms can be far greater.

The hazards identified by the THMC are in line with those discussed in the State Hazard Mitigation Plan and are of greatest concern to the Town. However, there are a few hazards discussed in the State plan that are not addressed in this Hazard Mitigation Plan. Tiverton is situated along the Sakonnet River and has not experienced or is concerned about coastal issues like storm surge and coastal erosion. However, the Sakonnet River is rather large and properties along it are considered coastal. Therefore, coastal flooding is discussed as a hazard.

The following hazards will not be addressed in this Hazard Mitigation Plan: avalanche, expansive soils, land subsidence, landslides, volcanoes, and tsunamis. These hazards were not considered due to the lack of frequency in which they occur and the minimal probability of their occurrence.

The primary sources of data researched to identify occurrences of natural hazard events in Tiverton were the RI State Hazard Mitigation Plan 2014 Update, National Climatic Data Center within the National Oceanic Atmospheric Administration (NCDC-NOAA) (<http://www.ncdc.noaa.gov/stormevents/>), the United States Geological Survey (USGS) Earthquake Hazards Program (<http://neic.usgs.gov/>), the 1998 Journal-Bulletin: Rhode Island Almanac, and the Taunton, MA, National Weather Service Forecast Office. The parameters and description of particular events are limited to the availability of information contained in the aforementioned sources.

### 3.1 Hazards of Concern

The Hazard Mitigation Planning Committee recognizes the following hazards as having the most potential to inflict damage to people and or property of the Town of Tiverton.

- Coastal Flooding
- Winter Storms (snow loads and icing)
- Hurricane/Nor'easter
- High Winds
- Extreme Heat and Cold

The following are considered less of a risk due to a combination of their frequency and damage extent:

- Brushfire
- Dam failure
- Drought
- Earthquake
- Riverine Flooding
- Hail
- Lightning Storms
- Tornado

At the kick-off meeting on February 19, 2016, the Committee identified the following hazards in Table 2 and their associated risks.



Frequency

**Low** - 1%- 10% probability within 100 years  
**Medium** - 10%-100% probability within 10 years  
**High** - 100% probability within 1 year-5 years

Damage Potential

**Low** - some local property damage not town wide, minor injuries/ loss of life  
**Medium** - 50 % of property could be damaged and possible injuries/ loss of life  
**High** - major town wide property damage, injuries and loss of life

Priority Rank

Developed by the THMC to rank the various hazards based on frequency and damage potential.

**Low** - Not expected to occur with any frequency, damages will be limited.  
**Medium** - Will occur within the next 10 years but the Town has resources to reduce risks.  
**High** - Expected to occur within the next 5 years, and is a major concern for the Town.

Probability of Future Occurrence

Developed by the THMC based on past events and future predictions.

**Highly Likely:** Near 100% probability within the next year  
**Likely:** Between 10% and 100% probability within the next year, or at least one chance in the next 10 years  
**Possible:** Between 1% and 10% probability within the next year, or at least one chance in the next 100 years  
**Unlikely:** Less than 1% probability in the next 100 years.

**Table 2: Natural Hazards**

Type	Frequency	Damage Potential	Impacts (populations, infrastructure, natural environment, economy)	Priority Rank	Future Probability
<b>Flooding (Coastal)</b>	High	High	Property damage, life safety, road/bridge damage, businesses shut down, oil storage, mobile parks.	High	Highly Likely
<b>Hurricane/Nor'easter</b>	High	High	Power loss, property damage, economic losses post-disaster, debris, natural environment	High	Highly Likely
<b>Winter Storm</b>	High	Medium	Roadways, utilities, infrastructure, Power outages, tree damage, roof collapse, businesses shut down	High	Highly Likely
<b>High Winds</b>	High	Medium/High	Population inconvenience, debris, closed roads, downed utility wires	Medium	Highly Likely
<b>Extreme Temperatures</b>	High	Low	Vulnerable aging populations, road infrastructure	Medium	Likely
<b>Brushfire</b>	High	Low (5-10 acres)	Localized to immediate population and natural	Low	Highly Likely

Type	Frequency	Damage Potential	Impacts (populations, infrastructure, natural environment, economy)	Priority Rank	Future Probability
			environment		
<b>Thunder/Lightning Storm</b>	Medium	Low (Localized)	Brush and wildfires, house fires, power loss, propane tank explosion	Low	Likely
<b>Hail</b>	Medium	Low	Personal property, vehicles	Low	Likely
<b>Drought</b>	Medium	Low/Medium	Localized if short term. Long term drought could affect water supply quantity.	Low	Likely
<b>Earthquake</b>	Medium	Low	None	Low	Unlikely
<b>Dam Failure</b>	Creamer- low Nonquit- low Mill Pond- low	Creamer- High loss of life Nonquit- low, marsh is downstream Mill Pond- low	Creamer- population, infrastructure Nonquit- natural environment, public drinking water Mill Pond- natural environment	Low	Possible
<b>Flooding (Riverine)</b>	Low	Low	Natural resources (marsh)	Low	Possible
<b>Tornado</b>	Low	Low (Localized)	Infrastructure, personal property, debris	Low	Unlikely

The THMC chose to review the above hazards based on past experiences and present vulnerabilities. The Rhode Island State Hazard Mitigation Plan was reviewed for comparison. Due to the Town’s rural inland location, the THMC did not consider storm surge or sea level rise.

**Table 3: Manmade Hazards**

<b>Hazard</b>	<b>Application Mode</b>	<b>Hazard Duration</b>	<b>Impacts</b>	<b>Of Specific Concern</b>	<b>Mitigating and Exacerbating Conditions</b>
<b>Terrorism</b>	Targeted attack on or near target via person, vehicle, or projectile	Minutes to days	Varies based on target and explosive device.	<ul style="list-style-type: none"> <li>• Fuel storage and transportation</li> <li>• Natural gas pipelines</li> <li>• Power plant</li> <li>• Proximity to war college</li> <li>• Bridges</li> <li>• Water infrastructure</li> <li>• Power plant</li> </ul>	Inadequate security can allow easy access to target, easy concealment of weapons and undetected initiation of an attack.
<b>Hazardous Material Release Into Soil &amp; Water</b>	Solid, liquid and/or gaseous contaminants may be released from fixed or mobile containers.	Hours to days.	Chemicals may be corrosive or otherwise damaging over time. Contamination of drinking water supply. Contamination of the ground outside of homes, businesses, and recreation areas.	<ul style="list-style-type: none"> <li>• Fuel storage and transportation</li> <li>• Stafford Pond</li> </ul>	Weather conditions (rain and wind) will directly affect how the hazard develops.

The above were manmade hazards that were discussed as a concern for the THMC. Mitigating these hazards requires a highly facility-specific approach not explored in depth in this plan. However, including them in this plan was important for the Committee to explore all the hazards that they are concerned about.

3.1.1 Flooding (Coastal and Riverine)

Description

According to the Rhode Island 2014 Hazard Mitigation Plan Update, “Flooding is a localized hazard that is generally the result of excessive precipitation. Flooding is the most commonly occurring natural hazard, due to the widespread geographical distribution of river valleys and coastal areas, and the attraction of human settlements to these areas. Floods are among the most frequent and costly natural disasters in terms of human hardship and economic loss.”

“A flood, which can be slow or fast rising but generally develops over a period of days, is defined by the National Flood Insurance Program (NFIP) as:

- A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from: overflow of inland or tidal waters; unusual and rapid accumulation or runoff of surface waters from any source; or a mudflow; or
- The collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.”<sup>9</sup>

Tiverton is not on the ocean coast but is bordered on the west by the tidally influenced Sakonnet River. The smaller rivers and streams that crisscross the town are generally surrounded by marsh and are not known to cause destructive flooding. Historically, runoff during torrential rain storms, tidally influenced water tables, and the Sakonnet River are the main cause of flooding in Tiverton, Rhode Island. For the purpose of this plan, the area adjacent to the Sakonnet River will be discussed in terms of being affected by coastal, not riverine flooding.

Severe storms with heavy rain can generate flash floods which strike and end quickly. Less common in Tiverton, flash flooding isn't limited to streams and rivers but also streets.

Flooding due to runoff occurs when water runs over the land's surface impervious surfaces (paved areas, building subdivisions, and highways). Two major environmental modifications are primarily responsible for drastically altering the rain fall-runoff relationship.

1. Making the land surface impervious by covering it with pavement and construction work.
2. Installing storm sewer systems that collect urban runoff rapidly discharging large volumes of water into stream networks and/or freshwater wetland system

#### Location

The Town of Tiverton is bordered by and divided by rivers and streams. The town has approximately 1,352 acres of flood hazard areas representing 6% of total acres in the town. Floodplains in Tiverton include “A” and “AE” zones. “A” zones are areas that would be inundated by the 1% annual chance flood. “The A Zone is that portion of the Special Flood Hazard Area that is not subject to high velocity wave action during the base flood and is not designated as Zone V due to primary frontal dune considerations. The source of flooding in an A Zone can be a stream or river that overflows its banks; a lake; or coastal storm surge accompanied by wave heights and wave run-up depths less than 3 feet.”<sup>10</sup> “AE” zones area zones depicted using specific elevation data. The Tiverton Resources map on page 37 depicts the FEMA flood zones which are mainly clustered along the Sakonnet River and the southwest corner around Nonquit Pond. The inland streams and areas around Stafford Pond, Sawdy Pond, and Cedar Swamp are not designated as Special Flood Hazard Areas. The areas whose flooding causes the most concern is 3 Rod Way at Fogland Beach, Riverside Drive, Souza Road at Main Road, and the northwest corner of the Villages at Mount Hope Bay property. All of the specific areas of concern are listed in Table 19.

#### Probability of Future Occurrence

Highly likely. As one of the top concerns of the THMC, coastal flooding is expected to occur in Tiverton, especially on the western side of town along the Sakonnet River.

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<sup>9</sup> Rhode Island Emergency Management Agency (RIEMA), Rhode Island 2014 Hazard Mitigation Plan Update

<sup>10</sup> “CRS Credit for Coastal A Zone Regulations.” <http://training.fema.gov/EMIWeb/CRS/>

Extent

Tiverton receives an average of 46 inches of rain each year.<sup>11</sup> The single day record rainfall was 6.3 inches which fell on August 10, 1992.<sup>12</sup> Based on recent historic data (see table below), Tiverton experiences one flood event a year which results in road closures.

Impact

Town officials and residents are most concerned about street flooding that cuts off access and damages the road infrastructure. This usually occurs in low lying and coastal areas after a heavy rain when the water table is higher than normal. Fortunately, there are few reports of private residents routinely being affected by flooding. This may create a false sense of security to the home and business owners that have literally built over the water along Main Road and Riverside Drive. During a storm, when the wind comes up the Sakonnet River, the long fetch pushes water up into the bay, creating a greater chance of flooding along Riverside Drive.

Flooding of local roads limit access for the population, may strand residents, and hinder emergency response or evacuation efforts. In an effort to prevent future losses or repetitive losses this HMP will identify projects to reduce losses from flooding in Chapter 6.

The Town of Tiverton also participates in the National Flood Insurance Program (NFIP). There are currently 177 NFIP policies in effect covering \$44,538,000 in property value. There have been 89 claims made since 1978, which paid out \$471,939 to policyholders. Currently there are two residential and 1 non-residential Repetitive Loss properties in the Town of Tiverton. A Repetitive Loss property is defined as an insurable building for which two or more claims of more than \$1,000 were paid out by the NFIP within a ten year period.<sup>13</sup>

History

Historically in Tiverton, torrential rainfall, thunderstorms, and snowmelt are the causal events that result in street, basement, and stream flooding.

**Table 4: Recent Flood Events<sup>14</sup>**

Date	Type	Damage	Comments
3/30/2010	Flood	\$3,52,000	5-8 inches of rain fell across Newport County, resulting in flooded roads in Tiverton.
8/50/12	Flood	\$0	Several roads were flooded near Tiverton Four Corners, the amount of water overwhelming storm drains.
6/7/2013 (Last flood event of record)	Flood	\$15,000 est.	3-5 inches of rain fell across Newport County from the remnants of Tropical Storm Andrea. Significant urban flooding.

<sup>11</sup> <https://rainfall.weatherdb.com/l/25822/Tiverton-Rhode-Island>

<sup>12</sup> Ibid

<sup>13</sup> As per communication with the Rhode Island State Hazard Mitigation Officer on 7/8/15

<sup>14</sup> NOAA <http://www.ncdc.noaa.gov/stormevents>

### 3.1.2 Hurricanes/Nor'easters

#### Hurricane Description

"Tropical cyclones, a general term for tropical storms and hurricanes, are low pressure systems that usually form over the tropics. These storms are referred to as "cyclones" due to their rotation. Tropical cyclones are among the most powerful and destructive meteorological systems on earth. Their destructive phenomena include very high winds, heavy rain, lightning, tornadoes, and storm surge. As tropical storms move inland, they can cause severe flooding, downed trees and power lines, and structural damage.



There are three categories of tropical cyclones:

1. Tropical Depression: maximum sustained surface wind speed is less than 39 mph.
2. Tropical Storm: maximum sustained surface wind speed from 39-73 mph.
3. Hurricane: maximum sustained surface wind speed exceeds 73 mph.

Once a tropical cyclone no longer has tropical characteristics it is then classified as an extratropical system. Most Atlantic tropical cyclones begin as atmospheric "easterly waves" that propagate off the coast of Africa and cross the tropical North Atlantic and Caribbean Sea. When a storm starts to move toward the north, it begins to leave the area where the easterly trade winds prevail, and enters the temperate latitudes where the westerly winds dominate. This produces the eastward curving pattern of most tropical storms that pass through the Mid-Atlantic region. When the westerly steering winds are strong, it is easier to predict where a hurricane will go. When the steering winds become weak, the storm follows an erratic path that makes forecasting very difficult. Howling winds associated with Nor'easters also have the potential to produce significant storm surge, similar to that of a Category One hurricane. In addition, these types of storms can also produce wind gusts to near hurricane force as well as flooding rain and crippling snowfall.

Hurricanes are categorized according to the Saffir/Simpson scale with ratings determined by wind speed and central barometric pressure. Hurricane categories range from 1 through 5, with Category 5 being the strongest (winds greater than 155 mph). A hurricane watch is issued when hurricane conditions could occur within the next 36 hours. A hurricane warning indicates that sustained winds of at least 74 mph are expected within 24 hours or less."<sup>15</sup>

The Saffir-Simpson scale below is based primarily on wind speeds and includes estimates of barometric pressure and storm surge associated with each of the five categories. It is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall."<sup>16</sup>

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<sup>15</sup> Rhode Island Hazard Mitigation Plan, 2013 <http://www.riema.ri.gov/prevention/mitigation/RI%20SHMP%2011-26-2013.pdf>

<sup>16</sup> Hurricanes and Tropical Storms: Saffir-Simpson Hurricane Scale" *Weather.com*. The Weather Channel, 1995-2001. <http://www.thefreedictionary.com/hurricane>

**Table 5: Saffir/Simpson Hurricane Wind Scale<sup>17</sup>**

Category	Central Pressure		Winds		Damage
	Millibars	Inches	(mph)	(kts)	
1	>980	>28.9	74-95	64-83	Minimal
2	965-979	28.5 - 28.9	96-110	84-96	Moderate
3	945-964	27.9 - 28.5	111-129	96-112	Extensive
4	920-944	27.2 - 27.9	130-156	113-136	Extreme
5	<920	<27.2	157+	>137	Catastrophic

While there is at least a 10% chance that a hurricane will significantly impact the Town in the next five years, one direct hit on the State of Rhode Island could be catastrophic for all of the cities and towns. Tiverton has been impacted by hurricanes several times throughout the past century, all of which are referenced in Table 6. Changing global climate conditions may lead to stronger, more intense storms with hurricane-force winds in the region.

Nor’easter Description

An extra-tropical coastal storm, known as a Nor’easter, is typically a large, counterclockwise wind circulation around a low pressure center. The storm radius is often as large as 1,000 miles, and the horizontal storm speed is about 25 miles per hour, traveling up the eastern United States coast. Sustained wind speeds of 10-40 MPH are common during a nor’easter, with short term wind speeds gusting up to 70 MPH. Unlike hurricanes and tropical storms, nor’easters can sit off shore, wreaking damage for days.<sup>18</sup>

Nor’easters are a common winter occurrence in New England (September to April) and repeatedly result in flooding, various degrees of wave and erosion induced damage to structures, and erosion of natural resources, such as beaches, dunes and coastal bluffs. In this region, Nor’easters can bring rain or snow but because of the high wind component, they were included with hurricanes in this hazard mitigation plan.

Location

Hurricanes that strike the Eastern United States originate in the tropical and subtropical North Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico. The Atlantic hurricane season spans a six-month period (June 1st through November 30<sup>th</sup>). Being along a tidal river, Tiverton may be susceptible to tide surges associated with coastal storms. The entire town is vulnerable to the wind and rain damage that a hurricane or Nor’easter may bring.

Probability of Future Occurrence

Highly Likely.

Extent

Hurricanes that likely make it up to Rhode Island are usually weak (Category 1) or downgraded tropical systems. The wind speeds may be less but the storms can still bring a lot of rain. Nor’easters are not frequent (one every couple of years) but have a tendency to stall and unload precipitation for a few days.

Impact

<sup>17</sup> Saffir-Simpson Hurricane Wind Scale [http://www.nhc.noaa.gov/pdf/sshws\\_2012rev.pdf](http://www.nhc.noaa.gov/pdf/sshws_2012rev.pdf)

<sup>18</sup> Rhode Island Emergency Management Agency (RIEMA), Rhode Island 2014 Hazard Mitigation Plan Update

The Town of Tiverton is developed along the coast and heavily wooded inland. Areas farther inland would be susceptible to wind damage with tree damage and potential power losses. Also the potential for flash flooding and water damage from heavy rains exists. There is a risk of high water and coastal flooding along the western side of town.

### History

The two hurricanes that resulted in the largest loss of life in the State were "The Great New England Hurricane of 1938" and "Hurricane Carol". "The Great New England Hurricane" occurred on September 21st, 1938, and is considered the worst disaster in Rhode Island history. It resulted in the deaths of 262 people and caused damage estimated at \$100,000,000. The eye of this hurricane tracked to the west of Rhode Island and hit at high tide. During the storm, two storm surges almost 30' high destroyed most of the beach homes along the South Shore of Rhode Island. In downtown Providence, the surge flooded the area to a depth of more than 13'9" above the mean high-water mark. As a result, persons drowned trying to escape automobiles submerged in the streets and from buildings where the first floors were flooded to the ceiling.<sup>19</sup>

Throughout Rhode Island, the American Red Cross (ARC) spent \$433,485 for the rehabilitation of 3,074 families. A total of 19,695 families suffered property loss; 797 permanent homes were destroyed; 1,169 summer homes were washed away; 899 boats destroyed and 888 damaged, 177 barns and 1,800 other buildings of various types were destroyed.<sup>20</sup>

On August 31, 1954, "Hurricane Carol" hit Rhode Island, in the same manner as "The Great New England Hurricane of 1938". As a result, downtown Providence was flooded when the water reached 13' above mean high-water level.

The winds from Hurricane Gloria in 1985, Hurricane Bob in 1991, and Tropical Storm Irene in 2011 caused downed tree limbs and power outages.

The most recent significant weather event to affect the state was a downgraded hurricane. On October 29<sup>th</sup> 2012, Hurricane Sandy which had been sweeping up the Mid-Atlantic Coast had been downgraded by the time it had reached Rhode Island. Super Storm Sandy hit Rhode Island with strong winds, and storm surge, causing significant coastal erosion. Along the south coast, the storm surge was 4 to 6 feet and seas from 30 to a little over 35 feet were observed in the outer coastal waters. The very large waves on top of the storm surge caused destructive coastal flooding along stretches of the Rhode Island exposed south coast. Washington and Newport Counties suffered the most damage and received FEMA disaster declarations. More than \$39 million has been paid in federal support. Sadly, at least 182 people nationwide lost their lives in what turned out to be the nation's second most costly weather disaster. Fortunately there were no disaster-related deaths in Rhode Island. Tiverton did not have any significant damage from Super Storm Sandy, just fallen trees and brush.

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<sup>19</sup> Providence Journal-Bulletin, 1998 Journal-Bulletin: Rhode Island Almanac 112th ed. (Providence, RI: Providence Journal Company, 1998) 255.

<sup>20</sup> Ibid



**Table 6: Recent Hurricanes in Rhode Island<sup>21</sup>**

Hurricane	Date	Description
1938	9/21/1938	<p>The hurricane of September 21, 1938 brought major devastation to the State, with 262 persons losing their lives and damage estimated at \$100 million. Another major hurricane occurred on September 14, 1944; no lives were lost, but property damage was over \$2 million. The coastal area from Westerly to Little Compton experienced the heaviest damage, but there was no tidal wave, since the storm hit at ebb tide.</p> <p>Sustained winds of 95 MPH recorded; damage estimated at \$100 million; 262 fatalities. Tide 15 feet above mean sea level (at USGS gage in Westerly). Virtually all the State was without power. Ten percent of electric customers still without power 12 days after hurricane.</p>
1944	9/14/1944	Affected Rhode Island and southeastern Massachusetts; \$2 million property damage, no loss of life.
Carol	8/31/1954	<p>On August 31, 1954, Hurricane Carol swept into Rhode Island with little warning. The result was 19 deaths and \$200 million in property damage. The storm center passed to the west of Providence and came at high tide. The central area of Providence was flooded to a depth of 13 feet, and 3,500 cars were inundated in the downtown areas. Hurricane Edna occurred 12 days after Carol, with heavy rain and major river flooding.</p> <p>There were 19 fatalities in New England, \$200 million property damage and 13' flooding. In Providence, wind speed of 90 MPH, with 115 MPH gusts; nearly 3,800 homes destroyed. Tide 12.2 feet above mean seal level (at USGS gage in Westerly). Most of State without power. Four days after storm, approximately 50% had power restored; 90% after seven days.</p>
Edna	9/11/1954	Heavy rain and major flooding in the Blackstone River Valley.

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<sup>21</sup> Rhode Island Emergency Management Agency (RIEMA), Rhode Island 2014 Hazard Mitigation Plan Update. Most comprehensive hurricane history.

Hurricane	Date	Description
Diane	8/ 17-20/1955	<p>In 1955, remnants of the August Hurricane Diane swept over Rhode Island, but its wind velocities were far below hurricane force because of its long inland trip over North Carolina, Virginia, and Pennsylvania. Damage to power lines was high, and at one time 82% of Rhode Island's homes were without electricity. Ample warning permitted people to return home from school and work early, and as a result, only two lives were lost. Property damage amounted to \$170 million, most resulting from torrential rains which caused serious river flooding.</p> <p>Heavy rain; Blackstone River crests 15' above normal; \$170 million in property damage. Heavy rain and 6' tidal surge; \$5 million in property damage; 82% of electric customers lose power.</p>
Donna	9/12/1960	Heavy rain and major flooding in the Blackstone River Valley.
Esther	9/21/1961	Heavy shore damage at Sakonnet Point in Little Compton and Misquamicut in Westerly.
Gloria	9/27/1985	Two fatalities in New England; property damage estimated at \$19.8 million; 8,596 of electric customers lose power an estimated 23,700 people evacuated.
Bob	8/18/1991	Southern New England damage at \$1.5 billion; 60% of residents across Southeastern New England lost power; 6'-10' storm surge in Narragansett Bay; Two (2) unconfirmed tornadoes in Rhode Island. There were 18 fatalities in Southern New England, although none in Rhode Island.
Irene	8/27/2011	<p>Preliminary damage assessment report from FEMA brings the total Public Assistance cost to \$9,260,898.</p> <p>Irene knocked down trees and power lines, leaving up to half of Rhode Island residents without power. Gusts of wind up to 71 MPH were reported, and storm surge in Narragansett Bay caused some coastal damage. However, the majority of damage was caused by wind.</p> <p>The storm surge experienced along the coast was generally in the two to four foot range with a high of 4.78 feet at Fox Point in Providence, Rhode Island. The highest sustained wind speed was 54 knots (62 MPH) at the Physical Oceanographic Real Time System station at Conimicut Light in Narragansett Bay, RI. Newport County reported trees downed onto wires.</p>
Sandy	10/29/2012	<p>Hurricane Sandy swept through the region in October 2012 leaving significant damage all along the coast. Beaches along Westerly, including Misquamicut, were devastated and almost unrecognizable. More than 122,000 people lost power. Tiverton experienced damaging winds.</p> <p>It is estimated that more than \$39.4 million in support from four federal disaster relief programs is helping RI recover from this disaster, a majority of which is from the NFIP (\$31.1 million).</p>

### 3.1.3 Winter Storm

#### Description

The majority of Rhode Island lies outside the heavy snow and ice regions of the northeast. Due to its maritime climate, Rhode Island generally experiences cooler summers and warmer winters than inland areas. However, snow and ice do occur and can be more than an inconvenience and cause extensive damage. The two major threats from these hazards are loss of power due to ice on electrical lines and snow loading on rooftops. Additionally, loss of power could mean loss of heat for many residents.

Winter storms vary in size and strength and can be accompanied by strong winds that create blizzard conditions and dangerous wind chill. There are three categories of winter storms. A blizzard is the most dangerous of the winter storms. It consists of low temperatures, heavy snowfall, and winds of at least 35 miles per hour. A heavy snow -storm is one which drops four or more inches of snow in a twelve-hour period. An ice storm occurs when moisture falls and freezes immediately upon impact. For the purpose of this plan, severe winter storms include heavy amounts of snow and ice. All of which may occur independently or at the same time.

#### Location

A severe winter storm could have a serious impact in private, and public structures, as well as the general population throughout Tiverton. Those most at risk to extreme cold are the elderly and those who work outside.

#### Probability of Future Occurrence

High Likely.

#### Extent

On average, Tiverton receives 33.8 inches of snow throughout the winter. The record single day snowfall is 20 inches on February 7, 1978. The average winter temperature in Tiverton is 43.2 Fahrenheit.<sup>22</sup>

#### Impact

The town is in a rural area and many of the roads are lined with trees. A winter storm could create a long-term power outage, which would have an effect of isolating residents with downed trees and loss of power. The loss of power could affect heating systems and water for those properties that use private wells. It would also have a major effect on emergency response. Failed Internet and phone switches could affect town wide communication.

#### History

Historically, severe winter storms for Rhode Island have resulted in the closing of schools/businesses, power outages, fallen trees/wires, disruption of transportation systems, and damage to commercial and residential property. The winter of 1978 is considered one of the worst winters on record for the State. On January 13, 1978 an ice storm hit the State. Heavy ice cover was most severe in Cranston and Warwick. Statewide the storm destroyed thousands of trees and left nearly 120,000 people without power and heat in some circumstances. A little more than three weeks later, on February 6, 1978, the State was pounded by what became known as the "Blizzard of 78". In Warwick, the official measure of snowfall at T.F. Green Airport was 28.6". Snow accumulations ranged from 10" on Block Island to 56" in northern areas. Because the heavy snowfall arrived during rush hour, nearly 30,000 vehicles were left stranded. The State was immobilized for almost a week and the President declared Rhode Island a disaster area. During that week

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<sup>22</sup> <https://temperature.weatherdb.com>

400 Army and Navy personnel aided local crews to clear streets and highways. The statewide estimated losses from the blizzard were near \$110 million and there were 21 storm-related deaths.

Since then, numerous winter storms events dumping 2 feet or more of snow have occurred: January 7, 1996 (12-24 inches across the state), January 22, 2005 (15-25 inches across the state), February 8, 2013 (24 inches-30 inches across the state), and March 22, 2013 (12-24 inches reported). The severe winter storm that swept through Rhode Island on March 22, 2013 was declared a major disaster (DR-4107) by the Federal Emergency Management Agency. This large storm which stretched from New Jersey into Canada brought more than two feet of snow to Rhode Island in less than 24 hours. National Grid estimated more than 180,000 customers in Rhode Island lost power.

The winter of 2015 produced record snow in Rhode Island. In January 2015, winter storm Juno dropped over 18 inches of snow and created treacherous icing conditions on the roads, forcing the State to implement a driving ban during the worst of the storm. Tiverton received a total of 19 inches. Subsequent storms only added to the snow load as melting was late to occur.

**Table 7: Recent History of Winter Weather in Newport County, RI<sup>23</sup>**

Date	Type	Comments
2/10/2010	Winter Storm	5-8 inches of snow fell across Newport County
12/26/2010	Winter Storm	6-10 inches of snow fell across Newport County
1/12/2011	Winter Storm	6-10 inches of snow fell across Newport County
1/26/2011	Heavy Snow	5-7 inches of snow fell across Newport County
1/21/2012	Heavy Snow	8-9 inches of snow fell across the coast
12/29/2012	Heavy Snow	5-8 inches of snow fell across Newport County
2/8/2013	Blizzard	13-16 inches of snow fell across Newport County. Blizzard of 2013 also produced prolonged period of very strong winds.
1/2/2014	Heavy Snow	7-9 inches of snow fell across Newport County
1/21/2014	Heavy Snow	5-8 inches of snow fell across Newport County
2/15/2014	Heavy Snow	6-8 inches of snow fell across Newport County
1/26/2015	Blizzard	16-19 inches of snow fell across Newport County
2/14/2015	Heavy Snow	9-10 inches of snow fell across Newport County
3/05/2015	Heavy Snow	8-11 inches of snow fell across Newport County
1/23/2016	Heavy Snow	4-9 inches of snow fell across Newport County
2/8/2016	Winter Weather	4-6 inches of snow fell across Newport County

<sup>23</sup> NOAA <http://www.ncdc.noaa.gov/stormevents> Winter weather is not a localized event in Rhode Island towns. The best available data was for Newport County, of which Tiverton is a part of.

3.1.4 High Winds

Description

Wind is the movement of air caused by a difference in pressure from one place to another. Local wind systems are created by the immediate geographic features in a given area such as mountains, valleys, or large bodies of water. National climatic events such as high gale winds, tropical storms, thunderstorms, nor'easters, hurricanes, and low-pressure systems produce wind events in Rhode Island. Wind effects can include blowing debris, interruptions in elevated power and communications utilities, and intensification of the effects of other hazards related to winter weather and severe storms.

The Beaufort Wind Scale is a 17 level scale used to describe wind speed and observed wind conditions at sea and on land. A wind classification of 0 has wind speeds of less than 1 mile per hour are considered calm. On the other end, a classification of 10 with wind speeds reaching 63 miles an hour will blow down trees and cause considerable damage.

**Beaufort Wind Chart – Estimating Winds Speeds**

Beaufort Number	MPH		Terminology	Description
	Range	Average		
0	0	0	Calm	Calm. Smoke rises vertically.
1	1-3	2	Light air	Wind motion visible in smoke.
2	4-7	6	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	11	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	15	Moderate breeze	Dust and loose paper is raised. Small branches begin to move.
5	19-24	22	Fresh breeze	Smaller trees sway.
6	25-31	27	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult.
7	32-38	35	Near gale	Whole trees in motion. Some difficulty when walking into the wind.
8	39-46	42	Gale	Twigs broken from trees. Cars veer on road.
9	47-54	50	Severe gale	<b>Light structure damage.</b>
10	55-63	60	Storm	<b>Trees uprooted. Considerable structural damage.</b>
11	64-73	70	Violent storm	<b>Widespread structural damage.</b>
12	74-95	90	Hurricane	<b>Considerable and widespread damage to structures.</b>

Location

Wind events are expected throughout the year in Tiverton.

Probability of Future Occurrence

Highly Likely- The Tiverton HMP Committee agreed that there is a very high likelihood of strong winds causing damage in Tiverton within the next year. This is consistent with the geographic extent of winds throughout Rhode Island.

Extent

Wind speeds in neighboring Providence are indicative of Tiverton (local data unavailable). “With an average wind speed of 9.3 MPH, Providence is a windy city, 1.00 MPH higher than the national average. The average wind speed in Providence is about the same as the [State] average. The windiest season in Providence is spring, with spring wind speeds reaching 10.27 MPH on average - 1.17 MPH higher than in the rest of the U.S.”<sup>24</sup>

Impact

Strong wind gusts of 40 miles an hour (Beaufort Scale of 8) can blow off twigs and small branches from trees. Occasional gusts and sustained winds at this speed (and above) are of concern to the Town. Damages from wind events range from power outages, property damage to vehicles and buildings and fallen trees/limbs. Wind events in Tiverton have resulted primarily in power outages and downed tree limbs with minimal property damage. It is important that the Town of Tiverton maintain their public tree trimming program that will reduce the likelihood of fallen trees/limbs from disrupting transportation routes and/or taking down power lines.

History

Table 8 provides a history of significant wind events for the Newport County area.

**Table 8: High Wind Events<sup>25</sup>**

Date	Magnitude (mph)	Damage Comments
3/14/2010	57 mph	Rain and strong winds resulted in numerous downed trees and wires, and some minor structural damage in Newport, Middletown, and Portsmouth.
2/25/2011	57 mph	Heavy snow and wind brought down telephone poles in nearby Middletown.
10/30/2011	61 mph	Rare Nor’easter brought down utility lines in Middletown.
10/29/2012	60 mph	Hurricane Sandy brought heavy winds. Numerous trees were downed in Middletown, Tiverton, and Little Compton.
11/2/2014	46 mph	Downed wires in Middletown
1/19/2016	46 mph	Utility wires were downed in Tiverton, blocking Crandall Road.
2/25/16	57 mph	Trees and wires were downed in Tiverton.
9/5/2016	50 mph	A tree was downed onto wires, a garage, and a car on Gibbs Avenue in Newport. The downed lines sparked a brush fire. A tree was downed onto a transformer on Rhode Island Avenue. In Tiverton, a tree was downed onto a house. Wires were downed onto East Road. In Middletown, trees were downed on Indian Avenue and Goldenrod Drive.

<sup>24</sup> Weather DB <https://wind-speed.weatherdb.com/l/206/Providence-Rhode-Island>. Best available data.

<sup>25</sup> NOAA Storm Events Database

3.1.5 Extreme Temperatures

Description

Excessive heat warnings are generally issued when the maximum heat index temperature is expected to be 105 degrees Fahrenheit or higher for at least 2 days and night time air temperatures will not drop below 75 degrees Fahrenheit.<sup>26</sup>

Extreme cold is regionally defined. In Rhode Island, it usually involves temperatures below zero degrees Fahrenheit. Wind conditions can drive the temperature down even further. The wind chill index attempts to quantify the cooling effect of wind with the actual outside air temperature to determine a wind chill temperature that represents how cold people and animals feel, based on the rate of heat loss from exposed skin. A wind chill index of -5 indicates that the effects of wind and temperature on exposed flesh are the same as if the air temperature alone were five (5) degrees below zero (0), even though the actual temperature could be much higher. The NWS issues a wind chill advisory when wind chill temperatures are potentially hazardous and a wind chill warning when the situation can be life-threatening.<sup>27</sup>

Location

Extreme temperatures could have a serious impact on private and public structures, as well as the general population throughout Tiverton. Those most at risk to extreme temperatures are the elderly and those who work outside.

Probability of Future Occurrence

Highly Likely.

Extent\*

In 2011, Newport State Airport reported heat indexes of 106 to 110 over an eight-hour period. Wind chills of 32 below zero were reported at Newport State Airport in 2016.

\*Newport State Airport (4 miles southwest of Tiverton) is the closest reporting station.

Impact

Personal exposure to dangerous heat conditions may lead to heat cramps, heat exhaustion, and heat stroke. These are especially important to monitor in children, and vulnerable populations that are not able to move to cooler conditions. Extreme cold conditions may occur during, after, or without any connection to a winter storm. Exposure to extreme cold can lead to hypothermia and frostbite.

History

The table below summarizes some of the recent periods of extreme heat and cold within the region.

**Table 9: Extreme Temperatures<sup>28</sup>**

Date	Type	Comments
7/22/11	Excessive Heat	Heat indexes of 106 to 110 over a five-hour period in Newport County
2/16/2015	Extreme Cold/Wind Chill	Wind chills as low as 26 below zero reported at Newport State Airport.

<sup>26</sup> NOAA Heat Safety <http://www.nws.noaa.gov/os/heat/ww.shtml>

<sup>27</sup> Rhode Island Emergency Management Agency (RIEMA), Rhode Island 2014 Hazard Mitigation Plan Update

<sup>28</sup> NOAA Storm Events Database [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov). Best available data.



Date	Type	Comments
2/14/2016	Extreme Cold/Wind Chill	Wind chills as low as 34 below zero were reported at Newport Airport.

3.1.6 Brushfire

Description

A brushfire is a fire burning in vegetation that is predominantly shrubs, brush, and scrub growth.<sup>29</sup> Favorable fire conditions arise from extended periods of hot, dry weather and accumulated vegetation. While wildfires are generally associated with thousands of acres of trees burning, brushfires tend to be smaller, confined to the understory, and manageable.



Various natural (i.e. lightning) and human actions (i.e. campfires or auto accidents) can ignite brushfires. Fuel (dry grasses, leaves, and dead trees), topography and weather (wind conditions and humidity) will dictate the extent of a brushfire.

Greater wildfires that cover thousands of acres of land are classified by their size and progression. Once a wildfire has been detected and the area assessed, the wildfire is assigned one of the following categories from lowest to highest: category 1 (incipient- initial), category 2 (growing and threatening), category 3 (major aggressive fires), category 4 (major aggressive fire of at least 5,000 acres expanding at 400 acres per hour), or category 5 (major very aggressive fire of at least 16,000 acres expanding at 1000 acres per hour or more). These categories may change as the wildfire continues to burn. Fires do not grow to that size in Tiverton due to the small land area, lack of fuel, and quick response to brushfires.

Probability of Future Occurrence

Highly Likely.

Location

When drought conditions are present, the brushfire threat increases. Approximately 16,000 acres of land in Tiverton (about 70%), remains unimproved, including 4,253 acres of open space and conservation areas.<sup>30</sup> The largest track of contiguous forest is Weetamoo Woods (541 acres) in the center of Tiverton.

Extent

The U.S. Forest Service has established the National Fire Danger Rating System (NFDRS) to determine the daily risk to fire experienced by different regions of the country (Table 10). The system uses mathematical formulas including wind speed and fuel type to determine a fire index. The fire indexes are grouped into five groups based on severity, and each group has an associated class rating (Classes 1 through 5) and an associated fire risk level. A fire index of zero occurs when there is snow on the ground or there has been a prolonged period of substantial rain.<sup>31</sup>

<sup>29</sup> National Park Service, USDA Forest Service <http://www.fs.fed.us/nwacfire/home/terminology.html>

<sup>30</sup> Tiverton Comprehensive Community Plan, 2009

<sup>31</sup> Rhode Island Emergency Management Agency (RIEMA), Rhode Island 2014 Hazard Mitigation Plan Update



**Table 10: National Fire Danger Rating System**

Fire Index	Rating	Description
0	Class 1	No rating
1-30	Class 2	Low danger
31-60	Class 3	Medium danger
61-80	Class 4	High danger
81+	Class 5	Extreme

Impact

A large brushfire in Tiverton could destroy large tracts of forest, threaten homes and utility lines, and affect power, internet and phone service. Smoke inhalation could cause breathing problems to residents.

History

Historically, brushfires (up to 2-3 acres) have burned through vegetated areas. Most of the smaller brushfires were at the southern part of town. 1995 was the last major brushfire of record, it burned for 3 days underground, affecting 1-3 acres. The last controlled burns were in the 1960s and 70s. The debris cover is currently too thick to safely do a controlled burn without the danger of the fire going underground.

3.1.7 Thunder/Lightning Storms

Description

Thunderstorms are formed when the right atmospheric conditions combine to provide moisture, lift, and warm unstable air that can rise rapidly. Thunderstorms occur any time of the day and in all months of the year, but are most common during summer afternoons and evenings and in conjunction with frontal boundaries. The National Weather Service (NWS) classifies a thunderstorm as severe if it produces hail at least one inch in diameter, winds of 58 MPH or greater, or a tornado. About 10 percent of the estimated 100,000 annual thunderstorms that occur nationwide are considered severe.<sup>32</sup> Thunderstorms affect a smaller area compared with winter storms or hurricanes, but they can be dangerous and destructive for a number of reasons. Storms can form in less than 30 minutes, giving very little warning; they have the potential to produce lightning, hail, tornadoes, powerful straight-line winds, and heavy rains that produce flash flooding.<sup>33</sup>



All thunderstorms contain lightning. Thunderstorms can occur singly, in clusters, or in lines. Therefore, it is possible for several thunderstorms to affect one location in the course of a few hours. Thunderstorms usually bring heavy rains (which can cause flash floods), strong winds, hail, lightning, and tornadoes.<sup>20</sup> Lightning is caused by the attraction between positive and negative charges in the atmosphere, resulting in the buildup and discharge of electrical energy. Lightning is one of the most underrated severe

<sup>32</sup> National Oceanic and Atmospheric Administration, <http://www.nws.noaa.gov/om/severeweather/resources/ttl6-10.pdf>.

<sup>33</sup> Rhode Island Emergency Management Agency (RIEMA), Rhode Island 2014 Hazard Mitigation Plan Update

weather hazards, yet ranks as the second-leading weather killer in the United States. “Hundreds of people across the nation are injured annually by lightning, most commonly when they are moving to a safe place but have waited too long to seek shelter. Lightning strike victims often suffer long-term effects such as memory loss, sleep disorders, weakness and fatigue, chronic pain, depression and muscle spasms. Lightning has the potential to start both house fires and wildfires. Lightning causes an average of 55-60 fatalities, 400 injuries, and over \$1 billion in insured losses annually nationwide.”<sup>34</sup> Lightning often strikes as far as 10 miles away from any rainfall.

Probability of Occurrence

Likely.

Location

All areas of Tiverton are vulnerable to damage from thunder/lightning storms.

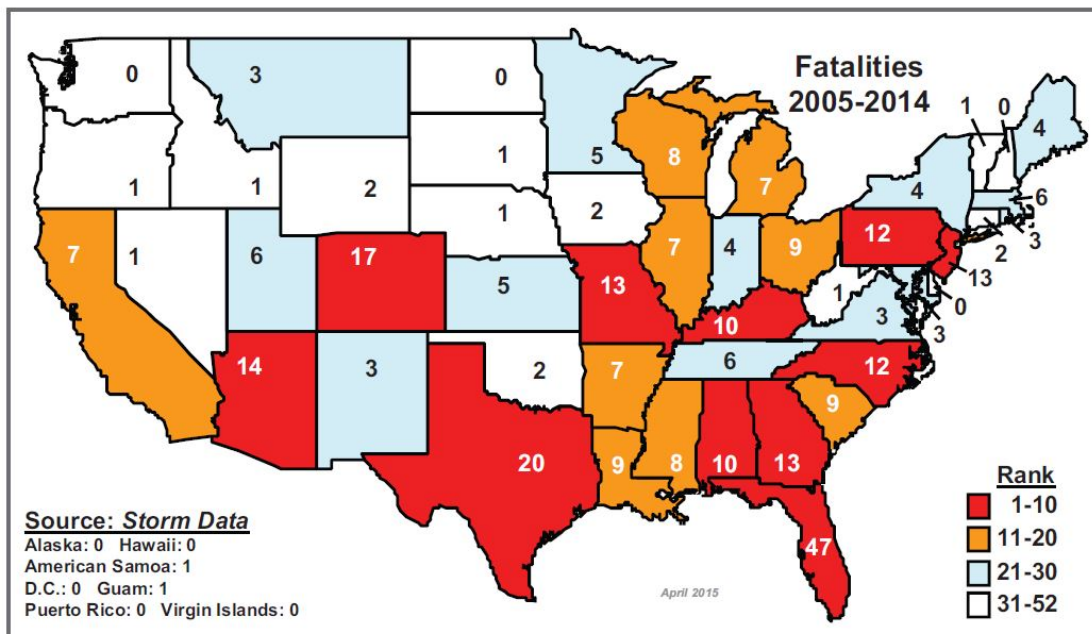
Extent

There is no universally accepted standard for measuring the strength or magnitude of a lightning storm. Lightning events are often measured by the damage they produce.

Impact

Large tracts of forested land and homes could be struck by lightning causing fires. In general, buildings are more likely to be struck by lightning if they are located on high ground or if they have tall protrusions such as steeples or poles which the stepped leader can jump to. Electrical and communications utilities are also vulnerable to direct lightning strikes. Damage to these lines has the potential to cause power and communications outages for businesses, residences, and critical facilities.

**Map 2: Number of lightning deaths in the United States, 2005-2014<sup>35</sup>**



<sup>34</sup> Ibid

<sup>35</sup> National Lightning Safety Institute, NOAA.

### History

Every year there are 2-3 reported lightning strikes in Tiverton. Some are more notable than others. From 2008-2016, fire department records estimate \$11,000 in damage from fires initiated by lightning strikes. The table below highlights recent thunderstorms storms that have affected Tiverton.

**Table 11: Recent Damaging Thunderstorms Events Near Tiverton<sup>36</sup>**

Date	Type	Damage	Comments
7/4/1999	Lightning	unknown	Thunderstorms with lightning moved across RI and started a house fire in Tiverton.
6/24/2008	Lightning	Fatality	Man struck by lightning while fishing on a jetty in Bristol (Bristol is 2 miles from Tiverton)
8/5/2009	Lightning	\$20,000	Lightning struck a house on North Lane in Bristol, resulting in a house fire (Bristol is 2 miles from Tiverton).
6/5/2010	Lightning/Thunderstorm	\$20,000	Several trees and wires were downed by lightning strikes. Portsmouth fire communications were knocked out by a lightning strike (Portsmouth is adjacent to Tiverton).
7/28/2015	Lightning/Thunderstorm	\$5,000	Lightning struck a house on Main Road in Tiverton and knocked down a tree.

### 3.1.8 Hail

#### Description

One of the less life-threatening yet very damaging natural hazard events is hail. Hail is not discussed in depth in the State hazard mitigation plan but is briefly mentioned here. Hail is formed in towering cumulonimbus clouds (thunderheads) when strong updrafts carry water droplets to a height at which they freeze. Eventually, these ice particles become too heavy for the updraft to hold up, and they fall to the ground at speeds of up to 120 MPH. Hail falls along paths called swaths, which can vary from a few square acres to up to 10 miles wide and 100 miles long.<sup>37</sup> Hail larger than ¾ inch in diameter can do great damage to both property and crops, and some storms produce hail over two (2) inches in diameter. Hail causes about \$1 billion in damages annually in the U.S.<sup>38</sup>

During a thunderstorm, severe downdrafts may cause microbursts, a rapid column of airflow with the force of tornado able to knock down mature trees. Microbursts are capable of creating wind speeds over 150 mph. In 2002 the Town of Hopkinton suffered a microburst resulting down trees and minor damage to property. A similar event occurred in 2015 in Cranston and Warwick.

<sup>36</sup> NOAA <http://www.ncdc.noaa.gov/stormevents> Tiverton fire department records are inconclusive to accurately state specific lightning strikes. NOAA data was used to show nearby events.

<sup>37</sup> University Corporation for Atmospheric Research, <http://www.ucar.edu/communications/factsheets/Hail.html>.

<sup>38</sup> Ibid

**Table 12: Hail Size**<sup>39</sup>

<b>HAIL DIAMETER</b>	<b>SIZE DESCRIPTION</b>
1/4"	Pea Size
1/2"	Mothball Size
3/4"	Penny Size
7/8"	Nickel Size
1" (Severe Criteria)	Quarter Size
1 1/4"	Half Dollar Size
1 1/2"	Walnut or Ping Pong Ball Size
1 3/4"	Golf Ball Size
2"	Hen Egg Size
2 1/2"	Tennis Ball Size
2 3/4"	Baseball Size
3"	Teacup Size
4"	Grapefruit Size
4 1/2"	Softball Size

Location

All if Tiverton is susceptible to hail.

Probability of Occurrence

Possible.

Extent

Localized, up to 1 inch in diameter

Impact and Vulnerability

Large hail can dent automobiles, break windows, and destroy roofs.

History

The table below summarizes the recent history of damaging hail near Tiverton, RI

**Table 12: Hail Events**

<b>Date</b>	<b>Location</b>	<b>Size</b>	<b>Comments</b>
8/7/2014	Little Compton, RI	Penny (0.75")	Showers and thunderstorms produce large hail (0.75 inches in diameter)
8/4/2015	Fall River, MA	Nickel (0.88")	Line of severe thunderstorms produced high winds and hail 0.88 inches in diameter.
6/21/2016	Newport, RI	Penny (0.75")	Showers and thunderstorms produced hail

<sup>39</sup> National Weather Service [http://www.weather.gov/btv/skywarn\\_hailwind](http://www.weather.gov/btv/skywarn_hailwind)

### 3.1.9 Drought

Drought is a gradual phenomenon that occurs slowly, over a multi-year period. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Due to its coastal location in a temperate climate, Rhode Island rarely experiences extended periods of drought. However, seasonal droughts have occurred when precipitation levels are low. Drought conditions can impact crops, water available for fire suppression, and reservoir levels. In Rhode Island, drought conditions can trigger fire hazard warnings.

There are four different ways that a drought can be defined:

1. Meteorological – A measure of departure of precipitation from normal. Due to climatic differences, what is considered a drought in one location may not be a drought in another location.
2. Agricultural – refers to a situation when the amount of moisture in the soil no longer meets the needs of a particular crop.
3. Hydrological- occurs when surface and subsurface water supplies are below normal.
4. Socioeconomic- refers to the situation that occurs when physical water shortage begins to effect people.

Characteristics and impacts of drought differ in many ways, so it is difficult to quantify drought. An existing index called the Palmer Drought Severity Index (PDSI) that used temperature and precipitation levels to determine dryness, measuring a departure from the normal rainfall in a given area. The PDSI uses temperature and precipitation levels to determine dryness. The advantage of the PDSI is that it is standardized to local climate, so it can be applied to any part of the country to demonstrate relative drought or rainfall conditions. A monthly PDSI value below -2.0 indicates moderate drought, and a value below -3.0 indicates severe drought.

**Table 13: Palmer Drought Severity Index**

Severity	Index Value
Extreme Drought	-4 or less
Severe Drought	-4 to -3
Moderate Drought	-3 to -2
Mild Drought	-2 to -1
Incipient Dry Spell	-1 to -0.5



#### Location

According to the Rhode Island Water Resource Board the potential for a drought exists every eleven years in Rhode Island. Although temporary drought conditions may occasionally exist in Rhode Island, affecting Tiverton, devastating, long term drought conditions are not indicative of this temperate region.

#### Probability of Future Occurrence

Likely.

Extent

According to The National Weather Service Rhode Island receives on average 39” to 54” annually. Notwithstanding the same, the State experiences extended periods of dry weather. Some type of drought in Rhode Island occurs approximately once every 11 years.

Impact

Roughly 45-50% of the town residents get their water from private wells on their property. Many of those wells are shallow and use ground water for their source. A long-term drought could affect those wells and their homes water supply leading to health and sanitation issues. Further, the Town’s drinking water resources come from within the town at Stafford Pond. Prolonged drought conditions could also impact town water supplies and water available for firefighting.

Tiverton has approximately 2,000 acres of land used for agricultural (11% of total land area). The land is primarily used for potatoes, corn, and livestock feed. Long-term drought could have a major effect on these farmers suffering crop loss. An extended period of drought would also degrade stream health and impact recreational fishing areas.

History

Past drought events in Rhode Island have affected the entire state. It is generally not an issue that is handled at the local level although the Town can enforce particular water bans as dictated by the State. Due to the broad nature of droughts, the Town of Tiverton does not have specific mitigation actions for this hazard. For specific statewide mitigation efforts, refer to the current Rhode Island State Hazard Mitigation Plan located online <http://www.riema.ri.gov/prevention/mitigation/index.php>.

**Table 14: Recent Droughts in Tiverton, RI<sup>40</sup>**

Date	Type	Damage
April 12, 2012 to May 15, 2012	Severe Drought (Meteorological)	None. Very high fire danger, small pond levels were reduced, soil moisture was well below normal.
9/13/2016 through the month	Severe Drought (Meteorological)	None. A somewhat unique situation to Tiverton is a lack of water to fight fires. Tiverton has no fire hydrants, so firefighters rely on nearby ponds and rivers for their tanker trucks. With ponds and rivers well below their normal levels, it has become more and more difficult for firefighters to draw water from these sources.

3.1.10 Earthquake

Description

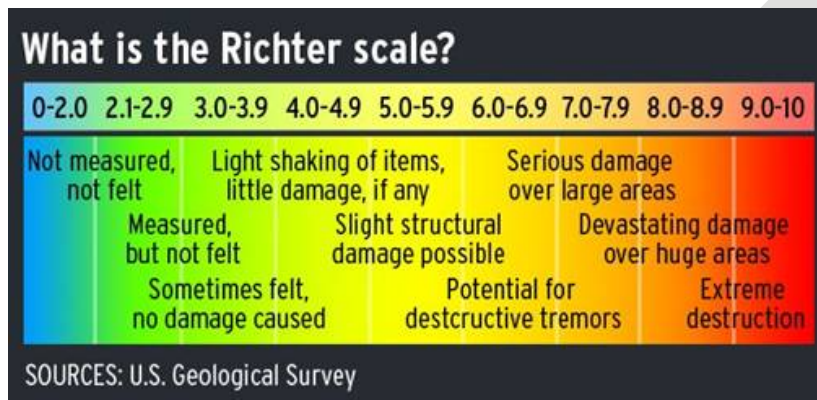
An earthquake (also known as a quake, tremor or temblor) is the result of a sudden release of energy in the Earth's crust that creates seismic waves. The seismicity or seismic activity of an area refers to the frequency, type and size of

<sup>40</sup> NOAA <http://www.ncdc.noaa.gov/stormevents>



earthquakes experienced over a period of time. Earthquakes are measured with a seismometer. The size or magnitude is recorded on a device known as a seismograph. Earthquakes with a magnitude 3 or lower are mostly imperceptible (too low to recognize) and magnitude 7 earthquakes cause serious damage over large areas.

Although earthquakes are not considered to be a major problem in the Northeast United States, they are more prevalent than one might expect. Table 13 presents historical seismic activity for Rhode Island. It highlights the earthquake epicenter, the Richter magnitude at the epicenter, and the Mercalli Intensity Level. Richter magnitudes are technical quantitatively based calculations that measure the amplitude of the largest seismic wave recorded. Richter magnitudes are based on a logarithmic scale and are commonly scaled from 1 to 8. See the graphic below. The higher the magnitude on the Richter Scale, the more severe the earthquake. Mercalli intensity levels are based on qualitative criteria that use the observations of the people who have experienced the earthquake to estimate the intensity level. The Mercalli scale ranges from I to XII. The higher the intensity level on the scale, the closer the person is to the epicenter.<sup>41</sup>



Modified Mercalli Intensity	Description of Intensity Level
I	Not felt except by a very few under especially favorable circumstances.
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all; many frightened. Some heavy furniture moved; a few instances of fallen plaster.

<sup>41</sup> Michelle Wood. "UPSeis: An Educational Site for Budding Seismologists," 21 May. 1997, 5 January, 2004. <http://www.geo.mtu.edu/UPSeis/intensity.html>.

<b>Modified Mercalli Intensity</b>	<b>Description of Intensity Level</b>
	Damage slight.
<b>VII</b>	Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars.
<b>VIII</b>	Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
<b>IX</b>	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
<b>X</b>	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
<b>XI</b>	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
<b>XII</b>	Damage total. Lines of sight and level distorted. Objects thrown into the air.

Location

Rhode Island is located in the North Atlantic tectonic plate and is in a region of historically low seismicity. Only three (3) or four (4) earthquakes of Modified Mercalli Intensity Scale (MMI) V or greater have been centered in Rhode Island, including the 1951 South Kingstown earthquake of magnitude 4.6 on the Richter scale.<sup>42</sup> The Town of Tiverton is about 20 miles northeast of South Kingstown.

Probability of Future Occurrence

Unlikely. Damaging earthquakes do not normally occur in this region.

Extent

Rhode Island is located in an area of “moderate” seismicity and “high” risk. Seismic risk applies to the seismic hazard, location demographics, and regional economics to the vulnerabilities of the structure or lifeline on the site. However, based on past occurrences, current geologic makeup and future climate changes, the Town of Tiverton is not anticipating any disturbances higher than a Class IV intensity.

Impact and Vulnerability

The committee recognizes that the potential for an earthquake to strike the Town of Tiverton is low but the hazard could afflict town wide damage, causing; power outages, building collapses, water main breaks, dam failures, gas leaks, fires and injuries or deaths. Buildings that are most at risk from earthquakes are the old masonry buildings and large structures such as those in the Historic Districts.

History

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<sup>42</sup> Rhode Island Emergency Management Agency (RIEMA) Rhode Island 2014 Hazard Mitigation Plan Update



No major earthquakes have happened in Tiverton but the resulting damage it could produce makes it a threat.

**Table 15: Historic Seismic Activity in/near Rhode Island<sup>43</sup>**

Date	Epicenter	Epicenter Magnitude	Mercalli Intensity Level
10/16/1963	Coastal MA	4.5	Caused some cracked plaster (MMI V) at Chepachet, Rhode Island.
6/14/1973	Western Maine	unknown	The intensities in Rhode Island were IV at Charlestown and I-III at Bristol, East Providence, Harmony, and Providence.
3/11/1976	Near Newport, RI	3.5	Intensity level VI shock effects felt throughout Southern New England. This earthquake has the distinction of being the largest earthquake to originate in Rhode Island.
4/20/2002	Plattsburgh, NY	5.2	Intensity level II to III shock effects felt throughout Rhode Island.
03/11/2008	Central Connecticut	2.9	No data reported for Rhode Island
6/23/2010	Ontario-Quebec	5.0	Felt throughout Rhode Island.
2011	Rhode Island	0.9	Felt locally
2012	Rhode Island	1	Felt locally
2013	Kingston, RI	Unknown	Felt locally
1/12/2015	Wauregan, CT	3.3	Intensity level II to III shock effects felt in Tiverton
7/22/2015	East Providence, RI	2.3	Intensity level II to III shock effects felt in Tiverton

3.1.11 Dam Failure

Description

Dam failures can result from natural events, human-induced events, or a combination of the two (2). Failures due to natural events such as prolonged periods of rainfall and flooding can result in overtopping, which is the most common cause of dam failure. Overtopping occurs when a dam’s spillway capacity is exceeded and portions of the dam which are not designed to convey flow begin to pass water, erode away, and ultimately fail.<sup>44</sup>

<sup>43</sup> United States Geologic Survey [http://neic.usgs.gov/neis/states/rhode\\_island/rhode\\_island\\_history.html](http://neic.usgs.gov/neis/states/rhode_island/rhode_island_history.html) and Earthquake Hazards Program “Did You Feel It” Archives.

<sup>44</sup> Rhode Island Emergency Management Agency (RIEMA), Rhode Island 2014 Hazard Mitigation Plan Update

The hazard classifications are defined in the Rhode Island Dam Safety Regulations as follows:

- High Hazard – means a dam where failure or mis-operation will result in a probable loss of human life.
- Significant Hazard – means a dam where failure or mis-operation results in no probable loss of human life but can cause major economic loss, disruption of lifeline facilities, or impact other concerns detrimental to the public’s health, safety, or welfare.
- Low Hazard – means a dam where failure or mis-operation results in no probable loss of human life and low economic losses. Intense storms may produce a flood in a few hours or even minutes for upstream locations. Flash floods occur within six (6) hours of the beginning of heavy rainfall, and dam failure may occur within hours of the first signs of breaching. Other failures and breaches can take much longer to occur, from days to weeks, as a result of debris jams or the accumulation of melting snow.

#### Probability of Future Occurrence

Possible.

#### Location

There are 4 dams throughout the Town of Tiverton listed on the Rhode Island 2014 Dam Safety Report. Two dams are privately owned, one is owned by the City of Fall River, MA and one is owned by the City of Newport, RI. Eagleville (owned by Fall River) is located in the north central region of town. Creamer (a high hazard dam owned by a homeowners association) is located in a developed area of town, just south of Route 24, 0.4 miles from the Sakonnet River. Mill Pond (a significant hazard dam owned by a private trust) is located in a less developed area in the southeast corner of Tiverton. Nonquit Pond (a significant hazard dam owned by the City of Newport) is located in the southwest corner of Tiverton. Nonquit Pond, the body of water behind the dam is a water source for the City of Newport.

#### Extent

All three dam hazard classifications are represented in Tiverton. The extent of a failure would vary. Nonquit Pond, the largest dammed waterbody in Tiverton has a maximum storage capacity of 1,950 acre-feet (6.3 billion gallons).

#### Impact and Vulnerability

The Tiverton Hazard Mitigation Planning Committee recognizes that a dam failure is not a natural hazard in itself but several of the hazards listed in our hazard list could bring dam failure upon the Town of Tiverton. Severe winter storms, flooding, and a hurricane could all bring enough rain and or snowfall to cause a dam failure. The age of these dams also pose a risk to the structural integrity of these dams. A failure of the Creamer Dam could cause considerable loss to lives, property and economy.

#### History

There are no dam failures in recent memory in the Town of Tiverton.

See Appendix E for a list of Tiverton dams as identified by the Rhode Island Department of Environmental Protection.

### 3.1.12 Flooding (Riverine)

#### Description

Flooding typically results from a large weather systems generating prolonged rainfall or on-shore winds. Other causes of flooding include locally intense thunderstorms, snowmelt, ice jams, and dam failures. The excessive rainfall accumulates within a body of water and overflows onto the adjacent lands. The land adjacent to a water body is referred to as a floodplain. Flash floods are characterized by rapid on-set and high velocity waters, carry large amounts of debris. Floods are capable of undermining buildings and bridges, eroding shorelines and riverbanks, tearing out

trees, washing out access routes, and causing loss of life and injuries (FEMA's Multi-Hazard Identification and Risk Assessment 1997, Chapter/Section Number: Subpart C. Natural Hazards: Hydrologic Hazards, pg. 138).

The Tiverton HMC chose to differentiate between coastal floods (discussed above) and riverine floods in this hazard mitigation plan. The streams in Tiverton generally run in a north/south direction through undeveloped or lightly developed areas. Fortunately, the swamps and vegetated areas on either side of most of the streams are able to absorb any floodwaters, preventing water from moving towards the developed areas. Unlike the coastal area along the Sakonnet River, there isn't much infrastructure that is impacted by the flooded streams. Therefore, the THMC gave riverine flooding a low risk value.

#### Probability of Future Occurrence

Unlikely. Floodwaters will overtop the stream banks but is it expected to be absorbed by the adjacent floodplain.

#### Location

Borden Brook: South of Route 117/Bulgarmarsh Rd., runs through Weetamoo Woods into Nonquit Pond in the southwest corner of town

Adamsville Brook: South of Route 117/Bulgarmarsh Rd., runs through Great Swamp to the southeast corner of town.

Quaker Creek: South end of Nannaquaket Pond, runs through Weetamoo Woods, parallel to Route 77/Main Road before joining Borden Brook in the Four Corners area of town (179/Route 77)

#### Extent

Localized flooding can be expected to occur on an annual basis. The flood event which occurred in March, 2010 was a 250 year +/- event. Impact

#### Impact

The flooding along these rivers is common during heavy rain events as the ponds fill up and the watersheds drain. The surrounding marsh, woods, and undeveloped areas protect the built environment from rising riverine floodwaters. Maintaining these important natural areas not only provides specific habitat for plants and animals, but also provides water storage, lowers flood heights and reduces erosion.

#### History

The remarkable flood events that have occurred in Tiverton have mainly been urban flooding during heavy rain events, or coastal flooding.

#### 3.1.13 Tornadoes

##### Description

A tornado is a violent windstorm with a twisting, funnel-shaped cloud. They are often spawned by thunderstorms or hurricanes. Tornadoes are produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado is a result of the high wind velocity and wind-blown debris. Tornado season is generally March through August, although tornadoes can occur at any time of year. Over 80 percent of all tornadoes strike between noon and midnight.<sup>45</sup> During an average year, about 1,000 tornadoes are reported across the United States, resulting in 80 deaths and over 1,500 injuries. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of one-mile-wide and 50 miles long.<sup>46</sup>



Tornadoes are categorized according to the damage they produce using the Fujita Scale (F-scale). Below is the Enhanced Fujita (EF) Scale and the Old Fujita (F) Scale. An F0 tornado causes the least amount of damage, while an F5 tornado causes the most amount of damage. Relatively speaking, the size of a tornado is not necessarily an indication of its intensity. On August, 7th, 1986, a rare outbreak of seven tornadoes occurred in New England. One such tornado, rated F2 on the Fujita Scale, carved its way through Cranston, RI, and Providence, RI, causing twenty injuries and \$2,500,000 in damages. Table 17 highlights more tornado events that have affected, Rhode Island.

**Table 16: Fujita Scale**

Fujita Scale			Enhanced Fujita Scale		Damage Scale
F Number	Fastest ¼ mile (MPH)	3 Second Gust (MPH)	EF Number	3 Second Gust (MPH)	
0	40-72	45-78	0	65-85	<b>Light damage.</b> Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
1	73-112	79-117	1	86-110	<b>Moderate damage.</b> Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads
2	113-157	118-161	2	111-135	<b>Considerable damage.</b> Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
3	158-207	162-209	3	136-165	<b>Severe damage.</b> Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown
4	208-260	210-261	4	166-200	<b>Devastating damage.</b> Well-constructed

<sup>45</sup> Rhode Island Emergency Management Agency (RIEMA), Rhode Island 2014 Hazard Mitigation Plan Update

<sup>46</sup> National Weather Service, <http://www.erh.noaa.gov/box/hurricane/hurricaneBob.shtml>

Fujita Scale		Enhanced Fujita Scale		Damage Scale	
F Number	Fastest ¼ mile (MPH)	3 Second Gust (MPH)	EF Number	3 Second Gust (MPH)	
					houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
5	261-318	262-317	5	Over 200	<b>Incredible damage.</b> Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yds); trees debarked; incredible phenomena will occur.

Probability of Future Occurrence

Unlikely. Tornadoes rarely occur in this region.

Location

The hazard mitigation planning committee recognizes that the risk of tornadoes is low for the State of Rhode Island and Town of Tiverton but with the recent changing weather patterns and touchdowns of tornadoes, it would be unjust not to consider them a possible hazard.

Extent

Small weak tornado-like formations or waterspouts in Tiverton.

Impact

Tornadoes could cause significant damage to structures, trees and utility lines. Flying debris could be cause injuries to residents. Mobile homes are generally more vulnerable to damage than steel framed structures. The town has 270 mobile or manufactured homes within its borders, these properties are more susceptible to the threat of a tornado.

History

**Table 17: Recent Tornado Events in Rhode Island<sup>47</sup>**

Date	F-Scale	Injuries	Damage	Location
8/16/2000	-	0	\$0	Providence County
8/7/2004	-	0	\$0	Kent County
7/23/2008	1	0	\$47,987	Bristol County
8/10/2012	-	0	\$50,000	Washington County

<sup>47</sup> Rhode Island Emergency Management Agency (RIEMA), Rhode Island 2014 Hazard Mitigation Plan Update. There have been no reported tornadoes in Tiverton.

### 3.2 Summary of Likelihood of Future Events

In developing a mitigation plan it is also important to gauge the future likelihood and potential impact of natural hazard occurrences. To do this each member of the Committee ranked the events based upon the probability of the event occurring and its impacts. The scores were then averaged and represented below. The resulting events were then classified as having various incremental probabilities of occurring in Tiverton (see Table 18).

**Highly Likely:** Will occur every 1-5 years

**Likely:** Will occur every 5-10 years

**Not Very Likely:** Will occur every 10-50 years

**Unlikely:** In intervals greater than 50 years

**Table 18: Likelihood of Future Events**

Hazard	Future Probability
Flooding (Coastal)	Highly Likely
Hurricane/Nor'easter	Highly Likely
Winter Weather	Highly Likely
High Winds	Highly Likely
Extreme Heat and Cold	Highly Likely
Brushfire	Highly Likely
Lightning	Likely
Hail	Possible
Drought	Likely
Earthquake	Unlikely
Dam Failure	Possible
Flood (Riverine)	Possible
Tornado	Unlikely

## Chapter 4: Risk Assessment

This chapter presents the natural hazard risk assessment performed for the Town by the Committee. The purpose of the assessment is to identify those facilities and population at risk from natural hazards, to overview the particular concerns, to gauge the potential level of impact on people and property, and to assess the level of risk posed within the Town.

The Assessment has six primary components that culminate in the Risk Assessment Matrix (3.8). The primary components include a: Facilities Inventory (Section 4.1), Hazard Mitigation Mapping (Section 4.2), Fiscal Impact Analysis (section 4.3), Built Environment (Section 4.4), Population Impact Analysis (Section 4.5), Natural Environment (Section 4.6) and Vulnerability of Future Structures (section 4.7).

#### 4.1 Facilities Inventory

The first step in the assessment process was to create the inventory of facilities of special concern to the Town. The THMC identified the following as community assets:

- Flood Prone Drainage Systems
- Bridges
- Wastewater facilities
- Water facilities
- Electrical facilities
- Dams
- Critical municipal hazard response facilities
- Populations
- Businesses
- Schools
- Recreational Facilities
- Historic resources

These inventories can either be found depicted on the map presented in Section 4.8, in the Community Assets Matrix.

#### 4.2 Hazard Mitigation Mapping

The Town's GIS data base, including parcel data, orthophotography and FEMA flood zone information, were utilized to complete the assessment. The use of this system not only allowed the THMC to estimate potential fiscal and population impacts for individual parcels (see sections 4.3 and 4.4 for results) but also allowed them to analyze spatial relations between variables.

The final output of this exercise is the Town of Tiverton Resources map later in this section. The focus of the maps is not to duplicate all of the spatial information generated through the inventorying process but rather to present the location of the identified risks as they relate to the Town's response facilities.

#### 4.3 Fiscal Impact Analysis

The Town of Tiverton's parcel data and FEMA's 1% annual chance floodplain data were utilized to generate estimates of potential fiscal impacts from natural hazard events such as flooding. The information utilized from the tax assessor's database and GIS included the improvement values, land usage, and unit counts. The analysis showed that Tiverton is comprised of 23,232 acres of land, with 1,352 acres (<6%) in the regulatory floodplain. These 1,352 acres are mainly located on the western shore of town.

HAZUS-MH was used to further understand the potential risk from a large hurricane<sup>48</sup>. HAZUS-MH is a software tool that contains models for estimating potential losses from earthquakes, floods, and hurricanes. For the purpose of this plan, a scenarios was run that capture the town's risk from hurricane damage. The table below summarizes some of the potential damages. The hurricane scenario model uses the same path as the hurricane which tracked west of Tiverton.

In 1954 Hurricane Carol (peak gusts at 89 mph) tore through Southern New England, causing extensive damage throughout Rhode Island. If this same storm were to strike again today, it would cause over \$10.7 million dollars in

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<sup>48</sup> HAZUS modeling conducted by CDR Maguire on 6/23/2015 using HAZUS-MH 2.2

total economic losses (property damage and business interruption loss).<sup>49</sup> Only 27 buildings are expected to be at least moderately damaged, one of which would be total destroyed.

<b>HAZUS Qualitative Damage Description</b>
<b><u>No Damage or Very Minor Damage</u></b> Little or no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof over, with no or very limited water penetration.
<b><u>Minor Damage</u></b> Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or
<b><u>Moderate Damage</u></b> Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water
<b><u>Severe Damage</u></b> Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.
<b><u>Destruction</u></b> Complete roof failure and/or, failure of wall frame. Loss of more than 50% of roof sheathing.

**Table 19: HAZUS-MH Scenarios for Tiverton, RI**  
**1954 Hurricane Carol Scenario**

<b>DAMAGE</b>	<b>AMOUNT</b>
Debris generated	8,708 tons
Buildings destroyed	1
Buildings at least moderately damaged	27
Displaced households	0
Essential Facility Damage (fire, police, schools)	<1 day loss
Residential Property (capital stock)	\$10 million
Business interruptions	\$666,170



<sup>49</sup> HAZUS-MH: Hurricane Event Report, run 4/12/2016.



Table 18 displays potential damage estimates of property values of parcels that are located wholly or partially within the Town’s Special Flood Hazard Area (SFHA, or regulatory floodplain). The parcel information, using the best available data, provides the number of parcels in the SFHA, and values of the buildings on each property. Land value was not considered for this exercise. The values provided are an estimate considering some properties are located in more than one sub-watershed. This percentage was calculated in order to assist with identifying which areas are at greater risk. According to Table 18, the town wide total potential building damages for these floodplain areas are over \$42,000,000. The watershed with the most parcels in the SFHA is the Quequechan River. Of the 1,588 parcels in that region, 253 have buildings in the SFHA

The most expensive property in the SFHA belongs to Inland Fuel, estimated building value of \$1,913,000. (Note: the storage tanks themselves are not in the Special Flood Hazard Zone). The most valued private structure is a residential structure in the southwestern corner of town valued at over \$1.4 million.

Approximately 80% of Tiverton’s revenue is generated from property tax.<sup>50</sup> Should any of the properties forming the tax base be destroyed by a hazardous event, a causal effect would be those property owners whose parcels remain intact would carry an increased financial burden with regards to property taxes. It is an important course of action for the Town to protect both lives and property from natural disasters. However, as Tiverton’s population grows, the burden of protecting lives and property grows.

Using data from the RI Geographic Information System (RIGIS) and information from the Tiverton Tax Assessor, the following table summarizes the value of the properties that are located within the Special Flood Hazard Areas.

**Table 20: Assessment of Building Values within Flood Plains<sup>51</sup>**

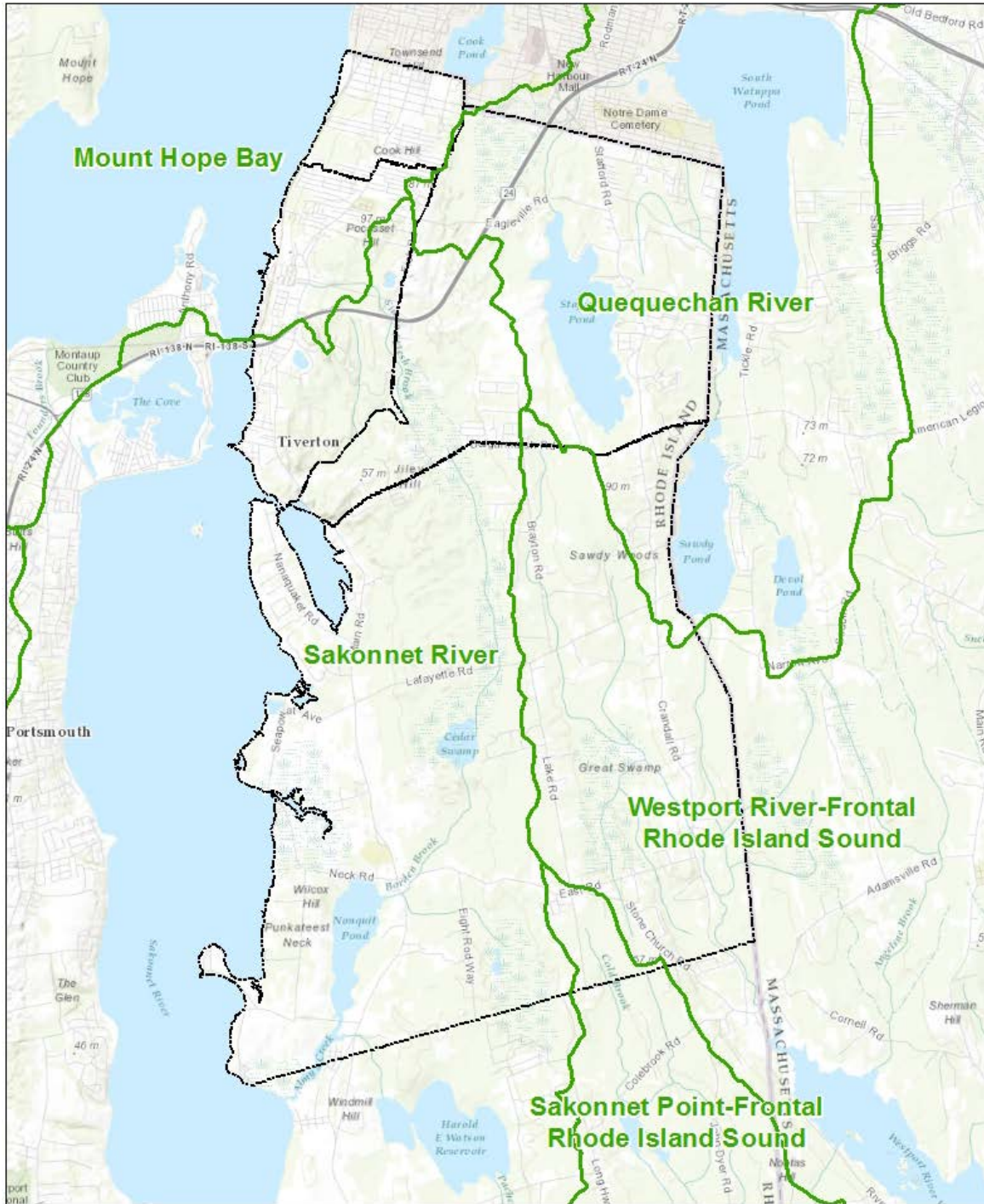
Watershed	# Parcels in SFHA w buildings	Residential	Commercial	Agriculture	Industrial	TOTAL
Mount Hope Bay	22	\$ 2,539,700.00	\$ 2,402,700.00	\$ -		\$ 4,942,400.00
Quequechan River	253	\$ 32,089,400.00	\$ 5,579,000.00	\$ 687,100.00	\$ 38,600.00	\$ 38,394,100.00
Sakonnet River	0					\$ -
Westport River	0					\$ -
Sakonnet Point	0					\$ -
<b>TOTAL</b>	<b>275</b>	<b>\$ 34,629,100.00</b>	<b>\$ 7,981,700.00</b>	<b>\$ 687,100.00</b>	<b>\$ 38,600.00</b>	<b>\$ 43,336,500.00</b>



<sup>50</sup> As per the Tiverton Tax Assessor on 5/2/2016

<sup>51</sup> Tiverton 2015 Parcel Data

Map of Sub-watershed Basins<sup>52</sup>



<sup>52</sup> RIGIS Watershed Boundary Dataset, HUC12\_RI\_09, 2009

### 4.4 Built Environment

According to HAZUS-MH, Tiverton has 7,165 buildings with a total replacement value (excluding contents) of \$1.8 billion. Approximately 81% of which are associated with residential housing.

The THMC has identified critical infrastructure listed in the Community Asset Matrix (Table 19). The list includes: flood prone drainage systems (23), Bridges (4), Wastewater Facilities (6), Drinking Water Facilities (5), Electrical Facilities (5), Dams (4), Critical Municipal Hazard Response Facilities (13), Special Populations (8), Businesses (2), Schools (7), Recreational Facilities (11), and Historic Resources (33). All of these important community resources have the potential to be affected by a natural or manmade hazard. The magnitude of the losses would be dependent upon the type, location, and extent of each unique hazard.

The town’s zoning laws help dictate future development while maintaining Tiverton’s rural character. Continued enforcement of Rhode Island State building codes and new regulations as required will lessen potential damage caused by a natural hazard event. The codes adopted by the Town of Tiverton range from building codes and design standards, to zoning regulations.

Some of the developed parts of Tiverton are particularly susceptible to flooding. The 1% annual chance flood (base flood) is an event that has a one-percent probability of happening in any given year and is the storm event used to identify the flood zones which impact zoning and building requirements throughout the Town. In Tiverton, the THMC is most concerned about the coastal area along the tidally influenced Sakonnet River where many homes and businesses are located in the flood zone or even perched above the water. Fortunately, there are fewer structures around the streams that traverse the Town.

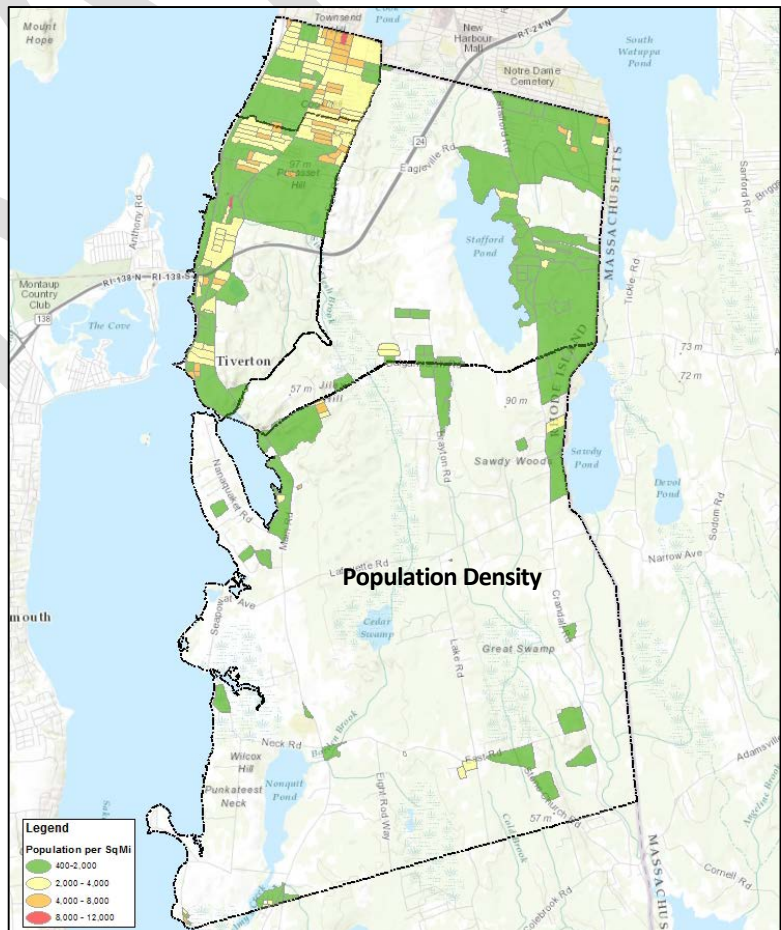
### 4.5 Population Impact Analysis

Of primary concern during a hazard event is protecting the health and safety of Tiverton residents. In addition to knowing the total population of the town, it’s also important to estimate how many people would be impacted by loss of service or need to evacuate. To start, according to the 2014 US Census, there are 7,443 housing units in Tiverton supporting a population estimate of 15,805. The population is not spread evenly throughout the town.

Using the 2014 Tax Assessor’s Database, the Rhode Island GIS e911 structure file, and the Town’s GIS, it was determined that there are total of 315 structures within Town’s 100-year flood zone (37 are commercial, 1 is public, and 273 are residential buildings).

In addition to private wells which serve most of the population, there is water service in the norther part of town.

Should there be a need to open an emergency shelter, Tiverton has adequate space. Tiverton Middle School located on Quintal Drive is the primary Red Cross shelter for the Town. Ranger Elementary School on Brayton Road can be used





as a backup shelter. Maintaining access to both of these facilities during a hazard event is crucial. Neither of these buildings is located in a SFHA but roads leading to the shelters are crossed by streams that may cutoff access. On average, the shelter is opened twice a year as a heating or cooling center.

Because of their non-residential nature, at-risk population estimates could not be developed for historic resources, critical municipal hazard response facilities, and recreational facilities.

#### **4.6 Natural Environment**

According to the Comprehensive Plan, “farms, broad open spaces, forests and miles of scenic roadways in the south, and the rich ethnic and architectural heritage in the north give the town its fascinating diversity. Along the west side lies the beauty of an unspoiled coastline, treed neighborhoods, while low lying heather, bogs and swamps alternate with farms and crossroads hamlets in the eastern portion of the town. These are all precious qualities of small town New England that are rapidly disappearing, and qualities that townspeople fear will be lost in Tiverton’s future.

“Extensive wetlands are protected by state and federal wetlands regulations, while many other areas are not suitable for development because of poor soil conditions for residential septic systems. With the town’s Building Official, Planning Board and Conservation Commission monitoring construction activities and state regulatory efforts, development cannot occur in many areas of the town”.<sup>53</sup>

Fresh water resources in Tiverton include Stafford Pond (primary source of the drinking water supply), Nonquit Pond (part of the City of Newport’s water system), and groundwater. Efforts between the Rhode Island Department of Environmental Management and the Town of Tiverton have enacted regulations within the watersheds that protect these critical resources.

“Wetlands form a significant component of the land area of the town and are a major natural feature. Coastal wetlands comprise over 528 acres. These include large areas at Seapowet and Fogland Marshes. Inland wetlands comprise nearly 4,500 acres throughout the town. Major areas include Great Swamp and Cedar Swamp in south Tiverton, and Basket Swamp and Pocasset Cedar Swamp in the northern section of town”.<sup>54</sup>

Weetamoo Woods (541 acres) in the central part of town is the largest area of contiguous forest. Combined with nearby Pardon Gray Preserve (230 acres), the area is a unique oak/holly forest community and habitat for fire state listed rare species.

#### **4.7 Vulnerability of Future Structures**

A sufficient amount of land is available to meet Tiverton’s near-future development needs for both residential and non-residential structures. An estimated 21% of the town is zoned for residential uses. A build out analysis conducted in 2006 projected that an additional 3,681 dwelling units could be developed based on current land available and zoning in place. Future growth will likely be centered along expansions of water and sewer services areas in the central part of the town.

Tiverton’s vulnerability to natural hazards is not expected to change dramatically over the next five years due to increased development. Enforcement of current building codes will ensure that development will be stronger and more resilient than some of the older structures in Tiverton.

#### **4.8 Risk Assessment Matrix**

The matrix (Table 19: Critical Infrastructure/Community Assets) represents the culmination of the risk assessment process and is the final product. Its purpose is to gather all the pertinent results in one place for ease of presentation

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<sup>53</sup> Tiverton Comprehensive Community Plan 2009

<sup>54</sup> Tiverton Comprehensive Community Plan 2009

and to serve as a starting point for discussion of specific mitigation actions. It not only lists the specific areas of concern, but provides detailed location information, summarizes the applicable hazard, problem, and mitigation benefits.

DRAFT

**Table 21: Critical Infrastructure/Community Assets**

AT RISK	LOCATION	HAZARD	PROBLEM	MITIGATION BENEFITS	PROPOSED ACTIONS
<b>I. Flood Prone Drainage Systems</b>	A. Fogland Beach/3 Rod Way B. Riverside Drive C. Souza Rd @ Main Rd/Villages at Mount Hope D. Main Road @ Creamer Pond E. Fish Road @ Birch St. F. Fish Road @ Louis Dr. G. Fish Road @ Trout Pond (south of Souza Rd.) H. Fish Road @ Bulgarmarsh I. Mill Street @ Hooper J. 433 Main Rd. Area K. Main Rd. @ Mt. Hope Ave. L. Main Rod. @ Lawrence Court M. Lee Way @ Hancock St. N. Eagleville Rd.@ New England Hardwood O. Old Colony Terrace Area P. Seapowet Ave. north of bridge Q. Bulgarmarsh/Lucy/Main Rd. Area R. Evans Ave. @ Riverside Drive S. Stone Bridge Area T. Furey Ave. @ Brayton Rd. U. Stafford Rd. @ Frazier Lane V. Fairwood Drive @ Devin Way W. Crandall Rd. @ Blueberry Lane	Flooding from heavy rain	Flooding of local roads limit access and may strand residents and hinder rescue or evacuation efforts	Drainage, road access, reducing infrastructure loss.	Actions #1-5 Drainage Study  Sewer Outfall Inspection  Elevate Roadways  NFIP Substantial Improvement Compliance  Waterfront Construction Class
<b>II. Bridges</b>	A. Pond Bridge Road Bridge- town owned B. Route 24/138 C. Nannaquaket Road Bridge- State owned D. Seapowet Bridge- DEM owned	Flooding Access Terrorism/vandalism	Bridge closures limit access and may strand residents and hinder rescue or evacuation efforts	Fewer bridge closures, protecting infrastructure safety, maintain emergency response time	Actions #6-8 Bridge Upgrade Bridge Replacement Bridge Repair
<b>III. Wastewater</b>	E. Tiverton Wastewater District (pumps to Fall River for treatment) F. 5 Pump Stations -Schooner Drive (in a flood area but elevated) -Blackbird Court (Countryview Estates) -Hurst Lane (for Countryview Estates) -50 Industrial Way (DPW & Police Station) -Mill Street @ Canonicus (Bourne Mill) G. Interceptor by the bay floods but has its own generator tested weekly, and has a grinder with backup power.	Drought Flooding  Hazardous Material Release into Soil & Water	Aging infrastructure within wastewater district.	Public health and safety	Not an immediate focus for this 2017 plan.

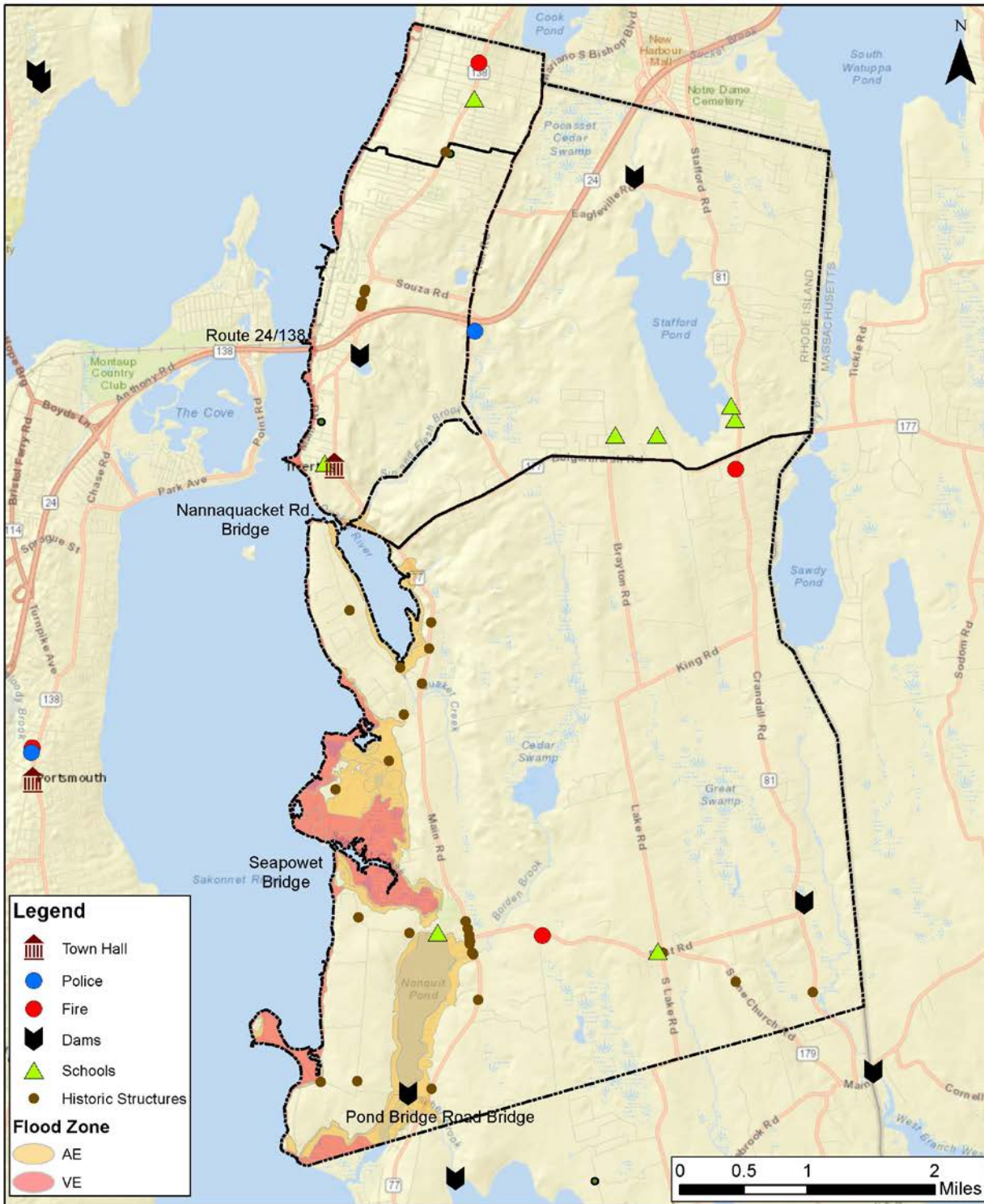
AT RISK	LOCATION	HAZARD	PROBLEM	MITIGATION BENEFITS	PROPOSED ACTIONS
<p><b>IV. Water</b></p>	<p>A. Interconnection w. Stone Bridge Water, North Tiverton Fire, and Fall River                      B. Dry Hydrants at Pond Bridge, Old Nonquit School, and Sandra Lee @ Crandall                      C. Water Tank @ Pocasset Ave., North Brayton Road, and Quintal Drive</p>	<p>Drought                      Flooding</p>	<p>Contamination of water in the water towers could leave (% pop) without potable water.</p> <p>Destruction of water towers could cause widespread flooding</p> <p>Infrastructure used to carry water for fire suppression as well as municipal drinking water. Failure of the systems could increase risk of widespread wildfire, and affect human health.                      Aging infrastructure within the water district.</p>	<p>Safe and abundant drinking water.</p>	<p><u>Actions #9a-9c</u>                      Improve communication with distributors.</p>
<p><b>V. Electrical Facilities</b></p>	<p>A. Duke Energy Substation @ Canonicus St.                      B. Power Plant @ Progress Way (Tiverton Power)                      C. Overhead telephone lines- antiquated lines owned by Verizon                      D. Cell phone towers (Landfill, DPW)</p>	<p>Winter Storm                      Thunder/Lightning Storm                      Hurricane/Nor'easter                      Tornado                      Terrorism/vandalism</p>	<p>Drought (low water) at Stafford Pond or a compromised gas pipeline would affect the power plant.</p> <p>Downed high tension wires could create an electrocution hazard.</p> <p>Verizon has no intention of replacing antiquated lines.</p> <p>Failed Internet and phone switches could affect town wide communication.                      Security of towers from terrorism or vandalism activities (based on previous experience).</p>	<p>Provision of essential utility service, reduction in cleanup and repair costs, and the promotion of public health, safety, and welfare.</p>	<p><u>Action #10</u>                      Physical security of communication towers</p>
<p><b>VI. Dams</b></p>	<p>A. Creamer Pond (high hazard). Dam Emergency Action Plan in Place. Owned by Daniel T. Church Homeowners Assoc.                      B. Eagleville Pond (low hazard). Dam Emergency Action Plan in Place. Owned by Fall River, MA.                      C. Mill Pond (significant hazard). Dam Emergency Action Plan in Place. Owned by Dennis O'Keefe Trust                      D. Nonquit Pond (significant hazard). Dam Emergency Action Plan not signed by DEM. Owned by the City of Newport, RI.                      E. The 8 dams in Fall River have no immediate impact on Tiverton.</p>	<p>Flooding related to heavy rain events or lack of ongoing maintenance.</p> <p>Structural damage due to earthquake.</p> <p>Terrorism/vandalism</p>	<p>Dam failure could lead to damaged roads, flooded homes and businesses, and economic loss.</p>	<p>Structural preservation preventing catastrophic flooding, reducing property loss and protecting public health, safety, and welfare.</p>	<p><u>Actions #11a-12</u>                      Improve residents' knowledge of dam failure evacuation</p>

AT RISK	LOCATION	HAZARD	PROBLEM	MITIGATION BENEFITS	PROPOSED ACTIONS
<b>VII. Critical Municipal Hazard Response Facilities</b>	A. Fire Station 2 (85 Main Road) B. Fire Station 3 (45 Crandall Road) C. Fire Station 4 (287 East Road) D. Police Department (20 Industrial Way) E. Town Hall (343 Highland Road) F. Public Works Garage (50 Industrial Way) G. Tiverton Wastewater District H. Stone Bridge Water District I. North Tiverton Fire Dist. J. Radio Tower (800 MHZ) on Pocasset Ave. Water Tower K. Library- Warming and Cooling Center L. Tiverton Middle School- Red Cross Shelter M. Senior Center- Warming and Cooling Center	All hazards	Depended upon for responding to all natural hazard events  Potential loss of physical access, power supply and critical systems, thus hindering the governmental and emergency response to natural hazard events.  Aging infrastructure within the water and wastewater districts.	Protection of essential public services, records, evacuation routes, and the general livelihood of Tiverton’s residents and their property.	<u>Actions #13-14</u> Implement CERT program  Secondary emergency access road for police and DOT
<b>VIII. Populations</b>	A. 207 Canonicus St. Senior Center (Town owned) B. 1215 Main Rd. Brookdale Sakonnet Bay (Assisted Living-Private) C. 40 Alicia Circle Stafford Point (Low Income Units- Private) D. 99 Hancock Street (Low Income Units-Private) E. 213 Hurst Lane Countryview Estates (55+ community of manufactured homes- Private) F. 73 Jiley Hill Rd Life Inc. (Group Home- State) G. 340 King Road Looking Upwards (Disability Programs- State) H. 35 Highland Court, (Group Home- private)	All hazards	Special needs populations that may need assistance during hazard events. Ambulatory needs for remote areas.	Care facilities for welfare improvement of special needs populations.	<u>Action #15</u> Promote heating and cooling centers
<b>IX. Businesses</b>	A. Inland Fuel @ 25 State Ave. B. Algonquin (Spectra Energy) gas transmission pipelines throughout the town.	Terrorism/vandalism  Hazardous Material Release into Soil & Water	Possible terrorism targets.  Transportation of fuel in and out of Inland Fuel via truck. Storage of fuel in tanks along the coast at the Massachusetts border.  Rupture of gas transmission lines.  Water contamination, public health and safety.	Protection of nearby natural resources  Improved infrastructure safety  Improve protection of public health and safety	<u>Actions #16-17</u> Review mitigation plan for Inland Fuel  Educate coastal business owners
<b>X. Schools</b>	A. Future Scholars Preschool B. Sakonnet Early Learning Center C. Fort Barton School (near Town Hall) D. Ranger Elementary School (Brayton Rd) E. Pocasset School F. Tiverton Middle School (Red Cross Shelter) G. Tiverton High School	Winter storm Lightning Hurricane/Nor’easter	Potential loss of physical access, power supply and structural integrity thus compromising sheltering abilities.	Protecting a Red Cross Shelter  Improved structural integrity, allowing for faster recovery.	<u>Actions #18-20</u> Improve access  Upsize generator at Middle School (Red Cross Shelter)  Generator at Ranger



AT RISK	LOCATION	HAZARD	PROBLEM	MITIGATION BENEFITS	PROPOSED ACTIONS
<b>XI. Recreational Facilities</b>	A. Weetamoo Woods B. Fort Barton (more developed) C. Bulgarmarsh Recreation Area D. Town Farm Recreation Area E. Bayview Playground F. Fogland Beach cabana G. Pocasset Field H. South Field I. Florence St. Area J. Grinnell’s Beach K. Harbors	Winter Storm Lightning Storm Hurricane/Nor’easter Drought Brushfire	These facilities provide residents of Tiverton places to go for recreational and leisure activity. The occurrence of a natural hazard event creates a threat of property damage and natural systems.	Preservation of recreational facilities and reducing risk to residents.	<u>Actions #21-23</u> Weetamoo Woods site improvements  ATV for rescue  Sanitary facilities at Fogland Beach
<b>XII. Historic Resources</b>  (none in VE zone)	A. Almy Farm B. Almy House C. Amicable Congregational Church Parsonage D. Andrew White Store E. Arnold Smith House F. Barker House G. Benjamin F. Seabury House H. Joseph Hicks House I. Barker House J. Capt. Abel Manchester House K. Capt. Henry F. King House @ 137 Seapowet Ave. <b>(AE zone)</b> L. Chace-Cory House M. Col. D. Durfee House/Old Durfee Farm N. Cook-Bateman Farm O. Cory-Hicks-Borden-Gardner-Stevens House P. Edward Bennett House/James Otis Hambly House Q. Homelands @575 Nanaquaket Rd. <b>(AE zone)</b> R. Job Gray House S. Judge Joseph Osborn House T. King Cottage U. Nathaniel Briggs-Manchester House V. Old Durfee Farm W. Osborne House X. Capt. Thomas Osborne House Y. Pardon Cory House Z. Samuel Wilcox House/The Brick Front AA. Soule-Seabury House BB. Stone Grist Mill CC. Thomas-Grey-Durfee Farm DD. W.M. Durfee Farm EE. White Homestead FF. William Batemna/Preserved Tripp’s Wheelwright Stop GG. William Whitridge House	Flooding Winter Storm Lightning Storm Hurricane/Nor’easter	These historic resources, susceptible to property damage, contribute to Tiverton’s culture, heritage, and general character.	Protecting irreplaceable property that contributes to Tiverton’s culture, heritage, and general character.	<u>Action #24</u> Involve local historian in hazard mitigation activities where applicable

Tiverton Resource Map



Town of Tiverton, RI

## Chapter 5: Programmatic Capability Assessment

### 5.1 Purpose

This capability assessment examines the existing studies, plans, programs, and policies that have incorporated hazard mitigation and other pro-active tools into the Town system. The purpose of the capability assessment is to highlight successes, identify shortcomings, and to lay the groundwork for possible improvement. Tiverton recognizes that the inclusion of mitigation initiatives not only benefits the community by reducing human suffering, damages and the costs of recovery, but also helps build and maintain the sustainability and economic health of the Town. Section 5.2 details the Town's existing relevant plans, programs, and policies that were reviewed during the drafting of this plan.

### 5.2 Primary Plans, Regulations, and Departments

#### Tiverton Comprehensive Plan

In 1987 the town developed its first comprehensive plan. This current 2009 plan outlines actions that can be taken to address increased development pressures, economic stability, open space and recreation issues, and public infrastructure and facilities. The comprehensive plan also outlines goals, policies, issues, and actions to provide a framework for everyday operations within the town. The town recognized that incorporating mitigation initiatives (both pre-disaster and post-disaster) into the comprehensive plan would not only benefit the community by reducing human suffering, damages and the cost of recovery, but would also assist in building and maintaining the economic health of the town.

#### Land Development and Subdivision Regulations

Chapter 23/Appendix B of the Code of the Town of Tiverton has the Tiverton Land Development and Subdivision Regulations. These regulations promote the protection of the existing natural and built environment and the mitigation of all significant negative impacts. In addition to providing procedures for plan review, the regulations also promote land development designs that are consistent with the Comprehensive Plan.

#### Zoning Ordinance

Tiverton's Zoning Ordinance, adopted in 1994, manages growth and land use. Article XI Special Flood Hazard Area of the Zoning Ordinance was created to minimize property damage, protect watercourses from encroachment, and preserve the ability of floodplains to retain and carry off floodwaters. There is also a watershed protection overlay district (Article VIII) to protect the quality and quantity of surface water and drinking water supplies.

#### Emergency Operations Plan (EOP)

Tiverton revised its Emergency Operations Plan in 2010. The plan details the Town's responsibilities and actions in the event of an extraordinary emergency situation associated with natural, man-made and technological disasters. Tiverton's EOP offers pre- and post-disaster strategies and measures designed to utilize emergency response organizations for protection of Tiverton's population and infrastructure, thus reducing the loss of life and limiting damage to private and public property.

#### National Flood Insurance Program (NFIP)

The Town of Tiverton is an active and compliant member of the National Flood Insurance Program since 1983. As such, Tiverton residents are able to purchase flood insurance to protect their property against flood losses. The Town of Tiverton has adopted the most recent (April 2010) Flood Insurance Rate Maps (FIRM) and Flood Insurance Study (FIS). The Town has designated the Building Official as the NFIP Coordinator to manage the program.

#### Harbor Management Plan

The Tiverton Harbor and Coastal Waters Management Commission has a harbor management plan designed to help protect water quality for conservation and fishing areas, biological habitats, swimming, windsurfing, and aquaculture, as well as for safe navigation within the waters.

#### Forest Fire Management Assessment

Weetamoo Woods is a 650 acre “middle-aged” forest in central Tiverton. One of the biggest threats to the area is wildfire, especially since many areas within the reserve are not accessible by vehicle. Working with the Rhode Island Department of Environmental Management (RIDEM) and Tiverton’s Conservation Commission, Tiverton’s Emergency Management department created a Weetamoo Woods Preplan/Hazard Assessment. The purpose of this effort was to identify general areas of high risk (high level of usage) and areas of high hazard (concentrated fuel areas, fuels of concern, landscape concerns) within Weetamoo Woods. Recommendations from this study are incorporated into the mitigation actions proposed in this plan. The Emergency Management department continues to work with the Conservation Commission on maintaining trail access for fire suppression.

### DEPARTMENTS

#### Emergency Management

The Town maintains an Emergency Management Director (Fire Chief) and a Deputy Director. These are volunteer positions. The Town Council President is responsible for declaring emergencies and is the final authority for all emergency management decisions.

#### Planning Department

The Department of Planning carries out all the planning functions related to land use, environmental protection, and economic development required by the Town Charter, the ordinances of the Town, and the laws of the State of Rhode Island. Actions as outlined in this hazard mitigation plan will help prioritize the growth and resiliency goals of the community. This department also manages the GIS data and mapping requirements.

#### Code Enforcement

Code Enforcement is responsible for administration and enforcement of the state building code, the zoning ordinance, and the Housing Maintenance and Occupancy Code, and floodplain administration. The Code Enforcement Department aims to promote safety, health, and well-being of the people of Tiverton. The elevation certificates are maintained by this department.

#### Public Works

The Public Works Department has a staff of 11. It is charged with maintaining the town owned roads including snow removal, street sweeping, roadside mowing, catch basin cleaning and sign maintenance, as well as the town landfill operation, and the repair and maintenance of town buildings other than those used by the School Department. DPW has 3 dump trucks and 2 backhoes that can be used to move debris, and chainsaws and tools to clear debris from roads. Large scale disasters would require the Town to hire extra trucks and equipment to clear debris. There is adequate storage space for debris at the Tiverton landfill located in Main Road but the Town would need to hire a large tub grinder to process all the collected debris material in the event of a large disaster. Elements of this hazard mitigation plan will help the public works department prioritize projects and facilitate grant applications for funding. This department is out in the Town every day and offers firsthand experience on vulnerable systems, and infrastructure needs.

Tiverton coordinates snow removal efforts with the State DOT, to clear the state roads in town during snow emergencies. Public Works maintains 9 plows and hires up to 20 employees.

#### Tree Warden

Tiverton has a Tree Warden who periodically surveys the streets for potential overgrown or dead trees. The DPW works in conjunction with the Tree Warden to remove or trim high risk trees. In addition to the Tree Warden's surveys, Narragansett Electric has a program to remove trees and limbs which present a threat to utility lines.

#### Police and Fire

Police and Fire Departments in Tiverton ensure the safety and wellbeing of town citizens. Updated internal communication system and adding additional repeaters to improve radio communications. Upon request, the Tiverton Fire Department provides training for citizens in the use and handling of portable fire extinguishers. Fire department personnel offer a C.P.R. class for citizens on a regular basis. The town currently has 20 people trained in ARC Emergency Shelter Operations. As part of the hazard mitigation planning committee, members of the police and fire department can suggest actions that can improve disaster response. They can also use this plan as guidance when applying for grant funding.

In the event of overcrowding at the Middle School, Tiverton will also open other schools, public buildings and churches

#### Tiverton Wastewater District

The TWWD aims to safeguard public health by protecting and improving ground and surface water resources. Implement efficient and effective wastewater management and disposal within the Tiverton water District. TWWD manages the wastewater collection system which covers about one third of the Town.

#### Tiverton School Department

The School Department has a system in place to ensure the timely and safe removal of snow from school roofs and access areas, thus preventing structural damage and protecting human safety.

As of April 2016, the Rhode Island Department of Education has planned to conduct a full structural assessment of the schools in Tiverton as part of a larger project funded by a \$15.4 million dollar bond. The outcome of this assessment will help prioritize future mitigation actions. Currently, the Middle School has a failing roof and an undersized generator.

#### Mutual Aid & Coordination with Fall River

The Town of Tiverton has in place, a fire service mutual aid agreement with the towns of Bristol, Jamestown, Little Compton, Newport, the Newport Naval Station, Middletown, and Warren- collectively known as East Bay Control. This collaborative effort aids in emergency response as well as coordinated evacuations.

Tiverton has joined the interstate Emergency Management Assistance Compact (EMAC) and are co-signers of the Southern New England Fire Emergency Assistance Plan established to cover the firefighting and emergency responding needs of communities. There are a few residential areas of Fall River adjacent to the eastern border of Tiverton that are separated from the rest of Massachusetts by water. Because of their geographic location, either department may be called. If Tiverton emergency responders receive the call and are the first on the scene, they notify Fall River.

In 1746, Tiverton, Massachusetts was annexed to Rhode Island as part a boundary dispute settlement. Littoral rights and ownership of Stafford Pond are still in question. This creates a unique water rights agreement between Fall River and Tiverton.

#### Town Council

The Tiverton Town Council is comprised of 7 members, elected from the town at-large to serve for a term of two years. These elected members are the governing body by which new plans and policies but be adopted. They take a holistic view of the Town's operations when formulating policies and exercising town powers. Educating the Town Council

members about the importance of hazard mitigation is not only beneficial for the Town's resiliency but also facilitates plan adoption.

In 2004, in response to discovery of soil contamination, the Town Council passed a moratorium on excavating and digging in the Bay Street Area. The settlement has been agreed upon but the clean-up efforts have not been completed.<sup>55</sup>

#### Conservation Commission

An advisory body to the Tiverton Town Council on the following topics: protection of surface water and groundwater including the watersheds of Stafford and Nonquit Ponds; compliance with the RI Freshwater Wetlands Act; monitoring of storm water runoff and other nonpoint source pollution; compliance with soil erosion and sedimentation control regulations; monitoring of RI and Town wastewater management regulations; monitoring of underground storage tanks; monitoring the environmental impact of the Town landfill and solid waste management; compliance with regulations that protect coastal areas including salt marshes, bogs and ponds; protection of other environmentally sensitive or unique areas, protection of agricultural resources, protection of air quality, protection of the rural integrity and scenic character of the Town including tree and woodland preservation.

#### Economic Development Commission

The Tiverton Economic Commission acts to promote and facilitate business development in accordance with the Town's Comprehensive Plan, ordinances and regulations while preserving and enhancing the town's character. Managing development can improve hazard resiliency and protect valuable natural resources.

#### Sheltering

Tiverton has designated one Red Cross approved emergency mass care facility for the town, the Tiverton Middle School. The school has food storage, a backup emergency generator, and is equipped with a full kitchen capable of providing mass quantities of food. The American Red Cross (ARC) requires 40 square feet of usable space per person in each mass care facility. According to FEMA, in the event of a natural disaster that requires mass care, twenty percent of an evacuated population will seek public mass care. The Middle School is free of flood risk and the total mass care capacity is 136 people.

#### Tiverton Harbor and Coastal Waters Management Commission (THCWMC)

In 2012, the THCWMC conducted a visual inventory of the coastline from the Sakonnet River. Having this video on record is a valuable tool to monitor future sea level rise and changes in development.

#### Storm Ready Community

Tiverton is a StormReady community, having demonstrated necessary communication and safety procedures needed to save lives and property before and during a storm event. The Town has adopted Standard Operating Procedures to provide guidance in preparing for and dealing with the effects of hazardous weather conditions.

## STATE PROGRAMS

#### Rhode Island State Building Code

All municipalities within the State of Rhode Island share a single building code (RIGL 23-27.3-100 et. al.). The Code itself (which incorporates the International Building Code) was last amended in 2012 and provides comprehensive construction requirements designed to mitigate the impacts from natural hazards, such as high wind events. The Code

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<sup>55</sup> [http://clerkshq.com/content/Attachments/Tiverton-ri/101213\\_38.pdf](http://clerkshq.com/content/Attachments/Tiverton-ri/101213_38.pdf)

is enforced by the Tiverton Building Department and provides an additional layer of regulatory control to those discussed above.

#### Rhode Island State Fire Code Regulations

Tiverton has adopted the RI Fire Safety Codes to safeguard life and property from the hazards of fire and explosives in accordance with safe practice. The Code is enforced by the Tiverton Fire Department and provides reasonable minimum requirements for fire prevention and protection.

#### Rhode Island State Dam Safety Program

The Town of Tiverton participates in the State Dam Safety Program because the Wyoming Upper and White's Pond dams are classified as 2 of 28 high hazard dams within the State. The State Dam Safety Program was created to facilitate the enforcement of the primary dam inspection law (RIGL 46-19, Inspection of Dams and Reservoirs). RIGL 46-19 states that dam owners are responsible for the safe operation, maintenance, repair, and rehabilitation of a dam, which are the essential elements in preventing dam failure; furthermore, dam owners are liable for the consequences of accidents or failures of their dams. According to the State of Rhode Island 2014 Dam Safety Program Report, the following have been identified as program limitations: unclear ownership of numerous high hazard dams, construction of buildings within inundation areas below dams, lack of funding to repair or remove privately owned dams, inadequate spillway capacities and engineering analyses, lack of Emergency Action Plans across the state, inadequate staffing, increase in rainstorm intensities.

#### Rhode Island DEM Wetland Regulations

The Rhode Island Department of Environmental Management is responsible for regulating alterations of the freshwater wetlands throughout the State. Since many floodplains are also wetlands, appropriately managing these resources help maintain proper floodplain function. These regulations ensure that actions in this plan which will alter the physical landscape will not do so at the expense of wetlands.

#### CRMC Coastal Resources Management Program

The CRMC manages and implements the policies to preserve, protect, develop, and where possible restore the coastal resources of the state through comprehensive and coordinated long range planning and management designed to produce the maximum benefit for society from these coastal resources; and that preservation and restoration of ecological systems shall be the primary guiding principle upon which environmental alteration of coastal resources will be measured, judged, and regulated (CRMC RedBook).

#### Rhode Island Department of Education School Building Authority

In June 2015 the SBA was created within the RIDE to assist local applications to the Fast Track Repair Program and Major Projects Program. These programs provide funds to provide safe, healthy, and educationally appropriate school facilities for its students. The Governor has recently approved \$19,347,079 to be invested in structural improvements to school buildings in 18 communities. In Tiverton, the School Department expects funds to be used for replacing the boilers at and fixing the roof at both the Middle School and High School. The roof repairs will greatly improve the facility's resilience to snow, rain, and wind.

## Chapter 6: Identification of Mitigation Actions

Whereas the two preceding Chapters identify risks from natural hazards and programmatic capabilities, this chapter defines a broad mission for the Town in mitigating these risks, and establish a series of hazard mitigation goals and specific implementation actions.

### 6.1 Mission Statement

It is the mission of the Town and the THMC to protect and enhance the quality of life, property and resources by identifying areas at risk from natural hazards and implementing hazard mitigation actions to protect the Town's residents; infrastructure; economy and its historical, natural and cultural resources.

### 6.2 Mitigation Goals

The mitigation goal is to reduce or eliminate long-term risk to people and their property from the effects of natural hazards (i.e. floods, hurricanes, snow storms, severe wind storms, etc.). To achieve this goal, the Tiverton Hazard Mitigation Committee identified objectives which were used to focus mitigation efforts and provide a framework for discussion of specific actions. These objectives include: upgrading infrastructure and protecting property, strengthening capabilities, and improving emergency response effectiveness.

### 6.3 Identified Actions and Objectives

The first two tables below summarize mitigation actions that have been deleted or completed since the 2005 Plan.

The next set of mitigation actions and objectives were developed by the THMC with review and opportunity for input from each of the prospective project leads. They are organized by vulnerable areas and in relation to of the three mitigation goals discussed above. The text following the table below summarizes the specific problem and proposed possible solution, details the primary tasks to be undertaken, identifies an appropriate lead and anticipates financing options. Each action was given a priority ranking of low, medium, or high as determined by the THMC.

Since it has been over ten years since Tiverton's last hazard mitigation plan, there are necessary planning elements that need to be completed before additional mitigation actions can be considered. The Committee has identified a range of actions below, some of which are planning. However, there is a mitigation action identified for each vulnerable area where applicable.

#### Priority Level

**High:** Reduces the greatest risks, is important to accomplish first

**Medium:** May need other actions to be completed first

**Low:** Less of an impact on safety and property

#### Time Frame (from date of plan adoption)

**Short Term:** within 1-3 years

**Medium Term:** within 3-5 years

**Long Term:** greater than 5 years



**Table 22: Deleted Actions from 2005 Plan**

Old Number	2005 Plan Action	Action Type	Vulnerable Area Addressed	Benefit	Lead	Status	Reason for Deletion
6	Request RIDOT assistance w replacement of Pond (Nonquit) Bridge Road Bridge	Planning	Bridges	Protection of infrastructure, public safety and evacuation routes.	DPW	No longer relevant	Bridge is not a federal or state structure and cannot be funded through TIP funds.
12	Voluntary Citizens Fire Brigade	Public Outreach	Critical Facilities	The Fire Department would have trained citizens available to help support them in the event of a crisis in the town.	Fire Department	No longer relevant	Department has been focusing on strong permanent recruitment efforts.
17	Obtain and review the mitigation plan for Algonquin Gas/Spectra Energies	Preparedness	Businesses	Protection of residents and the environment	Fire Department	No longer relevant as written	As of 5/2016 Spectra Energies does not have a mitigation plan for their pipeline. All emergency response outcomes or actions are done on a case by case basis. Their response plan is proprietary-they will not share it with the Town.

Since the 2005 Hazard Mitigation Plan adoption, the Town of Tiverton has completed 10 action items. The most critical actions were the replacement of the Sakonnet Bridge and Main Road Bridge. Some actions that were proposed in the 2005 plan are now part of the Town’s regular preparedness efforts. These ongoing efforts have also been noted in Chapter 5: Programmatic Capability Assessment.

**Table 23: Completed or Ongoing Actions from 2005 Plan**

Old Number	2005 Plan Action	Action Type	Vulnerability Addressed	Benefit	Lead	Status	Comments
2	Identify alternate evacuation routes	Planning	Flood Prone Areas	Increased public safety in the event of road closures due to flooding.	DPW and Fire Departments	Completed	Emergency Exit Routes are currently posted. Currently directing evacuees to higher ground and emergency shelter locations. Which route police will direct citizens to utilize will depend on the type of storm, time and direction of an approaching event. Police will work in conjunction with RIDOT, State Police, Local DPW and Fire Department directing evacuation over and closing roadways and bridges where needed.
3	Replace Sakonnet Bridge	Property Protection, Structural Projects	Bridges	Protection of critical infrastructure, public safety and evacuation routes.	RIDOT	Completed	The Sakonnet River Bridge has been replaced with a new structure. The old bridge has yet to be demolished and removed.
4	Replace Main Road Bridge	Property Protection, Structural Projects	Bridges	Protection of critical infrastructure, public safety and evacuation routes.	RIDOT	Completed	The Main Road Bridge over Route 24 has been replaced with a new structure.
5	Monitor RIDOT bridge reports	Planning	Bridges	Protection of infrastructure, public safety and evacuation routes.	DPW	Ongoing	RIDOT bridge inspection reports are monitored and reviewed by the DPW Director for the Pond Bridge Road and Seapowet Bridges.

Old Number	2005 Plan Action	Action Type	Vulnerability Addressed	Benefit	Lead	Status	Comments
7	Identify alternate routes in the event of dam failure	Planning	Dams	Protection of infrastructure, public safety and evacuation routes.	DPW and Fire Department	Completed	Evacuation routes are noted in each Dam Emergency Action Plan.
8	Notify dam owners of their dam responsibility	Planning	Dams	Raise dam owners' awareness of their responsibilities. Protection of property, public safety and evacuation routes.	Town Administrator	Completed	Nothing came of this effort. Action re-written for 2017.
11	Continue annual tree trimming program	Property Protection	Utilities	Reduce damage to power and communications lines and public and private property. Minimize traffic disruption on roadways.	DPW, Narragansett Electric	Ongoing	None
13	Maintain existing snow removal program	Property Protection	Critical Facilities	Cleared roads for public safety and emergency vehicles.	DPW	Ongoing	None
14	Purchase a new front end loader	Property Protection	Critical Facilities	Acquisition of equipment necessary for snow removal, maintenance, and repair.	Town Administrator	Completed	Purchased new front end loader in 2006. Purchased new backhoe in 2015.
16	Perform ARC mass care facility inventory of stored supplies	Protection of Essential Services	Critical Facilities	The mass care facility has fresh supplies	Emergency Management Director	Completed	Updated October 2015.

**Table 24: Current Action Items**

Actions In 2017 Plan		Vulnerability Addressed	Priority Level	Time Frame	Status
1	Conduct a drainage study in the northern end of town	Flood Prone Areas	Medium	Medium	New
2	Purchase an ATV for sewer line inspections	Flood Prone Areas	Medium	Medium	New
3	Elevate a portion of 3 Rod Way	Flood Prone Areas	Medium	Medium	New
4	Purchase building permit software	Flood Prone Areas	Medium	Short	New
5	Conduct a waterfront construction class	Flood Prone Areas	Medium	Short	New
6	Repair and fortify Old Stone Bridge structure	Bridges	High	Long	Scheduled
7	Replace Pond Bridge Road Bridge	Bridges	Low	Long	New
8	Repair Nannaquacket Road Bridge	Bridges	Medium	Long	New
9a	Map North Tiverton Water District and Stone Bridge Water District water systems	Water	High	Short	New
9b	Obtain and review peak usage and capacity data for water districts	Water	High	Short	New
9c	Create Town oversight of water districts	Water	High	Short	New
10	Install security cameras at the communication towers	Utilities	High	Short	New
11a	Identify alternate routes in the event of failure of Mill Pond Dam	Dams	High	Medium	New
11b	Distribute via direct mailing, evacuation route information to households downstream of the Mill Pond Dam.	Dams	High	Medium	New
12	Get dam action plans on file with RIDEM through another round of public education and outreach to dam owners	Dams	Medium	Medium	New
13	Implement a CERT program	Critical Facilities	High	Medium	Not Completed
14	Build a secondary emergency access road for the police department and DOT facilities	Critical Facilities	Medium	Medium	New
15	Promote heating and cooling centers	Populations	Medium	Short	New
16	Obtain and review mitigation plan for Inland	Businesses	Medium	Short	Not

Actions In 2017 Plan		Vulnerability Addressed	Priority Level	Time Frame	Status
	Fuel Terminal				Completed
17	Conduct a meeting for coastal property owners	Businesses	Medium	Short	New
18	Improve footpath between middle and high schools	Schools	Medium	Short	New
19	Upsize generator and improve transfer switch at middle school (ARC Shelter)	Schools	Medium	Short	New
20	Purchase and install generator and transfer switch at Ranger Elementary School	Schools	Medium	Long	New
21	Site improvement at Weetamoo Woods	Recreational Facilities	Medium	Long	New
22	Purchase ATV for trail maintenance and rescue	Recreational Facilities	Medium	Medium	New
23	Improve sanitation facilities at Grinnell's Beach and Fogland Beach	Recreational Facilities	Medium	Medium	New
24	Invite local historians to annual and 5 year plan review	Historic resources	Medium	Short	New

\* Items marked as "Not Completed" are carryover actions from the 2005 plan. The Tiverton HMC has reviewed these items with the fresher goals in mind.

### Flood Prone Areas

**Action 1** - Review Robert Gray drainage plan written 15 years ago. If necessary, hire an engineering firm to do a drainage study in the northern end of town, especially along Riverside Drive which is prone to coastal flooding during moon tides. The drainage systems need to be better designed to handle the wet weather flows in this low-lying, developed part of town. A study will help the Town identify and prioritize future mitigation actions.

**Action Type** – Planning and Regulations (not mitigation)

**Pre or Post Disaster** – Pre Disaster

**Priority** – Medium

**Lead** – DPW

**Supporting** – DPW and Fire Department

**Financing Options** – Town/operating budget

**Cost Estimate** – \$15,000

**Time Frame** – Medium term

**Benefit** – Further understand the flooding problem and help set priorities for increased public safety.

**Action 2**- Purchase an ATV to aid in the bi-annual inspection of the sewer lines especially in the Village at Mount Hope Bay neighborhood where the sewer outfall is in a heavily vegetated area.

**Mitigation Action Type** – Prevention

**Pre or Post Disaster** – Pre Disaster  
**Priority** – Medium  
**Lead** –Town DPW  
**Supporting** – Tiverton Wastewater District  
**Financing Options** – Town DPW budget  
**Cost Estimate** – \$4,000-\$10,000  
**Time Frame** – Medium term  
**Benefit** – Improve emergency access and preserve structural integrity of the road

**Action 3-** Elevate the road along 3 Rod Way which runs along Fogland beach, connecting about 18 houses to the mainland. The houses are not threatened by flooding, but when the road is flooded, access is restricted.

**Mitigation Action Type** – Property Protection and Structural  
**Pre or Post Disaster** – Pre Disaster  
**Priority** – Medium  
**Lead** – DPW  
**Supporting** – none  
**Financing Options** – Town DPW budget, FEMA HMGP  
**Cost Estimate** – Roughly ¼ million dollars per mile, \$250,000  
**Time Frame** – Medium term  
**Benefit** – Improve emergency access and preserve structural integrity of the road

**Action 4-** Purchase updated building permit software that tracks cumulative cost of improvements to a property which may trigger the 50% (Substantial Improvement) Rule. If project costs to improve or repair a building are greater than 50% of the building value, the building must be brought into compliance with the NFIP.

**Mitigation Action Type** – Prevention  
**Pre or Post Disaster** – Pre Disaster  
**Priority** – Medium  
**Lead** – Building Official  
**Supporting** – Code Enforcement  
**Financing Options** – Town/operating budget  
**Cost Estimate** – \$10,000  
**Time Frame** – Short term, but dependent upon implementation of Statewide permitting and tracking system.  
**Benefit** – More NFIP compliant buildings in the floodplain will reduce losses and make the Town more resilient.

**Action 5** Conduct an annual ½ day waterfront construction class for area contractors using FEMA’s [Coastal Construction Manual](#) as a guide. Integrate the 1 hour Coastal Construction Manual online course, and the [Rhode Island Coastal Property Guide](#).

**Mitigation Action Type** – Public Education and Awareness  
**Pre or Post Disaster** – Pre Disaster  
**Priority** – Medium  
**Lead** – Code Enforcement  
**Supporting** – Emergency Management  
**Financing Options** – Town/operating budget, FEMA HMGP

**Cost Estimate** – \$1,500

**Time Frame** – Short term

**Benefit** – More NFIP compliant buildings in the floodplain will reduce losses and make the Town more resilient.

## Bridges

**Action 6** – Repair and upgrade the Old Stone Bridge structure. The structure serves as a storm surge protector and energy dissipater for properties located north of it. It is currently crumbling from previous hurricane damage. Federal funds are being used for engineering consultant services to study the structure and develop a design for temporary repairs and overall upgrade. The upgrade will include the addition of additional riprap to improve the function of the structure.

**Mitigation Action Type** – Property Protection (including acquisition and elevation), Structural Projects

**Pre or Post Disaster** – Pre Disaster

**Priority** – High

**Lead** – Town Administrator

**Supporting** – DPW

**Financing Options** – Staff time, FEMA

**Cost Estimate** – \$1.3 M Marc- where is the funding coming from?

**Time Frame** – Long term

**Benefit** – Protect Main Road (adesignated evacuation road), Riverside Drive and businesses and residences north of the structure from storm surge.

**SCHEDULED. Currently underway for 2017 construction**

**Action 7**–Replacement of the town-owned Nonquit Pond Bridge/Pond Bridge Road Bridge. The current bridge is structurally deficient, rated as a 2 by National Bridge Inventory. <sup>56</sup> Current structural redundancies keep the bridge usable for now. During bridge replacement, the Town needs to maintain dry hydrants on west side of bridge. Dam on north side of bridge owned by Newport Water Authority.

**Mitigation Action Type** – Property Protection, Structural Project

**Pre or Post Disaster** – Pre Disaster

**Priority** – Low

**Lead** – DPW

**Supporting** – Newport Water Authority

**Financing Options** – Town budget

**Cost Estimate** – \$700,000

**Time Frame** – Long term

**Benefit** – Protection of infrastructure, public safety and evacuation routes.

**Action 8**–Repair of the state-owned Nannaquaket Road Bridge. Widen by 4 feet, raise by 2 feet.

**Mitigation Action Type** – Property Protection, Structural Project

**Pre or Post Disaster** – Pre Disaster

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<sup>56</sup> NBI Condition Rating 2: deck, superstructure, substructure are in critical condition- advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.

**Priority** – Medium

**Lead** – State DOT

**Supporting** – Tiverton DPW

**Financing Options** –State highway funds

**Cost Estimate** – \$750,000

**Time Frame** – Long term

**Benefit** – Protection of infrastructure, public safety and evacuation routes.

## **Wastewater**

Currently all the wastewater facilities are in good working order and are not an immediate focus of the THMC.

## **Water**

**Action 9-** Improve the communication with the private entities that manage the distribution of the Town's drinking water. Currently the Town is required to approve future developments if they meet the building and zoning regulations but are approved without promise that there will be sufficient water to service them. There needs to be a better understanding of the system capacities so that the Town can manage development.

**Action 9a-** Map the North Tiverton Water District and Stone Bridge Water District water systems.

**Action Type** – Planning (not mitigation)

**Pre or Post Disaster** – Pre Disaster

**Priority** – High

**Lead** – Fire Department oversight

**Supporting** – Water Districts

**Financing Options** – Town budget for the water districts

**Cost Estimate** – staff time. Mapping should be done by the water districts

**Time Frame** – Short Term

**Benefit** – Promote safe and abundant drinking water; improve the fire department's knowledge of the system used for firefighting.

**Action 9b-** Obtain and review peak usage and capacity data for water districts.

**Action Type** – Planning (not mitigation)

**Pre or Post Disaster** – Pre Disaster

**Priority** – High

**Lead** – Fire Department

**Supporting** – Planning Board, Water Districts

**Financing Options** –Town budget

**Cost Estimate** – staff time

**Time Frame** – Short Term

**Benefit** – Promote safe and abundant drinking water, smarter future development planning by the Town

**Action 9c-** Create Town oversight of water districts.

**Action Type** – Planning (not mitigation)

**Pre or Post Disaster** – Pre Disaster



**Priority** – High

**Lead** – Town Administrator

**Supporting** – Water Districts

**Financing Options** –Town operating budget

**Cost Estimate** – Staff time

**Time Frame** – Short Term

**Benefit** – Promote safe and abundant drinking water, encourage smarter future development planning by the Town. **Obstacles**- unsure of how successful this will be considering it will require a legislative action.

## Electrical Facilities

**Action 10**- Install security cameras at the communication towers which have previously been compromised by vandals.

**Mitigation Action Type** – Prevention (hopefully keeps communication tower operational)

**Pre or Post Disaster** – Pre Disaster

**Priority** – High

**Lead** – Police Department

**Supporting** – Tiverton EMA

**Financing Options** – Annual Police Department Budget

**Cost Estimate** – \$8,000 per unit

**Time Frame** – Short Term

**Benefit** – Physical security of communication towers used for cell phones and town-wide radio communication.

## Dams

**Action 11a**- Identify alternate routes in the event of the failure of Mill Pond Dam (off Crandall Road) Failure of this significant hazard dam could result in the flooding of Adamsville in Little Compton which is downstream.

**Action Type** – Planning (not mitigation)

**Pre or Post Disaster** – Pre Disaster

**Priority** – High

**Lead** – Police

**Supporting** – DPW and Fire Department

**Financing Options** – Town/operating budget

**Cost Estimate** – Staff time

**Time Frame** – Medium term

**Benefit** – Protection of property, public safety and evacuation routes

**Action 11b**- Distribute via direct mailing, evacuation route information to households downstream of the Mill Pond Dam.

**Mitigation Action Type** – Public Education and Awareness

**Pre or Post Disaster** – Pre Disaster

**Priority** – High

**Lead** – Police

**Supporting** – DPW and Fire Department

**Financing Options** – Town/operating budget

**Cost Estimate** – Staff time

**Time Frame** – Medium term

**Benefit** – Protection of property, public safety and evacuation routes

**Action 12-** Get dam action plans on file with RIDEM through another round of public education and outreach to dam owners to update their dam plans. Although the Town has previously reached out to the dam owners, there are still no Dam Emergency Action Plans on file with RIDEM. Send dam owners via certified mail, an information packet on the RIDEM requirements, the RI General Law 46-19-9, and what next steps need to be taken.<sup>57</sup>

**Action Type** – Planning (not mitigation)

**Pre or Post Disaster** – Pre Disaster

**Priority** – High

**Lead** – DPW

**Supporting** – RIDEM

**Financing Options** – Town budget

**Cost Estimate** – \$4,000

**Time Frame** – Medium term

**Benefit** – Identifies the areas, structures, facilities and roads that could be affected by dam failures, establishes a monitoring system which can activate the plan, identifies the corresponding official(s) along with their responsibilities in regards to implementing the plan.

### Critical Municipal Hazard Response Facilities and Services

**Action 13** – Implement an ongoing Community Emergency Response Training (CERT) program. There are currently has 3 people in town who received CERT training from another town. Tiverton would like to train additional people in CERT.

**Action Type** –Preparedness, Incentive Programs (not mitigation)

**Pre or Post Disaster** – Pre Disaster

**Priority** – High

**Lead** – FEMA/RIEMA

**Supporting** – Fire Department

**Financing Options** – FEMA

**Cost Estimate** – \$1,000

**Time Frame** – Medium term

**Benefit** – The town would have citizens trained in community emergency response.

**NOT COMPLETED.** Still interested in creating a CERT program but need to see how it will effect funding for Red Cross shelters. Tiverton has lost all volunteers who were previously interested in the program. The Fire Chief is currently in discussions with the state about how to institute the program.

**Action 14-** Build a secondary, emergency access road for the police department and DOT facilities on Industrial Way. Having a second point of entry/exit can provide additional level of safety during an event.

**Mitigation Action Type** – Protection of Essential Services (including critical facilities)

**Pre or Post Disaster** – Pre Disaster

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<sup>57</sup> See <http://www.dem.ri.gov/programs/benviron/compinsp/pdf/dameaps.pdf>

**Priority** – Medium

**Lead** – Tiverton DPW

**Supporting** – Tiverton Police

**Financing Options** –Town Budget

**Cost Estimate** – \$15,000 to \$20,000 if utilized for emergencies only, and construction done by Town DPW workers.

**Time Frame** – Medium term

**Benefit** – Protection of essential services

### Populations

**Action 15-** Promote heating and cooling centers, and Special Needs registry at quarterly emergency management seminars at the Senior Center. Quarterly outreach message to also be posted in local newspaper, on social media, and disseminated to Meals on Wheels recipients.

**Mitigation Action Type** – Public Education

**Pre or Post Disaster** – Pre Disaster

**Priority** – Medium

**Lead** – EMA Deputy

**Supporting** – Director of Tiverton Senior Center

**Financing Options** –Town Budget, volunteer time

**Cost Estimate** – \$1,000

**Time Frame** – Medium term

**Benefit** – Ensure that vulnerable populations are adequately protected from the impacts of extreme temperatures

### Businesses

**Action 16** – Obtain and review the mitigation plan for Inland Fuel Terminal, Inc. The facility is located in a V flood zone in the northern section of Tiverton near Mount Hope Bay. The town needs to ensure that the company has a mitigation plan in place that will provide the highest degree of safety for Tiverton residents and the surrounding environment.

**Action Type** – Planning and Preparedness (not mitigation)

**Pre or Post Disaster** – Pre Disaster

**Priority** – Medium

**Lead** – Fire Department

**Financing Options** – Town budget

**Cost Estimate** – Staff time

**Time Frame** – Short term

**Benefit** – Protection of residents and the environment.

**NOT COMPLETED.** Outreach efforts have not been returned. Recent change of ownership. Tiverton Fire Chief has continued to reach out to Thomas Notarile, Regional Manager of Inland Fuel. They have a mitigation plan but have not been responsive to the Town's requests. Estimate to have this task complete within 3 months of hazard mitigation plan adoption.

**Action 17-** Conduct an annual evening meeting for coastal business owners to educate them on the risks associated with having property in the flood zone. Specifically address reducing their damage potential by elevating/retrofitting electrical equipment, pump stations, and storage tanks. Damage to these items can also cause harm to the surrounding natural and manmade environment.

**Mitigation Action Type** – Public Education and Awareness

**Pre or Post Disaster** – Pre Disaster

**Priority** – Medium

**Lead** – Tiverton NFIP Coordinator

**Supporting** – Tiverton EMA, Building Official, Harbor & Coastal Waters Management Commission

**Financing Options** – Town Budget (Code Enforcement)

**Cost Estimate** – Staff time

**Time Frame** – Short term

**Benefit** – Reduce damages from hurricane force waves and coastal flooding

## Schools

**Action 18-** Improve the condition of the 1/4 mile footpath from the Tiverton Middle School to the High School. The THMC would like to make this path usable for vehicular traffic in the event of an emergency evacuation to safely transport large groups of people to a safer location. Currently Quintal Drive (a dead end) is the only way in or out of the school. Of specific concern is the high pressure Algonquin natural gas pipeline that runs through the school property.

**Mitigation Action Type** – Structural Project

**Pre or Post Disaster** – Pre Disaster

**Priority** – Medium

**Lead** – School Department

**Supporting-** Tiverton DPW

**Financing Options** – School budget, Emergency Management budget

**Cost Estimate** – Staff time

**Time Frame** – Short

**Benefit** – Safeguard children and staff during an emergency.

**Action 19-** Upsize generator and improve transfer switch at the Middle School (Red Cross Shelter). The shelter is opened at least twice a year but if it were ever to lose power, the current generator would not be able to supply the shelter with enough power to function.

**Mitigation Action Type** – Emergency Service Protection

**Pre or Post Disaster** – Pre Disaster

**Priority** – Medium

**Lead** – Emergency Management Director

**Financing Options** – School budget, Emergency Management budget, FEMA HMGP

**Cost Estimate** – \$80,000

**Time Frame** – Short term

**Benefit** – Public safety for shelter clients.

**Action 20-** Purchase and install a generator and transfer switch at the Ranger Elementary School (back-up shelter).

**Mitigation Action Type** – Emergency Service Protection

**Pre or Post Disaster** – Pre Disaster

**Priority** – Medium

**Lead** – EMA Director

**Financing Options** – Town Emergency Management budget, FEMA HMGP grant

**Cost Estimate** – \$80,000  
**Time Frame** – Long term  
**Benefit** – Public safety for shelter clients.

**Recreation Facilities**

**Action 21-** Carry out site improvement recommendations for mitigation hazards as put forth in the Weetamoo Woods Preplan/Hazard Assessment (see Annex 1). Specific focus will be on making Lafayette Road, and yellow trail to blue or red trail to gas line passable in a pick-up truck.

**Mitigation Action Type** – Natural Resource Protection  
**Pre or Post Disaster** – Pre Disaster  
**Priority** – Medium  
**Lead** – EMA Director  
**Supporting-** RI Department of Environmental Management Forestry Division  
**Financing Options** – Town Emergency Management budget  
**Cost Estimate** – staff time  
**Time Frame** – Long term  
**Benefit** – Public safety

**Action 22-** Purchase an ATV/UTV for accessing the deeper parts of the woods necessary for rescue, trail maintenance, and firefighting (same equipment item as Action #3).

**Mitigation Action Type** – Natural Resource Protection  
**Pre or Post Disaster** – Pre Disaster  
**Priority** – Medium  
**Lead** – Tiverton DPW  
**Supporting-** RI Department of Environmental Management Forestry Division, Waste water districts  
**Financing Options** – Rhode Island Legislative Gant (financing approved December 2016)  
**Cost Estimate** –\$10,000  
**Time Frame** – Medium term  
**Benefit** – Public safety

**Action 23-** Improve sanitation facilities at Fogland Beach. The cesspool at Fogland will have to be phased out as per State regulations. The Town is currently considering a tight tank system. Tight tanks are similar to septic tanks, except that they have no outlet and must be pumped out at regular intervals. Currently a similar project is underway to upgrade the facilities at Grinnell’s Beach where the septic field is barely functional.

**Mitigation Action Type** – Property Protection  
**Pre or Post Disaster** – Pre Disaster  
**Priority** – Medium  
**Lead** – Town Administrator until DPW Director position is filled  
**Supporting-** Recreation Department  
**Financing Options** – Town recreational budget  
**Cost Estimate** – \$40,000  
**Time Frame** – Medium term  
**Benefit** – Public health

**Historic Resources**

**Action 24-** Invite Sue Anderson (Tiverton Historic Preservation Advisory Board), Stuart Hardy (Tiverton Historic Preservation Advisory Board), and Barry Simpson (RIDOT's Principal Historic Preservation Specialist) to the annual and 5 year plan review. Currently there are no known immediate vulnerabilities to the identified structures but it will be helpful in the future for the committee to bring in the local experts to discuss preparing historic resources for disasters (see FEMA 386-6, Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning).

**Action Type** – Planning (not mitigation)

**Pre or Post Disaster** – Pre Disaster and Post-Disaster

**Priority** – Medium

**Lead** – EMA Deputy

**Supporting-** Tiverton Historic Preservation Advisory Board

**Financing Options** – staff time

**Cost Estimate** – staff time

**Time Frame** – Medium term

**Benefit** – Historic preservation

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## Chapter 7: Public Input

### 7.1 Summary

This hazard mitigation plan benefits from various distinct types of public input strategies that were utilized by the THMC during the drafting process and prior to its adoption by the Town Council. Public input for the Tiverton hazard mitigation plan was primarily collected through a public survey, public meetings and an invitation to comment.

Early on in the planning process, the THMC distributed a “Hazard Perceptions” survey both online and at Town Hall. The purpose of the anonymous survey was to hear from residents the hazards and neighborhoods they are most concerned about. Over 90 individuals participated in the survey. Not surprisingly, most were concerned about hurricanes, blizzards, and ice storms. The survey also provided the THMC with a list of problematic areas that are susceptible to flooding. The THMC used the input from the survey to focus their mitigation planning efforts.

Prior to public release of the 2017 HMP, the THMC drafted the plan through a series of committee meetings. While these meetings did not rise to the level of public hearings and were not advertised, they were open to the public.

The 2017 THMC included town residents. The THMC’s roles focused on reviewing the content of the risk assessment matrix to ensure proper classification of problems and estimates of potential impacts; formulation of mitigation actions and sequencing of primary tasks; and identification of feasible implementation methods and schedules. Their comments were incorporated into the final 2017 HMP.

Prior to the public meeting on January 23, 2017, the draft plan was emailed to the neighboring Emergency Management Directors in Little Compton, Portsmouth, and Fall River, MA for review. Reviewers were asked to email the Tiverton EMA Director with comments, questions, or suggestions. [enter comment info].

The second public input strategy used in the formulation of this plan was geared toward the general public as opposed to specific stakeholders. The general public was encouraged to become involved through a public participation process. Prior to updating the plan, an online survey was distributed via social media and direct email to Tiverton residents. The purpose of the survey was to further identify vulnerable areas understand the public perception of natural hazards. During the draft review portion of the plan development, an electronic copy of the draft 2017 HMP was posted to the Town of Tiverton’s website. The public was informed of both the webpage posting and the public hearing and were encouraged to comment on the HMP and attend the meeting. Notice of the public hearing was also posted as an agenda item on the Town’s website in accordance with state law. On January 23, 2017, the Town Council conducted a public meeting on the HMP as part of their regular meeting. Review and comments from the Federal Emergency Management Agency and the Rhode Island Emergency Management Agency were incorporated prior to adoption by the Town Council.

Before the THMC even met, the Town was already working on updating their Comprehensive Plan- which includes discussions on floodplains, resource protection districts, and development trends. The public participation program of the Tiverton Comprehensive Plan Update is currently underway started as of January 2017. Members of the THMC are involved in the Comprehensive Plan update and will be bringing elements here into the other plan.

## Chapter 8: Implementation and Adoption

### 8.1 Prioritization of Mitigation Actions

Having identified appropriate mitigation actions the Tiverton Hazard Mitigation Committee set about prioritizing them for implementation. After the mitigation actions were identified and drafted, the THMC had an informed discussion about the prioritization of each action. They ranked each as “high”, “medium”, and “low”. The following were considered when ranking the actions:

- Protecting human health and safety
- Reducing damages
- Economic feasibility
- Political climate
- Environmental impact

**High Priority:** Greatest beneficial impact for the greatest good

**Medium Priority:** May need other actions to be completed first

**Low Priority:** Less of an impact on safety and property

**Table 25: Activity Prioritization**

<b>High</b>	Repair and upgrade the Old Stone Bridge structure
	Map North Tiverton Water District and Stone Bridge Water District systems
	Obtain peak usage and capacity data for water districts
	Create Town oversight of water districts
	Install security cameras at the communication towers
	Identify alternate routes in the event of the failure of Mill Pond Dam
	File dam action plans with RIDEM
	Implement a CERT program
<b>Medium</b>	Drainage study in the northern end of Town
	ATV for sewer line inspection, forest rescue, trail maintenance, and firefighting
	Elevate road along 3 Rod Way (Fogland Beach)
	Utilize updated building permit software
	Conduct an annual ½ day waterfront construction class for area contractors
	Widen Nannaquaket Road Bridge by 4 feet, raise by 2 feet
	Build a secondary emergency access road for Police Dept. and DOT facilities
	Promote heating and cooling centers
	Review mitigation plan for Algonquin Gas
	Conduct an annual evening meeting for coastal business owners
	Improve the condition of the footpath from Tiverton Middle School to the High School
	Upsize generator and improve transfer switch at Middle School/shelter
	Purchase and install a generator and transfer switch at Ranger Elem. School
	Carry out site improvement recommendations as per Weetamoo Woods Preplan/Hazard
Improve sanitary facilities at Grinnell’s Beach and Fogland Beach	
Invite local historians to HMP review in a year.	
<b>Low</b>	Replace Nonquit Pond Bridge/Pond Bridge Road Bridge



## **8.2 Implementing the Plan**

The Town of Tiverton and the Tiverton Hazard Mitigation Committee realize that successful hazard mitigation is an ongoing process that requires implementation, evaluation, and updates to this plan. The Town also understands the importance of integrating appropriate sections of the plan into the Town's Comprehensive Plan, Emergency Operations Plan, and site plan review process. It is intended that this plan and the ongoing efforts of the THMC will preserve and enhance the quality of life, property, and resources for the Town of Tiverton.

Adoption of this mitigation strategy increases Tiverton's eligibility for federal hazard mitigation grants. These grants originate from FEMA's Pre-Disaster Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM) and post-disaster Hazard Mitigation Grant (HMGP) Programs. (Refer to Appendix B for further information.)

## **8.3 Monitoring**

The THMC, under the leadership of the Town's Emergency Management Director, will meet annually (or more frequently if necessary), to monitor and evaluate the actions contained in the plan. At each meeting, the committee members will discuss the actions assigned to them to ensure continual progress with mitigation efforts. The status of each mitigation action will be documented and minutes recorded for the record. The THMC will also continue to re-evaluate membership on the committee to ensure effective engagement of the appropriate parties. New members may be invited to serve on the THMC as priorities shift.

## **8.4 Evaluation**

At the annual meetings, the THMC will evaluate both the actions and the planning process. The THMC will base its evaluation on whether or not the actions have met the following criteria: increased public awareness/education, reduction in hazard damage, actions being implemented in the designated time frames, and actions staying within the cost estimate. The committee will document and report its findings to the Planning Board and Town Council. The THMC will involve the public in the action evaluation process by holding an annual advertised public meeting in order to review the evaluation and solicit input.

During the annual evaluation process, the plan will be promoted online, in the local library, at Town Hall, and the Community Center for public review. Comments and suggests can be sent directly to the Emergency Management Director or brought up at the advertised public meeting.

## **8.5 Revisions**

Recognizing that this is a living document, the THMC will make changes to it after each annual revision or a disaster, as conditions warrant. These revisions will also reflect changes to priorities and funding strategies that may have been implemented.

A full revision of the plan will commence a year in advance of the current plan expiration date in order to ensure the Town always has an approved plan. The update will be completed every five years and will incorporate a formalized process for prioritizing actions and weighing the cost/benefit of such actions. All updates or revisions to the plan will be submitted to the RIEMA. The Town Council will involve the public in the plan revision process by holding an annual advertised public meeting to present recommended revisions and solicit input. Revised plans will also be sent to the neighboring communities for comment.

All future meetings will again be open to the public and it is the hope of the THMC Committee that once the public education and outreach actions begin, public involvement in the Plan will increase and will be reflected in future revisions. The THMC will involve the public in the annual meeting by posting it on the website, in the local library, and in the local newspaper to encourage involvement.

**8.6 Adoption**

After each evaluation cycle (every 5 years), the Tiverton hazard mitigation plan will be presented to and adopted by the Town Council. The associated ordinance documentation will be kept as part of this plan.

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**APPENDICES**

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## Appendix A- Resources

### Technical and Financial Assistance for Mitigation State Resources

#### **Coastal Resources Center**

University of Rhode Island  
Narragansett Bay Campus  
Narragansett, RI 02882  
(401) 874-6224

#### **Coastal Resources Management Council**

Stedman Government Center  
4808 Tower Hill Road  
Wakefield, RI 02879  
(401) 222-2476

#### **Department of Administration/Division of Planning**

One Capitol Hill  
Providence, RI 02908  
(401) 222-6478

#### **Department of Environmental Management**

235 Promenade Street  
Providence, RI 02908  
(401) 222-6800

#### **Rhode Island Banking Commission/Associate Director**

233 Richmond Street  
Providence, RI 02903  
(401) 222-2405

#### **Rhode Island Builders Association**

Terry Lane  
Gloucester, RI 02814  
(401) 568-8006

#### **Rhode Island Department of Business Regulations**

233 Richmond Street  
Providence, RI 02903  
(401) 222-2246

#### **Rhode Island Emergency Management Agency**

645 New London Avenue  
Cranston, RI 02920  
(401) 946-9996

#### **Public Utilities Commission**

100 Orange Street  
Providence, RI 02903  
(401) 222-3500 Ext. 153

#### **State Fire Marshal's Office**

272 West Exchange Street  
Providence, RI 02903  
(401) 222-2335

#### **State of Rhode Island Building Committee Office**

Building Commissioner's Office  
One Capitol Hill  
Providence, RI 02903  
(401) 222-3529

**Technical and Financial Assistance for Mitigation  
Federal Resources**

**Economic Development Administration**

Philadelphia Regional Office  
The Curtis Center  
601 Walnut Street, Suite 140 South  
Philadelphia, PA 19106-3323  
(215) 597-8822

**Federal Emergency Management Agency**

**Mitigation Division**

Mitigation Division  
Region I Office  
99 High Street  
Boston, MA  
(617) 223-9561

**Small Business Administration**

10 Causeway Street  
Room 265  
Boston, MA 02222  
(617) 565-5590

**U.S. Department of Agriculture**

**Natural Resources Conservation Service**

451 West Street  
Amherst, MA 01002  
(413) 253-4362

**U.S. Department of Commerce**

**National Weather Service Forecast Office**

445 Myles Standish Boulevard  
Taunton, MA 02780 (508) 823-2262

**U.S. Department of Housing and Urban  
Development**

**Community Development Block Grants**

Region I – O’Neill Federal Building  
10 Causeway Street  
Boston, MA 02222  
(617) 565-5354

**U.S. Department of the Interior**

**National Park Service**

Rivers and Trails Conservation Program  
Regional Office  
15 State Street  
Boston, MA 02109  
(617) 223-5203

**U.S. Environmental Protection Agency**

Region I Offices  
5 Post Office Square - Suite 100  
Boston, MA 02109-3912  
(617) 565 3400

**U.S. Fish and Wildlife Service**

Northeast Regional Office  
U.S. Fish and Wildlife Service  
300 Westgate Center Drive  
Hadley, MA 01035-9587  
(413) 253-8200

## Other Resources

### **The Association of State Floodplain Managers (ASFPM):**

The ASFPM is a professional association with a membership of almost 1,000 state employees that assists communities with the NFIP. ASFPM has developed a series of technical and topical research papers and a series of proceedings from their annual conferences. Many mitigation “success stories” have been documented through these resources and provide a good starting point for planning.

### **Floodplain Management Resources Center:**

The Floodplain Management Resources Center is a free library and referral service of the ASFPM for floodplain management publications. Co-located with the Natural Hazards Center at the University of Colorado in Boulder, staff can use keywords to identify useful publications from the more than 900 flood-related documents in the library.

### **Institute for Business and Home Safety (IBHS) (formerly Insurance Institute for Property Loss Reduction):**

The IBHS is an insurance industry sponsored nonprofit organization dedicated to reducing deaths, injuries and property damage resulting from natural hazards. IBHS efforts are directed at five specific hazards: flood, windstorm, hail, earthquake and wildfire. Through its public education efforts and information center, IBHS communicates the results of its research and statistical gathering, as well as mitigation information, to a broad audience.

### **Volunteer Organizations:**

There are a number of volunteer organizations such as the American Red Cross, the Salvation Army, Habitat for Humanity, Interfaith and the Mennonite Disaster Service, that are often available to help after disasters. Service organization, such as the Lions, Elks and VFW are also available. These organizations have helped others with food, shelter, clothing, money, etc. Habitat for Humanity and the Mennonite Disaster Service provide skilled labor to help rebuild damaged buildings incorporating mitigation or flood proofing concepts. The offices of individual organizations can be contacted directly or the FEMA Regional office may be able to assist.

### **Flood Relief Funds:**

After a disaster, local businesses, residents and out-of-town groups often donate money to local relief funds. They may be managed by the local government, one or more local churches or an ad hoc committee. No government disaster declaration is needed. Local officials should recommend that the funds be held until an applicant exhausts all sources of public disaster assistance. Doing so allows the funds to be used for mitigation and other projects that cannot be funded elsewhere.

### **New England States Emergency Consortium (NESEC) – Lakeside Office Park:**

NESEC conducts public awareness and education programs on natural disaster and emergency management activities throughout New England. Brochures and videotapes are available on such topics as earthquake preparedness, mitigation and hurricane safety tips. NESEC maintains a web site that is accessible at <http://www.serve.com/NESEC>.

### **The New England Floodplain and Stormwater Managers Association (NEFSMA):**

The NEFSMA is a professional organization for New England’s floodplain and stormwater managers. This organization provides workshops, conferences and a newsletter to its membership and interested individuals and companies. NEFSMA web site is accessible at <http://www.seacoast.com/~nefsma>.

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## Appendix B- Public Notice

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ANNEXES

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## Annex 1: Weetamoo Woods Preplan/Hazard Assessment

### Purpose:

Identify general areas of high risk (high level of usage) and areas of high hazard (areas of concentrated fuels, fuels of concern, landscape concerns). This is a summary of a brief visual survey and not a comprehensive hazard assessment. This survey done to help derive a possible plan of action for mitigating risks related to emergency response in the Weetamoo Woods block. The challenge is to match the incident with the resources responding, before it occurs.

### Types of Emergency Response:

- Medical/ SAR- Life safety
- Wildfire- property/ environment safety

### Findings:

#### Areas of Concern

- Fuel loading
- Areas of High frequency with fall risk
- Areas of high frequency with Ignition risk
- Access
- Environmental concerns

#### *Fuel Loading*

Fuel conditions currently are a major concern. Largely an oak, beech over story with a moderate shrub layer in greater than 50 percent of forest. This shrub layer consists of fuels with vertical and horizontal continuity of 1 to 6 feet in height. A large portion of this shrub layer is comprised of mountain laurel, blueberry and green briar. Numerous wind events and succession have also left large quantities of cured woody debris on forest floor. This is mostly in the 100 hour fuel category. Presently a thick duff layer can be found over nearly 100% of forest. Also areas of environmental significance are noted with a scattered holly component in the southern end of forest and in pockets elsewhere. It is unclear what management goals and methods are at this time. Note: Due to the thin bark, holly trees are extremely susceptible to fire damage.

#### *Areas of high frequency with fall injury and/or ignition risk*

Multiple rock outcroppings lend themselves to be attractive areas of activity. Signs of multiple campfires may be found on any number of these areas as well as unmarked trails frequented by mountain bikers, off road vehicles and equestrians. These areas have increased risk associated with them due to slippery rocks, sudden/ steep/ high drop offs, voids/ tripping hazards in rocks. Woodlands north of Lafayette risk of incident is most likely to be on the exterior of woods where the majority human interaction occurs.

**Access**

Current condition of access is poor. Yellow trail is passable by small, light equipment only to the area of the red and blue trail intersections. Lafayette road from the west is blocked by stones near the spur trail intersection. Access from the lake road side appears to be too narrow to accommodate emergency vehicles. Green trail, orange trail and portions of the red, blue, and yellow trails are too narrow and mostly single track trails. Trail markings are inconsistent. Aluminum tags while partially reflective are small and maybe difficult to see at night. Also side trails to areas of interest are not marked or mapped.

**RECOMMENDATIONS FOR MITIGATING HAZARDS****Prevention**

- Start a Fire Wise prevention program focusing on surrounding properties
- Patrolling during high usage, drought, holidays
- Posting of fines for negligent and criminal ignition
- Establishing of trail logs
- Public outreach in times of increased fire danger

**Training**

- Rural water supply and tanker shuttles
- Lookouts, Communications, Escape Routes, and Safety Zone training
- Preplanning drills- Focus on realistic specific scenarios
- Wilderness medical response training for personnel (Solo has a good program)
- Wildfire behavior, handline construction
- Engine operations in the urban interface
- Urban interface structure triage and protection
- Minimum Impact Suppression Techniques (M.I.S.T.)

**Tactical**

- ATV/UTVs- advance them on run cards, seek funding to purchase one
- During summer drought and deep burning fire conditions, contain and monitor maybe best tactical approach due to limited water and resources
- Utilize other local resources; make them known during preplan- farm equipment/ helicopters

**Site Improvements**

- Lafayette Rd should be made passable by at least a pick up as it is a primary point of access and egress
- Yellow trail to blue or red trail to gas line should be made accessible for pick up
- Trails should be further evaluated to determine which would be most beneficial as control lines and improved as such.
- Meadow should be assessed to determine usage as medical helicopter landing zone for prolonged patient transport
- Stone bridges should be evaluated by an engineer to determine safe working load
- Other access should be assessed
- Trail markings should be clear and consistent along the length of the trails
- Unique location identifiers should be placed at major intersections to allow for clear location communication

- Unmapped trails should be mapped and encouraged or hidden and eradicated to control the flow of people
- Abandoned WELLS MUST BE FILLED or made safe. Filling with sand allows for future use if needed
- Identify areas that are of significant environmental, cultural importance and plan for their protection
- Fuel reduction program is recommended but may not be possible for management objectives or practical
- Explore creating Community Wildfire Protection Plan. May not be necessary for this community

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## Annex 2: StormReady Standard Operating Procedures

Americans live in the most severe weather-prone country on Earth. Each year, Americans cope with an average of 10,000 thunderstorms, 2,500 floods, 1,000 tornadoes, as well as an average of 6 deadly hurricanes. Potentially deadly weather impacts every American. Communities can now rely on the National Weather Service’s StormReady program to help them guard against the ravages of Mother Nature.

Some 90% of all presidentially declared disasters are weather related, leading to around 500 deaths per year and nearly \$14 billion in damage. StormReady, a program started in 1999 in Tulsa, OK, helps arm America's communities with the communication and safety skills needed to save lives and property– before and during the event. StormReady helps community leaders and emergency managers strengthen local safety programs.

StormReady communities are better prepared to save lives from the onslaught of severe weather through better planning, education, and awareness. No community is storm proof, but StormReady can help communities save lives. StormReady makes a difference!

This purpose of this SOP is to provide guidance to the town of Tiverton in preparing for and dealing with the effects of hazardous weather conditions. [NOAA's National Weather Service](#) urges residents to keep abreast of local forecasts and warnings and familiarize themselves with key weather terminology.

**Warning Notification:** A warning for severe weather will be received from one or more of the following systems:

NATIONAL WEATHER SERVICE (NWS) RECEIVER/Specific Area Message Encoding (SAME) Radio  
EMERGENCY ALERT SYSTEM (EAS)  
CABLE and BROADCAST RADIO and TELEVISION

Station Name	Station Call Sign	Cox Cable Channel	Broadcast Channel
NWS Weather			162.40 Mhz
ABC 6	WLNE	6	6
NBC 10	WJAR	10	10
CBS 12	WPRI	12	12
The Weather Channel		51	51
WPRI Continuous Weather		106	106
1540 WADK	WADK		AM 1540
630 WPRO	WRPO		AM 630
Echolink	WX1BOX	(New Eng) group	Node

RI SkyWarn	Cranston	146.76, -600hz	No PL
RI ARES	Cranston	146.70, -600hz	No PL

Rhode Island Law Enforcement Teletype (RILETS)

INTERNET: WeatherBug, Interactive Weather Information Network (IWIN), Weather Underground

SAME Weather Radio Receivers have been installed in the following locations: School Administration office, Tiverton Police dispatch office, Tiverton Fire Dept, Tiverton Public Works Dept, Town Hall Personnel office, Community Center

Activation Procedures for Dispatchers

When you receive a weather “Warning” your Specific Area Message Encoding (SAME) receiver will sound a warning tone for eight seconds followed by the voice broadcast of the National Weather Service. The type of alert will be indicated by the lights on the front panel of the display and the type of alert will also scroll across the text window on the front panel of the receiver. This alert notification procedure will only be activated for weather “WARNINGS” that present an immediate threat to life, Such as a severe thunderstorm or tornado.

A “Weather Warning” is defined as: The type of weather event the warning is issued for is imminent, occurring, or likely to occur for the Newport county area. A weather “Watch” is defined as: conditions are favorable for the development of (weather event) in and close to a defined area. A watch should increase your weather awareness, but will not activate this alert notification procedure.

Actions: Tiverton Police Dept dispatcher: When you receive a Weather “Warning” you will:

1. Announce the warning on all fire and police channels. Include warning type, effective times and affected area. Notify Tiverton EMA for notification to NWS
2. Patrol Units: Upon receiving weather warning, or through observance of local conditions such as a severe thunderstorm or tornado, will proceed to the following local outdoor recreation areas to advise public to seek shelter: Town Farm Recreation Area, Grinnells and Fogland Beach, Pocasset Fields, Bulgamarsh Recreation Area. For a Tornado Warning, every attempt will be made to notify the inhabitants of all local trailer parks of the imminent threat of a tornado and they should be strongly advised to seek safer shelter!
3. Notify Tiverton School Administration. Include warning type, effective times and affected area (Only during school year)
4. Notify Tiverton Public Works. Include warning type, effective times and affected area
5. Notify Tiverton Fire and Water District. Include warning type, effective times and affected area
6. Notify Tiverton Public Library. Include warning type, effective times and affected area

\* Continue down the list until all individuals have been contacted

Title	Name	Office	E-mail
Police Chief	Tom Blakey	401-625-6722	tblakey@tivertonpoliceri.com
Fire Chief	Robert Lloyd	401-624-6707	chief@tivertonfire.com

Title	Name	Office	E-mail
Emergency Manager	Bill Tavares		<a href="mailto:ema@tiverton.ri.gov">ema@tiverton.ri.gov</a>
Town Administrator	Matt Wojcik	401-625-6710	administrator@tiverton.ri.gov
Recreation Director	[open]		gr@fwwebb.com
Public Works Director	[open]	401-625-6760	<a href="mailto:dpw@tiverton.ri.gov">dpw@tiverton.ri.gov</a>

**EOC Activation Criteria:** The Tiverton EOC will be activated at the discretion of the Town Administrator, Emergency Manager, Fire Chief, or Chief of Police. The decision will be based upon:

1. The need for State or Federal assistance
2. The need for close coordination with local Town Council members
3. Anytime a shelter is open
4. During a technological or natural disaster..ie blizzard or severe thunderstorm

All Clear: All Clear will be transmitted by the same means as the initial warning

Additional Weather Reporting items:

Fire Dept; The following events should be reported to the Director of Emergency Management, Chief Robert Lloyd or Bill Tavares. If the EMA Director is not available, you should contact the National Weather Service office in Taunton directly.. This is a private unlisted number for reporting significant weather by public safety officials ONLY and is not to be released to the general public.

- Tornadoes or funnel clouds
- Wall clouds, especially if they are rotating
- Hail
- Winds in excess of 40 MPH
- Rain, greater than 1” in one hour, or 2” or greater storm total
- Flooding: Streams and rivers, Coastal, Street (when more than the usual poor drainage puddles)

Winter Weather

- Precipitation type change (rain to sleet/snow) when change has taken hold
- Thunder, when accompanied by snow
- New snowfall:
- First 2”; every 2-3” thereafter  
1 inch per hour or greater

Lightning Safety/Sheltering: If caught out in the open during a severe weather event, you should immediately seek shelter! All Recreation areas will have hand held lightening detectors on site. Notification by device in these areas will activate immediate response!

**When a Safe Location is nearby**

When a safe location is nearby, follow the "30/30 Rule."

- Seek safe shelter when you first hear thunder, see dark threatening clouds developing overhead or lightning. Count the seconds between the times you see lightning and hear the thunder. You should already be in a safe location if that time is less than 30 seconds.
- Stay inside until 30 minutes after you last hear thunder.

**Plan Ahead!** Your best source of up-to-date weather information is a [NOAA Weather Radio \(NWR\)](#). Portable weather radios are handy for outdoor activities. If you don't have NWR, stay up to date via internet, TV, local radio or cell phone. If you are in a group, make sure all leaders or members of the group have a lightning safety plan and are ready to use it.

Determine how far you are from a [safe enclosed building](#) or a [safe vehicle](#). As soon as you hear thunder, see lightning or see dark threatening clouds, get to a safe location. Then wait 30 minutes after the last rumble of thunder before you leave the safe location. If you are part of a group, particularly a large one, you will need more time to get all group members to safety. NWS recommends having professional lightning detection equipment so your group can be alerted from significant distances from the event site.

When groups are involved, the time needed to get to safety increases. So you need to start leaving sooner. Your entire group should already be in a safe location when the approaching storm reaches within 5 miles from your location.

**When a Safe Location Is Not Nearby**

The lightning safety community reminds you that there is NO safe place to be outside in a thunderstorm. If you absolutely can't get to safety, this section is designed to help you lessen the threat of being struck by lightning while outside.

Being stranded outdoors when lightning is striking nearby is a harrowing experience. Your first and only truly safe choice is to get to a safe building or vehicle. If are [camping](#), [climbing](#), on a [motorcycle or bicycle](#), [boating](#), [scuba diving](#), or enjoying other outdoor activities and cannot get to a safe vehicle or shelter, follow these last resort tips.

- Do NOT seek shelter under tall isolated trees! The tree may help you stay dry but will significantly increase your risk of being struck by lightning. Rain will not kill you, but the lightning can!
- Do NOT seek shelter under partially enclosed buildings
- Stay away from tall, isolated objects. Lightning typically strikes the tallest object. That may be you in an open field or clearing.
- Know the weather patterns of the area. For example, in mountainous areas, thunderstorms typically develop in the early afternoon, so plan to hike early in the day and be down the mountain by noon.
- Know the weather forecast. If there is a high chance of thunderstorms, curtail your outdoor activities.
- Do not place your campsite in an open field on the top of a hill or on a ridge top. Keep your site away from tall isolated trees or other tall objects. If you are in a forest, stay near a lower stand of



trees. If you are camping in an open area, set up camp in a valley, ravine, or other low area. A tent offers NO protection from lightning.

- Wet ropes can make excellent conductors. This is BAD news when it comes to lightning activity. If you are mountain climbing and see lightning, and can do so safely, remove unnecessary ropes extended or attached to you. If a rope is extended across a mountain face and lightning makes contact with it, the electrical current will likely travel along the rope, especially if it is wet.
- Stay away from metal objects, such as fences, poles and backpacks. Metal is an excellent conductor. The current from a lightning flash will easily travel for long distances

If lightning is in the immediate area, and there is no safe location nearby, get into the lightning desperation position. Crouch down but do NOT lie down. Bend your knees down while keeping your feet together (see Figure 2).



Figure 2: Lightning Desperation Position

## Weather Related Terms

### SPRING AND SUMMER WEATHER TERMS

Coastal Flooding - Prolonged strong onshore flow of wind and/or high astronomical tides causing a rise in sea level that floods coastal areas.

Drizzle - Precipitation in the form of liquid drops. It's diameter is less than .5 millimeters. Drizzle falls at a much slower rate than rain does.

Dust Devils - A small but rapidly rotating column of wind of short duration that is made visible by dust, sand, and debris picked up from the ground. Diameter usually ranges from 10 to 100 feet and develop best on clear, dry, hot afternoons. Fairly uncommon in this part of the country.

Excessive Heat Warning - Issued within 12 hours of the onset of the heat conditions listed in the excessive heat watch.

Excessive Heat Watch - Issued for the potential of the following conditions within 12 to 36 hours: heat index of at least 105 degrees Fahrenheit for more than 3 hours per day for 2 consecutive days or heat index more than 115 degrees Fahrenheit for any period of time.

Flash Flood - A flood which is caused by heavy or excessive rainfall in a short period of time, generally under 6 hours, leading to water that rises and falls quite rapidly. The term may also be used to alert the public of non-life threatening flooding of small streams, streets, storm drains, and low lying urban areas. A flash flood can also be caused by the failure of a dam or from ice jams on waterways.

Flash Flood Warning - Issued to inform the public, emergency management, and other cooperating agencies that flash flooding is in progress, imminent, or highly likely.

Flash Flood Watch - Issued to indicate current or developing hydrologic conditions that are favorable for flash flooding in and close to the watch area, but the occurrence is neither certain or imminent.

Flood - The condition that occurs when water overflows the artificial or natural boundaries of a stream, river, or other body of water. Also issued for the ponding of water at or near where the rain is falling or has fallen. The term may also be used to alert the public of non-life threatening flooding of small streams, streets, storm drains and low lying urban areas. It may also be used if small streams in rural areas reach or exceed bank full.

Flood Crest - Maximum height of a flood wave as it passes a certain location.

Flood Stage - The level at which a stream, river or other body of water begins to or will begin to leave its banks.

Flood Warning - Issued to inform the public, emergency management, and other cooperating agencies that flooding is in progress, imminent, or highly likely.

Fujita Tornado Damage Scale - A scale correlating the damage from a tornado with wind speed of the tornado.

Funnel Cloud - A rapidly rotating column of air extending from a cumulonimbus cloud with a circulation that does not reach the ground. once a funnel cloud reaches the ground it is then called a tornado.

Hail - Precipitation in the form of transparent or partially opaque balls or irregular lumps of concentric ice. Hail is normally defined as having a diameter of 5 millimeters or more and is produced by thunderstorms.

Heat Advisory - Issued within 12 hours of the onset of the following conditions: heat index of at least 105 degrees but less than 115 degrees for less than 3 hours per day. Nighttime lows remain above 80 degrees for 2 consecutive days.

Rain - Precipitation in the form of liquid drops the diameter of which must be .5 millimeters or greater. Implies a steady precipitation that might last for several hours.

Severe Thunderstorm - A thunderstorm with winds of 58 mph or greater and/or with hail 1 inch diameter or larger.

Severe Thunderstorm Warning - Issued to warn the public, emergency management and other cooperating agencies when a severe thunderstorm is forecast to occur or is occurring. The warning will include where the storm was occurring, its direction of movement and the primary threat from the storm.

Severe Thunderstorm Watch - Issued when conditions are favorable for the development of severe thunderstorms in and close to a defined area.

Shower - Intermittent rainfall of short duration that falls from a cumulus cloud. Heavy precipitation is possible. Implies more of a scattered rainfall.

Squall Line - A line of solid or nearly solid thunderstorms or strong winds that might extend for several hundred miles.

Supercell - A severe thunderstorm whose updrafts and downdrafts are in near balance allowing the storm to maintain itself for several hours. Supercells often produce large hail and tornados.

Tornado - A rapidly rotating column of air extending from a cumulonimbus cloud with a circulation that reaches the ground. However, the visible portion might not extend all the way to the ground.

Tornado Warning - Issued to warn the public, emergency management and other cooperating agencies when a tornado is forecast to occur or is occurring. The warning will include where the storm was occurring and its direction of movement.

Tornado Watch - Issued when conditions are favorable for the development of severe thunderstorms and possible tornados in and close to a defined area.

Wall Cloud - An area of clouds that extends beneath a severe thunderstorm. If a wall cloud rotates, it might precede tornado development.

Waterspout - A rapidly rotating column of air extending from a cumulonimbus cloud with a circulation that reaches the surface of the water.

#### HURRICANE SEASON WEATHER TERMS

SMALL CRAFT ADVISORY- When winds 25 knots) or 5 foot wave conditions threaten a coastal area, small craft operators are advised to remain in port or to not venture into the sea.

GALE WARNING- Wind Speeds of 34 knots sustained

STORM WARNING- Winds of 47 knots or more sustained

**TROPICAL DEPRESSION-** A disturbance with a clearly defined low pressure area; highest wind speed is thirty-eight (38) miles per hour.

**TROPICAL STORM WATCH-** An announcement for specific areas that a tropical storm, (or the potential of a newly developing tropical storm) poses a threat to coastal areas, generally within 36 hours.

**TROPICAL STORM WARNING-** A warning that tropical storm conditions, including possible sustained winds within the range of 39-73 miles per hour, are expected in specific coastal areas within 24 hours.

**TROPICAL STORM-** A distinct low pressure area well defined by a rotating circulation, with winds of 39-73 miles per hour.

**HURRICANE-** Once a tropical storm's constant wind speed reaches 74 miles per hour or greater, it is classified as a hurricane.

**HURRICANE WATCH-** An announcement for specific areas that a hurricane or hurricane conditions pose a threat to coastal area, generally within 36 hours.

**HURRICANE WARNING-** An alert that a hurricane is expected in a specified coastal area within 24 hours. When a hurricane warning is issued, all precautions should be completed immediately. If the hurricane's path is unusual or erratic, the warning may be issued only a few hours before the beginning of hurricane conditions.

**HIGH WIND WATCH/ WARNING-** A warning will be issued for inland counties where hurricane force winds are anticipated.

**HURRICANE HAZARDS-** A striking hurricane creates four major hazards; storm surge, high winds, tornadoes and heavy rains.

**EVACUATION ORDER:**

The most important instruction you will receive from local government officials, relayed over local radio and television stations. Once issued, an evacuation order is mandatory under law in the State of Rhode Island. If you live in a mobile home or an area ordered to evacuate, gather your survival kit and leave immediately. If you live in a safe area, secure your home and be prepared to stay. Because of long evacuation times and the unpredictability of hurricanes, you may be ordered to leave before a hurricane watch or warning is issued. For hurricane information listen to NOAA Weather Radio 162.4 MHZ.

Evacuation routes are clearly marked by the following sign;



These signs will direct by the safest route to the Mass Care Shelter, located at the Middle School

#### WINTER WEATHER TERMS

**Winter Storm Warning:** Issued when hazardous winter weather in the form of heavy snow, heavy freezing rain, or heavy sleet is imminent or occurring. Winter Storm Warnings are usually issued 12 to 24 hours before the event is expected to begin.

**Winter Storm Watch:** Alerts the public to the possibility of a blizzard, heavy snow, heavy freezing rain, or heavy sleet. Winter Storm Watches are usually issued 12 to 48 hours before the beginning of a Winter Storm.

**Winter Storm Outlook:** Issued prior to a Winter Storm Watch. The Outlook is given when forecasters believe winter storm conditions are possible and are usually issued 3 to 5 days in advance of a winter storm.

**Blizzard Warning:** Issued for sustained or gusty winds of 35 mph or more, and falling or blowing snow creating visibilities at or below ¼ mile; these conditions should persist for at least three hours.

**Lake Effect Snow Warning:** Issued when heavy lake effect snow is imminent or occurring.

**Lake Effect Snow Advisory:** Issued when accumulation of lake effect snow will cause significant inconvenience.

**Wind Chill Warning:** Issued when wind chill temperatures are expected to be hazardous to life within several minutes of exposure.

**Wind Chill Advisory:** Issued when wind chill temperatures are expected to be a significant inconvenience to life with prolonged exposure, and, if caution is not exercised, could lead to hazardous exposure.

**Winter Weather Advisories:** Issued for accumulations of snow, freezing rain, freezing drizzle, and sleet which will cause significant inconveniences and, if caution is not exercised, could lead to life-threatening situations.

**Dense Fog Advisory:** Issued when fog will reduce visibility to ¼ mile or less over a widespread area.

**Snow Flurries:** Light snow falling for short durations. No accumulation or light dusting is all that is expected.

**Snow Showers:** Snow falling at varying intensities for brief periods of time. Some accumulation is possible.

**Snow Squalls:** Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant. Snow squalls are best known in the Great Lakes region.

**Blowing Snow:** Wind-driven snow that reduces visibility and causes significant drifting. Blowing snow may be snow that is falling and/or loose snow on the ground picked up by the wind.

**Sleet:** Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects. However, it can accumulate like snow and cause a hazard to motorists.

**Freezing Rain:** Rain that falls onto a surface with a temperature below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Even small accumulations of ice can cause a significant hazard.

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