TOWN OF FOXBOROUGH
HAZARD MITIGATION PLAN

2020

Draft for Public Review

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I. INTRODUCTION

BACKGROUND AND PURPOSE

The Disaster Mitigation Act

The Disaster Mitigation Act of 2000 (DMA), commonly known as the 2000 Stafford Act amendments, was approved by Congress and signed into law in October 2000, creating Public Law 106-390. The purpose of the DMA is to establish a national program for pre-disaster mitigation and to streamline administration of disaster relief.

The DMA requires local communities to have a Federal Emergency Management Agency (FEMA)-approved mitigation plan to be eligible to receive post-disaster Hazard Mitigation Assistance (HMA).

The HMA "umbrella" contains three competitive grant programs designed to mitigate natural hazard impacts:

- Pre-Disaster Mitigation (PDM) grant program
- Hazard Mitigation Grant Program (HMGP) for post-disaster mitigation activities
- Flood Management Assistance (FMA).

Note that HMA programs are funded at the discretion of Congress. These programs are briefly described below.

Pre-Disaster Mitigation (PDM) Program

The PDM program was authorized by Part 203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 U.S.C. 5133. The PDM program provides funds to states, territories, tribal governments, communities, and universities for hazard mitigation planning and implementation of mitigation projects prior to disasters, providing an opportunity to reduce the nation's disaster losses through pre-disaster mitigation planning and the implementation of feasible, effective, and cost-efficient mitigation measures.

Funding of pre-disaster plans and projects is meant to reduce overall risks to populations and facilities. PDM funds should be used primarily to support mitigation activities that address natural hazards. In addition to providing a vehicle for funding, the PDM program provides an opportunity to raise risk awareness within communities.

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Hazard Mitigation Grant Program (HMGP)

The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration.

The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not "lost" during the recovery and reconstruction process following a disaster.

Flood Mitigation Assistance (FMA) Program

The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FEMA provides FMA funds to assist States and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, homes, and other structures insurable under the NFIP.

The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities. Three types of grants are available under FMA. These are Planning, Project, and Technical Assistance grants.

Changes Since Adoption of the Previous Hazard Mitigation Plan

The Biggert-Waters Flood Insurance Reform Act of 2012 eliminated the Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL) programs and made the following significant changes to the FMA program:

- The definitions of repetitive loss (two or more NFIP claims of more than $1,000) and severe repetitive loss properties have been modified
- Cost-share requirements have changed to allow more Federal funds for properties with repetitive flood claims and severe repetitive loss properties; and
- There is no longer a limit on in-kind contributions for the non-Federal cost share.

Effective August 15, 2013, acquisitions and elevations will be considered cost-effective if the project costs are less than $276,000 and $175,000, respectively. Structures must be located in Special Flood Hazard Areas (the area of the 1-percent-annual-chance flood). The benefit-cost analysis (BCA) will not be required.

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The NFIP provides the funding for the FMA program. The PDM and FMA programs are subject to the availability of appropriation funding, as well as any program-specific directive or restriction made with respect to such funds.

Another important change to the PDM, HMGP, and FMA programs is that "green open space and riparian area benefits can now be included in the project benefit cost ratio (BCR) once the project BCR reaches 0.75 or greater." The inclusion of environmental benefits in the project BCR is limited to acquisition-related activities.

Table I-1 presents potential mitigation project and planning activities allowed under each FEMA grant program described above as outlined in the most recent HMA Unified Guidance document. Many of the strategies and actions developed in this plan fall within the above list of eligible activities.

Table I-1: Eligible Mitigation Project Activities by Program

Source: Table 3 – HMA Unified Guidance document, February 27, 2015

*** indicates that any proposed action will be evaluated on its own merit against program requirements. Eligible projects will be approved provided funding is available.*

Eligible Activities	HMGP	PDM	FMA
1. Mitigation Projects	✓	✓	✓
Property Acquisition and Structure Demolition	✓	✓	✓
Property Acquisition and Structure Relocation	✓	✓	✓
Structure Elevation	✓	✓	✓
Mitigation Reconstruction	✓	✓	✓
Dry Floodproofing of Historic Residential Structures	✓	✓	✓
Dry Floodproofing of Non-residential Structures	✓	✓	✓
Generators	✓	✓	
Localized Flood Risk Reduction Projects	✓	✓	✓
Non-localized Flood Risk Reduction Projects	✓	✓	
Structural Retrofitting of Existing Buildings	✓	✓	✓
Non-structural Retrofitting of Existing Buildings and Facilities	✓	✓	✓
Safe Room Construction	✓	✓	
Wind Retrofit for One- and Two-Family Residences	✓	✓	
Infrastructure Retrofit	✓	✓	✓
Soil Stabilization	✓	✓	✓
Wildfire Mitigation	✓	✓	
Post-Disaster Code Enforcement	✓		
Advance Assistance	✓		
5 Percent Initiative Projects	✓		
Aquifer and Storage Recovery**	✓	✓	✓
Flood Diversion and Storage**	✓	✓	✓
Floodplain and Stream Restoration**	✓	✓	✓
Green Infrastructure**	✓	✓	✓
Miscellaneous/Other**	✓	✓	✓
2. Hazard Mitigation Planning	✓	✓	✓
Planning Related Activities	✓		
3. Technical Assistance			✓
4. Management Cost	✓	✓	✓

WHAT IS HAZARD MITIGATION?

Defined by FEMA, the term hazard means "an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss.[1]" In a simpler context, a hazard may be described as a condition with the potential for harm to the community or environment. Hazard mitigation is commonly defined as any sustained action that reduces or eliminates long-term risk to people, property, and resources from hazards and their effects.

Examples of hazard mitigation actions include outreach programs that increase risk awareness, projects to protect critical facilities, and the removal of structures from flood hazard areas. Local mitigation actions and concepts can be incorporated into land use plans and building codes.

The primary purpose of a hazard mitigation plan (HMP) is to identify natural hazards and risks, existing capabilities, and activities that can be undertaken by a community to prevent loss of life and reduce property damages associated with the identified hazards. Consideration may also be given to preservation of history, culture and the natural environment. The plan is intended to be integrated into the community's land use, environmental, and capital improvement frameworks, rather than being referenced during emergency management situations.

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[1] FEMA, Multi Hazard Identification and Risk Assessment, 1997, p. xxi

II. COMMUNITY PROFILE

Located at the intersection of Interstates 95 and 495 south of Boston, Foxborough, known to its residents as "the gem of Norfolk County," is a growing community that had a population of 16,865 at the time of the 2010 Census; the US Census estimates the 2017 population was 17,448. The population of Norfolk county was 670,850 in 2010 and estimated at 694,389 in 2017, while the Massachusetts statewide population was 6,547,629 in 2010 and estimated at 6,863,246 in 2017 (US Census). The land area of Foxborough is 19.85 square miles, with about one square mile of water; the population density was therefore about 879 individuals per square mile in 2017, around the average of the surrounding communities. Foxborough is bordered by Walpole on the north, Norfolk on the northwest, Sharon on the northeast, Wrentham and Plainville on the west, and Mansfield on the south and southwest. Foxborough is 17 miles west of Brockton, 24 miles south of Boston, and about 195 miles from New York City. See Map 1 on page II-7.

Table II-1: Population Statistics for Foxborough and Surrounding Towns

Community	2010 Census			2000 Census		
	Population (count)	Land Area (square mile)	Density (count/mile)	Population (count)	Land Area (square mile)	Density (count/mile)
Foxborough	16,865	19.85	849.7	16,246	20.08	809.1
Norfolk	11,227	14.90	753.3	10,460	14.84	705.1
Sharon	17,612	23.44	751.4	17,408	23.31	747.0
Wrentham	10,955	21.71	504.7	10,554	22.20	475.5
Plainville	8,264	11.00	751.5	7,683	11.06	694.6
Mansfield	23,184	20.09	1,153.8	22,414	20.46	1,095.4
Norfolk County	670,850	396.11	1,693.6	650,308	399.58	1,627.5
Massachusetts	6,547,629	7,800.06	839.4	6,349,097	7,840.02	809.8

Table II-1 presents census data for Foxborough, the surrounding towns, the county, and the state, for both 2000 and 2010. The population of Foxborough increased by 619 over that time period, or by about 3.8-percent; this was slightly faster than Norfolk County (3.2-percent) and the State (3.1-percent). Additional 2010 census data for Foxborough is presented in Table II-2.

Table II-2: 2010 Census Data for Foxborough

Feature	Count	Percent
Total Population	16,865	
Median age (years)	42	
Under 16	3,536	
16 - 18 years	544	3%
18 - 21 years	453	3%
21 - 632 years	9,486	56%
62 - 65 years	541	3%
Over 65	2,305	14%
Male Population	8,273	49%
Female Population	8,592	51%

Feature	Count	Percent
White	15,665	93%
Black or African American	324	2%
American Indian and Alaska Native	27	0%
Asian	539	3%
Native Hawaiian and Other Pacific Islander	4	0%
Some Other Race	104	1%
Hispanic or Latino (of any race)	309	2%
Total Households	6,504	

The 2015 Foxborough Master Plan expects population to reach between 17,889 and 18,880 by 2030, based on previous population growth trends and projections from the Metropolitan Area Planning Council (MAPC).

Open Town Meeting is the form of government managed by a five-member Board of Selectmen and a Town Manager. The Town provides its own public water service, and electrical service is provided through National Grid. Charitable organizations within town include the Newcomers, Jaycees, Lions, Rotary, Knights of Columbus, St. Alban's Lodge, Grange, and Scouts. The Council on Aging/Human Services conducts many programs including counseling in addition to activities, entertainment and assistance to all ages. The Foxborough Public Health Nurse provides well-child clinics, lead level screening, immunizations, etc. and blood pressure clinics. The Foxborough area is served by Steward Norwood Hospital, Norcap Lodge, and Foxborough Health Center. Dana Farber Cancer Institute and Partners Healthcare which includes Mass General Hospital and Brigham & Women's Hospital in Foxborough, and Sturdy Memorial Hospital in Attleboro also provide local health care. The Town maintains a website at www.foxboroughma.gov.

The Town is the home of the New England Patriots National Football League franchise and Major League Soccer New England Revolution. Gillette Stadium was built in 2002 and is surrounded by Patriot Place which is 1,300,000 square foot open-air shopping/restaurant center. Gillette Stadium has a capacity of 65,878, a number that is reportedly reached during every Patriot's home game; this temporarily increases the Town's population by 500%.

While Foxborough is proud of these and other high-profile businesses, the Town also prides itself on its small-town community feeling. The Town has been extremely successful in maintaining its small-town image and rural characteristics while providing for significant growth.

The 700-acre Foxborough State Forest (also called the F. Gilbert Hills State Forest) and an additional 1,700 acres of conservation area owned by the Town (including the Harold B. Clark Town Forest, Kersey Point on the Neponset Reservoir, Hersey Farm, and Wolf Meadow), perpetuate a rural, country setting which is complimented by the Town's close-knit neighborhoods.

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Map 1: Location Map

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Civic and sports organizations also play a major role in promoting and maintaining the strong sense of community spirit felt by town residents. Founder's Day, complete with parades and other events, is attended by thousands. This civic pride is instilled in new residents as well and is exemplified annually by the success of many fundraising events. Residents are particularly proud of the fact that Foxborough High School is renowned for its strong sports tradition with the football team a perennial contender for the Division Championship.

The Town of Foxborough has several unique characteristics to keep in mind while planning for natural hazards:

- Tree-lined streets are considered a defining characteristic of Foxborough. Although these trees may be vulnerable to high winds and winter storms, their presence is valued by the Town; the Town believes that removing these trees for the sake of hazard mitigation should be avoided if possible.
- The Town has proactive municipal officials that frequently share information and coordinate with one-another on a regular basis.
- Foxborough is home to historic structures and sites that are irreplaceable and bring economic value to the Town. Historic resources are often uniquely vulnerable to natural hazard effects because they were built before modern building codes were adopted, their age may correspond to a degree of inevitable degradation, mitigation options that can be implemented while retaining historic character may be limited, and historic designation exempts structures from some mitigation requirements.
- Foxborough contains several major roadways that provide emergency routes for evacuation and for routes to medical facilities.
- Foxborough has some bridge crossings and roadways that could be at risk in the event of flooding.
- Foxborough may be a good candidate for flood-related grants due to the potential impact to property, transportation emergency routes, economic/historic resources, and the ability to solve the flooding problems through structural measures such as culvert upgrades, dam and bridge upgrades or flood proofing. The cost-benefit analysis for some projects may be in the Town's favor.
- Much of the critical infrastructure in the Town is located in clusters, often near areas of floodplain. These facilities are therefore at higher risk during natural hazards.

Map 2 on page II-11 presents a base map of Foxborough.

EXISTING LAND USE

The most recent land use statistics available from the state are from 2005 aerial photography. Table II-3 breaks the Town into 29 land use categories. The table shows the square miles and acreage of each land use category, as well as the percentage of area in Foxborough (including open water) in each category.

Table II-3: Land Use, 2005

Land Use	Square Miles	Acres	Percent of Town
Brushland/Successional	0.05	34	0.3%
Cemetery	0.04	26	0.2%
Commercial	0.32	204	1.5%
Cranberry Bog	0.02	11	0.1%
Cropland	0.10	66	0.5%
Forest	10.90	6977	52.3%
Forested Wetland	1.14	728	5.5%
Golf Course	0.13	84	0.6%
High Density Residential	0.14	91	0.7%
Industrial	0.48	308	2.3%
Junkyard	0.00	1.6	0.0%
Low Density Residential	2.10	1345	10.1%
Medium Density Residential	1.55	991	7.4%
Multi-Family Residential	0.21	135	1.0%
Non-Forested Wetland	0.77	491	3.7%
Nursery	0.04	27	0.2%
Open Land	0.19	123	0.9%
Orchard	0.00	1.3	0.0%
Participation Recreation	0.19	120	0.9%
Pasture	0.11	73	0.5%
Powerline/Utility	0.08	48	0.4%
Spectator Recreation	0.49	310	2.3%
Transitional	0.03	20	0.2%
Transportation	0.50	318	2.4%
Urban Public/Institutional	0.22	140	1.0%
Very Low Density Residential	0.18	114	0.9%
Waste Disposal	0.01	4.9	0.0%
Water	0.86	548	4.1%
Water-Based Recreation	0.00	0.2	0.0%
Total	**20.84**	**13341**	

For more information on land use categories, see https://www.mass.gov/service-details/massgis-data-layers and navigate to "Land Use (2005)".

Map 3 shows 2016 land use for Foxborough.

Map 2: Town Map

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Map 3: Land Use

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POTENTIAL FUTURE LAND USE

In 2000, the Metropolitan Area Planning Council (MAPC), under contract to the Executive Office of Environmental Affairs, prepared a buildout analysis for every community in the Boston region. A buildout analysis helps communities understand the potential impacts of future growth that might occur given the amount of developable land remaining and how that land is zoned.

The buildout is based on available land within each zoning district and it estimates the number of additional housing units and commercial development that could be accommodated. Generally, the projections account only for as-of-right development. The results of the 2000 Census were not released when MAPC performed the analyses.

Table II-4: Buildout Potential in Foxborough, 2000 MAPC Analysis

Developable Land Area (acres)	3,718
Additional Residents	5,249
Additional K-12 Students	936
Additional Residential Units	2,034
Additional Commercial/Industrial (sq. ft.)	6,695,849
Additional Roadway at Buildout (miles)	44

The 2015 Master Plan lays out four future growth scenarios for Foxborough that limit the expected buildout. The scenarios identify four areas of future growth: along the Route 1 corridor, downtown, in the Chestnut Green area, and near the Mansfield Border. Within these four "growth nodes" there are approximately 1,280.1 acres of developable land, divided into 93 parcels; the vast majority located on the Route 1 corridor.

Preservation of open space is a priority in all scenarios presented in the Master Plan, though the degree to which that would occur varies. The scenarios are:

1. **"Decentralization":** growth focused along Route 1 corridor, in the Chestnut Green area, and near the Mansfield border. An open space buffer would be pursued between Route 1 and the neighborhoods south of Route 1.
2. **"Small Rural Town":** growth focused along Route 1 corridor and the Mansfield border, with infill residential development occurring downtown. Protecting open space would be a priority.
3. **"Growth Nodes":** growth focused along a north-south corridor through town, using transit-oriented development principles. Growth would occur on the Route 1 corridor, downtown, around chestnut green, and at the Mansfield border. Protecting open space would be a priority, and this approach would allow for new open space to be added in some areas.
4. **"Route 1 Growth Corridor":** growth focused on Route 1 corridor. Residential growth would occur downtown, and some growth would occur at the Mansfield border. This approach would allow for protection of additional open space.

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In 2010, town staff provided a list of development projects current at the time. The table below expands on that list by presenting recent development projects while also summarizes the statuses of those previously listed.

Name	Location	Description	Notes / Status
River Ridge	East Belcher Road	19 single family units	Project previously titled "River's Edge" and proposed 40 single family homes. Approved in 2019 for 19 units.
Patriot Place	Route 1	1.3 million square foot mixed-use commercial retail zone.	Completed
Chestnut Green (State Hospital Site)	Chestnut and Main Street	Mixed-use development & redevelopment, with about 105 housing and commercial units	Completed Includes subsidized apartments (Chapter 40B), single & multiple-family housing, offices, and shops. Some original buildings were razed for homes or open land.
Lodge at Foxborough (Previously called "Foxborough Boulevard")	Foxborough Boulevard	250 subsidized (Chapter 40B) units	Completed
The Bleachery	Morse St	Commercial redevelopment	Completed
Governors Meadow	Main Street	34 single family units	Underway
Autumn Valley Estates	Off East Street	27 single family	Completed
Durham Park	Cocassett Street	9 single family homes.	Dropped from 13 units. Project underway.
Mixed Use	Route 106	3 single family units, as well as commercial use.	Project listed in previous edition of this HMP, but current town staff are unaware of this project.
Foolish Hill	East Belcher Road	Future commercial development in limited or light industrial zone	Project listed in previous edition of this HMP. No specific project is known
Mill Street	Mill Street	8 single family homes.	Previously 12 units. Project is completed
Hanover Foxborough (Previously Domain-Foxborough)	10 Fisher Street	248 luxury apartments. A percentage are affordable under Chapter 40B.	Completed
Lawson Farm	242 Main Street	30 Single Family Unites	Underway
London Estates	95 Main Street	18 Single Family Units	Underway Flooding due to insufficient drainage has been reported at this site.
29 Wall Street	Wall Street	50 Apartments	Approved
35-45 Panas Road	Panas Road	3 Warehouses 120,000 square feet	Underway
9 Perry Drive	Perry Drive	Warehouse 7,500 square feet	Approved
17 Perry Drive	Perry Drive	Warehouse 10,000 square feet	Under review by Planning Board
Regional Dispatch Facility	100 High Rock Road	Critical Facility	Underway
The Gables at Foxborough Green	Route 106	9 Single Family	Underway
Land Fill	East Belcher Road	Future Solar Array	Proposed

CRITICAL FACILITIES

Map 4 and Table II-5 present critical facilities in Foxborough. Critical facilities include those that perform an important function during a natural disaster such as shelters and emergency operation centers. Critical infrastructure also includes locations that house sensitive populations, such as schools or nursing homes. There are other critical facilities and infrastructure that may not be mapped because the information was not available. These may include utilities, communication facilities, or transportation corridors. The purpose of mapping the natural hazards and critical facilities is to present an overview of hazards in the community and how they relate to critical facilities.

Much of the Critical infrastructure in Foxborough is clustered near the center of town and in Southwest and Eastern Foxborough. All of these clusters are located in or near floodplain areas. Two facilities are located within the 1% annual-chance FEMA floodplain (AE), and none are located in the 0.2% flood area. Eight facilities are located within locally-identified areas of flooding that are not coincident with SFHAs.

The entire town has snow accumulation averages of 36.1 to 48 inches based on the historical record, and therefore most critical infrastructure sites are classified as being at a high risk for annual snow accumulation in that range. The current edition of the Massachusetts State Building Code (Ninth Edition CMR 780; June 8, 2018) defines design wind speeds for critical facilities in Foxborough as 142 mph (Risk Category III or IV) regardless of location within town; this indicates a uniform risk from wind for all critical facilities in town, regardless of location. Landslide risks across the Town are low.

Critical sites the Town staff has emphasized that are particularly important and vulnerable include:

- Underground Storage Tanks (USTs) in or near flooding areas
- Dams
- Water/Sewer pumping stations in or near flooding areas
- Communications towers and centers
- Hazardous materials storage sites
- Electrical substations

The breakdown of the critical sites and how they relate to selected hazards follows in Table II-5. Some of the critical facilities are described after the table with focus on changes since the previous plan was adopted. Critical facilities are mapped in Map 4. Numbered features correspond to the numbers in Table II-5. Areas of concern shown on the map are described in detail in other sections of this document.

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Foxborough Public Safety Building

The Foxborough Public Safety Building (PSB) is located on a portion of the former Foxboro State Hospital campus at the intersection of North Street, Payson Road, and Chestnut Street. The facility houses the Police Department, Fire Department, and Emergency Operations Center (EOC). The Foxborough Emergency Management Agency (Foxborough EMA) operates out of the FSB and is organizationally a part of the Foxborough Fire Department.

Construction of the PSB was completed in 2007, during the development of the previous edition of the Foxborough HMP; therefore, the previous HMP listed the Police and Fire Departments separately from this building.

Regional Emergency Communications Center

A new Regional Emergency Communications Center (RECC) is being completed in the western part of Foxborough, at 100 High Rock Road. When completed in 2020, this completely self-sufficient facility, with backup power and fuel and its own drinking water well, will serve Foxborough, Mansfield, Easton, and Norton.

Schools

The Charles Taylor Elementary School is the Town's primary shelter. It has an emergency generator.

The Mabelle M. Burrell Elementary School is currently undergoing major renovations and expansion. The expansion will include a new wing and a 6,000 square-foot gym. Mitigation measures are expected to be taken, including using hurricane-glass for windows. The project is expected to be completed for the 2021-2022 school year.

Water Utilities

A new water treatment plant is currently under construction and expected to be completed in 2020. The plant is located at the site of Water Pump Station 1, at 25 Pumping Station Road. Four public water supply wells are also being re-drilled at this site to feed this treatment plant.

The Town has two large water tanks. The three million-gallon tank located off of Hill Street in the northern edge of town was completely rehabilitated in 2015. The one million-gallon tank located near Gillette Stadium will receive a complete rehabilitation in 2021. The Main Street water tank, listed in the previous version of this plan, has been decommissioned and will be demolished within the next five years.

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Map 4: Critical Facilities

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Table II-5: Relationship of Critical Facilities and Selected Hazard Types

ID	Name	Type	Shelter	Generator	FEMA Zone	Locally Identified Flood Area
1	Foxborough Public Safety Building	EOC Police Fire		Yes	No	No
2	Public Safety Communications Tower	Communications		Yes	No	No
3	Public Safety Communications Tower	Communications			No	No
4	Regional Emergency Communications Center	Communications		Yes	No	No
5	Charles Taylor Elementary School	School	Primary	Yes	No	No
6	Foxborough High School	School		Yes	No	No
7	Foxborough Regional Charter School	School		Yes	No	No
8	Vincent M Igo Elementary School	School		Yes	No	No
9	Mabelle Burrell Elementary School	School		Yes	No	No
10	John J Ahern Middle School	School		Yes	No	No
11	The Sage School	School		Yes	No	No
12	Lakeview Carpenter Pond Dam	Dam			A	No
13	Foundry Pond Dam	Dam			A	No
14	Water Street Dam	Dam			A	No
15	Alby Way Dam (Stadium)	Dam			A	No
16	Glue Factory Pond East Dam	Dam			AE	No
17	Glue Factory Pond West Dam	Dam			AE	No
18	New Water Treatment Plant	Municipal		Yes		
19	Station 3 Water Pump Station	Water Pumping Station		Yes	No	No
20	Station 3 Water Pump Station	Water Pumping Station		Yes	No	No
21	Station 5 Water Pump Station	Water Pumping Station		Yes	No	No
22	Station 1 Water Pump Station	Water Pumping Station		Yes	No	No
23	Station 1 Garage Water Department	Municipal			No	No
24	Station 2 Water Pump Station Complex	Water Pumping Station		Yes	A	No
25	Station 2 KOH Building	Municipal			A	No
26	Station 4 Water Pump Station	Water Pumping Station		Yes	No	No
27	Water Booster Pump Station	Water Pumping Station		Yes	No	No
28	Water Storage Tank (Pressure District)	Water Tank			No	No
29	Water Storage Tank	Water Tank			No	No
30	Wastewater Reuse Tank	Sewer Re-Use Tank			No	No
31	Chestnut Street Sewer Pump Station (FHA)	Sewer Pumping Station		Yes	No	No
32	Sampson Road Sewer Pump Station	Sewer Pumping Station		Yes	No	No

ID	Name	Type	Shelter	Generator	FEMA Zone	Locally Identified Flood Area
33	South Street Sewer Pump Station	Sewer Pumping Station		Yes	No	No
34	Sewer Pump Station	Sewer Pumping Station			No	No
35	Igo School Sewer Pump Station	Sewer Pumping Station		Yes	No	No
36	Charter School Sewer Pump Station	Sewer Pumping Station			No	No
37	High School Sewer Pump Station	Sewer Pumping Station		Yes	No	No
38	Morse Street Sewer Pump Station	Sewer Pumping Station		Yes	AE	No
39	Foxborough Business Park Sewer Pump Station	Sewer Pumping Station			No	No
40	Schneider Electric Sewer Pump Station	Sewer Pumping Station			No	No
41	Schneider Electric Sewer Pump Station	Sewer Pumping Station			No	No
42	Doolittle Elderly Housing	Elderly Housing		YES	No	No
43	N. Carl Annon Court	Elderly Housing			No	No
44	N. Carl Annon Court	Elderly Housing			No	No
45	Centennial Court Elderly Housing	Elderly Housing			No	No
46	Chestnut Green	Population Center				
47	Department of Public Works	DPW		Yes	No	Yes
48	DPW State Facility	DPW			AE	No
49	DPW State Facility	DPW			AE	No
50	Foxborough Town Hall	Municipal		Yes	No	No
51	EOC (Secondary)	EOC			No	No
52	Neponset Avenue Sub Station	Sub Station			No	No
53	Elm Street Electrical Sub Station	Sub Station			No	No
54	Schneider Electric Corporation	HazMat			No	No
55	Boyden Library	Municipal		Yes	No	No
56	Gillette Stadium	Entertainment		Yes		
57	Council on Aging Senior Center	Municipal		Yes		No

- *See Table V-2 on page V-36 for a description of FEMA Flood Hazard Zones.*
- *Locally-Identified Flood Area: Whether the site is located within an area that was identified by town officials and staff as a localized area of flooding. These areas may or may correspond with FEMA flood zones.*

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Department of Public Works

The Department of Public Works (DPW) facility is located on Elm Street, just north of Route 95. A new DPW office building was constructed in 2016 on site; along with the new building a generator was installed that can power the entire DPW facility.

Flooding due to poor drainage is reportedly a problem at the site, and the DPW reports that they have had to pump water off-site during rain events. Water flowing into underground fuel tanks is a specific concern.

Schneider Electric

The Schneider Electric company has replaced the Invensy Corporation in Foxborough, and is located in the former Invensy building.

Facilities Serving Marginalized or Underprivileged Populations

The Doolittle Home, at 16 Bird Street, is a retirement home with a Nursing Unit.

N. Carl Annon Court and Centennial Court are two affordable senior housing developments run by the Foxborough Housing Authority.

The Council on Aging Senior Center (75 Central Street). It has an emergency generator on-site. The facility owns a van it uses to transport senior citizens, which may be of use during an emergency situation.

Chestnut Green

Chestnut Green is a redeveloped mixed-use complex with apartments and offices. An important population and commercial center in Foxborough, it is located downtown near the PSB. It currently operates its own sewer treatment plant, but this will be abandoned within the next five years as the development connects to the municipal sewer system.

Gillette Stadium

As noted elsewhere, Gillette Stadium is, during events, a major population center. The facility operates its own sewer treatment plant.

Emergency Management

Foxborough Emergency Management Agency operates out of the Foxborough Fire Department.

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Other Critical Resources

Norfolk County Sheriff's Office

The Norfolk County Sheriff's Office (NCSO) provides support to municipalities during both emergency and non-emergency conditions. In 2008 the NCSO purchased a mobile command center which can be dispatched to local communities during a crisis.

The NCSO also administers the Rapid Alert Notification System (RANS) for county communities, including Foxborough.

Historic and Cultural Resources

The Foxborough Historical Commission is responsible for preserving and protecting historic resources and assets of Foxborough, which are key to its identity. The Commission protects resources including houses, streetscapes, landscapes, collections, and cultural traditions through preservation, education, advocacy, and partnership.

The Commission maintains an inventory of all cultural resources in town and is supported by a Demolition Delay By-Law that requires all buildings over fifty-years old to be reviewed by the Commission prior to demolition.

The Commission is not currently involved in hazard mitigation activities in any explicit way, but actions in this document aim to integrate hazard mitigation and historic preservation.

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III. PLANNING PROCESS

THE LOCAL HAZARD MITIGATION PLAN TEAM

Thomas Buckley, Assistant Fire Chief of the Foxborough Fire Department, coordinated the development of this Hazard Mitigation Plan Update. The following individuals were also involved with the update by providing input and reviewing drafts of the plan:

- Chris Gallagher - DPW Director
- Nick Riccio - Building Commissioner, Local Floodplain Manager
- Gaby Jordan - Staff Planner
- Paige Duncan - Planning Director, Deputy Local HMP Coordinator
- Jane Sears Pierce - Conservation Agent
- Jeff Peterson - Planning Board/Resident

DATA COLLECTION

A data collection, evaluation, and outreach program was undertaken to compile information about existing hazards and mitigation in the Town of Foxborough, as well as to identify areas that should be prioritized for hazard mitigation. The following is a list of data collection and public outreach efforts conducted to develop this Hazard Mitigation Plan Update:

- **A project initiation meeting was held March 5, 2019.** This meeting addressed the scope of services necessary to develop this HMP. Significant input was provided by the project team about the HMP update, including changes to the Towns capabilities and vulnerabilities with respect to each of the hazards covered by the HMP. Actions to include moving forward were also discussed.

- **An online survey was conducted in May and June 2019.** The survey was created though the website www.surveymonkey.com and was posted on the Town website. Participation was solicited through a press release published in the local newspaper as well as flyers posted in the Town Library and Town Hall.

Appendix A: STAPLEE Mitigation Strategy Matrix

Appendix B contains copies of meeting minutes and other records that document the development of this Hazard Mitigation Plan. Appendix C contains results of the online survey; these are also summarized below.

Public Survey

A public survey was posted online through the website www.surveymonkey.com to collect information about public perceptions of natural hazards and public interest in hazard mitigation measures. Results of the survey are summarized in this section.

A total of 43 individuals, residing throughout Foxborough as well as in surrounding communities, responded to the survey (see Figure III-1). The participation of people from

surrounding communities helps fulfil the requirement for participation of neighboring municipalities. About half of the respondents reported that they spend little or no time commuting (implying that many work from home, or have left the workforce), with the commutes of the other half of respondents lasting from 20 minutes to one hour. As visible in the graphic below, the participants located within the Town demonstrate a high degree of geographic spread in the Town.

Figure III-1: Approximate Home Addresses of Survey Respondents

65% of respondents indicated that they have had a high awareness of the danger of natural hazards for many years. Recent storm events that had increased awareness included the March Storms of 2018 and the Winter Storms of January 2015; both selections indicate a local awareness of winter storm hazards.

Natural Hazard Concern

Concern about winter storms was also reflected in answers to questions about specific hazards of concern and about which hazards had historically impacted respondents. Specific hazards of concern are summarized in Figure III-2. The top concerns of residents are winter storms, hurricanes and tropical storms, severe thunderstorms, and other high wind events. Residents are least concerned about dam failures, earthquakes, wildfires, and river flooding.

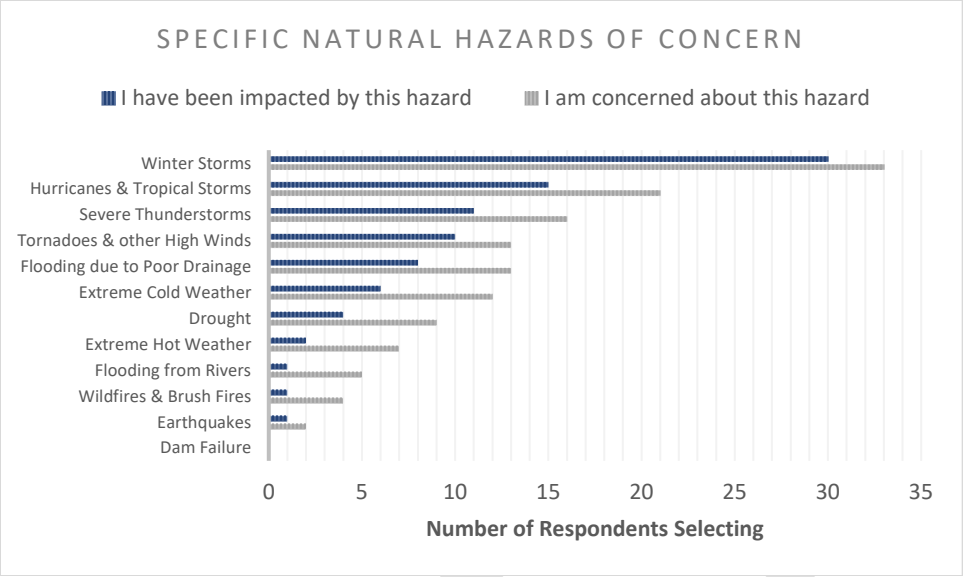

Figure III-2: Concern of Survey Respondents about Specific Hazards

Respondents were asked to identify specific areas of concern around the community. Answers are summarized in Table III-1.

Table III-1: Areas of Concern Identified by Survey Respondents

Area of Concern	Notes	# of Mentions
East Street & Cocasset Street	Flooding under railroad bridge	3
Mill Street	Trees are a concern	3
Booth Playground Fields		1
Central Street and Spring Street		1
Chestnut Street & Payson Road		1
Crackrock Pond Dam	On North Street	1
Cranberry Road & Cross Street		1
Elderly Housing	Ability to heat & cool	1
Lakeview Road		1
Morse Street		1
North High Street	Insufficient storm drainage	1
State Forest	Wildfire concern	1
Wooded Areas		1

Community Capabilities

About one-third of Foxborough residents reported that they have already been taking steps to reduce risks from natural hazards. Many of those measures have related to high wind, as well as snow, ice, and flooding. Responses are summarized in Table III-2.

Table III-2: Risk Reduction Measures Implemented by Survey Respondents

Area of Concern	Notes	# of Mentions
High Wind	70.59%	12
Snow or Ice	47.06%	8
Flood	35.29%	6

Area of Concern	Notes	# of Mentions
Extreme Hot or Cold	17.65%	3
Any / All Hazards	17.65%	3
Drought	11.76%	2
Wildfire	11.76%	2
Earthquake	5.88%	1

Measures reported by respondents include installation of sump pumps, improvements to drainage systems, tree and vegetation trimming and management, purchasing backup generators, purchasing snow removal equipment, upgrading roofs, updating utilities, and improving home insulation.

The survey asked about community capabilities. On a scale of zero ("I'm unaware of any efforts") to five ("Strong"), the average respondent rated Foxborough's existing mitigation effort capabilities at 1.77. Eleven of 30 respondents gave the Town a score of three (defined as "mediocre"), and ten respondents gave a score of zero; this indicates that as lack of public awareness about municipal hazard mitigation efforts may play a large role in public perception of the Town's capabilities.

Respondents identified emergency responders as the most important local resources for hazard preparation, response, or recovery. Other commonly identified resources were local government, individual community members or neighbors, and nonprofit organizations.

Mitigation and Response Needs and Recommendations

Survey respondents indicated the types of mitigation measures they believe are important for Foxborough to implement as a community. The top-scoring measures were those related to strengthening and improving the reliability of utilities, infrastructure, and emergency response in the face of natural disasters. Other highly-ranked mitigation categories were personal preparedness (for example, purchasing flood insurance or maintaining personal disaster plans and kits) and public outreach and education.

Respondents also listed specific actions and concerns they felt should be a high priority for the Town. A "word cloud" summarizing those responses is presented as Figure III-3; words are sized to reflect the number of times they were mentioned in responses. Note that power, water, and trees were mentioned many times.

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Figure III-3: "Word Cloud" Summarizing Recommended Community Actions

Respondents were asked about the top three priorities the Town should focus on when recovering from a hazard event. Responses are summarized in Table III-3, below. Responses have been altered for simplicity and clarity, and similar responses merged.

Table III-3: Top Priority Response Recommendations

Priority 1	#	Priority 2	#	Priority 3	#
Communication with Residents	4	Restore Utilities (including water)	4	Communication and distribution of information	3
Restore power	4	Ensure gas / electric service	4	Open shelters	3
Elderly assistance and outreach	3	Clearing of roads	3	Assistance to elderly or medically at-risk	2
Clear roads	2	Availability of first responders to help elderly/disabled or at-risk residents	2	Careful snow or debris removal	2
Drinking water	2	Financial support & governmental assistance	2	Additional support	1
Ensure safety of residents	2	Locations for shelters/assistance	2	Food	1
Access to daily needs (food, etc.)	1	Ability to stay safe (warm, dry, etc.)	1	Infrastructure repairs	1
Assistance to those affected	1	Food	1	Putting the Town back in order	1
Restore services	1			Address schools and the Senior Center	1
Lifesaving	1			Utilities	1
				Water quality	1

Numbers to the right of each response indicate the number of respondents that mentioned that action.

Finally, respondents were asked about what one action they think is most important for the Town to take to reduce hazard risks. Responses are summarized in Table III-4, below. Responses have been altered for simplicity and clarity.

Table III-4: Top Risk Reduction Action

Priority 1
Additional curbing/catch basins for street stormwater runoff
Alert system
Allow natural disasters to happen [without attempting to prevent damages]
Alternative heat source or portable power source in case of lost power in the winter
Attend to dead trees
Back up utilities
Communication; provide key contact information to residents
Coordinating with the power supply company to upgrade power transmission infrastructure
Cut branches near power lines
Electrical infrastructure improvement
Harden electrical system and create redundancies
Have the Town be storm ready
Increase department staffing when appropriate
Information
Maintain drainage systems
Prevention (education)
Remove all trees 12 feet or less from streets
Strong cutback program for trees
Timely and clear communication
Tree pruning
Upgrade power infrastructure

Coordination with Neighboring Communities

Letters were mailed to representatives of each of the communities that shares a border with Foxborough, as well as the Norfolk and Bristol County Commissioners. The letters informed recipients of the Foxborough HMP process underway, and invited comments to be directed to the Foxborough Local Coordinator or the consultant writing the Plan. To date, comments have not been received. Recipients were further invited to encourage members of their communities to participate in the online survey described above if they live or work in Foxborough. This appears to have resulted in a number of people outside the Town taking the survey as noted above.

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IV. HAZARD MITIGATION GOALS AND OBJECTIVES

The Foxborough Local Multiple Hazard Community Planning Team endorsed the following eight hazard mitigation goals at the March 5, 2019 team meeting:

1. Prevent and reduce the loss of life, injury, public health impacts and property damages resulting from all major natural hazards.

2. Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.

3. Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.

4. Prevent and reduce the damage to public infrastructure resulting from all hazards.

5. Encourage the business community, major institutions and non-profits to work with the Town to develop, review and implement the hazard mitigation plan.

6. Work with surrounding communities, state, regional and federal agencies to ensure regional cooperation and solutions for hazards affecting multiple communities.

7. Ensure that future development meets federal, state and local standards for preventing and reducing the impacts of natural hazards.

8. Take maximum advantage of resources from FEMA and MEMA to educate Town staff and the public about hazard mitigation.

Development of the goals were not necessary based on the evaluation of hazards and risks presented in Chapter V.

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V. HAZARD OVERVIEW

This section provides a general overview of natural hazards that may impact Foxborough. The following sections provides more detail about specific hazard vulnerabilities and existing mitigation efforts.

OVERVIEW OF HAZARDS AND IMPACTS

The 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) provides an overview of natural hazards in Massachusetts. It indicates that the following natural hazards may occur in Massachusetts:

- Inland Flooding
- Coastal Flooding
- Average and Extreme Temperature
- Drought
- Coastal Erosion
- Wildfire
- Landslide
- Tsunami
- Invasive Species
- Hurricanes & Tropical Storms
- Tornadoes
- Severe Winter Storm / Nor'easter
- Other Severe Weather (including thunderstorms and high wind events)
- Earthquakes

Foxborough is an inland community, and therefore not at risk from coastal flooding, coastal erosion, or tsunamis. Table V-1 presents Presidentially-Declared Disasters and Emergencies that have occurred in Norfolk County.

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Table V-1: Disaster and Emergency Declarations for Norfolk County

ID	Declaration	Type	Date
4379	Disaster	Severe Winter Storm and Snowstorm	March 13 – 14, 2018
4372	Disaster	Severe Winter Storm and Flooding	March 2 – 3, 2018
4214	Disaster	Severe Winter Storm, Snowstorm, Flooding	January 26 – 28, 2015
4110	Disaster	Severe Winter Storm, Snowstorm, Flooding	February 8 – 9, 2013
4097	Disaster &	Hurricane Sandy (Bristol County)	October 27 – November 8, 2012
3350	Emergency	Hurricane Sandy	October 27 – November 8, 2012
3343	Emergency	Severe Storm	October 29 – 30, 2011
4028	Disaster &	Tropical Storm Irene	August 27 – 29, 2011
3330	Emergency	Hurricane Irene	August 26 – September 5, 2011
1959	Disaster	Severe Winter Storm and Snowstorm	January 11 – 12, 2011
3315	Emergency	Hurricane Earl	September 1 – 4, 2010
1895	Disaster	Severe Storm and Flooding	March 12, 2010 – April 26, 2010
1813	Disaster &	Severe Winter Storm and Flooding	December 11 – 18, 2008
3296	Emergency	Severe Winter Storm	December 11 – 18, 2008
1701	Disaster	Severe Storms, Inland and Coastal Flooding	April 15 – 25, 2007
1642	Disaster	Severe Storms and Flooding	May 12 – 23, 2006
1614	Disaster	Severe Storms and Flooding	October 7 – 16, 2005
1512	Disaster	Flooding	April 1 – 30, 2004
3191	Disaster	Snowstorm	December 6 – 7, 2003
3175	Disaster	Snowstorm	February 17 – 18, 2003
3165	Disaster	Snowstorm	March 5 – 7, 2001
1364	Disaster	Severe Storms and Flooding	March 5, 2001 – April 16, 2001
1224	Disaster	Heavy Rain and Flooding	June 13 – July 6, 1998
1142	Disaster	Severe Storms/Flooding	October 20 – 25, 1996
1090	Disaster	Blizzard	January 7 – 13, 1996
3103	Emergency	Blizzards, High Winds, and Record Snowfall	March 13 – 17, 1993
920	Disaster	Severe Coastal Storm	October 30, 1991
914	Disaster	Hurricane Bob	August 19, 1991

Source: www.fema.gov

Based on the past experiences of hazards in Foxborough, as well as mapped hazard zones, the natural hazards addressed in this document are:

- Flood Hazards
  - Including riverine and shallow flooding
- Wind-Related Hazards
  - Including hurricane, tornado, and thunderstorm winds
- Winter-Related Hazards
  - Including snow and ice
- Fire-Related Hazards
  - Including drought
- Geologic Hazards
  - Including earthquakes and landslide

These are described further below.

Aside from the coastal hazards which are not applicable, the Town of Foxborough elected to not evaluate extreme temperature and invasive species. Drought was addressed within the chapter focused on fire-related hazards, but did not receive as detailed an analysis as other hazards. The loss estimates associated with extreme temperature, invasive species, and drought are very low for the county, which justifies that they do not need detailed profiling and analysis. No loss estimates are provided in the 2018 SHMCAP for extreme temperatures or drought. Money spent on invasive species control is noted, but losses are not estimated.

FLOOD HAZARDS

Flooding in Foxborough is often the direct result of weather events including nor'easters, heavy frontal rainstorms, tropical storms, and hurricanes. As a result of these events, Foxborough is at risk of the following types of inland flooding:

- **Riverine Flooding:** Also known as overbank flooding, it occurs when channels receive more rain or snowmelt from their watershed than normal, or the channel becomes blocked by debris. Excess water spills out of the channel and into the channel's floodplain area. Spring snowmelt or frozen ground conditions (which limits rainfall infiltration) can exacerbate riverine flooding caused by heavy precipitation.
    - **Ice Jams** occur when ice accumulates in a channel and acts as a dam, restricting flow and causing flooding
    - **Flash Flooding** is rapid rise of water along a water channel or low-lying urban area that is usually a result of an unusually large amount of rain and/or high velocity of water flow (particularly in hilly areas) within a very short period of time. Flash floods can occur with limited warning.
- **Shallow Flooding:** Occurs in flat areas where a lack of a water channel results in water being unable to drain away easily. The three types of shallow flooding include:
    - **Sheet Flow:** Water spreads over a large area at uniform depth.
    - **Ponding:** Runoff collects in depressions with no drainage ability.
    - **Urban Flooding:** Occurs when human-made drainage systems are overloaded by a larger amount of water than the system was designed to accommodate.

Municipal officials have also noted that flooding due to drainageways being clogged by beaver activity is a concern.

FEMA Flood Zones

In order to provide a national standard without regional discrimination, the 1% annual-chance flood (previously called the "100-year flood") has been adopted by FEMA as the base flood for purposes of floodplain management. The FEMA Special Flood Hazard Area (SFHA, described below) is coincident with the base flood. This flood has a 1% chance of being equaled or exceeded each year. Similarly, a 0.2% annual-chance flood (previously called the "500-year flood") has a 0.2% chance of being equaled or exceeded in a given year. The 0.2% annual-chance floodplain indicates areas of moderate flood hazard. The risk of having a flood of this magnitude or greater increases when periods longer than one year are considered. For

example, FEMA notes that a structure located within a 1% annual chance flood hazard area has a 26% change of suffering flood damage during the term of a 30-year mortgage.

Community flood hazards are described by FEMA in Flood Insurance Studies (FIS) that lay out flood sources, areas, and elevations where available. Flood hazard areas are mapped on Flood Insurance Rate Map (FIRM) panels and in digital format on Digital Flood Insurance Rate Maps (DFIRM).

The most recent FIRM and FIS for Foxborough was made effective June 16, 2015.

FEMA uses a variety of flood zones to delineate areas of annual chance flood hazard, described in Table V-2.

Table V-2: FIRM Zone Descriptions

Zone	Description
A	An area inundated by 1% annual-chance flooding, for which no base flood elevations (BFEs) have been determined.
AE	An area inundated by 1% annual-chance flooding, for which BFEs have been determined.
AH	An area inundated by 1% annual-chance flooding (usually an area of ponding), for which BFEs have been determined; flood depths range from 1 to 3 feet.
VE	An area inundated by 1% annual-chance flooding with velocity hazard (wave action); BFEs have been determined.
X	An area inundated by 0.2% annual-chance flooding (shaded X zone); an area inundated by 1% annual-chance flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from 1% annual-chance flooding.
Area Not Included (ANI)	An area that is located within a community or county that is not mapped on any published FIRM.

Historic Record

There have been a number of major rainstorms that have resulted in notable flooding in Foxborough in the past. Significant storms include:

- **September 11-12, 1954:** A storm that accompanied Hurricane Carol dropped more than 5 inches of rain near Foxborough.
- **August 19-20, 1955:** Hurricane Diane produced both record high volumes and very high intensities of rainfall, with amounts as high as 13 inches measured at Blue Hills. As much as 15 inches of water was reported on Morse Street at the Glue Factory Pond, and sections of Oak Street north of Cocasset Street upstream of Vandys Pond were washed out.
- **March 17-18, 1968:** Storm totals ranged from 5-7 inches of rainfall in southeastern Massachusetts.

- **April 1987:** A major rainstorm, immediately following another significant storm, dropped 4-7 inches of rain across Massachusetts.
- **June 12-14, 1998:** A very slow-moving storm moved through southeast New England and produced rainfall of 6 to 12 inches over much of eastern Massachusetts, which led to widespread urban, small stream, and river flooding. Several flash flood events occurred. The flooding resulted in a Presidential Disaster Declaration in Essex, Middlesex, Norfolk, Suffolk, and Bristol Counties. Dollar damage has been established at $13,000,000.
- **October 15, 2005:** Excessive rain and flooding occurred across Massachusetts. Approximately 1000 evacuations occurred and countless streets experienced flooding. Major thoroughfares were shut down. Approximately 2000 people were evacuated throughout downtown Taunton when failure of the Whittenton Pond Dam was "imminent." Nearly $6 million in damages were incurred across the state.
- **June 7, 2006:** A coastal storm brought 3 to 7 inches of rain to southeastern Massachusetts, causing widespread flooding of roads and small streams. Flooding closed roads in Taunton, Bellingham, and Walpole.
- **March 15, 2010:** Three to six inches of rain fell across Massachusetts, with rainfall totals on the order of six to ten inches in the eastern part of the state. Major flooding occurred in rivers, small streams, and drainage systems across eastern Massachusetts and Rhode Island. The Governor declared a state of emergency, followed by a federal disaster declaration for seven Massachusetts counties. Flooded of roads and property was widespread in Foxborough; the area around Glue Factory Pond (The Bleachery) was especially hard-hit, with the industrial buildings around the pond flooded. Over $16.64 million in property damage was incurred across Norfolk County.
- **July 24, 2010:** Heavy rain from thunderstorms produced localized flooding. Several streets in Foxborough were flooded, included Cocasset and Elm Streets. Cars were stranded at Chestnut and Baker Streets. Approximately $20,000 in damages were incurred.
- **August 9, 2013:** Torrential downpours led to flash flooding in some areas of southern New England. In neighboring Walpole a main road was flooded and several cars damaged.
- **July 12, 2017:** Heavy downpours and damaging thunderstorms struck the region around Foxborough, flooding streets in neighboring Wrentham.
- **August 15, 2018:** Thunderstorms produced hail, high winds, and high rains across Massachusetts. A portion of a road in neighboring Sharon was flooded.

Probability of Future Flood Events

According to the 2018 SHMCAP, Massachusetts is likely to experience a major flood even approximately once every three years. This aligns well with the list of significant historic flood presented above. While this list suggests that flooding may impact the region every few years, the data also suggests that flood events that cause economic or physical damage within Foxborough are less likely. Nuisance street flooding due to poor drainage was reported by Foxborough Town staff as being a frequent occurrence.

Dam failures are most likely triggered by the occurrence of another natural disaster or hazard and are not likely to occur when regular maintenance and inspections are performed. Therefore, dam failures are less likely to occur than the natural disasters that may trigger them. For example, a 1% annual chance flood will not always cause a dam failure. Dam failure is considered a low-likelihood occurrence in Foxborough.

Climate Change and Flood Hazards in Foxborough

Flood risk is typically determined through a review of historic events. However, research increasingly points to "non-stationarity" in hydrologic patterns. For example, a 2016 paper (Barrett and Salis, 2016) finds that flow rates during peak annual floods, as well as floods with recurrence intervals of 5, 10- and 20- years, have been increasing between 1962 and 2012. Average observed rates of increasing magnitude are from 0.9 to 1.8 percent per year. Therefore, when planning for inland flood hazards, it is essential to consider not just the past and present, but also potential future conditions.

According to the 2018 SHMCAP, Massachusetts is projected to experience more intense and frequent downpours in the future; this scenario is expected to lead to increased inland flooding as soils become saturated, river flows rise, and urban stormwater systems become overwhelmed. Additionally, climate change impacts on ecosystems may reduce the capacity of local vegetation to uptake water and reduce runoff.

The "resilient MA" Climate Change Data Clearinghouse was referenced to identify projected changes in precipitation patterns for the Foxborough area. Basin-scale projections were used rather than county-scale because the former are thought to better represent Foxborough's climate than the latter, which is larger and spans a wider variety of geographies and microclimates. The Taunton Basin was used despite the fact that the northern portion of Foxborough falls within the Boston Harbor Basin because the majority of the Town is contained by the Taunton Basin (this is following the guidelines of the MA Statewide and Major Basins Climate Projection Guidebook, 2018).

Table V-3 presents projected increases in total precipitation and days with more than one inch of precipitation. The "resilient MA" projections show an increase in annual precipitation amounts, with a large portion of that increase occurring in the spring; paired with spring snowmelt, this will likely lead to increased flooding. These projections also show an increase in the number of intense precipitation events throughout the year; the relatively high increase in springtime intense rainfall events may also mean more flooding, while increases in winter precipitation may lead to more snowpack and therefore more snowmelt in the spring.

Table V-3: resilient MA Precipitation Projections for the Taunton River Basin

		Baseline 1971-2000 Normals	Increase (Percent) 2030s	2050s	2070s	2090s
Total Precipitation (inches)	Annual	47.48	4.1%	6.6%	6.9%	7.0%
	Fall	12.42	2.6%	4.3%	2.6%	2.5%
	Spring	11.94	6.4%	8.0%	12.1%	12.7%
	Summer	10.99	2.3%	5.2%	5.4%	3.6%
	Winter	12.12	5.6%	7.4%	12.0%	16.1%
Days with Precipitation Greater than 1-inch	Annual	8.23	14.2%	20.4%	26.0%	29.2%
	Fall	2.44	9.8%	17.6%	18.4%	15.6%
	Spring	1.78	16.9%	26.4%	37.6%	43.3%
	Summer	2.02	7.4%	11.4%	11.4%	8.9%
	Winter	1.99	21.6%	29.6%	39.2%	51.3%

WIND-RELATED HAZARDS

Hazard Overview

Wind-related hazards include hurricanes and tornadoes as well as high winds during severe rainstorms and thunderstorms. Tree damage during high winds has the potential to be a significant hazard in Foxborough. Trees can knock out power and communication lines and block major roadways, which hinders emergency response. Wind and wind-borne debris can also damage structures and cause injuries.

While high winds or heavy precipitation are the primary causes of damage associated with severe thunderstorms, lightning strikes and hail can also cause property damage and injury

Historic Record

The region has been impacted by hurricanes throughout its history, starting with the Great Colonial Hurricane of 1635. The eye of one hurricane passed right through Boston in 1944.

According to NOAA historical records, 35 hurricane/tropical storm tracks have come within 100 miles of Foxborough since 1842. Of these storms, 26 reached tropical storm intensity, 9 were Category 1 hurricanes, four Category 2, and three Category 3 (note that storms that change in intensity are counted multiple times, once for each intensity level). Figure V-1 shows the historical tracks of only the hurricane-intensity storms as shown by the NOAA Historical Hurricane Tracks tool. The map does not include the tracks of extra-tropical systems, tropical depressions, or tropical storms that also came within 100 miles of the planning area.

Category	Name	Dates
1	UNNAMED 1858	Sep 14 to 17, 1858
3	UNNAMED 1869	Sep 07 to 09, 1869
2	UNNAMED 1869	Oct 04 to 05, 1869
1	UNNAMED 1879	Aug 13 to 20, 1879
1	UNNAMED 1894	Oct 01 to 12, 1894

Category	Name	Dates
1	UNNAMED 1896	Aug 30 to Sep 11, 1896
1	UNNAMED 1916	Jul 10 to 22, 1916
2	UNNAMED 1944	Sep 09 to 16, 1944
3	CAROL	Aug 25 to Sep 01, 1954
3	EDNA	Sep 05 to 14, 1954
2	DONNA	Aug 29 to Sep 14, 1960
1	GLORIA	Sep 16 to Oct 02, 1985
2	BOB	Aug 16 to 29, 1991

More information about recent high wind events that have impacted Foxborough, including those associated with tropical storms, nor'easters, and thunderstorms, is provided below:

- **August 21, 2004:** A thunderstorm spawned a tornado that touched down in West Wrentham and traveled northeast to Franklin and Interstate 495. The same storm downed several trees in Foxborough, causing about $25,000 in property damage.
- **July 4, 2006:** Severe thunderstorms brought down many trees in Foxborough State Park, and one large tree on South Street. $40,000 in property damage was caused across Norfolk County from these storms.
- **October 28, 2006:** A storm system caused widespread damage across eastern Massachusetts. Trees were knocked down onto wires on Route 1 in Foxborough, and large branches were brought down in several nearby communities, causing around $10,000 in property damage.
- **November 15, 2008:** Damaging winds were reported across southeast Massachusetts. Trees were downed in Stoughton, Norwood, Walpole, and Sharon. Large branches were downed on Beach Street in Foxborough. $45,000 in damage was reported in western Norfolk County.
- **August 28, 2011:** Tropical Storm Irene produced significant amounts of rain, storm surge, inland and coastal flooding, and wind damage across southern New England. Sustained winds resulted in widespread tree damage and power outages. In Massachusetts, winds resulted in $34.7 million in property damages, storm surge resulted in $75,000 in property damages, and inland flooding resulted in $24.13 million in property damage. One fatality was recorded in the State. In Foxborough trees and wires were downed on Lakeview Road, South Cross Street, and Main Street.
- **March 31, 2016:** Strong winds took down wires on Chestnut Street in Foxborough. $15,000 in damage were reported in Norfolk County.
- **September 5, 2016:** Tropical Storm Hermine was named in the Gulf of Mexico. It grew to a hurricane, then diminished so that by the time it reached the waters off of southern New England it was a tropical depression. Trees were still fully leaved and high wind gusts caused some tree damage. A four-inch diameter tree branch was downed onto Elm Street in Foxborough. In Sharon, a downed tree blocked East Foxborough Street, and in Bellingham, a large limb was downed on Brook Street. Downed trees caused approximately $6,500 of property damage in Norfolk County.

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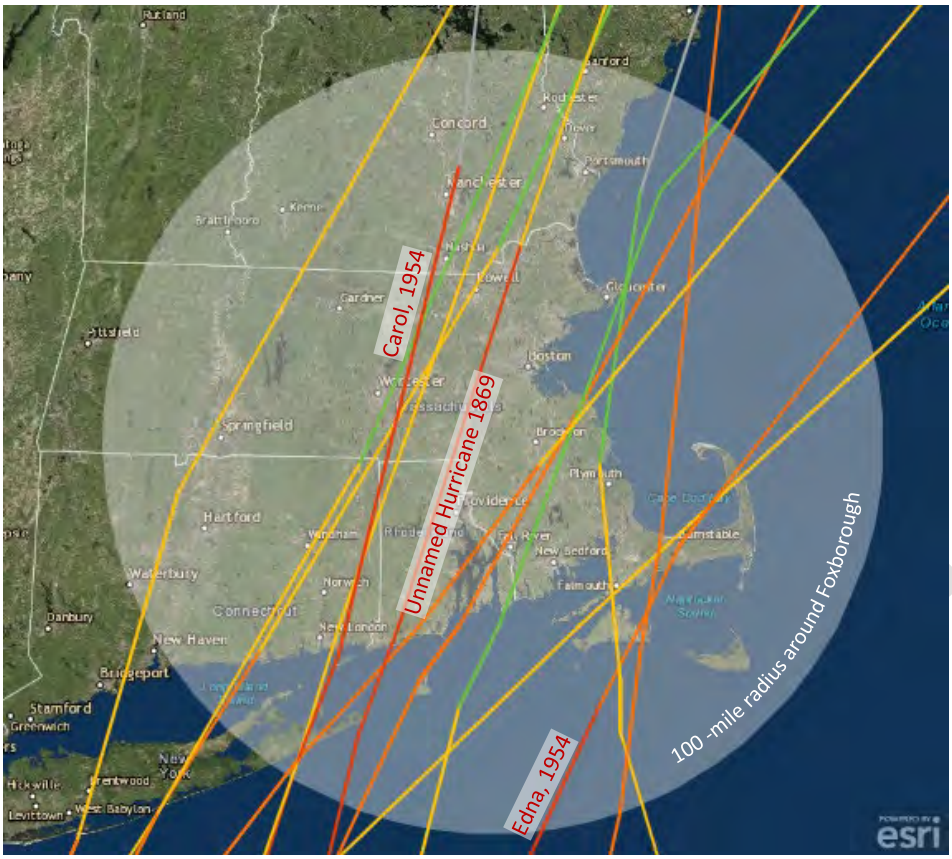

Figure V-1: Historic Hurricane Tracks Within 100 miles of Foxborough
Red line: Category 3
Orange Line: Category 2
Yellow Line: Category 1
Green Line: Tropical Storm
https://coast.noaa.gov/hurricanes/

- **March 2, 2017:** A strong cold front brought wind gusts around 65 mph to Foxborough. A tree fell on a road in Canton, and another onto power lines in Franklin.
- **March 2, 2018:** High winds knocked over many trees, including an entire stand of pine trees near the highway. Power outages were widespread (affecting 7,771 of 8,273 homes in Foxborough according to National Grid) and lasted five to six days in some areas.

Foxborough has numerous outdoor summer programs and microbursts have been a problem on at least one occasion. A microburst was recorded in town during the late 1990s, which caused some damage to trees and homes across a swath of the Town.

Probability of Future Wind Events

Based on the historic data presented above, high winds impact Foxborough on a nearly annual basis, with temporary road blockages and power outages, and damage to utilities or property, occurring approximately once every two years. The 2018 SHMCAP estimates that the Commonwealth experienced an average of 43.5 high wind events (defined as sustained winds of 40 mph or gusts of 58 mph) per year between 2008 and 2018.

According to the National Weather Service (NWS), thunderstorms impact eastern Massachusetts between 10 and 20 days a year (Figure V-2).

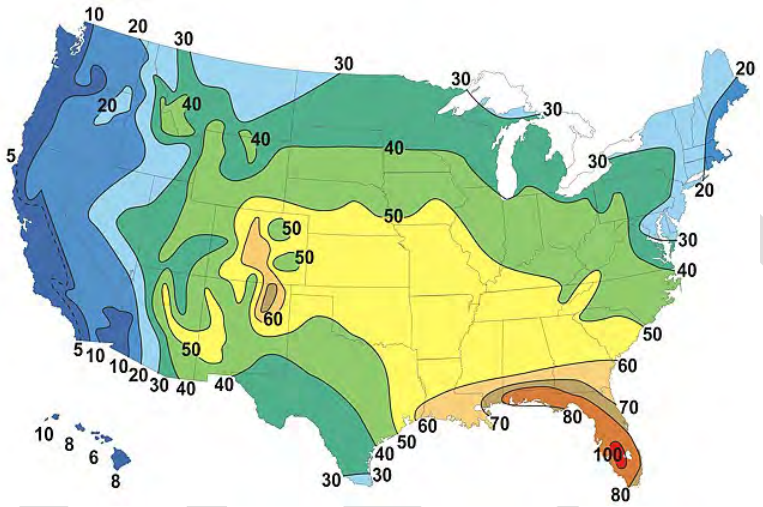

Figure V-2: Annual Average Number of Thunderstorm Days in the United States.
Source: NOAA NWS

Hurricanes and tropical storms have passed within 100 miles of Foxborough once every five years on average (based on NCEI data), though few of those have had significant impacts in town. The SHMCAP reports that hurricanes significant enough to result in a disaster declaration have occurred in the State once every 9 years.

Nor'easters occur every winter, bringing high winds. Tornadoes and straight-line winds occur very infrequently, and have a low likelihood of occurring any given year. According to the SHMCAP, the Commonwealth experienced 171 tornadoes from 1950 to 2017, or an average annual occurrence of 2.6 tornado events per year; Foxborough and the southeast region of the state have experience fewer tornadoes than other areas.

Climate Change and Wind Hazards in Foxborough

According to the 2018 SHMCAP, oceans that are warmer due to climate change provide more energy for storms, and so severe storm events and higher-intensity hurricanes are expected to become more frequent in the future. The NOAA Geophysical Fluid Dynamics Laboratory (GFDL) reports (as of April 25, 2018) the following expected impacts of climate change on hurricanes and tropical storms:

- **More Intense Tropical Cyclones:** Anthropogenic warming by the end of the 21st century will likely cause tropical cyclones globally to be more intense on average (by 2 to 11% for an IPCC mid-range scenario).
- **More Frequent Intense Tropical Cyclones:** There are better than even odds that anthropogenic warming over the next century will lead to an increase in the occurrence of very intense tropical cyclones globally, despite a likely decrease (or little change) in the global numbers of all tropical cyclones.
- **Higher Precipitation During Tropical Cyclones:** Tropical cyclone rainfall rates will likely increase on the order of 10-15% by the end of the 21st century.
- **Higher Storm Surge Flooding:** Sea level rise should be causing higher storm surge levels for tropical cyclones that do occur, all else assumed equal.

While climate models agree that severe storms will become more frequent, the effect of climate change on extreme wind events such as tornadoes and microbursts is less certain. Nevertheless, it is generally expected that more frequent and intense storms will produce more wind-related damage.

WINTER-RELATED HAZARDS

Hazard Overview

In Massachusetts, northeast coastal storms known as nor'easters, occur one to two times per year. Winter storms are a combination of hazards because they often involve wind, ice, flooding and snow fall. The average annual snowfall for most of the Town is 36 - 48 inches.

A number of public safety concerns can arise during snowstorms. Impassible streets are a challenge for emergency vehicles and affect residents and employers. Snow-covered sidewalks force people to walk in streets, which are already less safe due to snow, slush, puddles and ice. Large piles of snow can also block sight lines for drivers, particularly at intersections. Not all residents are able to clear their properties, especially the elderly. Refreezing of melting snow can cause dangerous roadway conditions.

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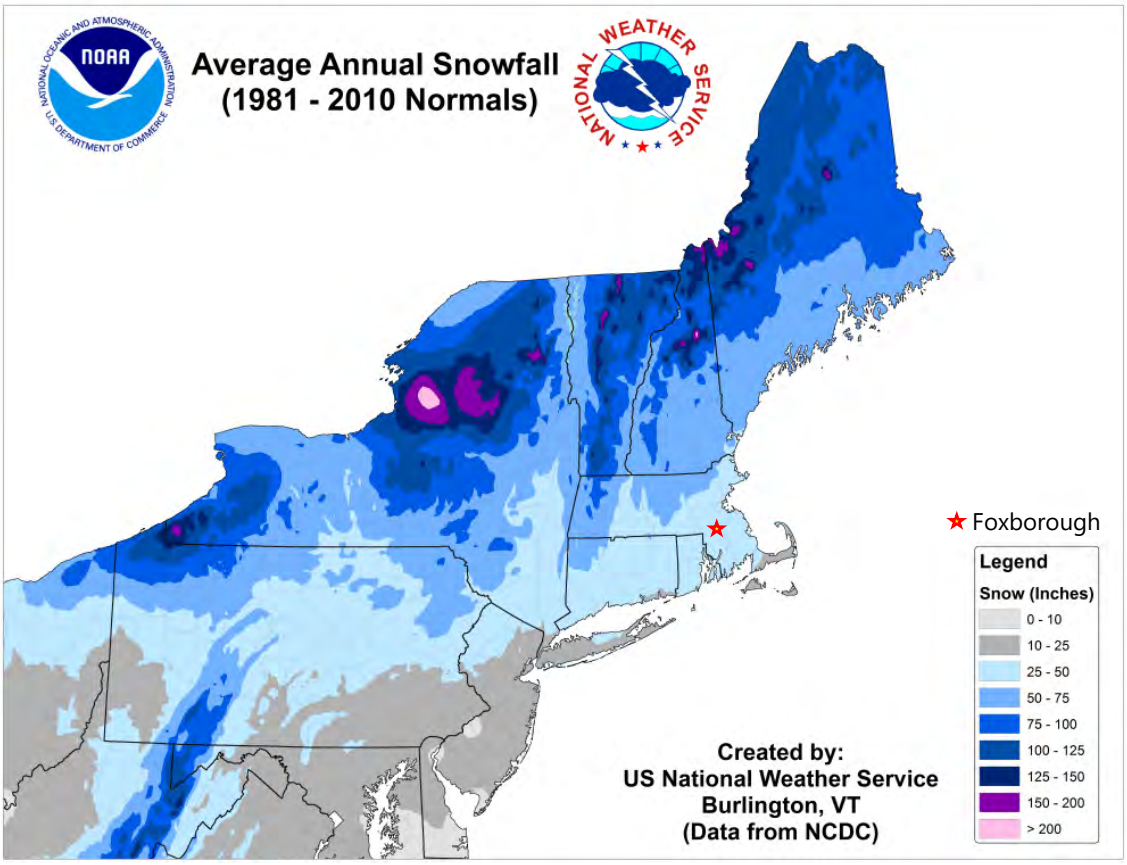

Figure V-3: 1981-2010 Average Annual Snowfalls Across New England
Source: NOAA

Historic Record

Recent winter events that have impacted Foxborough include:

- **January 7 - 8, 1996:** "The Blizzard of '96" dumped record snowfalls from the mid-Atlantic to southern New England. Total snowfall reached 20 to 25 inches in parts of Plymouth and Bristol Counties. The Massachusetts Emergency Management Agency reported $32 million in damage claims across the state, mostly for snow removal costs. NOAA estimates the total cost was as much as $1.6 million. In Foxborough, a roof collapsed at one of the water department buildings.
- **December 5 – 7, 2003:** A major winter storm brought heavy snow and strong winds to southern New England. One to two feet of snow fell across the state, with pockets of 28 to 35 inches near Interstate 95 southwest of Boston. 24 inches were reported in Foxborough.
- **December 26 – 27, 2004:** Nine inches of snow fell in Foxborough. Dozens of accidents were reported in the state due to slick roads and poor visibility.
- **March 12, 2005:** Eight inches of snow fell in Foxborough. Dozens of minor accidents and spinouts were reported in the state.

- **January 11 – 12, 2011:** A severe winter storm and snowstorm hit the region. A presidential disaster was declared for this event (D-1959) in Norfolk County, though no funding was requested by Foxborough.
- **January 31 – February 2, 2011:** The 2011 "Groundhog Day Blizzard" mostly impacted the western part of Massachusetts, but town officials report that the event led to the collapse of a warehouse roof in Foxborough.
- **February 8 – 9, 2013:** A severe winter storm, snowstorm, and flooding hit the region. A presidential disaster was declared for this event (D-4110) in Norfolk County, though no funding was requested by Foxborough.
- **January 26 – 28, 2015:** A severe winter storm, snowstorm, and flooding hit the region. A presidential disaster was declared for this event (D-4214) in Norfolk County, though no funding was requested by Foxborough.
- **February 15, 2015:** Two buildings at the Foxboro Terminals facility on North Street collapsed under the weight of snow.
- **Mar 2-3, 2018:** A severe winter storm and flooding hit the region. A presidential disaster was declared for this event (D-4372) in Norfolk County, though no funding was requested by Foxborough.
- **March 13, 2018:** Blizzard conditions were reported across southeastern Massachusetts. Fifteen to twenty-four inches of snow fell in Norfolk County. A large tree fell on a home in Foxborough. $47,000 in property damage is estimated by the NCEI to have occurred throughout western Norfolk County. A presidential disaster was declared for this event (D-4379) in Norfolk County, though no funding was requested by Foxborough.

Probability of Future Winter Events

Winter weather causes disruption annually, and significant damage from winter storms occurs approximately every three years, according to the historic record. The 2018 SHMCAP reports that high-impact snowstorms occur within the Northeast urban corridor, which includes Massachusetts, approximately once every year.

Climate Change and Winter Hazards in Foxborough

The 2018 SHMCAP explains that rising sea-surface temperatures, reduction in sea ice in the arctic, and altered atmospheric circulation patterns caused by climate change are all contributing to an increase in the frequency and severity of winter storms and nor'easter along the Atlantic coast. While warmer temperatures will reduce the amount of time snow and ice remains on the ground, snowfall amounts in Massachusetts will increase.

The "resilient MA" Climate Change Data Clearinghouse was referenced to identify projected changes in temperature and precipitation patterns for the Foxborough area. Basin-scale projections for the Taunton Basin were used. Table V-4 presents projected changes in total winter precipitation, winter days with more than one inch of precipitation, and winter days below zero degrees Fahrenheit. The "resilient MA" projections show an increase in total winter precipitation amounts as well as a significant increase in the number of intense precipitation

events during the winter. On the other hand, extreme cold days during the winter is expected to decrease significantly.

Table V-4: resilient MA Winter Weather Projections for the Taunton River Basin

Winter-Season Weather (December, January, February)	Normals 1971-2000	Increase (Percent) 2030s	2050s	2070s	2090s
Winter Precipitation (inches)	12.12	5.6%	7.4%	12.0%	16.1%
Winter Days with Precipitation Greater than 1-inch	1.99	21.6%	29.6%	39.2%	51.3%
Winter Days Below 0 °F	2.94	-36.05%	-41.84%	-44.56%	-46.26%

FIRE-RELATED HAZARDS

Hazard Overview

Foxborough considers brush fire, drought, and high temperature to fall under the category of fire-related natural hazards. Droughts that occur in Foxborough have not historically caused damages in their own right, but do increase the risk of wildfire.

According to local officials, natural fires in Foxborough are a significant concern. Nevertheless, fewer than 20 brush fires generally occur annually town-wide; much of that relative inactivity is attributed to successful public education campaigns about fire safety in the wooded areas of town. Less than 1% of the fires result in any significant property damage and there have been no deaths as a result of brush fires.

There are several causes for brush fires, including campfires, sparks from train tracks, and power line accidents. Fire can also be a result of other hazard events such as lightning and earthquakes. Foxborough fire officials have expressed concern about the potential for brush fires to be ignited by freight trains along the Mansfield-to-Framingham rail route. Fires have started within rail cars numerous times in the past, though none has spread beyond those cars.

Historic Record

Drought:

The Commonwealth of Massachusetts developed the *Massachusetts Drought Management Plan* and began tracking droughts in 2001, in response to a period of drought starting in 1999. The following table summarizes droughts that have impacted southeastern Massachusetts since the State began tracking droughts plan in 2001; however, the most severe drought of modern times was the drought of the 1960s, equivalent to a drought emergency, and a less severe drought occurred in the early 1980s. The drought of 2016, recorded in the table below, was also notable.

Table V-5: Recent Drought History of Southeastern Massachusetts

Year	Month	Drought Level
2001	Begin Date: 12/28/2001	Advisory
2002	February	Advisory
2002	March	Watch
2002	April	Watch
2002	May	Watch
2002	June	Advisory
2002	July	Advisory
2002	August	Watch
2002	September	Watch
2002	October	Advisory
2002	December	Normal
2003	End Date: 1/31/2003	Normal
2007	Begin: 10/1/2007	Advisory
2008	End: 3/18/2008	Normal
2010	Begin: 8/1/2010	Normal
2010	October	Normal
2010	End: 11/19/2010	Normal
2014	Begin: 10/1/2014	Advisory
2014	End 11/30/2014	Normal
2016	Begin: 7/1/2016	Advisory
2016	July	Watch
2016	August	Warning
2016	September	Warning
2016	October	Warning
2016	November	Warning
2016	December	Warning
2017	January	Warning
2017	February	Watch
2017	March	Advisory
2017	End: 4/20/2017	

Source: Massachusetts Department of Conservation and Recreation

Brush Fire:

- **April 15, 2012:** Dry conditions and a campfire led to a brush fire that burned about one acre on an island in Neponset Reservoir. The Foxborough Fire Department used a boat to reach the island. While Foxborough firefighters were tied up with the brush fire, Mansfield firefighters covered the Foxborough fire station and a Sharon ambulance had to respond to a Foxborough medical emergency.
- **October 26, 2013:** Foxborough firefighters responded to a brush fire on Blueberry Island in the Neponset Reservoir. Fire crews were forced to borrow boats from local residents to reach the island, and crews from Mansfield, Wrentham, and Sharon were called in to assist.

- **April 9, 2014:** Foxborough firefighters extinguished a two-acre brush fire that burned in the Cocasset Brook Greenbelt conservation land off of Main Street. The fire was blamed on human activity.
- **April 25, 2015:** A brush fire occurred deep in the woods off Munroe Street, near the Neponset Reservoir water line. Fire officials suspect the fire was started intentionally.
- **May 3, 2018:** A brush fire on Route 95 in Foxborough caused traffic delays but no significant damage. Sharon and Mansfield fire departments responded.

Figure V-4: Firefighters extinguish a brush fire off Route 95.
Photo: Brooke Coupal / www.whdh.com

Probability of Future Fire-Related Events

It is difficult to predict the likelihood of wildfires due to the number of factors affecting their initiation and growth, and the uncertainty around related conditions (such as development patterns, the presence of ignition sources, and the amount of fuel available in a given year). The 2018 SHMCAP anticipates at least once notable wildfire every year within the State. The historic record in Foxborough suggest a minor brushfire can be expected approximately every two years.

The 2018 SHMCAP calculates the probability of different levels of drought occurring in the state based on data from 1850 to 2012. This is summarized in Table V-6, below.

Table V-6: Frequency of Drought Events Exceeding Precipitation Index of MA Drought Management Plan

Drought Level	Occurrences 1850-2012	Probability of Occurrence in a Given Month
Emergency	5	1%
Warning	5	2%
Watch	46	8%

The historic record for Foxborough shows extended droughts occurring approximately twice a decade. None of those droughts have caused measurable damages to Foxborough.

Climate Change and Fire Hazards in Foxborough

Conditions in which wildfires are more likely to occur (dry weather and high temperatures) are expected to increase in the future, according to the 2018 SHMCAP. Average temperature,

maximum temperatures, and the number of days with temperatures above 90 degrees Fahrenheit are all expected to increase. Droughts are also expected to increase, in particular in the summer and fall. The SHMCAP even notes that research suggests that the frequency of lightning strikes could increase with warming temperatures, creating more opportunities for those strikes to spark fires.

The "resilient MA" Climate Change Data Clearinghouse was referenced to identify projected changes in temperature and precipitation patterns for the Foxborough area. Basin-scale projections for the Taunton Basin were used. Table V-7 presents projected changes relevant to wildfire hazards. The "resilient MA" projections show an increase in dry days during the fall and summer months, an increase in days above 90 degrees Fahrenheit (especially in the Fall), and increase in average temperatures year-round.

Table V-7: resilient MA Fire-Related Weather Projections for the Taunton River Basin

		Normals	Increase (Percent)			
		1971-2000	2030s	2050s	2070s	2090s
Consecutive Dry Days	Annual	17.33	4.27%	5.89%	5.77%	6.29%
	Fall	12.85	7.78%	10.43%	9.57%	12.53%
	Spring	11.68	-1.03%	0.43%	-0.09%	-1.11%
	Summer	13.62	2.13%	4.26%	5.73%	4.77%
	Winter	10.66	3.47%	6.85%	5.35%	7.13%
Days Above 90 °F	Annual	7.43	141.86%	255.32%	370.66%	492.06%
	Fall	0.29	382.76%	637.93%	986.21%	1631.03%
	Spring	0.5	60.00%	92.00%	154.00%	252.00%
	Summer	6.65	139.40%	251.58%	360.00%	454.59%
	Winter	0	0%	0%	0%	0%
Average Temperature (°F)	Annual	49.85	6.10%	8.97%	11.74%	13.88%
	Fall	52.14	6.60%	9.11%	11.93%	13.85%
	Spring	47.34	5.64%	7.98%	10.67%	13.08%
	Summer	69.57	4.18%	6.45%	8.29%	10.35%
	Winter	30.01	10.56%	16.06%	21.06%	23.93%

GEOLOGIC HAZARDS

Hazard Overview

Geologic hazards include earthquakes, landslides, sinkholes, subsidence, and unstable soils such as fill, peat and clay.

Earthquakes

An earthquake is a sudden rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines, and often cause landslides, flash floods, fires, avalanches, and tsunamis. Liquefaction is defined as the transformation of water-saturated granular material from the solid state to a liquid state. Earthquake-induced ground motion can cause the

ground to flow and/or lose its strength. Fill material has a much higher potential for liquefaction as compared to other surficial materials. Earthquakes can occur at any time without warning.

The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. Earthquakes are described based on their magnitude and intensity.

Magnitude is an estimate of the relative size or strength of an earthquake and is related to the amount of seismic energy released at the hypocenter of the earthquake. It is based on the amplitude of earthquake waves recorded on instruments that have a common calibration. The magnitude of an earthquake is thus represented by a single instrumentally determined value recorded by a seismograph, which records the varying amplitude of ground oscillations.

The Richter scale was developed in 1935 and was used exclusively until the 1970s. It set the magnitude of an earthquake based on the logarithm of the amplitude of recorded waves. Being logarithmic, each whole number increase in magnitude represents a tenfold increase in measured strength. Earthquakes with a magnitude of about 2.0 or less are usually called "microearthquakes" and are generally only recorded locally. Earthquakes with magnitudes of 4.5 or greater are strong enough to be recorded by seismographs all over the world.

As more seismograph stations were installed around the world following the 1930s, it became apparent that the method developed by Richter was valid only for certain frequency and distance ranges, particularly in the southwestern United States. New magnitude scales that are an extension of Richter's original idea were developed for other areas[2]. In particular, the Moment magnitude scale (Mw) was developed in the 1970s to replace the Richter scale and has been in official use by the USGS since 2002.

According to USGS[3], these multiple methods are used to estimate the magnitude of an earthquake because no single method is capable of accurately estimating the size of all earthquakes. Some magnitude types are calculated to provide a consistent comparison to past earthquakes, and these scales are calibrated to the original Richter scale. However, differences in magnitude of up to 0.5 can be calculated for the same earthquake through different techniques. In general, Moment magnitude provides an estimate of earthquake size that is valid over the complete range of magnitudes and so is commonly used today.

Although Moment magnitude is the most common measure of earthquake size for medium and larger earthquakes, the USGS does not calculate Mw for earthquakes with a magnitude of less than 3.5. Localized Richter scales or other scales are used to calculate magnitudes for smaller earthquakes. This is often the case in Massachusetts.

[2] https://www.usgs.gov/faqs/moment-magnitude-richter-scale-what-are-different-magnitude-scales-and-why-are-there-so-many?qt-news_science_products=0#qt-news_science_products
[3] https://www.usgs.gov/faqs/why-do-usgs-earthquake-magnitudes-differ-those-published-other-agencies?qt-news_science_products=0#qt-news_science_products

Regionally, the Weston Observatory utilizes two scales to track the magnitude of earthquakes. These include the Nuttli magnitude (Mn) for North America east of the Rocky Mountains and is more appropriate for the relatively harder continental crust in Massachusetts compared to California. Weston Observatory also utilizes the Coda Duration magnitude (Mc), which is based on the duration of shaking at a particular station. The advantage of the Coda Duration magnitude is that this method can quickly estimate the magnitude before the exact location of the earthquake is known.

Earthquakes in Massachusetts are intraplate or intratectonic as opposed to occurring at fault lines. In these types of earthquakes, soil composition determines the magnitude of the impact. Soft soils and filled wetlands conduct energy better than bedrock.

The effect of an earthquake on the earth's surface is called the intensity. The Modified Mercalli Intensity Scale consists of a series of key responses such as people awakening, movement of furniture, damage to chimneys, and total destruction. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It is an arbitrary ranking based on observed effects. A comparison of Richter magnitude to typical Modified Mercalli intensity is presented in Table V-8 while a description of each intensity level is presented as Table V-9.

Table V-8: Comparison of Earthquake Magnitude and Intensity

Moment Magnitude	Typical Maximum Modified Mercalli Intensity
1.0 to 3.0	I
3.0 to 3.9	II to III
4.0 to 4.9	IV to V
5.0 to 5.9	VI to VII
6.0 to 6.9	VII to IX
7.0 and above	VIII or higher

Source: USGS

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Table V-9: Modified Mercalli Intensity

Modified Mercalli Intensity	Description
I	Not felt except by a very few under especially favorable conditions
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 and 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. Damage slight.
VII	Damage negligible in buildings 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.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	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.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry), structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown in the air.

Source: USGS[4]

According to the State Hazard Mitigation Plan, the probability of an earthquake with a magnitude of 5.0 or greater occurring with an epicenter in New England is about 10-15% over a ten-year period. Massachusetts can be impacted by earthquakes centered outside of New England, including large earthquakes in Canada, which is more seismically active than New England.

Figure V-5 shows a USGS seismic hazard map for Massachusetts and the surrounding areas. The map indicates the Peak Ground Acceleration (PGA) expected during an earthquake with a 2% statistical likelihood of occurring over a 50-year period. PGA measures the strength of an earthquake in terms of ground movement expressed as a percentage of the acceleration of gravity. The potential damages due to an earthquake increase as the PGA increases. PGA in

[4] https://earthquake.usgs.gov/learn/topics/mag_vs_int.php

Foxborough during an earthquake with a 2% chance of occurring over a 50-year period is between 10% and 14% of the acceleration due to gravity.

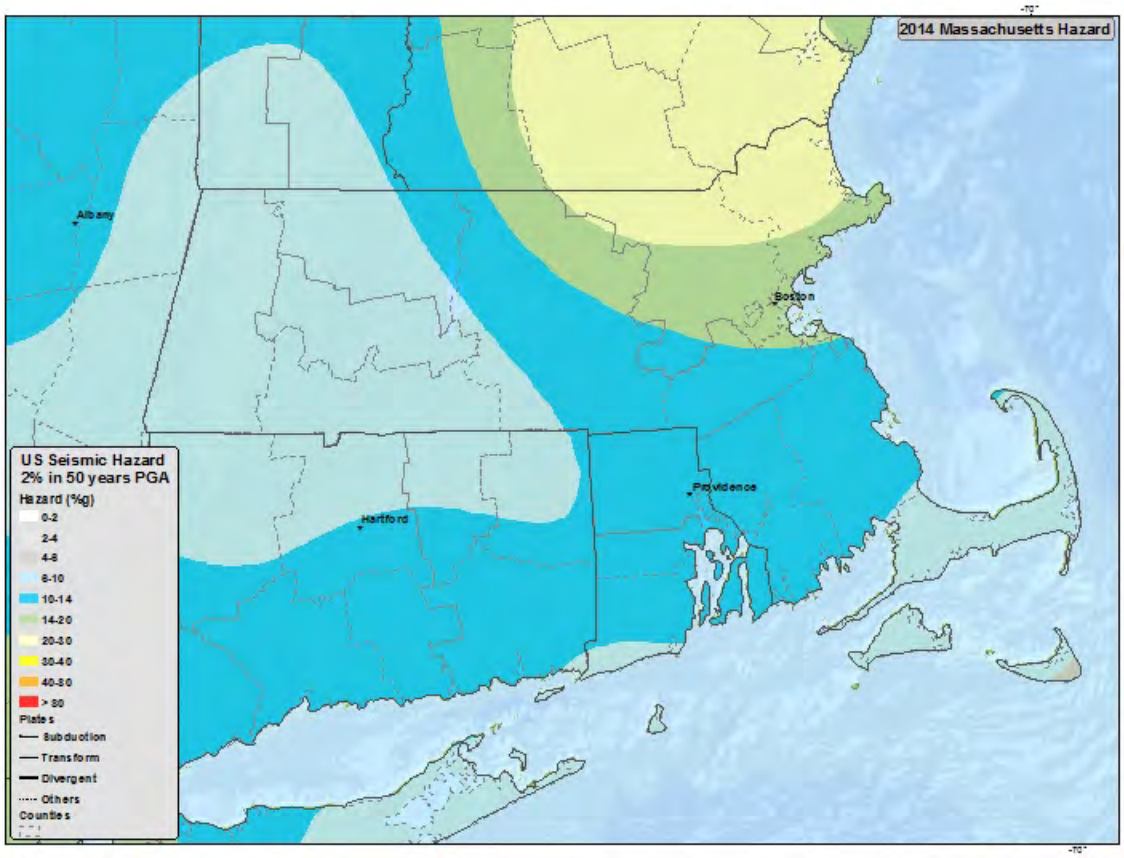

Figure V-5: 2014 Massachusetts Seismic Hazard Map (USGS)

Landslides

Landslides can result from human activities that destabilize an area or can occur as a secondary impact from another natural hazard such as flooding. In addition to structural damage to buildings and the blockage of transportation corridors, landslides can lead to sedimentation of water bodies.

The entire town of Foxborough has been classified as having a low risk for landslides.

Historic Record

From 1627 to 1989, 316 earthquakes were recorded in Massachusetts. Most have originated from the La Malbaie fault in Quebec or from the Cape Anne fault located off the coast of Rockport. The region has experienced larger earthquakes, of magnitude 6.0 to 6.5 in 1727 and 1755. Other notable earthquakes occurred here in 1638 and 1663 (Tufts University).

Moderate earthquakes in 1847, 1852, 1854, 1876, 1880, 1903, 1907, 1925, 1940, and 1963 were felt over limited areas of eastern Massachusetts. The epicenter of the 1925 shock was located

off Cape Ann; the quake was reportedly felt from Providence to Kennebunk, Maine. Residents of southeastern Massachusetts were jolted by a moderate earthquake on October 24, 1965. A magnitude 5.8 earthquake occurred 38 miles from Richmond, Virginia on August 23, 2011. The quake was felt from Georgia to Maine and reportedly as far west as Chicago. Residents of Massachusetts reported experiencing swaying during the earthquake although widespread damage was constrained to an area from central Virginia to southern Maryland. According to Cornell University, the August 23 quake was the largest event to occur in the east central United States since instrumental recordings have been available to seismologists. In April 2012, an earthquake swarm occurred on the continental shelf about 250 miles east of Boston; the largest earthquake measured 4.4 on the Richter scale.

Figure V-6 maps earthquakes measured in the northeastern United States and southeastern Canada between 1975 and 2017 (from The Northeast States Emergency Consortium, NESEC; http://nesec.org/massachusetts-earthquakes/).

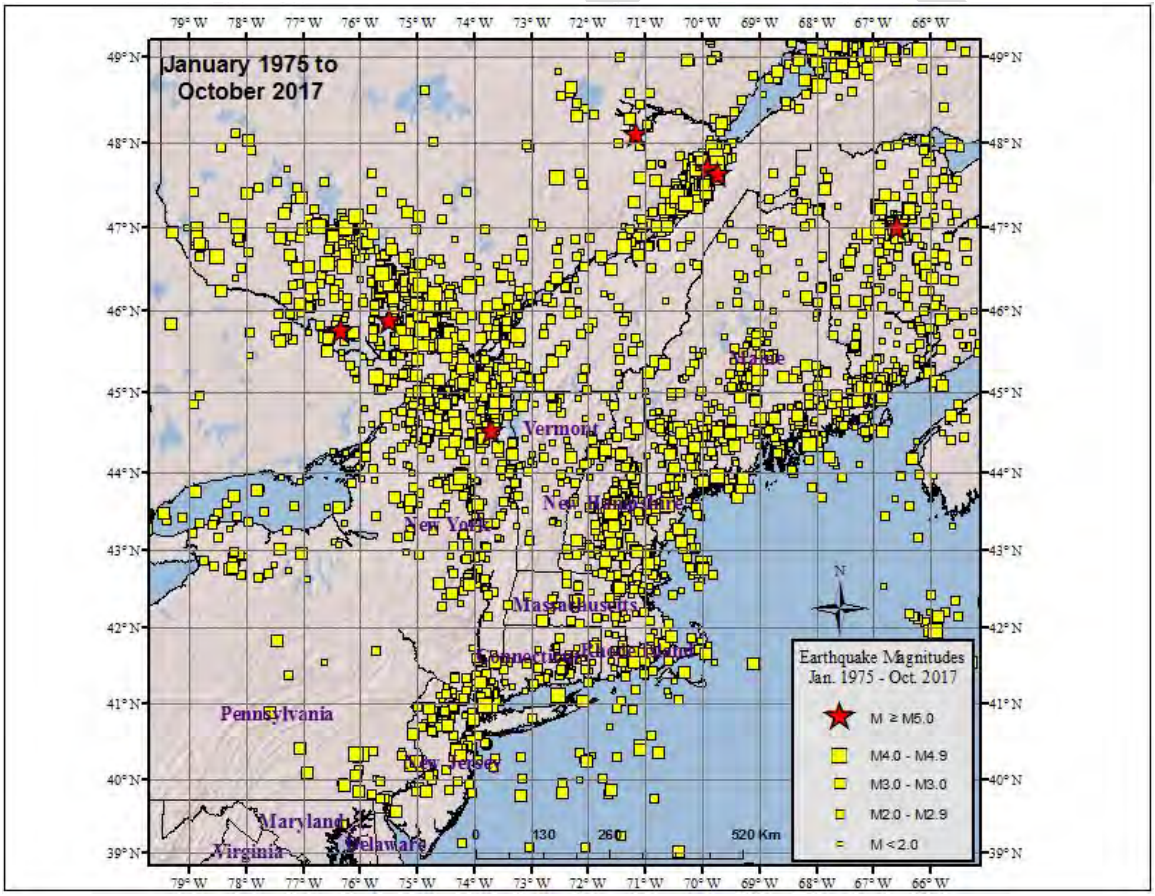

Figure V-6: Earthquakes of Northeastern U.S. and Southeastern Canada, 1975 to 2017 (NESEC)

No landslide damage is recorded as having occurred in Foxborough.

Probability of Future Geologic Events

Earthquakes in New England cannot be predicted and may occur at any time. The 2018 SHMCAP cites a 1994 USGS report that found that the probability of an earthquake with an epicenter in New England exceeding magnitude 5.0 is about 10-15% within a 10-year period. Small earthquakes occur somewhat regularly even within Massachusetts; there has been a small earthquake approximately every 2.5 years near Littleton, Massachusetts. New England experiences an average of six earthquakes per year; 6,470 earthquakes have occurred in the region (Weston Observatory Earthquake Catalog), but only 35 were considered significant.

There is a minimal chance of future damage in Foxborough caused by landslide events. The 2018 SHMCAP estimates one to three landslide events occur statewide every year.

OVERARCHING IMPACTS FROM NATURAL HAZARDS

A number of impacts can occur from any of the above-mentioned natural hazards. Most common and most visible are electrical outages and closures of roadways. This can occur due to high winds that knock down wires and limbs, from heavy snow falls that take time to clear, or from a landslide that carries large boulders or soil onto a roadway. In addition to causing inconveniences, these impacts can result in economic losses to local businesses that cannot function without electricity, or their customers or employees cannot get to the business. Minimizing vulnerability to natural hazards can help to reduce these and other impacts to people's safety, health, and overall economic viability.

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VI. VULNERABILITIES AND RISK ASSESSMENT

CAPABILITIES

Foxborough has a number of measures in place to mitigation natural hazards. These measures include regulations, plans, procedures, response and recovery equipment, public warning and communication mechanisms, structural mitigation measures, and more. This section presents hazard mitigation capabilities for each natural hazard type, highlighting new capabilities added since the previous edition of this Plan.

Flood Hazard Mitigation Capabilities

Participation in the National Flood Insurance Program

Foxborough has participated in the National Flood Insurance Program (NFIP) since December 15, 1979 (date of the initial Flood Insurance Study for the municipality) and plans to continue to participate in, and comply with the requirements of, the program. It has incorporated NFIP regulations into its municipal codes and regulations and complies with flood protection statutes within the State Building Code, as required by the Commonwealth.

Thirty-five property-owners in Foxborough hold a flood insurance premium for their properties. Through August 2018, Foxborough property owners filed a total of 8 losses with the National Flood Insurance Program. Of these, 6 have been paid for a total of $15,692. More details are provided in Table VI-1, on page VI-57.

There is one repetitive loss structure in Foxborough. As defined by the National Flood Insurance Program (NFIP), a repetitive loss property is any property which the NFIP has paid two or more flood claims of $1,000 or more in any given 10-year period since 1978.

Table VI-1: Flood Insurance Policies and Claims in Foxborough (as of July 2, 2018)

Flood insurance policies in force	35
Coverage amount of flood insurance policies	$11,924,900
Premiums paid	$59,447
Total losses (all losses submitted regardless of the status)	8
Closed losses (Losses that have been paid)	6
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	2
Total payments (Total amount paid on losses)	**$15,691.93**

Procedural Capabilities

- *Street Sweeping* – The Town of Foxborough owns two street sweeper and each street in town is swept two to three times per year. Other downtown areas such as main business district can be swept more frequently as needed from March through November. Poor draining streets can also be swept as needed following rainstorms.

- *Roadway Treatment* – The Town uses a salt for de-icing purposes. This is done to eliminate sand from entering catch basins and streams.

- *Infrastructure Maintenance* – Foxborough has mapped its drainage infrastructure and established a maintenance schedule and standard procedure. The Town of Foxborough contracts to have catch basin cleaning done each year, with approximately all of the 2,500 catch basins in town being cleaned each year. The Town also performs annual street sweeping to limit sedimentation of catch basins. The Town is confident in the effectiveness of its maintenance capabilities.

- *Glue Factory Dam* – The dam at this site can be used to lower the water surface elevation prior to forecast heavy rain events to increase flood storage in the impoundment.

Regulatory Capabilities

- *Stormwater Bylaw* – Foxborough adopted a new stormwater bylaw on May 8, 2017. The objectives of the bylaw included complying with state and federal statutes, protecting water resources, and establishing provisions for the long-term maintenance of stormwater management facilities and practices.

- *Floodplain Overlay District* – Foxborough has identified a Floodplain Overlay District (FPOD) that is coincident with FEMA-designated A and AE zones according to the July 16, 2015 FIRM. All development within the FPOD is required to comply with the Massachusetts State Building Code, Wetlands Protection Regulations, Inland Wetlands Restrictions, the Minimum Requirement for the Subsurface Disposal of Sanitary Sewage, and Foxborough Conservation Commission Regulations. Flood damage prevention requirements are included in the Town's zoning regulations (Chapter 275 of the Town Code) in section 9.3 (§275-9.3 Floodplain Overlay District). Detailed requirements are not included in the regulation; rather, references to the State Building Code are included.

- *Other Zoning Regulations* – The Town's zoning regulations include a section on Subdivisions Rules and Regulations, which contain a number of requirements that address flood hazard mitigation as noted above. Some of these provisions also relate to other hazards. The zoning by-law also includes provisions for Ground Water Protection Districts, Site Plan Approval, and Open Space Requirements. The Town also has a Wetlands Protection regulation.

- *Permit Review* – The Inspections Department reviews all new construction permits and site plans, and enforces compliance with FPOD regulations; the department generally discourages construction in the floodplain.

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Community Engagement Capabilities

- *Public Education on Stormwater* – Foxborough conducts public education about stormwater management and risks through the National Pollutant Discharge Elimination System (NPDES) Phase II program.

Completed Actions Since the Previous Plan

Foxborough has increased its capacity to mitigate flood events since the previous edition of this plan by adding to its flood-mitigation capabilities and completing actions listed in the previous plan. These include:

- *Rea-Craft Building – Central Street Commercial District Parking Lot:* a stormwater system sewer problem at this site was fixed, and no flooding issues have been observed or reported there since then.

- *Foxborough High School Culvert:* this has been upgraded to a larger size.

- *"Sunoco Culvert" Beneath Route 140:* during development of the London Estates property, drainage infrastructure was installed on that site that seems to have mitigating flooding issues in this area; since completion of that project, no flooding problems associated with the Route 140 Culvert have been observed or reported.

- *East Belcher Road Culvert:* The culvert under East Belcher Road, which was undersized and believed to have contributed to low severity flooding in the area, has been replaced and upgraded. Work has also been performed on a section of stream upstream from the culvert, mitigating some flood issues.

- *Paula Lane:* The Town installed an emergency overflow to the drainage system on Paula Lane, resolving a drainage-related flood issue at this site.

Dam-Failure Hazard Mitigation Capabilities

- *The Comprehensive Emergency Management Plan* – The CEMP addresses dam safety. The CEMP was updated between 2010 and 2012.

- *Permits required for construction* – State law requires a permit for the construction of any dam.

- *DCR dam safety regulations* – All dams are subject to the Division of Conservation and Recreation's dam safety regulations. These regulations were most recently updated and adopted by the State on February 10, 2017.

Completed Actions Since the Previous Plan

Foxborough has increased its capacity to mitigate dam failure events since the previous edition of this plan by completing actions listed in the previous plan. These include:

- *Upper Reservoir Dam:* The high hazard Upper Reservoir Dam, at the headwaters of Cocasset Brook upstream of Carpenter Pond, has been decommissioned and removed. The dam had been rated as a high hazard dam by the state.

- *West Street Dam:* The Town has received grant funding to rebuild the West Street Dam and associated culvert. The design and permitting is in the final stages with construction planned for 2020.

- *Neponset Reservoir Dam:* Located on the Lane Property at the western end of the reservoir, on the Neponset River. This dam was repaired and restored in 2008 at a cost of around $625,000 to meet state safety requirements. The dam was not listed as a hazardous dam in the previous edition of the Foxborough HMP.

Wind-Related Hazard Mitigation Capabilities

- *Tree Maintenance* – The Foxborough Tree Warden operates out of the Trees and Parks Division within the Public Works Department. The Division has a crew of six and a town-owned bucket truck, and runs an effective tree trimming program in public areas and along Rights-of-Ways, taking down about one-hundred trees a year. National Grid performs tree trimming and removal along power lines.

- *Underground Utilities* – Foxborough Subdivision Regulations require that new developments install utilities underground.

Completed Actions Since the Previous Plan

Foxborough has increased its capacity to mitigate wind-related hazards since the previous edition of this plan by adding to its wind-hazard-mitigation capabilities and completing actions listed in the previous plan. These include:

- *Power Utility Upgrades and Maintenance* – National Grid performed an upgrade on Foxborough's "Union Loop" in 2017 and 2018, boosting the reliability of the power system.

Winter-Related Hazard Mitigation Capabilities

- *Snow Removal Operations* – The Public Works Department provides standard snow plowing operations, including salting. The Town owns and operates its own equipment.

- *Contractor Agreements* – The Town has standing agreements with local contractors, with the capability to enlist up to 20 more plows if necessary.

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- *Overnight Parking Bans* – Overnight parking bans are in effect from November 1 to April 1 during snowstorms.

- *Snow Removal Bylaw* – The Town has a Snow and Ice Disposal bylaw that states no person shall put any snow or ice in any public place or upon any part of a public street or sidewalk.

- *Snow Storage* – The Town has sufficient snow storage and owns snow loaders that it can use to relocate snow piles.

Completed Actions Since the Previous Plan

Foxborough has increased its capacity to mitigate winter-related hazards since the previous edition of this plan by adding to its winter-hazard-mitigation capabilities and completing actions listed in the previous plan. These include:

- *Municipal Facilities* – Many municipal buildings have been renovated over the last five to ten years, including the new Public Safety Complex and the new Regional Emergency Communications Center. These building renovations have ensured those buildings are up to the most recent snow-load codes.

- *Snow Removal Equipment* – Foxborough has improved its snow removal capabilities by expanding and upgrading its fleet of snow removal equipment and by forming standing agreements with local contractors to enlist assistance during a winter storm.

- *Snow Removal Bylaw and Policy* – Foxborough approved an updated Snow Removal Bylaw and Policy in May 2017. The document clearly lays out the Town's snow removal procedures and the responsibilities of residents. The document is to be reviewed annually and updated as needed.

- *Sand and Salt for Private Homeowners* – sand and salt is available to Foxborough homeowners at the Town Highway Garage.

Fire-Related Hazard Mitigation Capabilities

- *FireWise Program* – Foxborough is one of only two communities in the state to have successfully taken part in the nationally recognized FireWise Program, which in Massachusetts is operated through the DCR's State Forest Fire Department.

- *Open Burning* – Town bylaws allow controlled open burning from January 15 until May 1, in accordance with state regulations, but a permit is required from the Fire Chief for each day of intended burning.

- *Site Plan Review* – The Fire department reviews all subdivision and site plans for compliance with site access, water supply needs, and all other applicable regulations.

- *Coordination with the DCR* – The Foxborough Fire Department has a strong relationship with the DCR's fire division at RF. Gilbert State Park, and the state fire division is well-trained in fighting brush and forest fires.

- *Public Information* – The Town provides public education and notices on its website and social media accounts during "drought watches."

Completed Actions Since the Previous Plan

- *Brush Fire Response Equipment* – The Foxborough Fire Department has expanded and upgraded its brush fire response capabilities in response to fire events such as those described in the historical record. It now operates three brush-trucks that carry their own water and are suitable for off-road driving.

- *Public Engagement* – The Foxborough Fire Department has created a Public Education Division responsible for outreach and education about fire hazards. Links to useful websites are available on the Fire Department website.

Earthquake Hazard Mitigation Capabilities

- *Shelters and Backup Facilities* – The Town does have shelters and backup facilities (see multi-hazard mitigation below).

- *Massachusetts State Building Code* – The State Building Code contains a section on designing for earthquake loads (780 CMR 1612.0). The criteria presented are the minimum considered to be "prudent and economically justified" for the protection of life safety; however, absolute safety and prevention of damage cannot be achieved economically for most buildings. Section 1612.2.5 of the State Building Code sets up seismic hazard exposure groups and assigns all buildings to one of these groups according to a Table 1612.2.5. Group II includes buildings which have a substantial public hazard due to occupancy or use and Group III are those buildings having essential facilities which are required for post-earthquake recovery, including fire, rescue and police stations, emergency rooms, power-generating facilities, and communications facilities.

- *Evacuation Plan* – The Town has an evacuation plan specified in its CEMP.

Landslide Hazard Mitigation Capabilities

- *Subdivision Regulations* – The subdivision regulations have maximum slope requirements for new roads.

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Completed Actions Since the Previous Plan

- *Earth Removal Bylaw* – Foxborough has an earth removal bylaw (Chapter 115 of the Municipal Code) that restricts and regulates excavation activities to mitigate the risk of such activities leading to landslides or other unstable conditions.

Multi-Hazard Mitigation Capabilities

There are several hazard mitigation capabilities that impact more than one hazard. These are summarized below.

- *Multi-Department Review of Developments* – Multiple departments, such as Planning, Zoning, Health, Public Works, Water and Sewer, Fire, Police, and Natural Resources, review all subdivision and site plans prior to approval.

- *Comprehensive Emergency Management Plan (CEMP)* – Every community in Massachusetts is required to have a Comprehensive Emergency Management Plan. These plans address mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies. These plans contain important information regarding flooding, dam failures and winter storms. The CEMP has been revised since the previous edition of this Plan by the Local Emergency Management Planning Committee. The document is reviewed and updated regularly.

- *Enforcement of the State Building Code* – The Massachusetts State Building Code contains many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing and snow loads. It has been adopted and is enforced locally, as required by State Law.

- *Local Emergency Management Planning Committee (LEPC)* – The LEPC consists of representatives from Public Works, Water and Sewer, Fire, Police, Health, School Transportation, Board of Selectmen, Emergency Management, and local businesses.

- *Backup Generators for Critical Facilities* – The Police and Fire Stations, emergency shelters, communications towers, and some of the water and sewer pumping stations, have backup generators.

- *Citizen Emergency Response Team (CERT)* – The Town has a CERT that provides training, supplies, and public education to neighborhoods. The CERT is part of the Foxborough Citizen Corps and Medical Reserve Corps. The group maintains a website with information about hazard preparedness, emergency notifications, and CERT participation at www.foxboroughcitizencorps.org

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- *Open Space Protection and Land Acquisition* – Foxborough has a strong open space *protection* program, a fact highlighted in the long-term conservation of open space built into the Town's most recent Master Plan.

- *Municipal Geographic Information System* – The Town maintains a geographic information system (GIS) that includes a variety of information useful for natural hazard mitigation and response. Data layers include hazard zone locations and evacuation routes.

- *Public Information* – Foxborough has information on hazard preparedness available on the Town website; this includes a downloadable pamphlet with resources, contact information, and personal action suggestions.

Completed Actions Since the Previous Plan

- *Open Space Protection and Land Acquisition* – The Town recently developed a land donation prioritization process to facilitate conservation of key open space parcels. Since the previous edition of this Plan, Foxborough has assembled a regional Open Space and Recreation Group with surrounding towns in order to pursue open space preservation at a regional scale.

- *Municipal Geographic Information System* – The Town integrated hazard mitigation information into its GIS database.

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LOSS ESTIMATES

The economic losses faced by the community from natural hazards can be estimated by reviewing historic loss figures and modeling future loss figures.

Two types of loss estimates are provided in this section:

- *Event-Specific Estimates* present the losses expected to be incurred under specific hazard conditions and are based on historic losses or modeled events.
- *Annualized Loss Estimates* (ALE) present the costs that a given hazard is expected to have on the community over a one-year period; in other words, it can be used to estimate the amount of money worth spending to mitigate that hazard each year. This tool also allows for comparison between loss estimates based on different types and magnitudes of events. ALE are based on models of a suite of events with different magnitudes, or on historic loss data divided by the number of years of record.

Loss Estimate Sources

It is difficult to accurately quantify losses, even after an event; therefore, a number of different sources are provided in this section. Taken together, they provide a range of possible loss estimates for each hazard addressed in this Plan.

HAZUS-MH

HAZUS-MH is FEMA's loss estimation methodology software that utilizes year 2010 U.S. Census data and a variety of engineering information to calculate potential damages (specified in year 2010 United States Dollars or USD) to a user-defined region.

There are three levels at which HAZUS-MH can be run. The analysis in this Plan was completed using Level 1 data. Level 1 relies upon default data on building types, utilities, transportation, etc. from national databases as well as census data. This analysis should be considered a starting point to understanding potential damage from hazard events. If interested, Foxborough can build a more accurate database and further test disaster scenarios.

HAZUS-MH was used to estimate losses for flood, wind, and earthquake hazards.

- **Hurricane Module:** *HAZUS-MH* hurricane loss estimates are based only on the effects of hurricane winds; during an actual hurricane, losses would likely be higher due to the combined effects of wind, surge, and rain.

- **Flood Module:** Losses due to inland flooding were generated by first using the Flood Information Tool (FIT) to model hydrology and hydraulics for local watercourses, and then feeding that information into *HAZUS-MH*. The FIT utilizes FEMA cross sections and Digital Elevation Model (DEM) data to calculate potential flood depths in the user-specified areas. The *HAZUS-MH* riverine module is not a reliable indicator of flooding in

areas where inadequate drainage systems, beaver activity, and increased impervious surfaces contribute to flooding even in areas outside of mapped flood zones.

- **Earthquake Module:** *HAZUS-MH* earthquake loss estimates can be modeled based on earthquake magnitude, location, and depth, or based on probabilistic earthquake return periods. The model incorporates local geological and soil conditions.

Public Assistance Reimbursements

Loss estimates for some hazards generated from the value of Public Assistance (PA) grants received by Foxborough and other entities within the Town. Because PA grants are not granted to private individuals, this source is not considered to be a complete estimate of losses from a hazard. Additionally, PA grants pay for 75% of an eligible project; the estimates provided in this Plan present the full costs of the projects based on that figure.

NFIP Payments

NFIP Payments are made to property owners who hold flood insurance policies. These figures can be used as a proxy for losses incurred by individuals during a storm event, and can be paired with PA grant amounts to estimate total losses to a community from an event. It is important to note that NFIP payments do not include losses incurred by property owners who do not hold flood insurance.

NCEI Storm Events Database

The National Centers for Environmental Information (NCEI, previously the National Climatic Data Center or NCDC) maintains a database of historic storm events across the country. The length of record for different hazard types varies within the database, as does the degree of detail for different events. When provided, estimated property damage figures can be used to inform loss estimates.

NCEI losses are reported on the county scale. To estimate losses for Foxborough, the ratio of Foxborough's population (16,693; 2010 Census) to that of Norfolk County (670,850; 2010 Census) was applied to the total loss estimate for Norfolk county for each hazard. That ratio is 0.0249 (Foxborough's population is 2.49% that of the county).

Municipal Records

Where available, records from the Town of Foxborough on direct losses from, or costs of response to, hazard events were also used to inform loss estimates.

Other Loss Estimate Sources

Other tools used to estimate losses are described below, as applicable.

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Estimated Losses from Flooding

HAZUS-MH Flood Loss Estimates

Flood losses were estimated for storm events with return periods of 10, 25, 50, 100, and 500 years. The 100-year return period flood corresponds to that mapped by the one-percent annual-chance FEMA flood zone (zones AE and A), while the 500-year return period flood corresponds to 0.2-percent annual-chance flood zone (zone X-500). By running these scenarios, *HAZUS-MH* was also able to calculate an ALE figure. Detailed *HAZUS-MH* results are provided in Appendix D. Summary data is provided in Table VI-2, below.

Table VI-2: *HAZUS-MH* Estimated Losses due to Flooding

	Return Period (Years)					Annualized
	10	**25**	**50**	**100**	**500**	
Building Damages						
Buildings sustaining minor damage	4	4	5	11	17	-
Buildings sustaining moderate damage	1	2	2	3	8	-
Sheltering Needs						
People displaced	142	152	167	229	307	-
People seeking public shelter	0	0	0	0	0	-
Debris						
Building debris generated (tons)	76	97	112	145	204	-
Truckloads to clear building debris	4	4	5	6	9	-
Economic Loss (Millions of dollars)						
Building Loss	2.62	3.17	3.54	4.70	6.48	0.32
Content Loss	2.92	3.63	4.00	4.93	6.73	0.35
Inventory Loss	0.10	0.13	0.15	0.17	0.24	0.01
Business Interruption Losses	5.67	6.31	6.88	8.30	11.49	0.62
Total Economic Losses	**11.31**	**13.25**	**14.57**	**18.09**	**24.94**	**1.30**

According to the *HAZUS-MH* data, the annualized losses due to flooding are **$1.3 million per year**. Based on historic experiences with flooding in the community, this is likely a significant overestimate.

HAZUS-MH was not used to estimate flood damages for the previous edition of the HMP.

Public Assistance Reimbursements

While Foxborough has experienced many flood events over its history (including severe flooding in October of 2005), and flooding has led to multiple Presidentially Declared disasters and emergencies within Norfolk County, the Town has only applied for Public Assistance funding in response to one flood event. This is reported in the table below.

Table VI-3: Foxborough Public Assistance Fund Requests in Response to Flooding

Disaster Number	Incident Dates	Total Cost
1895	3/12/2010 – 4/26/2010	$38,155.39
Total Cost		**$38,155.39**

Taking the total cost of PA-funded flood recovery projects and dividing them by the number of years for which the program has operated (20 years) gives an approximate ALE of **$1,907.77 per year.** This figure does not account for damages to private property; that is addressed through investigating NFIP payments, below.

NFIP Payments

As noted previously, 6 loss claims totaling $15,692 have been paid to Foxborough property owners by the NFIP. More details are provided in Table VI-1.

Table VI-4: Flood Insurance Policies and Claims in Foxborough (as of July 2, 2018)

Flood insurance policies in force	35
Coverage amount of flood insurance policies	$11,924,900
Premiums paid	$59,447
Total losses (all losses submitted regardless of the status)	8
Closed losses (Losses that have been paid)	6
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	2
Total payments (Total amount paid on losses)	**$15,691.93**

Taking the NFIP payment total and dividing them by the number of years for which the program has operated (40 years) gives an approximate ALE of **$392.30 per year.**

Combining NFIP payments, which reflect losses of private property owners, with PA reimbursements, which reflect municipal or nonprofit recovery costs, gives a total community loss estimate of **$2,300 per year.** This figure is considered somewhat low, considering historic experiences of the community.

NCEI Storm Events Database

The NCEI database includes records of inland flood events (identified in the database as "Flood" or "Flash Flood" events, and differentiated from "Coastal Flood" events) since 1996. According to the NCEI, significant floods have impacted Norfolk County on 61 days in the last 23 years (with some events lasting more than one day) and caused over $45 million in damage county-wide.

Based on the ratio of Foxborough's population to the county's population, it is estimated that approximately $1.13 million of those damages have occurred in Foxborough. Dividing that total by the 23 years of record gives an approximate ALE of **$49,096 per year.** This figure is considered relatively high, given historic experiences of the community.

Other Loss Estimate Sources

During development of the previous edition of this Hazard Mitigation Plan, the Town of Foxborough mapped locally-identified zones of flooding not associated with FEMA-mapped flood zones. The area covered by these zones, compared to the overall area of town and the average replacement value of a building in town, was used to estimate property damage exposure that could be caused by flooding of these zones. This analysis has been copied forward into this edition of the plan, with structure numbers and replacement values updated to be current.

Approximately 91 acres of Foxborough have been identified by local officials as areas of flooding (see Table VI-5); this amounts to 0.68% of the 13,342.3 acres of land area in Foxborough. HAZUS-MH estimates that there are 6,022 buildings in Foxborough with a total replacement value of $3.39 billion, or $562,936 per structure. Applying the percentage of Foxborough within the identified local flood zones to the HAZUS building count and value figures allows us to estimate that 41 structures ($23.052 million replacement value) are located in the flood areas. A range of loss estimates was calculated from 10% to 50% of building replacement values, as suggested in the FEMA September 2002 publication, "State and Local Mitigation Planning how-to guides" (Page 4-13).

The range of estimates is $2,305,200 – $11,526,000. For the previous edition of the plan, based on building numbers and values at the time, the range of estimates was $1,281,151 - $6,405,753. These calculations are not based on a particular type of storm (such as a 1% annual-chance flood), but the upper end of the estimate is similar to the *HAZUS-MH* estimate for a 10-year (10% annual-chance) storm. It is important to note that this technique is estimating losses caused by a different phenomenon than those estimated by *HAZUS-MH* (poor drainage flooding, rather than riverine flooding). It is also important to note that flooding in some of the locally-identified flood areas has been addressed through various mitigation measures, and may no longer pose a risk; the status of each area is noted below as "addressed" (mitigation actions taken and flooding is no longer considered an issue), "partially addressed" (mitigation actions taken but flooding is still a concern), or "ongoing" (no mitigation actions taken, flooding is still a concern). Finally, this methodology is describing an exposure analysis, rather than a true loss estimate, and so the monetary values will be higher than expected losses.

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Table VI-5: Locally-Identified Flood Areas

ID	Zone Name	Approximate Area (acres)	% Total Land Area	Status
7	Glue Factory Pond on Morse Street	0.48	0.004%	Ongoing
8	Culvert	4.57	0.034%	Addressed
9	Paula Lane	15.62	0.117%	Addressed
10	Summer Place, Summer Street	6.80	0.051%	Addressed
11	East Street at RR Overpass	4.45	0.033%	Ongoing
12	East Belcher Road	10.12	0.076%	Addressed
13	Carpenter Street	7.70	0.058%	No Concern
14	Central Street Commercial District	6.80	0.051%	Addressed
15	Main Street (Route 140) culvert at Sunoco	32.46	0.243%	Addressed
16	Mill Street by Prospect Street	2.06	0.015%	Ongoing
	Total	**91.07**	**0.68268%**	

Flood Loss Estimate Summary

Combining PA and NFIP reimbursements provides a relatively good estimate of annualized flood losses ($2,300 per year), but doesn't fully capture the costs borne by residents and businesses that don't have flood insurance. *HAZUS-MH* figures, on the other hand, provides a good estimate of losses from the lower return-period, high severity events simulated, but appears to overestimate losses expected during more frequent events, resulting in a high annualized flood loss ($1.3 million). The true annualized cost of flooding in Foxborough is probably of the order of magnitude of $10,000.

Estimated Losses from Dam Failure

National Performance of Dams Program

The National Performance of Dams Program (NPDP) maintains a database with information on dam incidents, and the consequences of those incidents. The database contains no information on dam failure in Foxborough.

State Hazard Mitigation and Climate Adaptation Plan

The 2018 SHMCAP addresses dam failure within the chapter on inland flooding. Loss estimates specifically for dam failure are not provided.

Other Loss Estimate Sources

By nature, dam failure tend to focus their impacts on areas along waterways. Therefore, damages from a dam failure can be approximated by modeling the impacts of a severe flood. The *HAZUS-MH* analysis estimates damages to the Town from a 1% annual-chance flood would be about $18.09 million. As a rough estimate of dam failure costs, this figure is used here as well.

Using FEMA's annualized loss equation, this figure gives an approximate ALE of **$136,000 per year.** This is considered to be a significant overestimate.

Dam Failure Loss Estimate Summary

Little data is available for loss estimates due to dam failure in Foxborough. Using the 1% annual flood zone as an approximation for dam failure gives an approximate ALE of $136,000. Based on the lack of historic occurrences of dam failure locally, the fact that a dam failure would not result in inundation of the Town's entire 1% annual-chance flood zone, and the expectation that *HAZUS-MH* is overestimating flood losses, it is expected that actual annualized losses due to dam failure are minimal.

Estimated Losses from Hurricanes

HAZUS-MH Loss Estimates

A suite of probabilistic hurricane scenarios was modeled in *HAZUS-MH*. Hurricanes with intensities with return-periods of 10, 20, 50, 100, 200, 500, and 1,000 years were modeled. Detailed Hazus-MH results are included in Appendix D. Overall losses are summarized in Table VI-6, below.

Table VI-6: HAZUS-MH Estimated Losses due to Hurricanes

	Return Period (Years)*						
	10	20	50	100	200	500	1,000
Building Characteristics							
Estimated total number of buildings							6,022
Estimated total building replacement value (Year 2010 $)							$3,390,000,000
Building Damages							
Buildings with minor damage	0	7	86	303	671	1,237	1,615
Buildings with moderate damage	0	0	8	38	106	281	469
Buildings with severe damage	0	0	0	1	5	22	55
Buildings completely destroyed	0	0	0	0	1	7	21
Sheltering Needs							
Households displaced	0	0	1	9	26	67	110
People seeking public shelter	0	0	0	4	13	33	54
Building Debris							
Debris generated (tons)	0	687	4,694	9,680	15,305	25,234	33,280
Truckloads to clear debris	0	1	17	48	100	204	314
Economic Loss (Thousands of dollars)							
Building	0	1,190	8,540	19,055	34,122	67,031	105,151
Content	0	501	3,033	6,397	11,570	24,559	41,235
Inventory	0	0	0.55	9.5	44	172	396
Business Interruption	0	0.44	198	734	2,221	5,881	11,379
Total Economic Losses	**0**	**1,691**	**11,771**	**26,196**	**47,957**	**97,643**	**158,160**

*In southeast Massachusetts, a Category One Hurricane has a return period between 10 and 20 years, while a Category 3 Hurricane has a return period between 50 and 100 years (NOAA, "What are the chances a hurricane with hit my home?" August 20, 2018).

Based on the suite of storms modeled in *HAZUS-MH*, an ALE of **$1,123,877 per year** can be calculated. This is likely an overestimate of annual costs due to tropical cyclone events.

Public Assistance Reimbursements

While Foxborough has experienced multiple hurricanes and tropical storm events over its history (including Tropical Storm Irene in 2011), and such storms have led to multiple Presidentially Declared disasters and emergencies within Norfolk County, the Town has only applied for Public Assistance funding in response to one hurricane event. This is reported in the table below.

Table VI-7: Foxborough Public Assistance Requests for Hurricanes

Disaster Number	Incident Dates	Total Cost
4028	8/26/2011 – 9/5/2011	$192,486.29
Total Cost		**$192,486.29**

Taking the total cost of PA-funded hurricane recovery projects and dividing them by the number of years for which the program has operated (20 years) gives an approximate ALE. **This figure is $9,624.31 per year.** This figure does not account for damages to private property, and is considered to be a low estimate.

NCEI Storm Events Database

The NCEI database includes records of hurricane events (storms reviewed in the database were the "Hurricane," Tropical Storm," and "Tropical Depression" types) since 1996. According to the NCEI, significant tropical storms have impacted Norfolk County on three days in the last 23 years (with some events lasting more than one day) and caused over $10.5 million in damage county-wide.

Based on the ratio of Foxborough's population to the county's population, it is estimated that approximately $263,500 of those damages have occurred in Foxborough. Dividing that total by the 23 years of record gives an approximate ALE of **$11,455 per year.** This figure is considered to be a low estimate.

Estimated Losses from Summer Storms and Tornadoes

NCEI Storm Events Database

The NCEI database includes records of tornado events since 1950, thunderstorm-wind and hail events since 1955, and other summer-storm related events (additional storms reviewed in the database included the "funnel cloud" and "lightning" types) since 1996. According to the NCEI, significant summer storm and related events have impacted Norfolk County on 139 days in the last 69 years and caused $6.3 million in damage county-wide. Forty-one lightning strikes are recorded since 1996. Nine tornadoes have been recorded since 1954.

Based on the ratio of Foxborough's population to the county's population, it is estimated that approximately $157,500 of those damages have occurred in Foxborough. Dividing that total by the 69 years of record gives an approximate ALE of **$2,283 per year.** This figure is considered to

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be a low estimate that correctly reflects thunderstorm losses but tends to neglect tornado losses if they occurred.

Estimated Losses from Winter-Related Hazards

Public Assistance Reimbursements

PA funds disbursed to entities in Foxborough are summarized in the table below. Note that each disaster event has two disbursements, one reflecting funding directed to a municipal entity and the other reflecting funding granted to a non-governmental non-profit organization.

Table VI-8: Foxborough Public Assistance Requests for Winter Storms

Disaster Number	Incident Dates	Total Cost
4214	1/26/2015 – 1/28/2015	$159,476.03
4110	2/8/2013 – 2/9/2013	$186,231.80
1959	1/11/2011 – 1/12/2011	$144,596.92
3201	1/22/2005 – 1/23/2005	$134,986.36
3191	12/6/2003 – 12/7/2003	$121,282.29
3175	2/17/2003 – 2/18/2003	$67,497.40
3165	3/5/2001 – 3/7/2001	$78,411.50
Total Cost		**$892,482.29**

Taking the total cost of PA-funded winter-storm recovery projects and dividing them by the number of years for which the program has operated (20 years) gives an approximate ALE. **This figure is $44,624.11 per year.**

NCEI Storm Events Database

The NCEI database includes records of winter storm events (storms reviewed in the database included "Blizzard," "Sleet," "Winter Storm," and "Winter Weather") since 1996. According to the NCEI, significant winter storm events have impacted Norfolk County on more than 33 days in the last 23 years and caused $25.2 million in damage county-wide.

Based on the ratio of Foxborough's population to the county's population, it is estimated that approximately $627,750 of those damages have occurred in Foxborough. Dividing that total by the 23 years of record gives an approximate ALE of **$27,293 per year.**

Other Loss Estimate Sources

Foxborough tracks the cost of municipal disaster response efforts during snow events to send to the state. Between 2013 and 2019, the Town spent approximately $706,726 on response and recovery. Dividing this figure by the 6 years of this record give an ALE of **$117,788 per year.**

Estimated Losses from Fire-Related Hazards

No loss estimate data was available with regards to brush fires in Foxborough. Brush fire loss data is often limited, especially since brush fires rarely impact buildings with measurable values.

An equation has been developed to estimate the annual damage caused by brush fires based on the number of fire events per year, the average size of a fire, and the population density of a community. As presented in the hazard assessment for fire-related hazards in Chapter IV, there have been five notable brush fires in Foxborough since 2012, each less than one acre in size. The previous version of this HMP noted "fewer than 20" brush fire events per year.

Taking a conservative estimate based on the data above of two to four brush fires per year, averaging one half-acre in size, gives an approximate ALE of **$2,000 - $4,000 per year** for Foxborough. This figure is considered appropriate for the community and consistent with the events described in the historical record.

Estimated Losses from Earthquakes

HAZUS-MH Flood Loss Estimates

A suite of probabilistic earthquake scenarios for a magnitude 7 earthquake with return periods of 100, 500, 1,000, and 2,500 years were run. In addition to providing estimates for losses under each scenario, these probabilistic models allow for calculation of average annualized losses due to an earthquake.

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Table VI-9: HAZUS-MH Estimated Losses due to Earthquakes

	Return Period (Years)				Annualized
	100	500	1,000	2,500	
Building Characteristics					
Estimated total number of buildings				6,022	-
Estimated total building replacement value (Year 2010 $)			$3,390,000,000		-
Building Damages					
Buildings sustaining slight damage	0	131	295	700	-
Buildings sustaining moderate damage	0	29	72	221	-
Buildings sustaining extensive damage	0	3	9	33	-
# of buildings completely damaged	0	0	1	3	-
Sheltering Needs					
# of households displaced	0	3	9	30	-
# of people seeking public shelter	0	1	4	15	-
Casualties (range)					
Severity Level 1	0	1	2-3	5-10	-
Severity Level 2	0	0	0	1-2	-
Debris					
Building debris generated (tons)	0	1	4,000	12,000	-
# of truckloads to clear building debris	0	40	160	480	-
Economic Loss (Millions of dollars)					
Income Losses	0	1.26	3.04	9.80	0.014
Capital Stock Losses	0	5.73	17.80	62.32	0.072
Transportation Lifeline Losses	0.076	0.28	0.83	3.23	0
Utility System Losses	0.004	0.01	0.01	0.04	0
Total Economic Losses	**0.08**	**7.27**	**21.68**	**75.38**	**0.086**

According to the *HAZUS-MH* data, the annualized losses due to earthquakes are **$86,000 per year**. Given the lack of historic damages from earthquakes in Foxborough, this is likely a significant overestimate; nevertheless, the potential for significant damage in the event a major earthquake were to occur is important to note.

Estimated Losses from Landslides

No loss data was available for landslide hazards. Annualized losses due to landslides are thought to be negligible.

Potential Impacts to Future Development

The Town of Foxborough has identified a number of parcels where development has been proposed, is underway or is expected to occur in the future. Table VI-10 indicates where areas of likely future development may be located within or partially within a natural hazard area.

Table VI-10: Hazard Exposure of Planned Development

Name	Location	Type	Status	Flood Zone	*Wildfire Zone
River Ridge	East Belcher Road	Residential	Approved	X	High
Governors Meadow	Main Street	Residential	Underway	X	
Durham Park	Cocassett Street	Residential	Complete	X	High
Lawson Farm	242 Main Street	Residential	Underway	X-0.2% Annual-Chance	Low
London Estates	95 Main Street	Residential	Underway	X	Moderate
29 Wall Street	Wall Street	Residential	Approved	X	Minimal
35-45 Panas Road	Panas Road	Commercial	Underway	X	High
9 Perry Drive	Perry Drive	Commercial	Approved	X	Moderate
17 Perry Drive	Perry Drive	Commercial	Under Review	X	Moderate
Regional Dispatch Facility	100 High Rock Road	Critical Facility	Underway	X	Very High
The Gables at Foxborough Green	Route 106	Residential	Complete	X	Low
Land Fill	East Belcher Road	Solar Array	Complete	X	High

** "Wildfire Zone" indicates relative risk of wildfire occurring based on urban-wild interface and emergency access routes at the site. Risk levels should be considered within larger wildfire risk context (natural fires in Foxborough are a significant issue, however less than 1% of the approximately 20 brush fires annually result in any significant property damage; see "Fire-Related Hazards" on page V-45). Wildfire zones are defined as follows:*

- ***Minimal**: infill development in urban area, multiple access routes*
- ***Low**: somewhat wooded area, multiple access routes*
- ***Moderate**: highly wooded area, multiple access routes*
- ***High**: highly wooded area, limited access*

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VII. HAZARD ASSESSMENT

This section provides more detail on how certain natural hazards affect specific parts of Foxborough. Existing mitigation measures are discussed under each hazard heading.

FLOOD-RELATED HAZARDS

Overview of Foxborough Flood Hazard Areas

Flooding from Waterbodies

Foxborough contains several bodies of water, including but not limited to the Neponset Reservoir, Canoe River, Wading River, Cocasset Brook, Robinson brook, Rumford River and several smaller lakes and ponds.

The Neponset Reservoir, Cocasset Brook, Canoe River and Glue Factory pond (also known as The Bleachery) tend to have the largest impact on flooding. Town personnel report that the commercially-redeveloped industrial buildings of The Bleachery have been flooded by the pond multiple times.

FEMA flood zones in Foxborough, which tend to be associated with specific waterbodies, are shown on Map 5.

Flooding from Poor Drainage

While the FEMA-mapped flood zones in Foxborough tend to be associated with the water bodies listed above, town officials have observed that more frequent flooding problems are often related to insufficient, undersized, poorly-maintained or non-operational drainage structures such as culverts, dams and drain pipes. In particular, flooding of roads due to inadequate drainage systems is the primary flood-related concern of town staff because it is a frequent disruption to the community; direct damage to buildings is not seen as a significant issue, though basement flooding is a concern.

Cocassett Street at the railroad underpass was specifically identified as vulnerable to flooding; four 12-inch-diameter pipes route water into the drainage structure at the underpass but only one 12-inch-diameter pipe directs water back out, leading to frequent flooding. Flooding due to poor drainage is also a concern at the Department of Public Works. Nuisance flooding has also been reported at London Estates off Main Street.

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Map 5: FEMA Flood Zones

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Flooding due to Beaver Activity

Municipal officials have indicated that beavers are starting to become a problem with regards to flooding; beaver activity includes construction of dams and lodges that block flows, often near culverts or other "pinch points." Specific locations of concerning beaver activity are a culvert on Route 106 (at the Wading River culvert) and in Glue Factory Pond.

Summary of Flood Risk Areas

The following areas were identified by Town staff as areas that have experienced more significant flooding in the past.

Table VII-1: Flood Risk Areas Identified by Municipal Staff

Area of Concern	Notes
Glue Factory Ponds	Flooding of the roads and industrial buildings of the Glue Factory Pond area ("The Bleachery") is a concern. Specific problems are the Rumford River culvert under Morse Street, and the culvert connecting the West and East Glue Factory Ponds under Morse Street. High beaver activity has been reported in his area.
Cocasset Street at Railroad Crossing	Four 12-inch pipes go into a structure and one 12-inch pipe leaves the structure.
Department of Public Works	Drainage related flooding.
East Street at Canoe River Crossing	Flooded occasionally.
London Estates, 95 Main Street	Poor-drainage flooding reported.
Heatons Marina on Neponset Heights Ave	Flooding from Neponset Reservoir.
Neponset Reservoir	Flooding concern on reservoir edges. Reservoir levels are managed by town. The spillway boards are pulled as needed. Local residents communicate with the Town about high water levels.
Edwards Road and Beach Street	Flood risk due to Neponset Reservoir and drainage from Dudley Hill. This is within the FEMA A-zone associated with the reservoir.
Kraft Parking Lot, 119 Washington Street	New parking lot. Seepage from groundwater, puddle and freezing problems. Connected to flooding of Pierce Street under Route 1
East Belcher Road	East Belcher Road near what is currently a Comcast building (where there is a sharp bend in the road) has historically experienced flooding issues where it crosses the Rumford River. This section of road is at the upstream end of a 0.2% annual-chance flood zone. Work has been performed on a section of stream upstream from the crossing, and the culvert under East Belcher Road has been upgraded, mitigating flood issues.
Paula Lane	Minor flooding used to occur about twice a year. A drainage system overflow system has been installed to address these issues.
Mill Street near Prospect Street	Undersized culvert leads to flooding.

Area of concern with regards to flooding, both those associated with waterbodies and those created due to drainage issues, are shown in Map 6.

More detail on some of these areas is provided below.

Glue Factory Pond

Flooding problems here are described as low to moderate in severity with flood events taking place every two or three years and resulting in an inch or two of water in the roadway. The property is largely within the 1% annual-chance floodplain, but was a previously developed commercial area and is in the process of being re-developed for future use. There is an existing dam associated with this site that can be partially drained before high rain events to at least partially retain floodwaters.

Paula Lane

This flood hazard has historically had a frequency of twice per year but at a low severity level. The issue at Paula Lane was a septic system that did not have an emergency overflow built-in. The Town secured a permit to install an emergency overflow to the existing system and completed the project in 2019 using town funds. It is believed the problem has been resolved and no other mitigation is needed.

Cocasset Street (at East Street) at R.R. overpass

Moderate flooding at this site is blamed on pre-existing drainage problems and the recent construction of a new development adjacent to the problem spot. Flooding here reportedly happens about twice per year, but does not produce any significant impacts. According to town officials, the problem needs to be studied in order to determine a course of action.

East Belcher Road, at Comcast

The issues here are considered low severity as flooding typically results in about 1/4 –inch of water in the parking lot of a commercial property and to this point has proven to be no threat to the building itself. The flooding occurs about once per year and is said to be caused by an existing inadequate culvert. Town officials have said that a larger culvert would probably be sufficient to alleviate the problem. Work has been performed upstream from the culvert and the culvert has been upgraded. It is believed the problem has been resolved and additional mitigation actions are not needed.

Mill Street Culvert by Prospect Street

This culvert is constructed of 60" corrugated metal pipe at the ends and an old granite stone culvert directly under the street pavement. The culvert is 22 feet below the level of the street. The inlet receives the stormwater flow from Foundry Pond. The inlet metal pipe collapsed during the late summer of 2008. The Town made the necessary repairs to the inlet. The outlet metal pipe is partially collapsed and requires repair. The entire culvert needs to be replaced. There is one home downstream of this area that could be impacted if the repairs are not made and a major release of water occurs.

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Map 6: Local Areas of Flood Concern

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Dam Failure

A specific category of flood hazard exists in the form of dam failure. Dam failure can happen for a number of reasons including as a result of natural disasters such as structural failure due to earthquakes or overtopping due to heavy precipitation. Failure due to material fatigue is also possible, but regular maintenance and dam inspections can detect leaks and other signs of material fatigue before the problem escalates. Dam failure can only occur at and along the watercourses and low-lying areas downstream of dams.

Dams in Foxborough are included in the map of critical facilities (Map 4 on page II-19).

Glue Factory Pond East Dam

Glue Factory Pond has two dams. The East Dam is in good functional shape according to town officials. However, there has been a "slumping" of the concrete pad atop the dam. The dam is not a high impact dam and the downstream road in the path of the river, Morse Street, was raised in the early 1980s and there have been no flooding issues since. The dam is otherwise in functional shape and the impact from a potential breach is considered low. The dam has been inspected by the state and is considered a low priority.

Glue Factory Pond West Dam

The second of two dams at Glue Factory Pond, this dam is of a more consequence. The dam includes a turret structure atop the dam and the Town owns the water rights and the turret, but the dam itself is privately owned by a foundry company. According to town officials, ice damage to the concrete wall over the years has created a need for repairs to the dam wall, but the turret was rebuilt in 1986 or 1987 and is in good condition/working order. There is also a capacity issue with this dam that needs to be studied long term.

Water Street Dam

The Water Street Dam is located on Cocasset Brook and is privately owned by the Cocasset Lake Association. The association has taken actions to protect and maintain the dam, such as removing trees near the base of the dam to prevent the roots from damaging the structure.

Lakeview Carpenter Pond Dam

Also located on the Cocasset Brook at Lakeview Road, the road itself is the functional dam. The dam consists of a culvert beneath the street, with sluice boards that can be removed in the culvert beneath the street and an associated sluice way to the side of the pond. The side sluiceway was recently rebuilt with town funding, but the main culvert has been identified as a concern by Town officials. Town officials are mainly concerned with tree removal and root structures that have caused some seepage near the base of the dam. There is no imminent threat of dam failure here, but the Town would like to replace the corrugated culvert pipe and make repairs, remove trees from the dam wall. The downstream of the area of the dam is largely swampy flood plain, so the project is a lower priority.

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Crack Rock Pond Dam

The Crack Rock Pond Dam is located at North Street near the Lane Property on the Neponset River. The Neponset Reservoir Company owns the dam. Municipal officials report the dam is aged and in poor condition. The culvert that carries water from the pond under North Street is also in questionable condition.

WIND-RELATED HAZARDS

The current edition of the Massachusetts State Building Code (Ninth Edition CMR 780; June 8, 2018) specifies design wind speeds for three categories of structure for each community in the Commonwealth. Structures of Risk Category I include those that pose a low risk to human life in the event of a failure (outbuildings, some commercial buildings). Structures of Risk Category III or IV pose substantial risk to human life, economic impact, or mass disruption in the event of a failure (building with large populations, critical facilities, etc.). Risk Category II includes most buildings. Design wind speeds for these buildings in Foxborough are:

- Risk Category I: 120 mph
- Risk Category II: 131 mph
- Risk Category III or IV: 142 mph

Foxborough does experience downed trees that cause power outages and roadway blockages following high wind events; however, Foxborough also takes prides in its tree-lined streets, and protecting roads and utilities while maintaining a healthy tree stock is an ongoing challenge the Town is willing to undertake.

Foxborough's energy utility is National Grid. Power is brought into town through a main line on Chestnut Street; when the line is brought down during storms, power is lost to the entire town. Municipal officials are interested in burying the line but have reported that National Grid prefers the line remain above ground.

No single area of Foxborough is more prone to high winds than any others. A large-scale wind event such as a hurricane will affect the entire town, while the locations of focused wind events like tornadoes and microbursts cannot be predicted.

WINTER-RELATED HAZARDS

The average annual average snowfall in most of Foxborough is between 36 and 48 inches (see Figure V-3). The Town provides standard snow plowing operations, and clearing snow has not posed any significant challenges. The Town does make plowing of roads a priority near emergency routes.

Other winter issues include ice storms that can affect utilities and cause isolated power outages. Additionally, icing during cold weather events that are not connected to a storm can create

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dangerous conditions for travel and can damage infrastructure. Foxborough officials have identified two locations where icing is a chronic problem during winter months:

- North Street Between Railroad Crossing and McKenzie Lane: groundwater seeps from the bedrock outcrop ("ledge") on the east side of the road and freezes.
- Cocasset Street Railroad Underpass: this area, which frequently floods due to poor drainage, experiences freezing during cold weather.

FIRE-RELATED HAZARDS

The greatest brush fire hazard areas tend to be at the "wildland/urban interface," where urban development and wildland areas are in close proximity. In these areas, the combined effect of having residences, businesses, and lifelines near a wildland area causes increased risk to life and property. This risk can be exacerbated if emergency access routes are limited, such as in areas located far from Fire Stations or developments with a single mode of access and egress.

The Town's largest area of brush fire concern is F. Gilbert State Park, on the Town's southwestern edge. The State Park is owned, maintained and monitored by the state's Department of Conservation and Recreation. The Town also has significant brush fire threats on its Eastern and southeastern edges bordering Sharon and Mansfield, at Windsor Drive and East and Willow streets. Wooded areas adjacent to train tracks in the Town, and other undeveloped wooded areas adjacent to local residential areas, are other areas of concern.

Growth in development in Foxborough over the last two decades has significantly reduced the amount of space that is prone to brush fires, according to the Fire Chief.

Areas of wildfire hazard are shown on Map 7.

GEOLOGIC HAZARDS

Earthquakes

Although new construction under the most recent building codes generally will be built to seismic standards, much of the development in the Town predates the most recent building code.

Both the fire and police departments are now housed in a relatively new facility built to modern earthquake codes.

Several major transportation routes into and out of town travel over water at some point. Town officials worry that during an earthquake, access to surrounding communities and hospitals could be hampered or limited by a failure of any of several bridges which stretch over waterways, rivers and brooks.

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Landslides

Figure VII-1 indicates that nearly the entire town of Foxborough is classified as "Very Low Risk" for slides, with small pockets of "Low Risk" scattered throughout town, primarily in the areas of F. Gilbert Hills State Forest, the forest across Interstate 95 from the Foxborough Highway Department, the Lane Property, and points around Neponset Reservoir. A few points in those same areas are mapped as "Moderate" risk of slide. None of these areas present significant risk to properties, infrastructure, or individuals. There are not many steep slopes in the Town and local officials state that landslides are not a major threat or occurrence in Foxborough. Town officials did not identify any problems with areas of geologic instability such as sinkholes or subsidence.

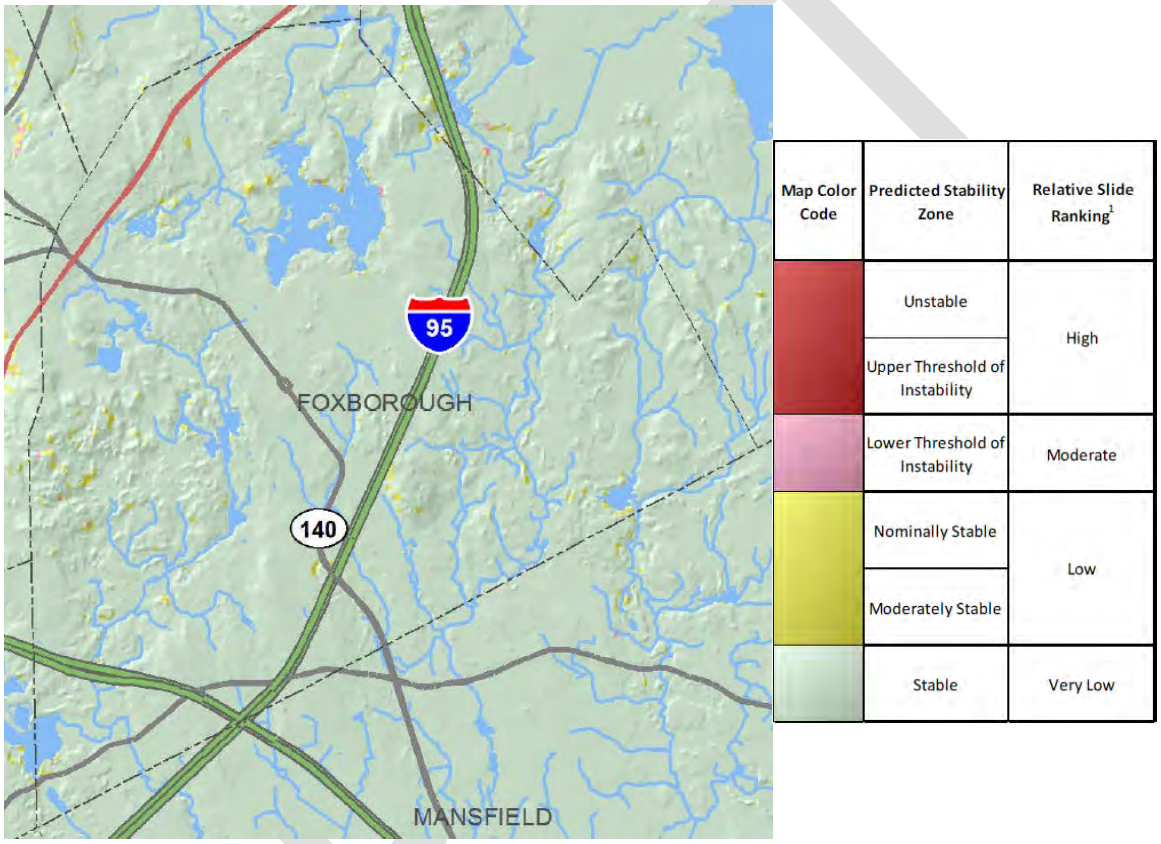

Figure VII-1: Relative Landslide Risk Map for Foxborough

Figure excerpted from Mabee, S., and C. Duncan, 2013. "Slope Stability Map of Massachusetts: Sheet 3 – Southeastern Massachusetts." Massachusetts Geological Survey, University of Massachusetts Amherst.

Foxborough's surficial geology is shown in Map 8.

Map 7: Wildfire Hazard Zones

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Map 8: Surficial Geology

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Flood-Related Mitigation measures

Measures to reduce the impact of an inland or urban flood event include managing new development, reducing the exposure of existing development to flood risk, and preserving and restoring natural resources. These are listed below under the categories of *prevention*, *property protection*, *structural projects*, *public education and awareness*, *natural resource protection*, and *emergency services*.

Prevention

Prevention of damage from flood losses often takes the form of floodplain regulations and redevelopment policies. In most communities, these are administered by building, zoning, planning, and/or wetland bylaw and regulation enforcement. The following general guidelines are preventive tools that municipalities may have available:

Open Space Preservation:

Municipal departments should identify areas for acquisition to remove the potential for flood damage. Acquisition of heavily damaged structures (particularly RLPs) after a flood may be an economical and practical means to accomplish this.

Planning and Zoning:

Zoning and subdivision ordinances should regulate development in flood hazard areas. Flood hazard areas should reflect a balance of development and natural areas. Policies can also require the design and location of utilities to areas outside of flood hazard areas and the placement of utilities underground.

Floodplain Development Regulations:

Development regulations encompass subdivision regulations, building codes, and floodplain ordinances. Site plan and new subdivision regulations should include the following:

- ✓ Requirements that every lot have a buildable area above the flood level;
- ✓ Construction and location standards for the infrastructure built by the developer, including roads, sidewalks, utility lines, storm sewers, and drainage ways; and
- ✓ A requirement that developers dedicate open space and flood flow, drainage, and maintenance easements.

Building codes should ensure that the foundation of structures will withstand flood forces and that all portions of the building subject to damage are above or otherwise protected from flooding. Floodplain ordinances should at minimum follow the requirements of the National Flood Insurance Program for subdivision and building codes. These could be included in the ordinances for zoning and building codes or could be addressed in a separate ordinance.

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Massachusetts municipalities are required to adopt and enforce the Massachusetts State Building Code, meaning local building codes cannot be more or less stringent than that code. For example, municipalities are not able to adopt "freeboard" standards higher than that required by the State.

Storm Water Management Policies:

Development and redevelopment policies to address the prevention of flood losses should include effective storm water management policies. Developers should be required to build detention and retention facilities where appropriate. Infiltration can be enhanced to reduce runoff volume, including the use of swales, infiltration trenches, vegetative filter strips, and permeable paving blocks. Generally, post-development storm water should not leave a site at a rate higher than under pre-development conditions.

In many communities, standard engineering practice is to avoid the use of detention measures if the project site is located in the lower one-third of a watershed. The effects of detention are least effective and even detrimental if used at such locations because of the delaying effect of the peak discharge from the site that typically results when detention measures are used. By detaining storm water in close proximity to the stream in the lower reaches of the overall watershed, the peak discharge from the site will occur later in the storm event, which will more closely coincide with the peak discharge of the stream, thus adding more flow during the peak discharge during any given storm event.

Drainage System Maintenance:

An effective drainage system should be continually maintained to ensure efficiency and functionality. Maintenance should include programs to clean out blockages caused by overgrowth and debris. Culverts should be monitored and repaired and improved when necessary.

Education and Awareness:

Other prevention techniques include the promotion of awareness of natural hazards among citizens, property owners, developers, and local officials. Technical assistance for local officials, including workshops, can be helpful in preparation for dealing with the massive upheaval that can accompany a severe flooding event. Research efforts to improve knowledge, develop standards, and identify and map hazard areas will better prepare a community to identify relevant hazard mitigation efforts.

Wetlands:

Inland Wetlands and Watercourses Commissions typically administer Wetland Regulations. The regulations simultaneously restrict development in floodplains, wetlands, and other flood prone areas. Many mitigation projects take place in wetland areas or the upland review zone and therefore are under the jurisdiction of the Wetland Commission. Thus, close coordination with this agency is required.

Coordination:

Regulations related to flood damage prevention often lie within several different regulations and ordinances, and are the responsibility of several different departments. Development of a checklist that cross-references the bylaws, regulations, and codes related to flood damage prevention that may be applicable to a proposed project can help streamline the permitting process and ensure maximum education of a developer or applicant.

> *It is important to promote coordination among the various departments that are responsible for different aspects of flood mitigation. Coordination and cooperation among departments should be reviewed every few years as specific responsibilities and staff change.*

Property Protection

Steps should be taken to protect existing public and private properties. Measures for public property protection include acquisition and relocation of properties at risk for flooding; purchase of flood insurance; and relocating valuable belongings above flood levels to reduce the amount of damage caused during a flood event.

Standard Flood Protection Techniques

Techniques applicable to property protection include elevating buildings, constructing barriers, dry floodproofing, and wet floodproofing.

- Home elevation involves the removal of the building structure from the basement and elevating it on fill, foundation, or piers to a height such that the first floor is located above the 1% annual-chance flood level. The basement area is abandoned and filled. All utilities and appliances located within the basement must be relocated to the first-floor level. Elevation is the only structural property protection technique permitted for residential buildings.
- Dry floodproofing refers to the act of making areas below the flood level water-tight. Walls may be coated with compound or plastic sheathing. Openings such as windows and vents should be either permanently closed or covered with removable shields. Flood protection should only be two to three feet above the top of the foundation because building walls and floors cannot withstand the pressure of deeper water. Dry floodproofing is only permitted for non-residential structures.
- Wet floodproofing should only be used as a last resort. Wet floodproofing refers to intentionally letting floodwater into a building to minimize pressures. Furniture and electrical appliances should be moved away from advancing floodwaters. Dry floodproofing is only permitted for non-residential structures.
- Barriers include levees, floodwalls, and berms, and are useful in areas subject to shallow flooding.

General Improvements

FEMA offers a variety of suggestions regarding general improvements that can mitigate flooding:

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- Relocate or elevate water heaters, heating systems, washers, and dryers to a higher floor or to at least 12 inches above the high-water mark (if the ceiling permits).
- Anchor the fuel tank to the wall or floor with noncorrosive metal strapping and lag bolts.
- Install a septic backflow valve to prevent sewer backup into the home.
- Install a floating floor drain plug at the lowest point of the lowest finished floor.
- Elevate the electrical box or relocate it to a higher floor and elevate electric outlets to at least 12 inches above the high-water mark.

Insurance

Although flood insurance does not prevent damage from occurring or remove structures from harm's way, it does provide an excellent means of recovering from losses. Changes to the NFIP insurance products in the 1990s added mitigation insurance coverage ("increased cost of compliance") at a very low cost. This coverage can provide people a portion of the additional financial resources needed to rebuild their repetitively flooded or substantially damaged homes and businesses to comply with local floodplain management regulations and building standards, therefore reducing the cost and amount of future flood damages.

Emergency Services

Emergency services that would be appropriate mitigation measures for inland flooding include:

- forecasting systems to provide information on the time of occurrence and magnitude of flooding;
- a system to issue flood warnings to the community and responsible officials; and
- emergency protective measures, such as evacuation and emergency flood-water control.

Public Education and Awareness

The objective of public education is to provide an understanding of the nature of flood risk, and the means by which that risk can be mitigated on an individual basis. Public information materials should encourage individuals to be aware of flood mitigation techniques, including discouraging the public from modifying channels and/or detention basins in their yards, and dumping in or otherwise altering watercourses and storage basins. Individuals should be made aware of drainage system maintenance programs and other methods of mitigation. The public should also be told what to expect when a hazard event occurs, and the procedures and time frames necessary for evacuation.

Natural Resource Protection

Floodplains can provide a number of natural resources and benefits, including storage of flood waters, open space and recreation, water quality protection, erosion control, and preservation of natural habitats. Retaining the natural resources and functions of floodplains can not only reduce the frequency and consequences of flooding, but also minimize storm water management and nonpoint pollution problems. Through natural resource planning, these objectives can be achieved at substantially reduced overall costs.

Measures for preserving floodplain functions and resources typically include:

- adoption of floodplain regulations to control or prohibit development that will alter natural resources
- development and redevelopment policies focused on resource protection
- information and education for both community and individual decision-makers
- review of community programs to identify opportunities for floodplain preservation

Measures for restoring diminished or destroyed natural resources and functions provide for re-establishment of an environment in which these functions can again operate. Such measures include development of land reuse policies focused on resource restoration and review of community programs to identify opportunities for floodplain restoration.

Structural Projects

Structural projects include the construction of new structures or modification of existing structures to lessen the impact of a flood event. Storm water controls such as drainage systems, detention controls such as dams and reservoirs, and conveyance structures such as culverts and bridges can be employed to lessen the impact of floodwater runoff. On-site detention can provide temporary storage of storm water runoff. Levees, floodwalls, and dikes physically control the hazard to protect certain areas from floodwaters. Channel alterations can be made to confine more water to the channel and accelerate flood flows. Care should be taken when using this technique to ensure that problems are not exacerbated in other areas of the watershed. Individuals can protect private property by constructing walls and levees around structures.

Dam Failure Mitigation

The following specific recommendations are offered for dam failure mitigation:

- Include dam failure areas in the Reverse 911 emergency contact database and/or similar notification systems
- Work with the Massachusetts Office of Dam Safety to ensure dam owners are maintaining their dams appropriately and have an Emergency Action Plan (EAP).
- Provide assistance regarding resources available to dam owners.

WIND-RELATED MITIGATION MEASURES

Damage to trees and resulting power outages and damage to buildings as a result of winds is a problematic issue during storms with high winds; therefore mitigating damage to utility lines and property and injury or loss of life must be implemented. Specific mitigation steps that can be taken to prevent property damage and protect property are given below. Note that natural resource protection and structural projects are generally not applicable categories of hazard mitigation for wind hazards.

Prevention

Wind-hazard preventions measures include tree inspection and maintenance programs and placement of utilities underground rather than as overhead wires. These two measures minimize utility damage, power outages, and road blockages due to debris following wind events.

Property Protection

Potential mitigation measures for property protection from high winds include designs for hazard-resistant construction and retrofitting techniques. These may take the form of increased wind and flood resistance, as well as the use of storm shutters over exposed glass and the inclusion of hurricane straps to hold roofs to buildings. In addition, living and working areas can be elevated to allow a storm surge to pass safely underneath.

The American Red Cross (ARC) has published a guidebook entitled *Standards for Hurricane Evacuation Shelter Selection* (ARC Publication #4496). The publication provides guidelines for selecting shelters relative to resilience from storm surges, flooding, and hurricane winds. Several FEMA publications provide design criteria for shelters, including *Design and Construction Guidance for Community Shelters* (FEMA Publication #361). A reference by the International Code Council (ICC) and the National Storm Shelter Association, *Standard on the Design and Construction of Storm Shelters* (ICC-500), also provides design criteria. In general, recommended design wind speeds range from 160 to 250 miles per hour (mph) in these publications.

The FEMA PDM program is the current FEMA mitigation grant program best suited to funding wind mitigation projects. The PDM program recognizes four categories of projects for wind damage mitigation in critical facilities as follows:

- "Shutter mitigation" projects protect all windows and doors of a structure with shutters or other systems that meet debris impact and wind pressure design requirements. All openings of a building are to be protected.
- "Load path" projects improve and upgrade the structural system of a building to transfer loads from the roof to the foundation. This retrofit provides positive connection from the roof framing to the walls, better connections within the wall framing, and connections from the wall framing to the foundation system.
- "Roof projects" involve retrofitting a building's roof by improving and upgrading the roof deck and roof coverings to secure the building envelope and integrity during a wind event.
- "Code plus" projects are those designed to exceed the local building codes and standards to achieve a greater level of protection.

Public Education and Awareness

Both the FEMA and the NOAA websites contain valuable information regarding preparing for a protecting oneself from high wind events, as well as information on a number of other natural hazards.

> *FEMA information is available at:*
> *http://www.fema.gov/library/prepandprev.shtm.*
>
> *Tornado-Specific information from NOAA is available at:*
> *http://www.nssl.noaa.gov/NWSTornado/*

Available information from FEMA includes:

- Design and construction guidance for community shelters.
- Recommendations to better protect from tornado damage for your business, community, and home. This includes construction and design guidelines for business and homes, as well as guidelines for creating and identifying shelters.
- Ways to better protect property from wind damage.
- Ways to protect property from flooding damage.
- Construction of safe rooms within homes.

NOAA information includes a discussion of family preparedness procedures and the best physical locations during a storm event. Foxborough should make the public aware of available shelters and of alternate routes to those shelters, in case roads are blocked by fallen debris.

Emergency Services

Emergency services that would be appropriate mitigation measures for high wind events include diligent use of forecasting, implementation of warning systems such as Reverse 911 to provide information on the time of occurrence and magnitude of a storm, and early evacuation of neighborhoods and localities ahead of some storms (such as hurricanes).

WINTER-RELATED MITIGATION MEASURES

Hazard mitigation measures addressing flood and wind hazards that may be associated with winter storms are covered in the previous sections. Winter storm mitigation measures listed below specifically address blizzard, snow, and ice hazards. Note that natural resource protection and structural projects are generally not applicable categories of hazard mitigation for blizzard, snow, and ice hazards.

Prevention

Cold air, snow, and ice cannot be prevented from impacting any particular area. Thus, mitigation should be focused on property protection, infrastructure protection, emergency

services (discussed below), and prevention of damage to structures and utilities as caused by breakage of tree limbs.

Previous recommendations for tree limb inspections and maintenance are applicable to winter storm hazards, as well. If utilities are underground, then heavy snow, ice, and winter winds cannot damage or destroy them.

Drifting snow can interfere with travel when roads are buried. Strategic installation of windbreaks, or snow fencing, along vulnerable roads can mitigate this issue.

Property Protection

Property can be protected during winter storms through the use of shutters, storm doors, storm windows, weather stripping, and other means of keeping cold air outdoors and heat indoors. Where flat roofs are used on structures, snow removal is important as the heavy load from collecting snow may exceed the bearing capacity of the structure. Heating coils may be used to remove snow from flat roofs. Pipes should be adequately insulated to protect against freezing and bursting. All of these recommendations apply to new construction, although they may also be applied to existing buildings during renovations.

Public Education and Awareness

The public is typically more aware of the hazardous effects of snow, ice, and cold weather than they are with regard to other hazards discussed in this plan. Nevertheless, every winter people become stranded in automobiles, get caught outside their homes in adverse weather conditions, and suffer heart failure while shoveling. Public education should therefore focus on safety tips and reminders to individuals about how to prepare for cold weather.

Emergency Services

Plowing the access to and from critical facilities, such as hospitals and shelters, should be prioritized. It is recognized that this may not be a priority to all residents, as people typically expect their own roads to be cleared as soon as possible.

FIRE-RELATED MITIGATION MEASURES

Potential mitigation measures for wildfires include a mixture of prevention, education, and emergency planning. Educational materials should be available at the Fire Department and Town Hall. Education of homeowners on methods of protecting their homes is far more effective than trying to steer growth away from potential wildfire areas, especially given that the available land that is environmentally appropriate for development may be forested and located within inland areas.

The following actions could be implemented to mitigate fire risk:

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- Continue to support public outreach programs to increase awareness of forest fire danger, equipment usage, and protecting homes from wildfires.
- Ensure that provisions of local Regulations regarding fire protection facilities are being enforced.

Water system improvements are an important class of potential mitigation for wildfires. The following recommendations are actions water companies can take to mitigate wildfires:

- Extend the public water supply systems into areas within growth boundaries that require water for fire protection.
- Identify and upgrade those portions of the public water supply systems that are substandard from the standpoint of adequate pressure and volume for fire-fighting purposes.
- Explore innovative solutions to fire protection where it is not feasible to extend a conventional water system. This recommendation is also suited for the DPW and Fire departments.

Prescribed burn programs serve to remove potential wildfire fuel under controlled conditions so that they are not available to help spread wildfires.

Mutual aid relationships with the fire departments of surrounding communities help increase a community's ability to fight larger fires.

Utilities should be placed underground where possible. This could occur in connection with new development and redevelopment or streetscape. If utilities are underground, then fires cannot damage or destroy them.

GEOLOGIC-HAZARD MITIGATION MEASURES

Because earthquakes cannot be predicted and can affect the entire community, potential mitigation can only include adherence to building codes, education of residents, and adequate planning.

FEMA has several publications that can assist homeowners and builders in designing structures to withstand the effects of earthquakes and should be made available to the public:

- "The Home Builder's Guide for Earthquake Design" should be made available to all design professionals, builders and others who are issued permits for new construction.
- "Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide" (FEMA-74, 1994) can also be made available.
- All commercial, industrial and institutional property owners should have an opportunity to obtain a copy of the FEMA publication entitled "Emergency Management Guide for Business and Industry" (FEMA- 141, 1993).

In order to be able to effectively mitigate earthquake damage at the community level, it is crucial to have an understanding of what is at risk in the event of an earthquake. Surveying critical facilities and critical infrastructure can identify those that may be unable to withstand earthquake and wind loading.

The following potential mitigation measures apply to earthquake hazards:

- Ensure fuel supplies for emergency generators at municipal facilities will be sufficient to withstand potentially long electrical outages following an earthquake (or storm event). Emphasis should be placed on critical infrastructure and shelters.
- Ensure that local departments have adequate backup supplies and facilities for continued functionality in case earthquake damage occurs to these buildings where these critical facilities are housed.
- Prevent residential development in areas prone to collapse such as below steep slopes or in areas prone to liquefaction.
- Require adherence to the amended, updated Massachusetts Building Code.
- Promote wood over masonry construction.
- Ensure that municipal departments that are housed in masonry buildings know how to evacuate in case of an earthquake.
- Ensure that municipal departments that are housed in masonry buildings have adequate backup facilities to utilize if damage occurs.
- Conduct activities to build public awareness and education

Landslide hazards can be mitigated by preventing development on or below steep slopes.

STATUS OF PREVIOUS RECOMMENDATIONS

Mitigation actions that were proposed in the previous edition of this HMP are listed in the table on the following page, along with their statuses and additional notes.

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Table VIII-1: Status of Previous Hazard Mitigation Recommendations

Measure	Details	Status	Notes
Expansion of Foxborough High School culvert	Replace a 12-inch diameter culvert with a 24-inch pipe.	Completed	This action has been completed
Expansion of culverts on Summer Place	Replace undersized culverts on Summer Place with larger structures.	Completed	This action has been completed
Rae-Craft Building - Central Street commercial district parking lot	Complete a comprehensive study of the pair of catch basins and underground drainage network at this site to identify a solution and find funding.	Completed	Stormwater system at this site was fixed between 5 and 10 years ago. No flooding issues have been observed or reported at this site since then.
Sunoco culvert beneath Route 140	Obtain Sunoco's cooperation in constructing a new culvert, adjacent to the Sunoco property, to replace the existing culvert that has collapsed beneath the roadway. The Town will maintain and own the culvert.	Completed	During development of London Estates property, drainage infrastructure was installed that seems to have addressed issues in this area. No flooding issues have been observed or reported at this site since site development began.
Mill Street culvert at Prospect Street	Replace entire pipe. The Town has already completed some repair work to the inlet side of the existing culvert.	Carry Forward	This action has not yet been completed, as the Town has not been able to secure funding. In the meantime, Foundry Pond Dam, upstream, provides some protection.
Installation of overflow on Paula Lane	Add an emergency overflow to the drainage system at this site. Flooding problems at this site are related to the lack of an overflow.	Completed	This action has been completed
Flooding study on East Street	Perform an in-depth study of the East Street area to determine the best course of action to mitigate flooding. Poor drainage and a recent development have exacerbated flooding problems. Flooding has not been severe and does not impact homes or roadways.	Carry Forward	Action not yet completed due to inability to secure funding.
Expand culvert on East Belcher Road	Replace and upgrade an inadequate culvert believed to be the cause of low severity flooding that typically results in a quarter of an inch of water covering a commercial parking lot.	Completed	Work has been performed on a section of stream upstream from the culvert and the culvert has been replaced and updated. Water flows down from hills both upstream and downstream of the culvert.
Update hazardous materials response plan	Update the Town hazardous materials response plan to reflect the most current conditions and latest technologies. Inclement weather could increase the chance of a chemical spill.	Drop	Town is confident in its existing hazardous materials plan and response capabilities, and no longer believes this action is necessary.

Measure	Details	Status	Notes
Assessment of historic structure natural hazard vulnerability	Perform a complete analysis to determine the vulnerability of each structure in the Town's database of historic structures to flooding, wind, snow, ice, earthquakes, and fire. Techniques for mitigation should be determined, such as flood proofing of structures.	Carry Forward with Revisions	Town feels this action is too broad to be achievable. Action is revised as follows: - Identify historic structures located in mapped hazard zones, and perform outreach to those owners about possible hazard mitigation actions they can implement that will maintain historic character. - Have the Foxborough Historical Commission create and/or adopt guidelines for hazard mitigation actions for historic resources to provide to interested property owners.
Continuation of Open Space Protection and Land Acquisition	Continue efforts for open space protection and purchases as prioritized in the draft Open Space Plan and Community Preservation Plan.	Capability	This is a capability.
Regulatory Revisions for Stormwater Management	Update subdivision and site plan standards for stormwater management to reflect more current trends to help prevent flooding from new development and redevelopment. In particular, the regulations could include: - Requirements for aggressive and legally-binding operation and maintenance agreements, with enforcement mechanisms, for private drainage facilities. - Regulatory controls to encourage Low-Impact Development (LID) practices.	Completed	Town adopted a new Stormwater Bylaw on May 8, 2017.
Maintenance of Existing Infrastructure	Develop and implement a complete maintenance plan for all catch basins, culverts and drainage pipes in existing flood hazard areas.	Completed	Infrastructure has been mapped and DPW is confident in its maintenance schedule and activities.
Video Exploration of Carpenter Street	Complete a video exploration of the drainage pipes of the Carpenter Street catch basins to map their routes and pursue a solution to recurring flooding in the area.	Drop	Flooding at Carpenter Street is no longer considered a problem.

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Measure	Details	Status	Notes
Raise roadway at Glue Factory	Raise the roadway here to alleviate flooding of the access route to the Glue Factory (Bleachery) parcel. Other solutions may be explored in a more in-depth study of the site. Site may be in line for redevelopment. There is an existing dam associated with the site that allows periodic draining of the site and helps with flood storage.	Carry Forward with Revisions	Action has not yet been completed due to the financial costs of elevating roadways. The Town is adding an action to remove the Glue Factory Pond Dam upstream of the road, which may require upsizing the culvert to increase capacity under the road; additionally, the Town wants to increase flood storage capacity. This is a complex problem that may require a feasibility study for removal and restoration of the dam, followed by a replacement of the downstream culvert (on Morse Street). The previous action is dropped and replaced with two actions: - Perform a study of the Glue Factory Pond and Rumford River system in this area to determine risks and mitigation options, considering flood storage capacity and the Morse Street culvert capacity. - Design and execute actions identified by the Glue Factory Pond and Rumford River study.
Assessment of Municipal Structures for Susceptibly to Snow Loads	Complete an assessment of municipal facilities at risk of collapse from snow loads, and identify mitigation actions. In some cases the solution may be a structural retrofit, but in other cases it may just be a matter of knowing which buildings to clear snow from.	Drop	Many municipal buildings have been renovated over the last 5-10 years (including the new PSB and the new RECC) and due to code requirements do not need additional snow load assessment. The Town no longer believes this action is necessary.

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NEW ACTIONS AND ACTIONS TO CARRY FORWARD

Identification of Potential Mitigation Measures

During the local hazard team meeting, officials in Foxborough determined possible mitigation measures for the various natural hazards that have impacted or could impact the Town. Review of the actions recommended in the previous edition of this plan resulted in a number of actions that have been carried forward, altered or otherwise, in this edition. State initiatives, Town plans and studies, and responses to the online survey were also reviewed to identify mitigation strategies and ensure the list of strategies included in the HMP addressed concerns found in those sources.

A list of mitigation measures identified by this Plan is below. Measures are described in more detail at the end of this section and in the STAPLEE table in Appendix A

Strategy	Source
Complete MVP program	State Initiative
Develop a beaver management plan	Kickoff Meeting
Incorporate hazard mitigation in the open space plan	Kickoff Meeting
Perform historic structure assessment and outreach	Carried Forward with Revisions
Post rapid alert notification system information on town web site	Survey
Protect DPW fuel tanks	Kickoff Meeting
Complete a flood study on East Street	Carried Forward
Complete a flood study of Rumford River at Glue Factory Pond	Carried Forward with Revisions
Complete High Rock Road regional dispatch	Kickoff Meeting
Replace Mill Street culvert at Prospect Street	Carried Forward
Develop historic structure hazard mitigation guidelines	Carried Forward with Revisions
Improve reliability of main power line	Kickoff Meeting
Implement findings of Rumford River study	Carried Forward with Revisions
Explore microgrid development at key facilities and sites	Kickoff Meeting
Perform West Street Dam repair	Kickoff Meeting
Perform Glue Factory Pond East dam removal	Kickoff Meeting
Perform Crack Rock Dam mitigation	Kickoff Meeting

Prioritization of Mitigation Measures using STAPLEE

To prioritize recommended mitigation measures, it is necessary to determine how effective each measure will be in reducing or preventing damage. A set of criteria commonly used by public administration officials and planners was applied to each proposed strategy. The method, called STAPLEE, is outlined in FEMA planning documents such as Developing the Mitigation Plan (FEMA 386-3) and Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5). STAPLEE stands for the "Social, Technical, Administrative, Political, Legal, Economic, and Environmental" criteria for making planning decisions. The following questions were asked about the proposed mitigation strategies:

- **Social:**
  - Benefits: Is the proposed strategy socially acceptable to the community?
  - Costs: Are there any equity issues involved that would mean that one segment of the population could be treated unfairly? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower-income people? Is the action compatible with present and future community values?
- **Technical:**
  - Benefits: Will the proposed strategy work? Will it reduce losses in the long term with minimal secondary impacts?
  - Costs: Is the action technically feasible? Will it create more problems than it will solve? Does it solve the problem or only a symptom?
- **Administrative**:
  - Benefits: Does the project make it easier for the community to administrate future mitigation or emergency response actions?
  - Costs: Does the community have the capability (staff, technical experts, and/or funding) to implement the action, or can it be readily obtained? Can the community perform the necessary maintenance? Can the project be accomplished in a timely manner?
- **Political**:
  - Benefits: Is the strategy politically beneficial? Is there public support both to implement and maintain the project? Is there a local champion willing to see the project to completion? Can the mitigation objectives be accomplished at the lowest cost to the community (grants, etc.)?
  - Costs: Have political leaders participated in the planning process? Do project stakeholders support the project enough to ensure success? Have the stakeholders been offered the opportunity to participate in the planning process?
- **Legal**:
  - Benefits: Is there a technical, scientific, or legal basis for the mitigation action? Are the proper laws, ordinances, and resolutions in place to implement the action?
  - Costs: Does the municipality have the authority to implement the proposed action? Are there any potential legal consequences? Will the municipality be liable for the actions or support of actions, or for lack of action? Is the action likely to be challenged by stakeholders who may be negatively affected?
- **Economic**:
  - Benefits: Are there currently sources of funds that can be used to implement the action? What benefits will the action provide? Does the action contribute to community goals, such as capital improvements or economic development?
  - Costs: Does the cost seem reasonable for the size of the problem and the likely benefits? What burden will be placed on the tax base or local economy to implement this action? What proposed actions should be considered but be tabled for implementation until outside sources of funding are available?

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- **Environmental**:
  - Benefits: Will this action beneficially affect the environment (land, water, endangered species)?
  - Costs: Will this action comply with local, state, and federal environmental laws and regulations? Is the action consistent with community environmental goals?

Each proposed mitigation strategy was evaluated and quantitatively assigned a score based on the above criteria, as outlined below:

- Benefits: a score of "1" was assigned if the project will have a beneficial effect for that particular criterion, or a "0" if the project would have a negligible effect or if the questions were not applicable to the strategy.

- Costs: a score of "-1" was assigned if the project would have an unfavorable impact for that particular criterion, or a "0" if the project would have a negligible impact or if the questions were not applicable to the strategy.

- Technical and Economic criteria were double weighted (multiplied by two) in the final sum of scores.

- The total benefit score and cost score for each mitigation strategy was summed to determine each strategy's final STAPLEE score.

An evaluation matrix with the total scores from each strategy can be found as Appendix A. After each strategy was evaluated, it was possible to prioritize them according to the final scores. Higher scores were determined to be of more importance economically, socially, environmentally and politically and were prioritized over those with lower scoring.

Mitigation Strategies and Actions

A detailed list of mitigation strategies and actions that have been identified by this Plan and that will be pursued by Foxborough over the next five years is presented below. Each strategy is presented with the following information:

Hazard – Identifies which hazard addressed by the HMP is being targeted by the strategy.

Lead – The lead department is responsible for implementation of the strategy. Most mitigation measures will likely require that several departments work together, and assigning staff is the sole responsibility of Foxborough. In some cases, a non-local entity would ideally be the lead.

Timeframe – Timeframe is based on a combination of the priority and complexity of a measure, and whether or not it is conceptual, in design, or already designed and awaiting funding. The

identification of a likely time frame is not meant to constrain a community from taking advantage of funding opportunities as they arise.

Estimated Cost – The cost data are estimates that represent a point in time and would need to be adjusted for inflation and for any changes or refinements in the design of a particular mitigation measure. Cost information is approximate only and is either provided by the community or from consultant experience.

Potential Funding Sources – This column attempts to identify possible sources of funding for a specific measure. This information is preliminary and varies depending on a number of factors such as whether a mitigation measure has been studied, evaluated or designed or is still in the conceptual stages. Each grant program and agency has specific eligibility requirements that would need to be taken into consideration. In most instances, the measure will require a number of different funding sources. Identification of a potential funding source in this table does not guarantee that a project will be eligible for or selected for funding. Upon adoption of this plan, the local committee responsible for its implementation should begin to explore the funding sources in more detail.

The best way to determine eligibility for a particular funding source is to review the project with the funding agency. The following websites provide an overview of programs and funding sources.

- Army Corps of Engineers (ACOE) – The website for the North Atlantic district office is www.nae.usace.army.mil. The ACOE provides assistance for a number of types of projects including shoreline/streambank protection, flood damage reduction, flood plain management services and planning services.
- FEMA – The three grant programs the FEMA offers to provide assistance for hazard mitigation planning and projects are described at www.fema.gov/hazard-mitigation-assistance. These grant programs are the HMGP, PDM, and FMA.
- Massachusetts Emergency Management Agency (MEMA) – The MEMA website (www.mass.gov/orgs/massachusetts-emergency-management-agency) provides information about the agency and its programs, resources and guides, and links to other sites that describe MEMA grant programs.
- United States Department of Agriculture – The USDA has programs by which communities can get grants or loans for essential community facilities, water and wastewater facilities, and renewable energy and energy efficiency initiatives. See the link below for examples. https://www.rd.usda.gov/ma.

Possible funding sources are described in more detail in Technical and Financial Resources on page X-122.

Priority – The designation of high, medium or low priority was determined using the STAPLEE method described above, and confirmed by the Local Multiple Hazard Community Planning Team. The designations could change as conditions in the community change.

Action #1	
Complete MVP Program	
Complete the Massachusetts Municipal Vulnerability Preparedness (MVP) planning grant program and pursue MVP action grants for the top-priority actions identified through that process	
Hazard	All Hazards
Lead	Planning
Timeframe	7/2020-6/2021
Estimated Cost	Mod. < $100,000
Funding Sources	MVP Planning Grant
Priority	High

Action #2	
Hazard Mitigation in the Open Space Plan	
Incorporate Hazard Mitigation concepts into Open Space Plan, currently under development; specifically, the existing screening criteria for land acquisition in the Plan should be modified to ensure floodplains are considered.	
Hazard	Flooding
Lead	Conservation
Timeframe	7/2020-6/2021
Estimated Cost	Low < $10,000
Funding Sources	Operating Budget
Priority	High

Action #3	
Beaver Management Plan	
Develop a Beaver Management Plan OR a beaver tracking protocol to identify where beavers are active and causing drainage problems.	
Hazard	Flooding
Lead	Conservation
Timeframe	7/2020-6/2021
Estimated Cost	Low < $10,000
Funding Sources	Operating Budget
Priority	Moderate

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Action #4	
Complete a flood study on East Street	
Perform an in-depth study of the East Street area to determine the best course of action to mitigate flooding. Poor drainage and a recent development have exacerbated flooding problems.	
Hazard	Flooding
Lead	Highway
Timeframe	7/2021-6/2023
Estimated Cost	Mod. < $100,000
Funding Sources	MVP Action Grant
Priority	Moderate

Action #5	
Complete a flood study of Rumford River at Glue Factory Pond	
Perform a study of the Glue Factory Pond and Rumford River system in this area to determine risks and mitigation options, considering flood storage capacity and the Morse Street culvert capacity.	
Hazard	Flooding
Lead	Highway
Timeframe	7/2021-6/2023
Estimated Cost	Mod. < $100,000
Funding Sources	MVP Action Grant
Priority	Moderate

Action #6	
Perform historic structure assessment and outreach	
Identify historic structures located in mapped hazard zones, and perform outreach to those owners about possible hazard mitigation actions they can implement that will maintain historic character.	
Hazard	Flooding
Lead	Planning / Historical Commission
Timeframe	7/2021-6/2023
Estimated Cost	Mod. < $100,000
Funding Sources	MHC
Priority	Moderate

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Action #7	
High Rock Road Regional Dispatch	
Complete development of New Regional Dispatch at High Rock Road	
Hazard	All Hazards
Lead	Police
Timeframe	7/2020-6/2021
Estimated Cost	High > $100,000
Funding Sources	DHS, Capital Imp
Priority	Moderate

Action #8	
Protect DPW Fuel Tanks	
Mitigate flooding of fuel tanks at DPW site through some combination of site grading, drainage improvements, and floodproofing of fuel pumps	
Hazard	Flooding
Lead	Highway
Timeframe	7/2022-6/2024
Estimated Cost	High > $100,000
Funding Sources	FEMA HMA
Priority	Low

Action #9	
Replace Mill Street culvert at Prospect Street	
Replace entire pipe of the Mill Street culvert at Prospect Street. The town has already completed some repair work to the inlet side of the existing culvert.	
Hazard	Flooding
Lead	Highway
Timeframe	7/2022-6/2024
Estimated Cost	High > $100,000
Funding Sources	FEMA / Capital Improvement Budget
Priority	Low

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Action #10	
Improve Reliability of Main Power Line	
Work with National Grid to evaluate alternatives to continue to improve the reliability of main power line into the town (on Chestnut Street, coming in near the Public Safety Building); for example, by burying the line or creating a redundant feed.	
Hazard	All Hazards
Lead	Town Manager
Timeframe	7/2023-6/2025
Estimated Cost	High > $100,000
Funding Sources	National Grid
Priority	Low

Action #11	
Implement findings of Rumford River Study	
Design and execute actions identified by the Glue Factory Pond and Rumford River study (Action #7)	
Hazard	Flooding
Lead	Highway
Timeframe	7/2023-6/2025
Estimated Cost	High > $100,000
Funding Sources	MVP Action Grant
Priority	Low

Action #12	
Explore microgrid development at key facilities and sites	
Evaluate the costs, benefits, and obstacles to developing a microgrid to maintain power at a selection of key facilities and sites. Possible locations include the downtown area near Town Hall, and the area near the DPW, including some number of businesses on Commercial Street. Attendees noted that Stop & Shop does not have a generator, and must manage perishables during power outages.	
Hazard	All Hazards
Lead	Town Manager
Timeframe	7/2022-6/2023
Estimated Cost	Low < $10,000
Funding Sources	Operating Budget
Priority	Low

Action #13	
Develop historic structure hazard mitigation guidelines	
Have the Foxborough Historical Commission create and/or adopt guidelines for hazard mitigation actions for historic resources to provide to interested property owners.	
Hazard	All Hazards
Lead	Planning / Historical Commission
Timeframe	7/2021-6/2023
Estimated Cost	Mod. < $100,000
Funding Sources	MHC
Priority	Low

Action #14	
West Street Dam Repair	
Complete repairs of West Street Dam (currently in design)	
Hazard	Flooding
Lead	Highway
Timeframe	7/2020-6/2021
Estimated Cost	High > $100,000
Funding Sources	Capital Improvement
Priority	Low

Action #15	
Glue Factory Pond East Dam Removal	
Remove Glue Factory Pond East Dam and perform restoration	
Hazard	Flooding
Lead	Highway
Timeframe	7/2024-6/2025
Estimated Cost	High > $100,000
Funding Sources	Mass DCR
Priority	Low

Action #16	
Crack Rock Dam Mitigation	
Repair or remove the Crack Rock Dam at North Street, and repair the culvert below the street.	
Hazard	Flooding
Lead	Highway
Timeframe	7/2024-6/2025
Estimated Cost	High > $100,000
Funding Sources	Capital Improvement
Priority	Low

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IX. REGIONAL AND INTER-COMMUNITY CONSIDERATIONS

Some hazard mitigation issues are strictly local. The problem originates primarily within the municipality and can be solved at the municipal level. Other issues are inter-community and require cooperation between two or more municipalities. There is a third level of mitigation which is regional and may involve a state, regional or federal agency or three or more municipalities.

REGIONAL PARTNERS

In many communities, mitigating natural hazards is more than a local issue. The facilities that serve these communities are complex systems owned and operated by a wide array of agencies, government, and private entities. The planning, construction, operations and maintenance of these facilities are integral to the hazard mitigation efforts of communities. These agencies must be considered the communities' regional partners in hazard mitigation. These agencies also operate under the same constraints as communities do, including budgetary and staffing constraints and numerous competing priorities. In the sections that follow, the plan includes recommendations for activities to be undertaken by these other agencies. Implementation of these recommendations will require that all parties work together to develop solutions.

REGIONAL FACILITIES WITHIN FOXBOROUGH

Major facilities owned, operated and maintained by federal, state, regional or private entities in Foxborough include:

- Interstate I-95 and I-495 (Mass Highways)
- State roads Routes 1, 106 and 140 (Mass Highways)
- Neponset Reservoir
- Canoe River (MA DCR)
- F. Gilbert State Park (MA DCR)
- Freight Rail Lines
- Gillette Stadium
- Patriot Place Mall
- MBTA Station

INTER-COMMUNITY CONSIDERATIONS

Mitigation measures for the following regional issues should be taken into account as Foxborough develops its own local plan:

A) Coordinate and Review Developments on a Regional Basis
As Foxborough and the surrounding communities are undergoing development, it is vital that these communities communicate and provide input during the review processes. When

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addressing housing, transportation, and economic development projects, the impacts to neighbors must be addressed. The Westwood Station Development in Westwood is a prime example of how one development has the potential to create impacts in Westwood, Norwood, Dedham and Foxborough.

B) Long-Term Regional Management Plan To Control Beaver Activity

One regional issue of significance is the widespread effects of beaver dams in the area. Most streams, wetland areas, and ponds in the region have had some degree of beaver activity in the past several years. Much of the localized flooding that occurs is due to beaver activity. The Towns will mitigate the problem temporarily by hiring trappers, removing dams, or installing pipes, but a long-term comprehensive approach should be considered.

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X. PLAN ADOPTION AND MAINTENANCE

PLAN ADOPTION

The Foxborough Hazard Mitigation Plan was adopted by the Board of Selectmen on [ADD DATE]. See Appendix F for documentation. The plan was approved by FEMA on [ADD DATE] for a five-year period that will expire on [ADD DATE].

PLAN MAINTENANCE

Milone & MacBroom, Inc., worked with the Hazard Mitigation Planning Team to prepare this plan. The Foxborough Hazard Mitigation Planning Team will continue to meet on an as-needed basis to function as the Local Hazard Mitigation Implementation Group. Thomas Buckley, the Assistant Fire Chief, is the current local coordinator for this Plan, with Paige Duncan, the Planning Director, as the deputy local coordinator; the two of them will oversee the Local Hazard Mitigation Implementation Group. Additional members could be added to the local implementation group from businesses, non-profits and institutions, and groups such as the Foxborough Citizen Corps.

IMPLEMENTATION SCHEDULE

Bi-Annual Survey on Progress– The coordinator of the Hazard Mitigation Implementation Team will prepare and distribute a biannual survey in years two and four of the plan. The survey will be distributed to all of the local implementation group members and other interested local stakeholders. The survey will poll the members on any changes or revisions to the plan that may be needed, progress and accomplishments for implementation, and any new hazards or problem areas that have been identified.

This information will be used to prepare a report or addendum to the local hazard mitigation plan. The Hazard Mitigation Implementation Team will have primary responsibility for tracking progress and updating the plan.

Develop a Year Four Update – During the fourth year after initial plan adoption, the coordinator of the Hazard Mitigation Implementation Team will convene the team to begin to prepare for an update of the plan, which will be required by the end of year five in order to maintain approved plan status with FEMA. The team will use the information from the year four biannual review to identify the needs and priorities for the plan update. At this point, the Hazard Mitigation Implementation Team may decide to undertake the update themselves or contract with an outside party.

Prepare and Adopt an Updated Local Hazard Mitigation Plan – However the Hazard Mitigation Implementation Team decides to update the plan, the group will need to review the current

FEMA hazard mitigation plan guidelines for any changes. The update of the Foxborough Hazard Mitigation Plan will be forwarded to MEMA for review and to FEMA for approval.

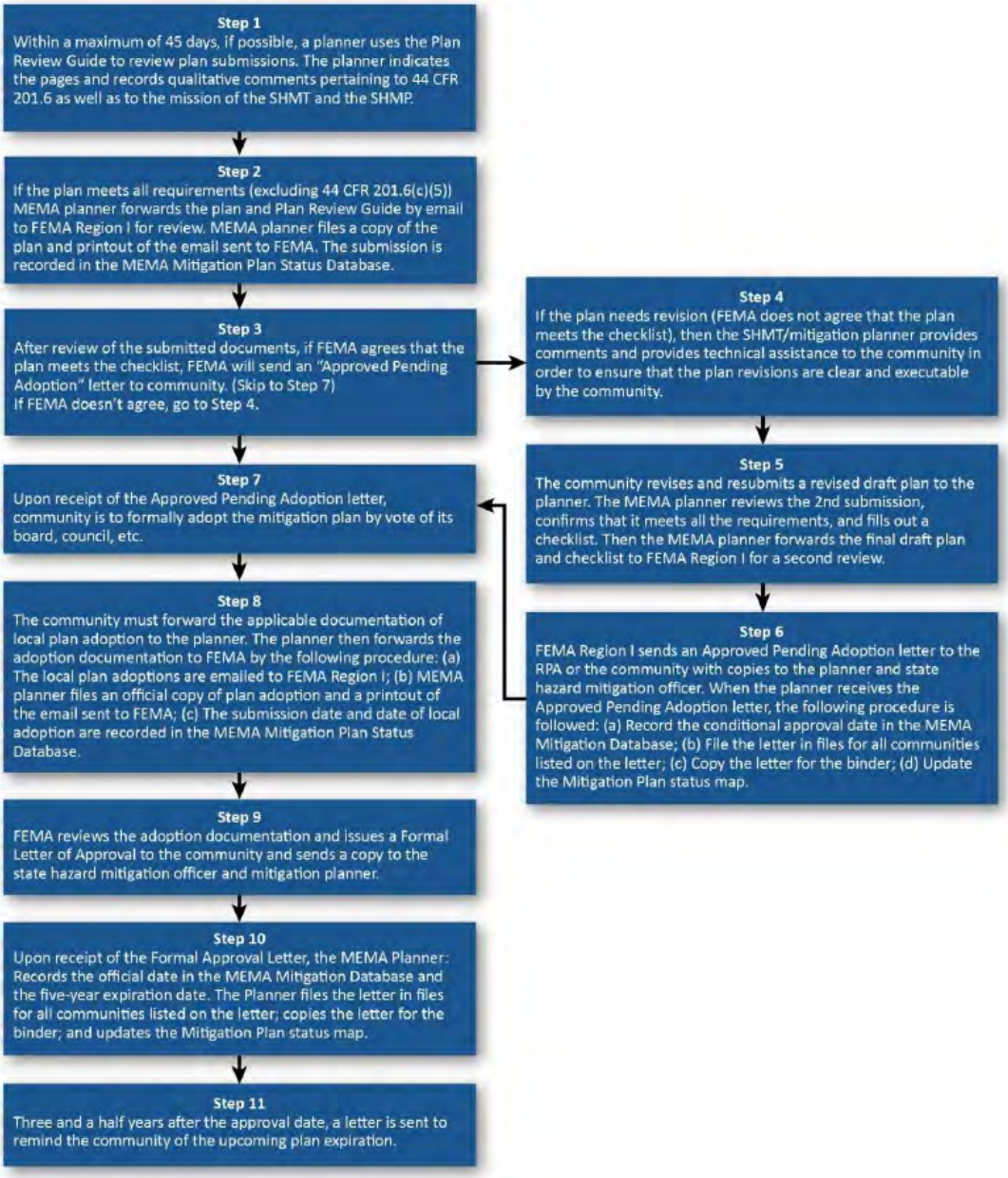

Figure X-1: Steps in the MEMA and FEMA Plan Review Process

Massachusetts State Hazard Mitigation and Climate Adaptation Plan, September 2018

INTEGRATION OF THE PLANS WITH OTHER PLANNING INITIATIVES

Upon approval of the Foxborough Hazard Mitigation Plan by FEMA, the Hazard Mitigation Implementation Team will provide all interested parties and implementing departments with a copy of the plan and will initiate a discussion regarding how the plan can be integrated into that department's ongoing work. At a minimum, the plan will be reviewed and discussed with the following departments:

- Fire
- Police
- Highway
- Water & Sewer
- Engineering
- Planning
- Conservation
- Recreation
- Health
- Inspections

Other groups, such as large institutions (like Gillette Stadium), the Tri-Town Chamber of Commerce, local land conservation organizations, and watershed groups should also be included in the plan review and update. This Plan will also be posted on the Foxborough website with a mechanism for citizen feedback, such as an e-mail address to send comments.

Integration with the Master Plan

Incorporation of information from the Hazard Mitigation Plan into a community's Master Plan is important for the successful implementation and long-term maintenance of the Hazard Mitigation Plan. The current edition of the Foxborough Master Plan (2015) includes information and goals relevant to hazard mitigation (such as a focus on open space preservation and sustainability), but does not explicitly address hazard mitigation. The next update of the Master Plan should incorporate hazard mitigation in the following ways:

- Describe risk areas and hazard concerns, as extracted from this document, in the community overview chapter, and other relevant chapters (such as those describing land use and natural resources).
- Describe how current and future hazard risks, as described in this HMP, inform development patterns and goals.
- Include hazard-mitigation specific actions (from this HMP or developed at a future time) as Master Plan actions within relevant chapters.
- Review the Master Plan to ensure it is consistent with the findings and goals of this HMP.

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Integration with the Capital Improvement Plan

Actions and capital improvement needs identified in the HMP should be incorporated into the Foxborough Capital Improvement Plan through collaboration with the Capital Improvement Committee. Because the Capital Improvement Plan and the HMP each have a five-year planning window, integration should be relatively simple.

TECHNICAL AND FINANCIAL RESOURCES

This subsection is comprised of a list of resources to be considered for technical assistance and potentially financial assistance for completion of the actions outlined in this plan. This list is not all-inclusive and is intended to be updated as necessary.

Federal Resources

Federal Emergency Management Agency
Region I
99 High Street, 6th floor
Boston, MA 02110-2320
(877) 336-2734

Mitigation Division

Administers all of FEMA's hazard mitigation programs, including: National Flood Insurance Program and Community Rating System; prepares and revises flood insurance studies and maps; information on past and current acquisition, relocation, and retrofitting programs; expertise in other natural and technological hazards, including hurricanes, earthquakes and hazardous materials. Financial assistance includes Hazard Mitigation Grant program (post-disaster); Flood Mitigation Assistance Program (pre-and post-flood), Pre-Disaster Mitigation (PDM) grant program; training for local officials at Emergency Management Institute in Emmitsburg, Maryland.

- ***Earthquake Hazards Reduction Assistant Program*:** As part of the National Earthquake Hazards Reduction Program (NRHRP), the purpose of the FEMA's State Earthquake Hazards Reduction Program is to provide funds for the development of comprehensive risk reduction programs at the State level and risk reduction measures at the local level to reduce future earthquake damages and losses. The fundamental goal of the program is to reduce earthquake impacts and the subsequent loss of lives, property damages, and economic losses. To accomplish these goals, technical assistance from State programs to local governments in the areas of structural and non-structural mitigation, building codes, and land-use planning ordinances is necessary.

- ***State Hurricane Program*:** This program is concerned with reducing the impacts of hurricanes and coastal storms on coastal areas of the United States and its territories as well as reducing the extent of subsequent losses. FEMA provides financial and technical assistance to State and local governments to support their efforts to mitigate the damaging effects of hurricane and coastal storms. State Hurricane Program funds are to be used for mitigation and

preparedness activities related to hurricane hazards. Each participating State receives a Local Assistance allocation of $5,000 in addition to the State Assistance Grant.

- ***Hurricane Program Property Protection - Mitigation Grants*****:** This element of the Hurricane Program provides grants to hurricane-prone States to implement mitigation projects. Each FEMA Region with States participating in the Hurricane Program receives funds for this activity. The Regional offices solicit the States to undertake projects that reduce the risk of loss of life or injury from damaged structures and reduce the overall cost of hurricane disasters due to property damage. This program is administered by the CT OEM.

- ***Multi-State Groups*****:** There are three multi-state (regional) consortia that FEMA funds: the Western States Seismic Policy Council (WSSPC), the New England States Emergency Consortium (NESEC), and the Central United States Earthquake Consortium (CUSEC). The mission of all three consortia is to support the National Earthquake Hazard Program (Reduction) funded State earthquake programs. They provide support in areas such as coordination between the States in a region and public awareness and education, and they also reinforce interactions between all levels of government, academia, non-profit associations, and the private section.

- ***Technical Assistance Contracts*****:** The Mitigation Directorate has in place several Technical Assistance Contracts (TAC) that support FEMA, States, territories, and local governments with activities to enhance the effectiveness of natural hazard reduction program efforts. The TACs support FEMA's responsibilities and legislative authorities for implementing the earthquake, hurricane, dam safety, and floodplain management programs. The range of technical assistance services provided through the TACs varies based on the needs of the eligible contract users and the natural hazard programs. Contracts and services include:

  - *The Hazard Mitigation Technical Assistance Program (HMTAP) Contract*- supporting post-disaster program needs in cases of large, unusual, or complex projects; situations where resources are not available; or where outside technical assistance is determined to be needed. Services include environmental and biological assessments, benefit/cost analyses, historic preservation assessments, hazard identification, community planning, training, and more.

  - *The Wind and Water Technical Assistance Contract (WAWTAC)*-supporting wind and flood hazards reduction program needs. Projects include recommending mitigation measures to reduce potential losses to post-FIRM structures, providing mitigation policy and practices expertise to States, incorporating mitigation into local hurricane program outreach materials, developing a Hurricane Mitigation and Recovery exercise, and assessing the hazard vulnerability of a hospital.

  - *The National Earthquake Technical Assistance Contract (NETAC)* – supporting earthquake program needs. Projects include economic impact analyses of various earthquakes, vulnerability analyses of hospitals and schools, identification of and training on non-structural mitigation measures, and evaluating the performance of seismically rehabilitated structures, post-earthquake.

- ***Hazard Mitigation Grant Program (HMGP)*:** HMGP is a post-disaster mitigation program that provides funding for hazard mitigation projects in affected counties following presidentially declared disasters. Available funds are based on a percentage of the total damages caused by the particular disaster. Grants from this program are limited to state and local governments and certain non-profit organizations. There is a need to demonstrate a positive cost/benefit analysis and a cost-share requirement of 25% to match the federal funds provided. Grants are competitive within the affected area. This program is administered by the state of Massachusetts, Massachusetts Emergency Management Agency (MEMA).

- ***Flood Mitigation Assistance Program (FMA)*:** FMA is a pre-disaster mitigation program created by the National Flood Insurance Reform Act of 1994. This program provides both project and planning grants annually for flood hazard mitigation planning and projects with direct demonstrable benefits to the NFIP insurance fund. Administratively, this program is very similar to the HMGP described above.

- ***Pre-Disaster Mitigation Grant Program (PDM)*:** PDM is a pre-disaster mitigation program that provides funding for hazard mitigation projects on a nationally-competitive basis. Projects are submitted by states and communities and rated by a national panel. Yearly funding for this grant is in the millions of dollars. There is a need to demonstrate a positive cost/benefit analysis and a cost-share requirement of 25% to match the federal funds provided. This program is administered by the state of Massachusetts, Massachusetts Emergency Management Agency (MEMA).

Response & Recovery Division

Information on dollar amounts of past disaster assistance including Public Assistance, Individual Assistance, and Temporary Housing; information on retrofitting and acquisition/relocation initiatives. Coordinates federal disaster assistance programs, including 75% grants for mitigation projects to protect eligible damaged public and private non-profit facilities from future damage through the Public Assistance Program, and 100% "minimization" grants through the Individuals and Family Grant Program.

Computer Sciences Corporation
New England Headquarters,
140 Wood Road, Suite 200,
Braintree, MA 02184
(617) 848-1908

A private company contracted by the Federal Insurance Administration as the National Flood Insurance Program Bureau and Statistical Agent, CSC provides information and assistance on flood insurance, including handling policy and claims questions, and providing workshops to leaders, insurance agents, and communities.

Small Business Administration
360 Rainbow Boulevard South, 3rd Floor

Niagara Falls, NY 14303
Disaster Program Director: Win Allred
(716) 282-4612 or 800-659-2955

SBA has the authority to "declare" disaster areas following disasters that affect a significant number of homes and businesses, but that would not need additional assistance through FEMA. (SBA is triggered by a FEMA declaration, however.) SBA can provide additional low-interest funds (up to 20% above what an eligible applicant would "normally" qualify for) to install mitigation measures. They can also loan the cost of bringing a damaged property up to state or local code requirements. Can be used in combination with the new "mitigation insurance" under the NFIP, or in lieu of that coverage.

Environmental Protection Agency
Region I - JFK Federal Building, Government Center,
Boston, MA 02203
(617) 565-3400

- ***Capitalization Grants for State Revolving Funds:*** Low interest loans to governments to repair, replace, or relocate wastewater treatment plants damaged in floods. Does not apply to drinking water or other utilities.
- ***Clean Water Act Section 319 Grants:*** Cost-share grants to state agencies that can be used for funding watershed resource restoration activities, including wetlands and other aquatic habitat (riparian zones). Only those activities that control non-point pollution are eligible. Grants are administered through the CT DEP, Bureau of Water Management, Planning and Standards Division.

U.S. Dept. of Housing and Urban Development
Thomas P. O'Neill, Jr. Federal Building
10 Causeway Street, 3rd Floor
Boston, MA 02222-1092
(617) 994-8200

- ***Community Development Block Grants (CDBG):*** Communities with populations greater than 50,000 contact HUD directly regarding CDGB. One program objective is to improve housing conditions for low- and moderate-income families. Projects can include acquiring flood prone homes or protecting them from flood damage. Funding is a 100% grant; can be used as a source of local matching funds for other funding programs, such as FEMA's "404" Hazard Mitigation Grant Program. Funds can also be applied toward "blighted" conditions, which is often the post-flood condition. A separate set of funds exists for conditions that create an "imminent threat." The funds have been used in the past to replace (and redesign) bridges where flood damage eliminates police and fire access to the other side of the waterway.

U.S. Army Corps of Engineers
Special Studies Branch
424 Trapelo Road
Waltham, MA 02254
(617) 647-8505

Provide 100% funding for floodplain management planning and technical assistance under the Floodplain Management Services Program (FPMS). Various flood protection measures such as beach re-nourishment, stream clearance and snagging projects, floodproofing, and flood preparedness funded on a 50/50 matching basis by Section 22 planning Assistance to States program. They are authorized to relocate homes out of the floodplain if it proves to be more cost effective than a structural flood control measure.

U.S. Department of Commerce
National Weather Service
445 Myles Standish Blvd.
Taunton, MA 02780
(508) 823-2266

Prepares and issues flood, severe weather, and coastal storm warnings. Staff hydrologists can work with communities on flood warning issues and can give technical assistance in preparing flood warning plans.

U.S. Department of the Interior
National Park Service
Rivers and Rails Conservation Program
Regional Office, 15 State Street
Boston, MA 02109
(617) 223-5203

Technical Assistance with open space preservation planning; can help facilitate meetings and identify non-structural options for floodplain development.

U.S. Fish and Wildlife Service
New England Field Office
22 Bridge Street, Unit #1
Concord, NH 03301

Can provide technical and financial assistance to restore wetlands and riparian habitats through the North American Wetland Conservation Fund and partners for Wildlife programs. Also administers the

- ***North American Wetlands Conservation Act Grants Program****:* Provides matching grants to organizations and individuals who have developed partnerships to carry out wetlands projects in the United States, Canada, and Mexico. Funds are available for projects focusing on protecting, restoring, and/or enhancing critical habitat. Projects must support long-term wetlands acquisition, restoration, and/or enhancement, and require a 1-to-1 match. The program includes both Standard Grants (grant requests between $50,001 and $1,000,000) and Small Grants (funds not to exceed $50,000).

Contacts: *Standard Grants proposals*: David Buie (david_buie@fws.gov), (301) 497-5870; *Small Grants Program proposals*: Keith Morehouse (keith_morehouse@fws.gov), (703) 358-1888. *General office number*: (703) 358-1784.

U.S. Department of Agriculture
Natural Resources Conservation Service (formerly SCS)
West Wareham Service Center
15 Cranberry Highway
West Wareham MA, 02576
(508) 295-5151

Technical assistance to individual land owners, groups of landowners, communities, and soil and water conservation districts on land-use and conservation planning, resource development, storm water management, flood prevention, erosion control and sediment reduction, detailed soil surveys, watershed/river basin planning and recreation, fish and wildlife management. Financial assistance is available to reduce flood damage in small watersheds and to improve water quality. Financial assistance is available under the Emergency Watershed Protection Program; the Cooperative River Basin Program; and the Small Watershed Protection Program.

State Resources

Massachusetts Emergency Management Agency (MEMA)
400 Worcester Road
Framingham, MA 01702-5399
(508) 820-2000

The Massachusetts Emergency Management Agency (MEMA) is the state agency responsible for coordinating federal, state, local, voluntary and private resources during emergencies and disasters in the Commonwealth of Massachusetts. MEMA provides leadership to develop plans for effective response to all hazards, disasters or threats; train emergency personnel to protect the public; provide information to the citizenry; and assist individuals, families, businesses and communities to mitigate against, prepare for, and respond to and recover from emergencies, both natural and man-made. MEMA administers FEMA's FMA, HMGP, and PDM programs with DCR.

Massachusetts Executive Office of Energy and Environmental Affairs (EEA)
100 Cambridge St., Suite 900
Boston, MA 02114
(617) 626-1000

The EEA oversees all of the Commonwealth's environmental and energy related departments and offices, including the Department of Agricultural Resources and the Department of Conservation and Recreation. The EEA Office of Grants and Technical Assistance focuses on developing responsible energy practices, conservation of natural resources, and outdoor recreational programs.

The EEA-facilitated ***Municipal Vulnerability Preparedness (MVP)*** program provides support for communities to plan for resiliency and implement key climate change adaptation actions. The state awards funding to complete vulnerability assessments and develop action-oriented resiliency plans using the Community Resiliency Building Framework. Funding is also available to implement actions identified through that process.

Massachusetts Department of Conservation & Recreation (DCR)
251 Causeway Street
Boston, MA 02114
(617) 626-1250

- ***Flood Management Grants*** – DCR's Department of Flood Hazard Management, in coordination with the Massachusetts Emergency Management Agency, offers two grant programs to local government in order to reduce the risks and costs of natural disasters, especially floods, on homeowners and community infrastructure. These programs include pre-disaster grants through the annual Flood Hazard Mitigation Grant Program (FMA) and post-disaster grants through the Hazard Mitigation Grant Program (HMGP).
- ***Rivers and Harbors Grant Program*** – A statewide program of matching grants from DCR's Office of Waterways to towns and municipalities for design and construction to address problems on coastal and inland waterways, lakes and great ponds.

MA Department of Public Safety
One Ashburton Place, Room 1301
Boston, MA 02108
(617) 727-3200

DPS is the lead agency responsible for emergency management. Specific responsibilities include emergency preparedness, response & recovery, homeland security, oversight of MEMA, and oversight of the Board of Building Regulations and Standards.

Massachusetts Historical Commission (MHC)
220 Morrissey Boulevard
Boston, MA 02125
(617) 727-8470

The MHC identifies, evaluates, and protects important historical and archaeological assets in Massachusetts. The MHC works with local preservation groups, provides technical assistance to communities, and promotes preservation through grant programs.

- ***The MHC Survey and Planning Grant Program*** supports completion of cultural resource inventories, nomination of properties to the National Register of Historic Places, completion of community-wide preservation plans, and completion of other studies, reports, publications, and projects.

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- ***The Massachusetts Preservation Projects Fund (MPPF)*** provides funding to assist with pre-development and development projects that involve property stabilization, protection, rehabilitation, and restoration.

Private and Other Resources

The Association of State Floodplain Managers (ASFPM)
4233 W. Belittling Highway
Madison, WI 53711
(608) 274-0123

Professional association of state employees that assist communities with the NFIP with a membership of over 1,000. ASFMP 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.

Climate Action Business Association
131 Cambridge Street
Boston, MA 02114
(617) 624-0919

Helps businesses take targeted action on climate change by providing members with resources and tools to work within their businesses on sustainability efforts, political advocacy, and building a community of shared values. Resources include Small Business Resilience Guides tailored to small businesses in Massachusetts.

Massachusetts Association for Floodplain Management (massFM)
www.massfm.org
massfloodplain@gmail.com

The Massachusetts state chapter of the ASFPM, massFM organizes educational seminars and conferences, helps members stay up to date on the latest regulations, funding opportunities, and state of the practice around floodplain management, and generally serves as a supportive framework for floodplain management in the Commonwealth.

Natural Hazards Center
(303) 492-6818

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

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National Center for Earthquake Engineering and Research
(716) 645-3391

A source for earthquake statistics, research, engineering and planning advice.

National Emergency Managers Association (NEMA)
c/o Council of State Governments
3650 Iron Works Pike, P.O. Box 11910
Lexington, Kentucky 4057-1910
606-244-8000

A national association of state emergency management directors and other emergency management officials. The NEMA Mitigation Committee is a strong voice to FEMA in shaping all-hazard mitigation policy in the nation. NEMA is also an excellent source of technical assistance.

New England States Emergency Consortium (NESEC)
(800) 445-6332

A clearinghouse for mitigation and preparedness information with cooperation from all of the New England states. NESED presents a unique, non-governmental approach to aid. This agency could secure access to private sources of monetary and logistics support.

Insurance Institute for Property Loss Reduction (IIPLR)
73 Tremont Street, Suite 510
Boston, MA 012109-3910
(617) 722-0200

A non-profit organization put together by the insurance industry to research ways of lessening the impact of natural hazard. IIPLR advocates the development and implementation of building codes and standards nationwide and may be a good source of model code language.

Volunteer Organizations
Volunteer organizations, such as the American Red Cross, the Salvation Army, Habitat for Humanity, Interfaith, and the Mennonite Disaster Service are often available to help after disasters. Service Organizations, such as the Lions, Elks, and VFW are also. Habitat for Humanity and the Mennonite Disaster Service Provide skilled labor to help rebuild damaged buildings incorporating mitigation or floodproofing concepts. The office of individual organizations can be contacted directly, or the FEMA Regional Office may be able to assist.

AmeriCorps
AmeriCorps is the recently installed National Community Service Organization. Teams of works can assist with landscaping projects such as surveying, tree planting, restoration, construction and environmental education. Some states have trained AmeriCorps members to help during flood-fight situations, such as filling and placing sandbags.

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Appendices

Appendix A: STAPLEE Mitigation Strategy Matrix
Appendix B: Hazard Mitigation Team Meeting Notes
Appendix C: Public Survey Results
Appendix D: HAZUS-MH Results
Appendix E: Records of Press and Announcements
Appendix F: Documentation of Plan Adoption

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