TOWN OF SHUTESBURY
MULTI-HAZARD MITIGATION PLAN

DECEMBER 2014 PUBLIC REVIEW DRAFT

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Cover photo of damage during the December 2008 ice storm courtesy of the Town of Shutesbury.

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1 - INTRODUCTION

HAZARD MITIGATION

The Federal Emergency Management Agency (FEMA) and the Massachusetts Emergency Management Agency (MEMA) define Hazard Mitigation as any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards such as flooding, storms, high winds, hurricanes, wildfires, earthquakes and other disasters, and man-made hazards such as hazardous material spills. Mitigation efforts undertaken by communities will help to minimize damages to buildings and infrastructure, such as water supplies, sewers, and utility transmission lines, as well as natural, cultural and historic resources.

Planning efforts, like the one undertaken by the Town of Shutesbury's Emergency Management Team (EMT) and the Franklin Regional Council of Governments (FRCOG), make mitigation a proactive process. Pre-disaster planning emphasizes actions that can be taken before a natural or man-made disaster occurs. Future property damage and loss of life can be reduced or prevented by a mitigation program that addresses the unique geography, demography, economy, and land use of a community within the context of each of the specific potential natural hazards that may threaten a community.

Preparing a Multi-Hazard Mitigation Plan before a disaster occurs can save the community money and will facilitate post-disaster funding. Costly repairs or replacement of buildings and infrastructure, as well as the high cost of providing emergency services and rescue/recovery operations, can be avoided or significantly lessened if a community implements the mitigation measures detailed in the Plan. Many disaster assistance agencies and programs, including FEMA, require that a community adopt a pre-disaster mitigation plan as a condition for both mitigation funding and for disaster relief funding. For example, the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance Program (FMA) and the Community Rating System (CRS), are programs with this requirement.

This plan was developed with an open public involvement process. Through this process, the town's risk and vulnerabilities to its hazards have been identified and, with the adoption of the plan, the Town will be implementing a mitigation strategy and commits to making progress towards reducing its risk for the long term.

PLANNING PROCESS

This plan represents the first effort by the Town of Shutesbury to plan for the mitigation of multiple hazards, natural and man-made, that pose a risk to Town and to its inhabitants. The Multi-Hazard Mitigation Planning process for the Town of Shutesbury included the following tasks:

- Identifying the natural and man-made hazards that may impact the community, and past occurrences of hazards at the local or regional level.

- Conducting a Vulnerability/Risk Assessment to identify the infrastructure (i.e., critical facilities, public buildings, roads, homes, businesses, etc.) at the highest risk for being damaged by the identified natural hazards, particularly flooding.

- Identifying and assessing the policies, programs, and regulations a community is currently implementing to protect against future disaster damages. Examples of such strategies include:

    - Preventing or limiting development in natural and man-made hazard areas like floodplains, wetlands, drinking water recharge areas, and conservation land;

    - Implementing recommendations in planning documents including Stormwater Management Plans, Master Plans, Open Space and Recreation Plans, Emergency/Evacuation Plans that address the impacts of natural and man-made hazards;

    - Requiring or encouraging the use of specific structural requirements for new buildings such as buried utilities, flood-proofed structures, and lightening grounding systems;

- Identifying deficiencies in the current strategies and establish goals for updating, revising or adopting new strategies; and

- Identification of specific projects that will mitigate the risk to public safety and damages to infrastructure from hazards.

- Adopting and implementing the final Multi-Hazard Mitigation Plan.

The planning process for the Town of Shutesbury also incorporated the following procedures:

- Providing an opportunity for the public to comment on the plan during the drafting and prior to the approval of the plan. Publicity was done with a press release in the Shutesbury Community Newsletter in [**fill in date**], as well as through flyers posted in town throughout the planning process. A copy of the draft plan was available to the public at the Town Hall, at the M. N. Spear Memorial Library, and on the Town website at www.shutesbury.org. Two Public Meetings were held at the Shutesbury Fire Station: on March 18, 2013 and November 17, 2014. Stakeholder letters were sent out on [**fill in date**] and a two-week Public Review and Comment Period was held from [**fill in dates**]. The comment period was advertised via a press release in the Greenfield Recorder and the Town website, as well as in the community newsletter.

- Providing an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities and agencies that have the authority to regulate development, and businesses, academia and other private and nonprofit organizations to be involved in the planning process by publicizing the planning process. In addition, relevant information that was gathered by the staff of the FRCOG Planning Department

in the course of updating the hazard mitigation plans from surrounding towns in Franklin County was also incorporated into this plan.

- Reviewing and incorporating, if appropriate, existing plans, studies, reports and technical information. Plans reviewed and incorporated are cited in footnotes throughout this plan, and include the following:

    - 2013 Shutesbury Electronic Comprehensive Emergency Management Plan
    - 2012 draft Shutesbury Open Space and Recreation Plan
    - 2004 Shutesbury Community Development Plan
    - 2004 Shutesbury Master Plan
    - Data sources cited in footnotes throughout this Plan

- Documenting the planning process, including how it was prepared, and how the public was involved.

Much of this work was carried out by the staff of the FRCOG Planning Department with the assistance of the Shutesbury Emergency Management Team, which includes the Emergency Management Director and representatives of the Police Department, Board of Health, Select Board, Highway Department, and Shutesbury Elementary School. Meeting minutes, sign in sheets and other correspondence are located in Appendix A, Public Participation Process, at the end of this document. Because this is the first plan developed by the Town of Shutesbury, it does not include the sections on the plan updates and changes or on action items completed from the previous plan that are typically included in updated plans.

2 – LOCAL PROFILE[1]

COMMUNITY SETTING

The town of Shutesbury is a rural community within Franklin County. The southern portion of the town borders other small towns in the Five-College Area, including Pelham and Amherst. The northern portion of the town is adjacent to the boundaries of Leverett, New Salem and Wendell, also very rural communities, and contains the majority of the Lake Wyola watershed. In 2010, the town's population consisted of 1,771 residents within a total land area of 27 square miles or 17,331 acres. Between 1970 and 2000, the town's population more than tripled. However, in the last ten years the population declined slightly by two percent. Shutesbury continues to have a very low density of population relative to its geographic size.

Located in the northeastern portion of the Pioneer Valley region, Shutesbury is one of the hill towns on the eastern flank of the Connecticut River Valley and stretches six miles from north to south and the same distance from east to west at its widest point. The eastern section of town contains a portion of the Quabbin Reservoir's watershed, the main source of municipal water for the City of Boston – precluding commercial and industrial development in this large portion of the town. Unlike several of the surrounding towns, the elevation of Shutesbury—1,225 feet at the benchmark in the center of town and 1,305 feet at the highest point—distinguishes it as an insular area of steep terrain when compared with several of the immediate surrounding towns.

Similar to other towns in western Massachusetts, Shutesbury has witnessed a conversion from an agrarian lifestyle to a largely-residential community whose residents commute elsewhere for their livelihood. Due to the proximity of five major colleges, the population growth that has occurred has resulted from an influx of young families with professional positions affiliated with these institutions, as well as employment at elementary and secondary schools. Although a number of multi-generational families continue to live in town—engaged in forestry and agricultural activities—this percentage of the population has decreased during the past three decades.

According to 2005 MassGIS Land Use data, 90 percent of town is forested. Residential uses comprise two percent of the town's land area, while water and wetlands make up roughly six percent. Because of the large areas of protected open space that occupy the eastern half of town, residential development is concentrated in the western half of town in the following areas: in the town center (an area that possesses an authentic and increasingly rare old New England charm), around Lake Wyola (an area having the highest residential density), in the January Hills area and along the following major roads: Leverett, Wendell, Locks Pond, Montague, West Pelham, Pelham Hill, and Baker. Very little commercial or industrial development is located within Shutesbury.

[1] Much of the information for this section was obtained from Shutesbury's 2012 draft Open Space and Recreation Plan.

INFRASTRUCTURE

Most of the infrastructure in Shutesbury consists of roads and bridges.

Roads and Highways

Shutesbury has 68 miles of roads, 36 percent of which are gravel.[2] The paved roads are Route 202 and most of the main routes through town (Leverett Road, part of Cooleyville Road, part of Wendell Road, Locks Pond Road, Lake Wyola Road, Pelham Hill Road, East Pelham Road, January Hills Road, and Weatherwood Road). Route 202 is a state highway that runs down the eastern side of town and is a major transportation route for traffic traveling from the area east to Boston and north. There are a number of private gravel roads, especially around Lake Wyola, and a few roads in the Quabbin watershed lands maintained by the Massachusetts Department of Conservation and Recreation. There are no bicycle lanes or sidewalks in town, but the roads are frequently used by both bicyclists and pedestrians, and occasionally by those riding horses.

Rail

There are no rail lines that run through Shutesbury.

Public Transportation

There is no regular public transportation in Shutesbury. The Franklin Regional Transportation Authority (FRTA) provides on-demand transportation for the elderly and people with disabilities.

Public Drinking Water Supply

There are five public water supply wells in town, with most homes being on private wells.

Sewer Service

There is no municipal sewer service in Shutesbury, which means that everyone has a private septic system to maintain. The Board of Health does a careful job of making sure new septic systems and wells are properly separated from one another. There has been discussion over the years about constructing a small wastewater treatment plant in the area of Lake Wyola to service the dense development of cottages and year-round houses around the lake located on poor soils with a high water table and having shallow wells.

NATURAL RESOURCES

Shutesbury's landscape is largely composed of steep, heavily-forested ridges that slope to the east in the eastern part of town, rolling, wooded hills and flats in the central and western parts of town and abundant interspersed areas of forested and non-forested wetlands. Approximately 43 percent of Shutesbury is permanently protected from development. Much of this land and water

[2] Massachusetts Department of Transportation, 2007.

is owned by the Massachusetts Department of Conservation and Recreation (DCR) for the protection of the Quabbin Reservoir drinking water supply. Additionally, DCR owns and manages the Lake Wyola State Park/ Carroll A. Homes Recreation Area, the Great Pond portion of Lake Wyola, and the Shutesbury State Forest. These areas are open to the public for recreational use. In addition, the Shutesbury and Amherst Conservation Commissions manage conservation land in Shutesbury, which is also considered permanently protected from development.

Water Resources

Shutesbury benefits from a diversity of water bodies, streams and wetlands that provide wildlife habitat, contribute to public water supplies, provide recreational opportunities, and enhance the town's aesthetics and natural landscapes. Two public agencies have direct interests in maintaining the high quality of water in the Quabbin Reservoir and Atkins Reservoir. Large areas of town are owned and maintained as protected watersheds by the Division of Water Supply Protection of the Massachusetts Department of Conservation and Recreation (DCR) and the Town of Amherst. In addition to three large lakes, there are several ponds, numerous beaver impoundments and a number of streams in Shutesbury.

Watersheds and Surface Waters

Surface water in the western half of town is part of the Connecticut River Watershed, drains to the west, and is composed of the Adams Brook Sub-watershed, the Sawmill Brook Sub-watershed, and the Roaring Brook Sub-watershed, as well as a small section of Amethyst Brook that drains south into the Fort River in Amherst. This small section of Amethyst Brook is located in the south-central section of town just north of the border with Pelham, and is tributary to a public water supply for the Town of Amherst, the Hawley Hill Intake (which is located in Pelham). The headwaters of Amethyst Brook contain both forested and non-forested wetlands. Surface water in the eastern half of town is part of the Chicopee River Watershed, drains to the southeast, and is composed of the Swift River Sub-watershed. Within these sub-watersheds, the Sawmill River, Roaring Brook, Dean Brook, Nurse Brook, Adams Brook, the West Branch of the Swift River, Atherton Brook, Camel Brook, Cobb Brook and Amethyst Brook have been designated by the Massachusetts Department of Fish and Game (DFG) as cold-water fisheries and are considered to be high-quality trout streams.

Aquifers

An aquifer is an underground body of water that is typically found in layers of sand deposited during the glacial period. When it rains heavily, a large percentage of water infiltrates the soil, slowly migrating down to the saturated zone. The area between the saturated zone and the unsaturated zone is known as the water table of the aquifer. When more rain enters the aquifer than is taken out, the water table rises. The US Geological Survey (USGS) and the Office of Massachusetts Geographic Information Systems (MassGIS) have mapped subsurface conditions that support low to medium yield aquifers. According to the USGS and MassGIS there are low- to medium yield aquifers located in the vicinity of the following water bodies:

- Lake Wyola and Ames Pond;

- Dudleyville marsh;
- West Branch of the Swift River;
- Roaring Brook; and,
- Dean Brook.

Low to moderate yield aquifers could provide enough water for a small community supply. It is estimated by DEP that low to medium yield aquifers can produce 0-50 gallons per minute (gpm).

Flood Hazard Areas

Flooding along rivers is a natural occurrence. Floods happen when the flow in the river exceeds the carrying capacity of the channel. Some areas along rivers flood every year during the spring, while other areas flood during years when spring runoff is especially high, or following severe storm events. The term "floodplain" refers to the land affected by flooding from a storm predicted to occur at a particular interval. For example, the "100-year floodplain" is the area predicted to flood as the result of a very severe storm that has a one percent chance of occurring in any given year. Similarly, the 500-year floodplain is the area predicted to flood in a catastrophic storm with a 1 in 500 chance of occurring in any year.

The Shutesbury Flood Insurance Rate Map (FIRM), dated June 18, 1980 identifies the Special Flood Hazard Areas in Shutesbury, shown as Zones A and A1. These include Lake Wyola, the West Branch of the Swift River, Dudleyville Pond, and the Atkins Reservoir. Baker Road is also identified in the 2014 eCEMP as a flood prone area. The Flood Plain Overlay District Bylaw was adopted in November 2012 to help ensure an adequate quality and quantity of water, regulating land uses in all special flood hazard areas.

According to 2005 MassGIS land use data, there are 27 dwellings located on 7.4 acres of Shutesbury's 233 total acres of floodplain.

Forests

The Town includes large blocks of contiguous forest which provide critical habitat for many wildlife species as well as providing for many of Shutesbury's available recreational opportunities. Evergreen forests of pine and hemlock dominate the lowland and riparian areas north and east of Atkins Reservoir; the areas along Dean Brook, Baker Brook and Roaring Brook; the area northeast of the Dudleyville Marsh and eastward to South Brook; and the area southeast of Ames Pond. Deciduous forests dominate uplands and drier, south-facing slopes on the north-south trending ridge located in the center of town and along the Leverett town line, just north of Leverett Road. The forests today are dominated by red oak, black oak, red maple, white pine, eastern hemlock, and black birch. American beech, white birch, yellow birch, sugar maple, quaking aspen, white ash, white oak and black cherry are also present. In addition, pioneer species, such as alders and gray birch, are often present in areas that have opened up when trees have fallen or been cut. Mountain laurel, witch hazel, highbush blueberry, lowbush blueberry, sassafras and other shrubs comprise the understory in many places. In contrast to the forces that shaped Shutesbury's forests over its past history, the major current threat to the forest is the hemlock wooly adelgid, which could decimate a large portion of the mixed-woods forest.

CULTURAL AND HISTORIC RESOURCES

The importance of integrating cultural resource and historic property considerations into hazard mitigation planning is demonstrated by disasters that have occurred in recent years, such as Hurricane Katrina in New Orleans, floods in the Midwest, and the June 2011 tornado in Springfield, Massachusetts. The effects of a disaster can be extensive—from human casualties to property and crop damage to the disruption of governmental, social, and economic activity. Often not measured, however, are the possibly devastating impacts of disasters on historic properties and cultural resources. Historic structures, artwork, monuments, family heirlooms, and historic documents are often irreplaceable, and may be lost forever in a disaster if not considered in the mitigation planning process. The loss of these resources is all the more painful and ironic considering how often residents rely on their presence after a disaster, to reinforce connections with neighbors and the larger community, and to seek comfort in the aftermath of a disaster.[3]

Historic properties and cultural resources can be important economic assets, often increasing property values and attracting businesses and tourists to a community. While preservation of historic and cultural assets can require funding, it can also stimulate economic development and revitalization. Hazard mitigation planning can help forecast and plan for the protection of historic properties and cultural resources.

Cultural and historic resources help define the character of a community and reflect its past. These resources may be vulnerable to natural hazards due to their location in a potential hazard area, such as a river corridor, or because of old or unstable structures. Currently, there are no resources in Shutesbury that are listed on the National Register of Historic Places. However, there are over 183 historic resources in town that are listed in the Massachusetts Cultural Resource Information System (MACRIS) database, and are of historic significance to the town. The 2014 Shutesbury electronic Comprehensive Emergency Management Plan (eCEMP) identifies cultural resources in Town (Table 2-1).

Table 2-1: 2014 Shutesbury eCEMP Cultural Resources

Resource Name	Resource Location	Resource Type
Cemetery	Pratt Corner Road	Cemetery
Cemetery Commission/Carriage House	158 Leverett Road	Cemetery; Historical building
DCR State Park	94 Lakeview Road	Historical building
Historical Commission	3 West Pelham Road	Archives; Historical building; Museum, artifacts
Jewish Cemetery of Amherst	218 Leverett Road	Cemetery
Locke's Village Cemetery	386 Lockes Pond Road	Cemetery
Shutesbury Congregational Church	Town Common Road	Archives; Historical building
Spear Memorial Library	10 Cooleyville Road	Library
Town Hall	1 Cooleyville Road	Archives; Historical building
Town Hall Annex	12 Wendell Road	Archives; Historical building

Source: 2014 Shutesbury eCEMP.

[3] Integrating Historic Property and Cultural Resource Considerations Into Hazard Mitigation Planning, State and Local Mitigation Planning How-To Guide, FEMA 386-6 / May 2005.

COMMUNITY FACILITIES AND RESOURCES

It is important for communities to determine which areas or specific populations in their community may need special attention in times of an emergency. In addition to the infrastructure previously described, these critical facilities are identified on the Critical Facilities and Infrastructure Map at the end of Section 3.

Critical Facilities

A community's critical facilities include important municipal structures (i.e., town hall), emergency service structures (i.e., municipal public safety complex, shelters, and medical centers), and locations of populations that may need special assistance (i.e., nursing homes, day cares, schools, prisons) and major employers or other areas where there is a dense concentration of people. The 2014 Shutesbury electronic Comprehensive Emergency Management Plan (eCEMP) identifies the following facilities as either public venues, special institutions, critical infrastructure, or shelters:

- Lake Wyola Association Building (peak population 500; shelter)
- Shutesbury Athletic Club (peak population 500)
- Camp Pinebrook (peak population 200)
- Morse Hill Recreation Area (peak population 100)
- DCR State Park
- Shutesbury Elementary School (peak population 205; shelter)
- Temenos (peak population 40)
- Town Hall (reception center)
- Police Department
- Fire Station
- WMUA – 91FM radio tower
- Shutesbury Post Office
- Solar Arrays (three located at 1 Cooleyville Road, 23 West Pelham Road, and 42 Leverett Road)

Multi-Hazard Emergency Shelters

The eCEMP for Shutesbury "outlines an emergency management program for planning and response to potential emergency or disaster situations," which includes emergency shelters to accommodate victims of disaster events. The Shutesbury eCEMP identifies two potential shelters within town: Shutesbury Elementary School and the Lake Wyola Association Building. According to the Emergency Management Director, the elementary school has a 100 kW back-up generator on-site that was installed in August 2012 and will power the entire school. The Turners Falls High School is identified in the eCEMP as a regional mass care shared facility.

The EMT should periodically review the available shelters to determine each shelter's potential occupancy, accessibility via evacuation routes, susceptibility to hazards (such as floods and high winds), access to back-up utilities, and available supplies. The Town uses Connect CTY, public address system on emergency vehicles, a town e-mail list, and door-to-door as warning and notification methods to alert residents of emergency conditions and instructions.

3 - HAZARD IDENTIFICATION & ANALYSIS

HAZARD IDENTIFICATION

Historical research, conversations with local officials and emergency management personnel, available hazard mapping and other weather-related databases were used to identify the hazards which are most likely to have an impact on the Town of Shutesbury. It should be noted that because different sources of data are used for various hazards, the year of most recent information available may vary from one hazard to another. In all cases the most recent information available at the time that work was done on this plan was used.

Two hazards, drought and temperature extremes, historically have not been significant hazards for Shutesbury. These hazards are no more likely to occur in Shutesbury than elsewhere in the state. Therefore, drought and extreme temperatures were not covered in detail in this plan, other than a summary of these two hazards, which is presented, below.[4] For more information on these hazards, please refer to the recently updated Massachusetts State Hazard Mitigation Plan (2013).[5]

Drought is a period characterized by long durations of below normal precipitation. Drought conditions occur in virtually all climatic zones yet its characteristics vary significantly from one region to another, since it is relative to the normal precipitation in that region. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life. The Commonwealth of Massachusetts is often considered a 'water-rich' state. Abundant precipitation results from frontal systems or storms that move across the continent and exit through the Northeast. Under normal conditions, regions across the state annually receive between 44 and 47 inches of precipitation.

There is no universal definition for extreme temperatures. The term is relative to the usual weather in the region based on climatic averages. Extreme heat, for this climatic region, is usually defined as a period of 3 or more consecutive days above 90 °F, but more generally a prolonged period of excessively hot weather, which may be accompanied by high humidity. Extreme cold, again, is relative to the normal climatic lows in a region. Temperatures that drop decidedly below normal and wind speeds that increase can cause harmful wind-chill factors. The wind chill is the apparent temperature felt on exposed skin due to the combination of air temperature and wind speed. Massachusetts has four well-defined seasons. The seasons have several defining factors, with temperature one of the most significant. Extreme temperatures can be defined as those that are far outside of the normal ranges for Massachusetts.

[4] Adapted from the 2013 Massachusetts State Hazard Mitigation Plan.
[5] http://www.mass.gov/eopss/agencies/mema/hazard-mitigation/planning/planning-and-the-state-hazard-mitigation-plan.html

Floods

General Description

The average annual precipitation for Shutesbury and the Connecticut River Valley region is 46 inches.[6] There are three major types of storms that bring precipitation to Shutesbury. Continental storms that originate from the west continually move across the region. These storms are typically low-pressure systems that may be slow-moving frontal systems or more intense, fast-moving storms. The second major storm type are coastal storms. There are two kinds that bring major precipitation and wind – nor'easters and hurricanes. Nor'easters bring heavy rain, high winds, ice storms or blizzards into New England from the coast of Maine and Canada. In late summer or early fall, hurricanes may reach Massachusetts from the south and result in significant amounts of rainfall. The third type of storm is the result of local convective action. Thunderstorms that form on warm, humid summer days can cause locally significant rainfall.

Floods are classified as either *flash floods*, which are the product of heavy, localized precipitation in a short time period over a given location or *general floods*, which are caused by precipitation over a longer time period in a particular river basin. There are several local factors that determine the severity of a flooding event, including: stream and river basin topography, precipitation and weather patterns, recent soil moisture conditions, amount of impervious surface area, and the degree of vegetative clearing. Floods occur more frequently and are one of the most costly natural hazards in the United States.

Flash flooding events typically occur within minutes or hours after a period of heavy precipitation, after a dam or levee failure, or from a sudden release of water from an ice jam. Most often, flash flooding is the result of a slow-moving thunderstorm or the heavy rains from a hurricane. In rural areas, flash flooding often occurs when small streams spill over their banks. However, in urbanized areas, flash flooding is often the result of clogged storm drains (leaves and other debris) and the higher amount of impervious surface area (roadways, parking lots, roof tops).

In contrast, *general flooding* events may last for several days. Excessive precipitation within a watershed of a stream or river can result in flooding particularly when development in the floodplain has obstructed the natural flow of the water and/or decreased the natural ability of the groundcover to absorb and retain surface water runoff (e.g., the loss of wetlands and the higher amounts of impervious surface area in urban areas).

A floodplain is the relatively flat, lowland area adjacent to a river, lake or stream. Floodplains serve an important function, acting like large "sponges" to absorb and slowly release floodwaters back to surface waters and groundwater. Over time, sediments that are deposited in floodplains develop into fertile, productive farmland like that found in the Connecticut River valley. In the past, floodplain areas were also often seen as prime locations for development. Industries were located on the banks of rivers for access to hydropower. Residential and commercial development occurred in floodplains because of their scenic qualities and proximity to the water.

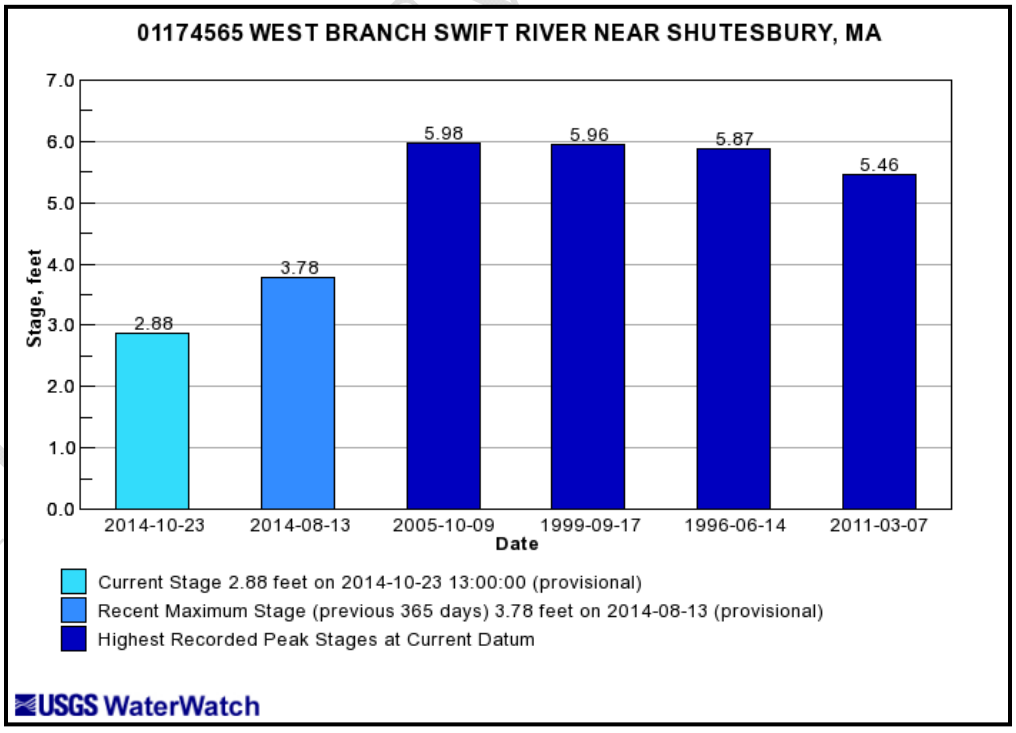
[6] Massachusetts Department of Conservation and Recreation precipitation data, http://www.mass.gov/dcr/watersupply/rainfall/index.htm.

Although periodic flooding of a floodplain area is a natural occurrence, past and current development and alteration of these areas may increase property damage caused by flooding.

Fluvial erosion hazard (FEH) zones are areas along rivers and streams that are susceptible to bank erosion caused by flash flooding. Any area within a mapped FEH zone is considered susceptible to bank erosion during a single severe flood or after many years of slow channel migration. While the areas of the FEH zones often overlap with areas mapped within the 100-year floodplain on Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) or Flood Hazard Boundary Maps (FHBMs), the FIRMs or FHBMs only show areas that are likely to be inundated by floodwaters that overtop the riverbanks during a severe flood. However, much flood-related property damage and injuries is the result of bank erosion that can undermine roads, bridges, building foundations and other infrastructure. Consequently, FEH zones are sometimes outside of the 100-year floodplain shown on FIRMs or FHBMs. FEH zones can be mapped using fluvial geomorphic assessment data as well as historic data on past flood events. Both the FIRMs and FEH maps should be used in concert to understand and avoid both inundation and erosion hazards, respectively.[7]

Location and Extent

Franklin County has several major rivers and numerous tributaries which are susceptible to flood events. The major rivers in the region include the Connecticut, the Deerfield, and the Millers. The West Branch of the Swift River, which flows through Shutesbury, is in the Chicopee River Watershed. The graph below shows the four high flow events on the West Branch of the Swift River in Shutesbury.[8] There is no listed flood stage for this gage.



[7] *Ammonoosuc River Fluvial Erosion Hazard Map for Littleton, NH*. Field Geology Services, 2010.
[8] http://waterwatch.usgs.gov/index.php?r=ma&id=ww_flood

Flooding poses a significant threat to life and public health and can cause severe property damage. Table 3-1 shows occurrences of flooding in Franklin County since 1993 through 2013, taken from NOAA data. The NOAA database does not include specific flood events in the Town of Shutesbury during this period. Information regarding historical flood events in Shutesbury was provided by the EMT and can be found in this section and throughout the plan.

Table 3-1: Flood Events in Franklin County Since 1993

Year	# of Flood Events	Annual Property Damage	Annual Crop Damage
2013	0	$0	$0
2012	2	$0	$0
2011	8	$22,275,000	$0
2010	1	$150,000	$0
2009	0	$0	$0
2008	3	$38,000	$0
2007	1	$250,000	$0
2006	0	$0	$0
2005	5	$11,435,000	$0
2004	2	$10,000	$0
2003	1	$10,000	$0
2002	0	$0	$0
2001	1	$0	$0
2000	1	$0	$0
1999	0	$0	$0
1998	4	$75,000	$0
1997	0	$0	$0
1996	11	$1,800,000	$0
1995	3	$0	$0
1994	2	$0	$0
1993	5	$0	$0
Total # of Years	**Total # of Flood Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
21	**50**	**$720,860**	**$0**

Source:
http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=10&endDate_dd=31&endDate_yyyy=2013&eventType=%28C%29+Flood&county=FRANKLIN&zone=ALL&submitbutton=Search&statefips=25%2CMASSACHUSETTS

In October 2005, rains from Tropical Storm Tammy and a subtropical depression caused severe flooding in New England, with Massachusetts sustaining $6.5 million in damages. A trailer park in Greenfield was destroyed, leaving 70 people homeless. Roads were washed out as more than 20 inches of rain fell on some areas of the region.

Flood in Greenfield, MA, October 2005

On August 27 and 28, 2011, Tropical Storm Irene brought heavy rain to the region, causing extensive and long term damage to Franklin County towns. According to the National Weather Service, up to 9.9 inches of rain fell during the storm, though amounts varied significantly across Franklin County. Rivers, streams, and brooks throughout the county reached and surpassed flood levels. Rising water gathered debris that clogged culverts, roads and bridges were washed out, and homes and businesses were flooded, and in some cases, literally washed downriver. After the storm, Franklin, Berkshire, Hampshire and Hampden Counties were declared a disaster area by President Obama, freeing up federal funds to assist towns with emergency work and road, bridge, and facility repairs. Up to 75 percent of repair costs can be covered by federal funds, as well as the cost of approved hazard mitigation efforts.

Impacts from Tropical Storm Irene to some towns in Franklin County were severe, particularly in Shelburne Falls, Colrain, Hawley, Conway and Charlemont. A section of Route 2 west of Charlemont washed out and the road was closed until mid-December. Total projected losses for Franklin County from the storm are estimated to be approximately $25,325,000. FEMA preliminary damage assessment (PDA) from the storm totals a cost of $27,713,911 statewide for municipal public damage, not including damage incurred by state-owned infrastructure. Franklin County's PDA estimates a total of $22,816,077 in damages, or 82% of ages, or 82% of the cost of all local public damage statewide.

Generally, officials in Shutesbury reported that they were very lucky and were not hit as hard as surrounding towns by Tropical Storm Irene. The Town experienced a limited power loss after the storm, but emergency response officials indicated that this was most likely a result of power company efforts to restore power to other towns that were more seriously impacted by the storm. Emergency response officials had management experience from dealing with the December 2008 ice storm and they monitored the situation throughout the storm. Water levels at the Wyola Dam were managed through multiple adjustments to the gates. The flow monitor of the West Branch of the Swift River peaked out at 1000 CFS, and officials estimated that Lake Wyola got about half of that amount. Trees were reported down around Town, including on Pratt Corner Road. The big impact of the storm was the failure of a Montague Road culvert that caused the road to wash out. The culvert was replaced with a larger one with a flat bottom and an arch at the top under difficult circumstances as the flooding from the storm continued. Mutual aid from the Town of Leverett was extremely helpful in addressing this problem. An emergency passage for 4-wheel drive vehicles only was cut through Carver Road due to 80 households being stranded until emergency access could be gained through Montague Road again. The old stone culvert at the Baker Reservoir has a history of being over-capacity and was overrun during Tropical Storm Irene. As a result, the Baker Reservoir started overtopping the earthen retaining wall. The Camel Brook culvert on Cooleyville Road also washed out, which the Highway Department Superintendent reported occurred 8-10 times between 1999 and 2011, including two years in a row in 2010 and 2011. Because of this history, the culvert was replaced with a larger culvert in 2012 to address the ongoing flood concerns. The bridges on Cooleyville Road at the Shutesbury/New Salem Town Line were also replaced, due to advanced rot in the timbers and planking.

In Shutesbury, the 100-year floodplain covers roughly 233 acres, or approximately 1.4 percent of the town, including an estimated 7.4 acres of land developed for residential use. In addition to

the 100-year floodplain, there are a number of areas in Shutesbury where localized flooding is a problem. The Shutesbury Comprehensive Emergency Management Plan identifies the area around Lake Wyola and Baker Road as flood prone areas in town. On June 13, 1996 a reported 5-7 inches of rain drenched the Lake Wyola area, while the Town Center remained basically dry. The Town of Leverett was particularly hard hit by the rain storm, and both Leverett and Shutesbury declared states of emergency.[9] (Note that this storm also resulted in one of the four highest recorded peak stages reported above for the West Branch of the Swift River.) Other key areas of concern include the following:

- The Locks Pond Road culvert located approximately 100 feet from the Lake Wyola Dam spillway is in need of replacement. In 2009, the culvert was found to be in disrepair, and likely not capable of conveying the design flood of the dam spillway, putting the road at risk of being washed out.[10]
- The Wendell Road culvert north of Locks Pond was incorrectly installed on private property.
- The Ames Brook culvert is an old stone culvert that needs repair. Previous engineering studies that recommended replacement of the culvert were reported by the EMT to be "too intense" for the neighbors.
- The Baker Road culvert is a concern due to a history of the Baker Reservoir overtopping the earthen retaining wall.

Potential Mitigation Measures for Floods

- Replace the Locks Pond Road culvert with one that would be capable of conveying the design spillway flood of the Lake Wyola Dam.
- Replace the Baker Road culvert.
- Replace the Wendell Road culvert north of Locks Pond Road.
- Repair the Ames Brook culvert on Wendell Road.

Severe Winter Storms

General Description

Severe winter storms can pose a significant risk to property and human life because the rain, freezing rain, ice, snow, cold temperatures and wind associated with these storms can disrupt utility service, phone service and make roadways extremely hazardous. Severe winter storms can be deceptive killers. The types of deaths that can occur as a result of a severe winter storm include: traffic accidents on icy or snow-covered roads, heart attacks while shoveling snow, and hypothermia from prolonged exposure to cold temperatures. Infrastructure and other property are also at risk from severe winter storms and the associated flooding that can occur following heavy snow melt. Power and telephone lines, trees, and telecommunications structures can be damaged by ice, wind, snow, and falling trees and tree limbs. Icy road conditions or roads blocked by fallen trees may make it difficult to respond promptly to medical emergencies or fires. Prolonged, extremely cold temperatures can also cause inadequately insulated potable

[9] "FEMA rejects disaster bid," Daily Hampshire Gazette, June 21, 1996.
[10] *Report of Internet-Based Project Database*, Milone and MacBroom, Inc. 2010.

water lines and fire sprinkler pipes to rupture and disrupt the delivery of drinking water and cause extensive property damage.

Severe winter storms can include blizzards, heavy snow, sleet, freezing rain and ice storms. A blizzard is a severe snowstorm characterized by strong winds and low temperatures. The difference between a blizzard and a snowstorm is the strength of the wind. To be a blizzard, a snow storm must have sustained winds or frequent gusts that are greater than or equal to 56 km/h (35 mph) with blowing or drifting snow which reduces visibility to 400 meters or a quarter mile or less and must last for a prolonged period of time — typically three hours or more.[11] Snowfall amounts do not have to be significant. A severe blizzard has winds over 72 km/h (45 mph), near zero visibility, and temperatures of −12 °C (10 °F) or lower. A ground blizzard has snowdrifts and blowing snow near the ground, but no falling snow.[12] Blizzards can bring near-whiteout conditions, and can paralyze regions for days at a time, particularly where snowfall is unusual or rare. Freezing Rain is rain that falls as a liquid but freezes into glaze upon contact with the ground.[13] Heavy Snow generally means snowfall accumulating to 4" or more in depth in 12 hours or less; or snowfall accumulating to 6" or more in depth in 24 hours or less.[14] Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces. Heavy sleet is a relatively rare event defined as an accumulation of ice pellets covering the ground to a depth of approximately ½" or more.[15] The term ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous. Significant ice accumulations are usually accumulations of approximately ¼" or greater.[16]

Location and Extent

Franklin County regularly experiences severe winter storm events between the months of December and April. The entire town of Shutesbury is equally susceptible to severe winter storms. According to the National Climatic Data Center (NCDC), there have been a total of 115 snow and ice events reported in Franklin County between 1993 and 2013, including heavy snow, snow, ice storms, snow squalls, freezing rain and winter storms.[17] The NCDC web site has more detailed information about each of the listed storms. Ten out of the 115 snow and ice events that impacted Franklin County (as well as other areas of Massachusetts) resulted in Presidential Disaster Declarations or Emergency Declarations, which then made the state, residents and businesses eligible for federal disaster relief funds. Table 3-2 lists the seventeen events that have led to Presidential Disaster or Emergency Declarations in Massachusetts that affected Franklin County, including ten severe winter disasters.

[11] http://w1.weather.gov/glossary/index.php?letter=b
[12] http://www.britannica.com/EBchecked/topic/69478/blizzard
[13] http://w1.weather.gov/glossary/index.php?letter=f
[14] http://w1.weather.gov/glossary/index.php?letter=h
[15] http://w1.weather.gov/glossary/index.php?letter=s
[16] http://w1.weather.gov/glossary/index.php?letter=i
[17] NOAA National Climatic Data Center, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms.

Table 3-2: Presidential Disaster Declarations Impacting Franklin County, 1985-2013

Disaster Name	Date of Event	Declared Areas	Disaster #/ Type of Assistance	Federal Share Disbursed
Hurricane Gloria	September 1985	Barnstable, Berkshire, Bristol, Dukes, Essex, Franklin, Hamden, Hampshire, Middlesex, Norfolk, Plymouth, Suffolk, and Worcester Counties	FEMA-751-DR	N/A
Severe Storms, Flooding	March 1987	Berkshire, Essex, Franklin, Hampden, Hampshire, and Middlesex Counties	FEMA-790-DR	N/A
Blizzards, High Winds and Record Snowfall	March 1993	All 14 Counties	FEMA-3103-EM (PA)	$1,284,873
Blizzard	January 1996	All 14 Counties	FEMA-1090-EM (PA)	$16,177,860
Snowstorm	March 2001	Counties of Berkshire, Essex, Franklin, Hampshire, Middlesex, Norfolk, and Worcester.	FEMA-3165-EM (PA)	$21,065,441
Snowstorm	February 2003	All 14 Counties.	FEMA-3175-EM (PA)	$28,868,815
Snowstorm	December 2003	Counties of Barnstable, Berkshire, Bristol, Essex, Franklin, Hampden, Hampshire, Middlesex, Norfolk, Plymouth, Suffolk, and Worcester	FEMA-3191-EM (PA)	$35,683,865
Snowstorm	January 2005	All 14 Counties	FEMA-3201-EM (PA)	$49,945,087
Hurricane Katrina Evacuation	August 2005	All 14 Counties	FEMA-3252-EM	$5,854,973
Severe Storms & Flooding	October 2005	Berkshire, Bristol, Franklin, Hampden, Hampshire Middlesex, Norfolk, Plymouth, and Worcester Counties	FEMA-1614-DR	$7,207478 (obligated)
Severe Winter Storm	December 2008	Berkshire, Bristol, Essex, Franklin, Hampden, Hampshire, Middlesex, Suffolk, and Worcester	FEMA-3296-EM-MA	$66,509,713 *(Figure as of 9/8/2009)
Severe Storms and Flooding	December 2008	5 counties (Berkshire, Franklin, Hampden, Hampshire, and Worcester Counties)	FEMA-1813-DR-MA(PA)	$32,058,172
Severe Storms, Inland & Coastal Flooding	April 2007	Barnstable, Berkshire, Dukes, Essex, Franklin, Hampden, Hampshire, and Plymouth Counties	FEMA-1701-DR	$8,309,448 (obligated)
Tropical Storm Irene	August 27-29, 2011	Berkshire, Franklin, Hampden, Hampshire, Norfolk, Bristol, Plymouth, Barnstable, Martha's	FEMA-4028-DR	$26,620,515

Disaster Name	Date of Event	Declared Areas	Disaster #/ Type of Assistance	Federal Share Disbursed
		Vineyard, and Nantucket Counties		
Severe Storm and Snowstorm	October 2011	Berkshire, Franklin, Hampden, Hampshire, Middlesex, and Worcester Counties	FEMA-4051-DR (PA)	$71,927,443 (obligated)
Hurricane Sandy	October 2012	All 14 Counties	FEMA-3350-EM	$8,540,428 (obligated)
Severe Winter Storm, Snowstorm and Flooding	February 8-9, 2013	All 14 Counties	FEMA-DR-4110	$16,474,989 (obligated)

Notes: Public Assistance (PA) Project grants. Supplemental disaster assistance to states, local governments, certain private non-profit organizations resulting from declared major disasters or emergencies.

Source: http://www.fema.gov/disasters/grid/year (Accessed 1-30-14) and the Commonwealth of Massachusetts 2013 State Hazard

Although ice storms occur much less frequently than snow storms (4 out of 115 in the NCDC database), the effects can be devastating. On December 11, 2008, Franklin County residents awoke to a landscape coated with ice. Half an inch of ice accumulated on exposed surfaces across Franklin County. This major ice storm affected interior Massachusetts and southern New Hampshire as well as much of northern New England. The ice buildup on exposed surfaces combined with breezy conditions resulted in numerous downed trees, branches, and power lines, which resulted in widespread power outages. More than 300,000 customers were reportedly without power in Massachusetts and an additional 300,000 were without power in the state of New Hampshire. Because of the breadth of this storm (from Pennsylvania to Maine), extra crews to reinstate power were harder to come by. Power crews from states as far away as South Carolina, as well as local National Guard teams, were called out to help with power restoration and clean up. While most people had their power restored within a week, others were still without power at Christmas (nearly 2 weeks later).

Shutesbury was greatly impacted by the 2008 ice storm. All roads became impassable due to downed trees and power lines, and the town declared a state of emergency. Residents were without power for days, some for over a week after the storm. The Town used its newly established reverse call system to provide residents with information on the conditions in town. The Town Hall was set up as a shelter, and it is estimated that 75-100 residents visited the shelter during the emergency. The Town called in professional tree removal crews to

help with the clean up. In addition, the Massachusetts Department of Conservation and Recreation and the Massachusetts National Guard sent help to Shutesbury. The storm cost the Town roughly $70,000 in overtime, gasoline, shelter expenses, and expenses for hiring the tree removal companies.[18] FEMA reimbursed the Town $64,535 in FY2009 for the December 2008 ice storm, and an additional $12,292 was received in FY 2011 and FY 2012 from MEMA for the storm.

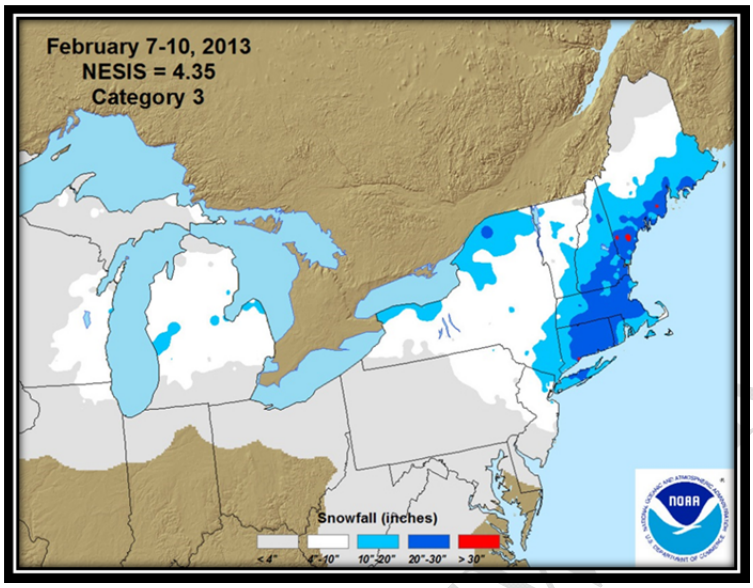
During this period in 2008, temperatures were mostly below normal and at least one major snowstorm affected the same area. At the time of the December 19th snowstorm, which dumped 7–12 inches of snow in eastern Franklin County and 9–14 inches of snow in western part of the county, over 100,000 customers were still without power in the two states combined. Two days later, on December 21, 5–7 inches of new snow blanketed eastern Franklin County.

The severe winter storm that hit Franklin County on October 29, 2011 was a rare and historic nor'easter that brought very heavy snow to portions of southern New England and is sometimes referred to as the "Snowtober" storm. Snowfall accumulations of one to two feet were common in the Monadnocks, Berkshires, Connecticut Valley, and higher elevations in central Massachusetts. Snowfall rates reached 3 inches per hour for several hours during the storm. The accumulation of the heavy wet snow on trees that still had their leaves and on power lines resulted in widespread tree damage and power outages across many communities in central and western Massachusetts. At the peak, 665,000 customers in Massachusetts were without power. Seventy-seven shelters were opened and sheltered 2,000 residents across the state. A state of emergency was declared on October 29, officially ending on November 6. In Shutesbury, residents around Lake Wyola experienced power outages of a couple of days following the storm. Other affected areas included the lower west section of the Atkins Reservoir, lower Pratt Corner Road, and January Hills Road. This storm resulted in reimbursements to Shutesbury of $1,232 from MEMA and $7,884.32 from FEMA in FY 2011.

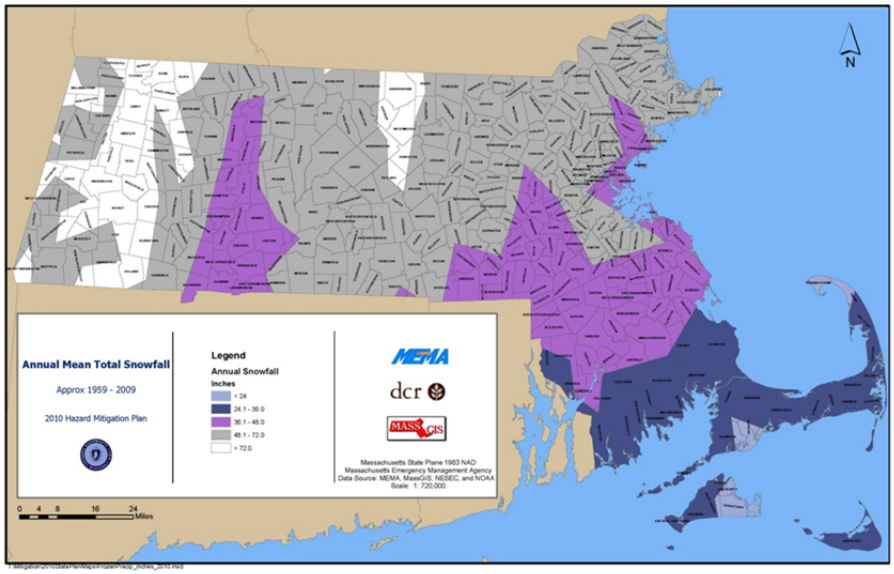
Not all severe winter storms result in Presidential Disaster Declarations or Emergency Declarations although damage to property and infrastructure, fatalities, and interruptions to critical services and businesses can occur as a result of these events. The Northeast Snowfall Impact Scale (NESIS) developed by Paul Kocin and Louis Uccellini of the National Weather Service (Kocin and Uccellini, 2004) characterizes and ranks Northeast snowstorms that have a large geographic impact. NESIS has five categories: Extreme (5), Crippling (4), Major (3), Significant (2), and Notable (1). The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. Thus NESIS gives an indication of a storm's societal impacts. This scale was developed because of the impact Northeast snowstorms can have on the rest of the country in terms of transportation and economic impact.[19] The NESIS database includes 47 storms, many of which have dumped at least 10-20 inches on Franklin County towns. The database also includes maps of the affected areas, as demonstrated below.[20] Because of the rural nature of the county, a storm classified as Extreme or Crippling for the affected area may not

[18] "It was a heck of a week," Janice S. Gray. *Our Town: Tri-annual Community News.* Winter 2009.
[19] http://www.ncdc.noaa.gov/snow-and-ice/nesis.php
[20] http://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis

have had as devastating an impact on the towns in Franklin County. However, the severity of these storms and their impact on Franklin County, neighboring counties and other New England states may affect the availability of disaster relief services.



The 2010 Massachusetts State Hazard Mitigation Plan included a map of Mean Annual Snowfall for the period 1959-2009. This map shows that many of the towns in western Franklin County receive the greatest amount of annual snowfall in the state. The mean annual snowfall for the Town of Shutesbury is between 48.1 and 72 inches. The entire town is vulnerable to the effects of winter storms, and roof collapses from accumulated snow loads are a concern. The EMT reports that there were three roof collapses in 2001, including the Lake Wyola Association building, as a result of "cumulative heavy snowstorms" through the winter. In addition, the EMT raised particular concerns about the roof of the elementary school, which underwent emergency repairs in 2006, and was re-analyzed in the winter of 2014. The roof is reported to be structurally sound, but continues to leak.



Hurricanes and Tropical Storms

General Description

Hurricanes are violent rainstorms with strong winds that can reach speeds of up to 200 miles per hour. Hurricanes generally occur between June and November and can result in flooding and wind damage to structures and above-ground utilities. August, September, and the first half of October are when most hurricanes occur in New England. The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures.[21]

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: http://www.nhc.noaa.gov/aboutsshws.php

Tropical storms, defined as having sustained winds from 34-73 mph, have also resulted in damages to buildings and infrastructure from the high winds and flooding associated with these storms.

Location and Extent

In Massachusetts, major hurricanes occurred in 1904, 1938, 1954, 1955, 1960 and 1976, 1985, 1991 and 2010. The Great New England Hurricane of 1938, a Category 3 hurricane which occurred on September 21, 1938, was one of the most destructive and powerful storms ever to strike Southern New England. Sustained hurricane force winds occurred throughout most of Southern New England. Extensive damage occurred to roofs, trees and crops. Widespread power outages occurred, which in some areas lasted several weeks. Rainfall from this hurricane resulted in severe river flooding across sections of Massachusetts and Connecticut. The

[21] National Weather Service National Hurricane Center: http://www.nhc.noaa.gov/aboutsshws.php.

combined effects from a frontal system several days earlier and the hurricane produced rainfall of 10 to 17 inches across most of the Connecticut River Valley. This resulted in some of the worst flooding ever recorded in this area. The most recent hurricane to make landfall in Franklin County was Hurricane Bob, a weak category 2 hurricane, which made landfall in New England in August 1991. In Franklin County, Hurricane Bob caused roughly $5,555,556 in property and crop damages.[22]

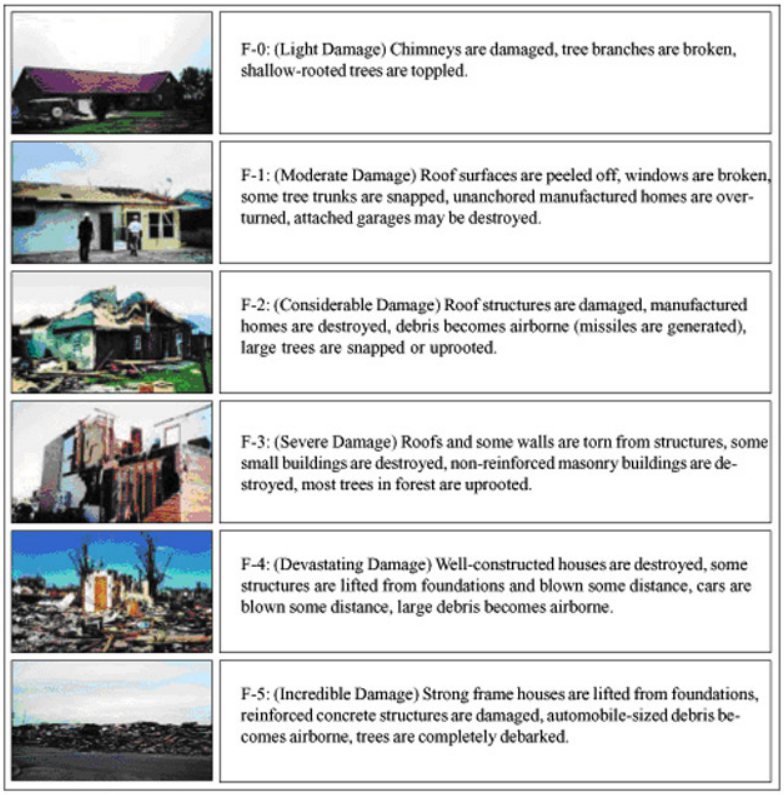
Tropical storms, defined as having sustained winds from 34-73 mph, have also resulted in high winds and damages in Franklin County. Between 1990 and 2008, 16 tropical storms impacted the County, causing almost $600,000 in property damages.[23] Tropical Storm Irene hit Franklin County on August 28, 2011, resulting in over $22 million in property damages from flooding and an additional $3,050,000 in other, mostly wind-related, damage.[24] In Shutesbury, there were trees on wires around Town, but the EMT reports that the impacts were limited due to the tree work that had been done following the 2008 ice storm and the lack of tall structures. However, there were significant enough damages to result in reimbursements to the Town of $1,011.99 from MEMA and $29,673.50 from FEMA.

The entire Town of Shutesbury is at risk to the effects of hurricanes and tropical storms.

Tornados, Microbursts and Thunderstorms

General Description

The category of Tornados and Microbursts includes thunderstorm events, and associated storm effects including hail and lightning. Tornados are swirling columns of air that typically form in the spring and summer during severe thunderstorm events. In a relatively short period of time and with little or no advance warning, a tornado can attain rotational wind speeds in excess of 250 miles per hour and can cause severe devastation along a path that ranges from a few dozen yards to over a mile in width.



The Enhanced Fujita Scale, implemented in February 2007, is used by meteorologists to rate tornado

[22] Spatial Hazard Events and Losses Database (SHELDUS), http://webra.cas.sc.edu/hvri/.
[23] Ibid.
[24] Hazards & Vulnerability Research Institute (2012). The Spatial Hazard Events and Losses Database for the United States, Version 10.0 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org.

damage on a scale from EF0 to EF5. The EF Scale incorporates more damage indicators and degrees of damage than the original Fujita Scale, allowing more detailed analysis and better correlation between damage and wind speed.[25]

The path of a tornado may be hard to predict because they can stall or change direction abruptly. Within Massachusetts, tornados have occurred most frequently in Worcester County and in communities west of Worcester, including towns in eastern Franklin County. High wind speeds, hail, and debris generated by tornados can result in loss of life, downed trees and power lines, and damage to structures and other personal property (cars, etc.).

Microbursts are another type of wind storm that are of concern. Microbursts often do tornado-like damage and can be mistaken for tornados. In contrast to the upward rush of air in a tornado, a microburst is a small, strong downdraft or downburst of wind descending vertically from a thunderstorm.[26] Both vertical and horizontal wind shears can be present and can be extremely hazardous to aircraft, property, and individuals. Due to their small size, short life span, and the fact that they can occur over areas without surface precipitation, microbursts are not easily detectable using conventional weather radar or wind shear alert systems. These strong horizontal winds occur within a few hundred feet of the ground.[27]

This category also includes thunderstorm events, and associated storm effects including strong winds, hail and lightning. Three key ingredients need to be present for a thunderstorm to form: moisture, rising unstable air, and a surface feature to lift the unstable air, such as a hill or mountain. Hot, humid conditions are very favorable for a thunderstorm occurrence. These conditions help generate the strong updrafts that feed hot, humid air into thunderstorms. The moist, unstable air rises and condenses into a cloud and, when electrical charges build up enough inside the cloud, energy is discharged in the form of a bolt of lightning, causing the sound waves heard as thunder.

The National Weather Service defines a severe thunderstorm as having large hail, at least 3/4 inches (0.75 inches) in diameter, and/or damaging winds, at least 58 mph, or 50 knots, which would be a 10 on the Beaufort Wind Scale.[28] The Beaufort wind scale is a standard scale, running from force 0 for calm to force 12 hurricane and above for the description of wind speed. Each value represents a specific range and classification of wind speeds with accompanying descriptions of the effects on surface features. It was originally developed as a system for estimating wind strengths without the use of instruments. The Beaufort wind scale was introduced in 1806 by Admiral Sir Francis Beaufort (1774-1857) of the British navy to describe wind effects on a fully rigged man-of-war frigate of the period, and it was later modified to include descriptions of effects on land features as well. It is currently still in use for this same purpose as well as to tie together various components of weather (wind strength, sea state, observable effects) into a unified picture.[29]

[25] More information on the Fujita Scale can be found at: http://www.spc.noaa.gov/faq/tornado/f-scale.html.
[26] http://www.fs.fed.us/r3/sfe/newsroom/2003/July/07-17-03MediaAdvisoryMicroBursts.html
[27] http://www.nwas.org/committees/avnwxcourse/teachl5.htm
[28] http://www.erh.noaa.gov/box/sevwxdef.html
[29] http://www.weatheronline.co.uk/reports/wxfacts/The-Beaufort-Scale.htm

Beaufort Scale

Beaufort number	Wind Speed (mph)	Seaman's term		Effects on Land
0	Under 1	Calm		Calm; smoke rises vertically.
1	1-3	Light Air		Smoke drift indicates wind direction; vanes do not move.
2	4-7	Light Breeze		Wind felt on face; leaves rustle; vanes begin to move.
3	8-12	Gentle Breeze		Leaves, small twigs in constant motion; light flags extended.
4	13-18	Moderate Breeze		Dust, leaves and loose paper raised up; small branches move.
5	19-24	Fresh Breeze		Small trees begin to sway.
6	25-31	Strong Breeze		Large branches of trees in motion; whistling heard in wires.
7	32-38	Moderate Gale		Whole trees in motion; resistance felt in walking against the wind.
8	39-46	Fresh Gale		Twigs and small branches broken off trees.
9	47-54	Strong Gale		Slight structural damage occurs; slate blown from roofs.
10	55-63	Whole Gale		Seldom experienced on land; trees broken; structural damage occurs.
11	64-72	Storm		Very rarely experienced on land; usually with widespread damage.
12	73 or higher	Hurricane Force		Violence and destruction.

Source: http://www.mountwashington.org/education/center/arcade/wind/beaufort_scale_tbp.gif

A typical thunderstorm produces periods of heavy rain and can last anywhere from 30 minutes to an hour. In cases where air is very unstable, severe thunderstorms can produce damaging winds, lightning, large hail, and sometimes microbursts. Lightning is always present in thunderstorms and can strike structures, trees, and individuals, potentially causing fire, injury, and even death. Lightning often strikes outside of heavy rain and may occur as far as 10 miles away from a thunderstorm center, increasing its unpredictability and risk to individuals and property. Hail is a form of precipitation that occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice.[30] Hail falls when the thunderstorm's updraft weakens and can no longer support the weight of the ice particles. The

[30] http://www.nssl.noaa.gov/primer/hail/hail_basics.html

stronger the updraft the larger the hailstone can grow. Since 1955, NOAA has reported hailstone sizes between one half and two inches.[31]

Location and Extent

Since the 1950s, there have been over twenty tornados in Franklin County. In the last fifteen years, four tornados have been reported in Franklin County, in the towns of Heath, Charlemont, Wendell, and New Salem, as shown on Table 3-3 below. No tornados have been recorded in Shutesbury.

Table 3-3: Tornado Events in Franklin County, 1995-2013

Date	Location	Hazard Type	Injuries	Fatalities	Property Damage	Crop Damage	Remarks
7/3/1997	Heath	Tornado	0	0	$ 50,000	$0	F1 Tornado
7/3/1997	Charlemont	Tornado	0	0	$ 50,000	$0	F1 Tornado
7/11/2006	Wendell	Tornado	0	0	$ 200,000	$0	F2 Tornado
9/1/2013	New Salem	Tornado	0	0	$0	$0	EFO Tornado; waterspout over the Quabbin Reservoir

Source: NOAA National Climate Data Center at http://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Tornado&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1995&endDate_mm=07&endDate_dd=31&endDate_yyyy=2014&county=FRANKLIN&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=25%2CMASSACHUSETTS

The July 2006 tornado in Wendell was rated F2 (Strong) on the Fujita Scale with winds estimated near 155 mph, and causing $200,000 in property damage.[32] While the likelihood of a tornado touching down in Shutesbury is low, an occurrence could cause damage along a path anywhere in town, including damage to the built and natural environment and potential injury to citizens.

On June 1, 2011, a tornado ripped through western and central Massachusetts, killing one person and injuring four others. In an area where tornados are rare, this event was a reminder that tornados do, in fact, impact the region. The fearsome storm downed trees, ripped roofs from hundreds of homes, and damaged many historic properties, causing property damage in excess of $24 million in towns such as Westfield, Springfield, and Monson. On June 15, President Obama signed a disaster declaration for Hampden and Worcester counties which provided federal funds for affected residents and properties. In August, the Department of Energy Resources (DOER) announced more than $8 million to help building owners affected by the June 1 tornados rebuild using energy efficiency practices and renewable energy technologies. Administered in partnership with the Massachusetts Clean Energy Center (MassCEC), the program—known as ReBuild Western Massachusetts—is designed to assist home and building owners who sustained documented structural damage as a result of the June 1 storms. For building owners, the incentives include energy efficiency financing, energy efficiency improvement grants, and renewable energy grants.

[31] http://www.ncdc.noaa.gov/stormevents/

[32] NOAA National Climatic Data Center Storm Events Database website: http://www.ncdc.noaa.gov/stormevents/.

Preservation groups—including Preservation Massachusetts and the Springfield Preservation Trust—have assisted hardest hit communities, especially Springfield and Monson. In part, these preservation groups are helping to inventory properties and to encourage towns not to rush to demolish historic structures. The groups are also offering a list of resources properties owners can consult to assist them in making decisions about repairing historic properties. MEMA also conducted a briefing for historic property owners and encouraged representatives of Historical Commissions, Historical Societies, libraries, museums, and other non-profit organizations dedicated to preserving historic structures communicate with town officials and FEMA and MEMA staff throughout the disaster recovery process.

Historic properties in Monson (left) and Springfield were hard hit by a June 1, 2011 tornado.

"Gustnado" is a slang term for a short-lived, ground-based, shallow, vortex that develops on a gust front associated with either thunderstorms or showers. Gustnadoes have been known to cause damage in Franklin County; however none have been reported in Conway. In 2009, a gustnado destroyed a tobacco barn and downed trees in the nearby Town of Sunderland. According to NOAA, a gustnado may only extend to 30 to 300 feet above the ground with no apparent connection to the convective cloud above. They may be accompanied by rain, but usually are 'wispy', or only visible as a debris cloud or dust whirl at or near the ground. Wind speeds can reach 60 to 80 mph, resulting in significant damage, similar to that of a F0 or F1 tornado. However, gustnadoes are not considered to be a tornado, and in some cases, it may be difficult to distinguish a gustnado from a tornado. Gustnadoes are not associated with storm-scale rotation (i.e. mesocyclones) that is involved with true tornadoes; they are more likely to be associated visually with a shelf cloud that is found on the forward side of a thunderstorm.

The aftermath of the gustnado that destroyed this Sunderland barn in 2009.

Compared with other Franklin County towns, damages in general to Shutesbury due to tornado-type events are relatively low. There was no impact to the Town of Shutesbury from any tornados during the reporting period.

The entire Town of Shutesbury is at risk to the effects of tornados, microbursts, and thunderstorms. As shown in Tables 3-4 and 3-5, thunderstorms are common in the region and in the Town of Shutesbury. Table 3-5 shows data supplied by the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center for high wind events in Franklin County between 1993 and 2013. A "high wind" event is defined by NOAA as one with sustained wind speeds of 40 mph or greater (at least 8 on the Beaufort scale) lasting for 1 hour or longer, or winds of 58 mph or greater (at least 10 on the Beaufort scale) for any duration. One high wind event on October 29, 2006 resulted in numerous instances of downed or uprooted trees and large branches blocking roadways throughout Franklin County. During this storm, a tree fell on a motorcyclist in Deerfield, resulting in a fatality.

Table 3-4: High Wind Events in Franklin County, 1993-2013

Year	# of High Wind Events	Annual Property Damage	Annual Crop Damage
2013	2	$35,000	$0
2012	0	$0	$0
2011	0	$0	$0
2010	0	$0	$0
2009	0	$0	$0
2008	0	$0	$0
2007	0	$0	$0
2006	5	$1,928,000	$0
2005	1	$305,000	$0
2004	1	$340,000	$0
2003	2	$1,350,000	$0
2002	0	$0	$0
2001	0	$0	$0
2000	0	$0	$0
1999	1	$0	$0
1998	0	$0	$0
1997	0	$0	$0
1996	2	$0	$0
1995	5	$0	$0
1994	4	$5,050,000	$0
1993	3	$550,000	$0
# of Years	**Average # of High Wind Events per Year**	**Average Annual Property Damage**	**Average Annual Crop Damage**
21	**1.24**	**$455,143**	**$0**

Note: No High Wind events were recorded prior to 1999 when this information was updated as of November 5, 2014. The NOAA database has been undergoing upgrades and no longer has most of the older data listed.
Source: NOAA National Climatic Data Center Storm Events Database, http://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+High+Wind&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=07&endDate_dd=31&endDate_yyyy=2014&county=FRANKLIN&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=25%2CMASSACHUSETTS.

Thunderstorm events with high winds have been reported by NOAA in or near Shutesbury six times since 1991, including strong winds with property damage in July 2014, as shown in Table 3-5. The EMT also reported power outages due to winds from Hurricane Sandy in late October 2012 on Pratt Corner, Baker and Montague Roads.

Table 3-5: Thunderstorm Wind Events in Shutesbury, 1991-2014

Date	Property Damage	Crop Damage	Description
7/3/1997	$0	$0	
6/10/2008	$10,000	$0	Trees were downed by thunderstorm winds.
7/18/2008	$6,000	$0	Trees and wires on Cooleyville Road were downed by thunderstorm winds. One tree fell onto a car.
5/26/2010	$25,000	$0	This storm resulted in significant wind damage throughout the Connecticut River Valley.
7/16/2010	$20,000	$0	Thunderstorm winds brought down large limbs on Wendell Road, and wires down on Silver Lane.
7/7/2014	$3,000	$0	Large limbs were downed onto wires on West Pelham Road.

Source: NOAA National Climatic Data Center Storm Events Database, http://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Thunderstorm+Wind&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1991&endDate_mm=07&endDate_dd=31&endDate_yyyy=2014&county=FRANKLIN&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=25%2CMASSACHUSETTS

Microbursts have been reported as having been associated with four thunderstorm events in Franklin County since 1994, according to NOAA, none of which took place in Shutesbury.[33] However, the EMT reported that the microburst that hit Leverett on July 9, 1997 also affected Shutesbury. A line of severe thunderstorms marched across the state from west to east, reaching the Connecticut River Valley just before 3:00 PM, affecting towns in Hampden, Hampshire, and Franklin Counties with heavy rains and winds causing downed trees. Hail was also reported in some locations. During this storm, North Laurel Drive washed out at the north end of Lake Wyola, leaving a five-foot deep hole, and there were mudslides reported in Leverett.

On May 26, 2010, as a result of being pummeled by microburst storms that ripped through the region, Greenfield declared a state of emergency. All public schools were closed and many roads were closed to all but emergency vehicles. More than 100 reports of downed trees, utility poles, and wires were received. The storms left more than 27,000 Western Massachusetts Electric Co. customers in the region without power. Assessment by the Greenfield DPW of total costs of the storm to the Town of Greenfield are approximately $98,000 while costs to private home owners are estimated to be about $150,000.

Wildfires and Brushfires

General Description

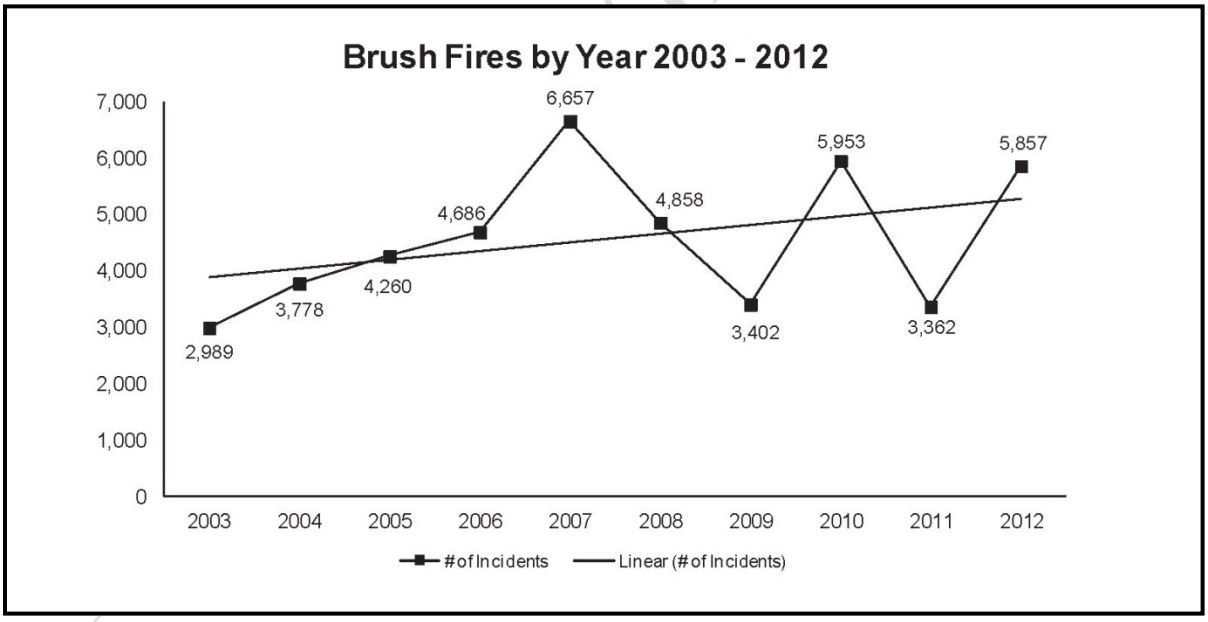
According to FEMA, there are three different classes of wildfires: *surface fires*, *ground fires* and *crown fires*.[34] The most common type of wildfire is a surface fire that burns slowly along the

[33] http://www.ncdc.noaa.gov/stormevents/
[34] FEMA, "Fact Sheet: Wildland Fires," September 1993.

floor of a forest, killing or damaging trees. A ground fire burns on or below the forest floor and is usually started by lightening. Crown fires move quickly by jumping along the tops of trees. A crown fire may spread rapidly, especially under windy conditions.

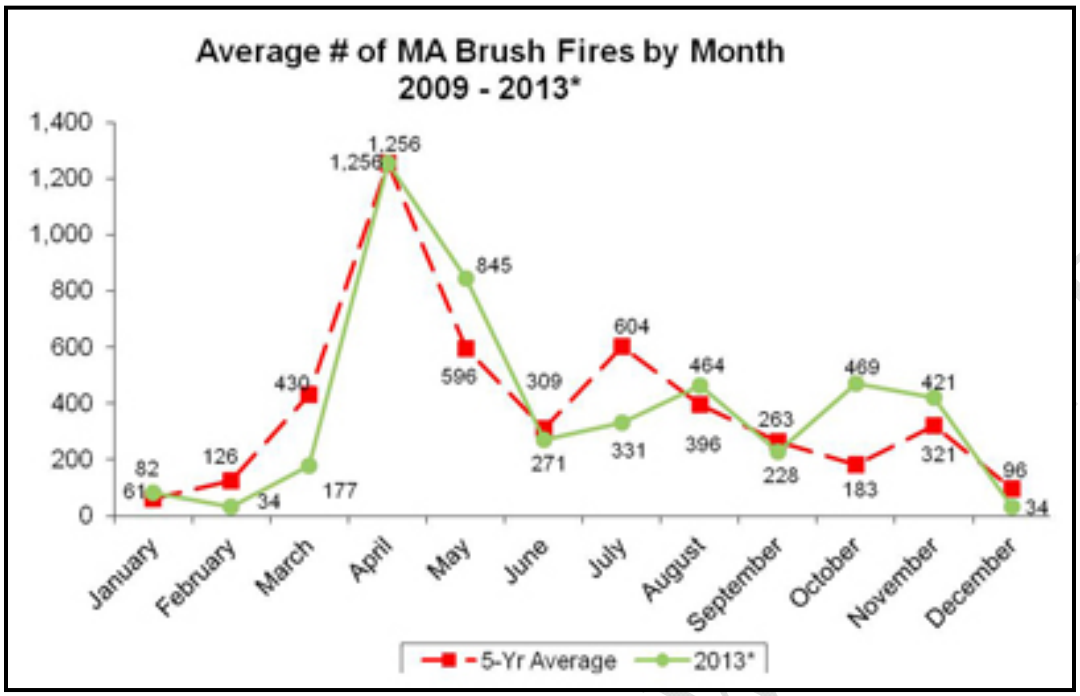
While wildfires have not been a significant problem in Shutesbury there is always a possibility that changing land use patterns and weather conditions will increase a community's vulnerability. For example, drought conditions can make forests and other open, vegetated areas more vulnerable to ignition. While moderate drought conditions were experienced in the western half of the state in July 2011, they were back to normal by October. Historically, drought has not been a problem in the Town of Shutesbury.

Once a fire starts, it will burn hotter and be harder to extinguish. Soils and root systems starved for moisture are also vulnerable to fire. Residential growth in rural, forested areas increases the total area that is vulnerable to fire and places homes and neighborhoods closer to areas where wildfires are more likely to occur. The statewide trend for outside and other fires seems to be developing a 'wave' pattern where the number of these types of fires rises or 'crests' every two to three years mostly due to the dry and hot weather patterns in the spring and summer that allow for an increased vulnerability of vegetation to brush fires.[35] In 2012, the reported number of brush fires in Massachusetts increased by 2,495 or 74%, from the 3,362 reported in 2011. 2012 had an abnormally dry winter and spring.[36] April is historically the month with the most brush fires as the snow pack recedes, the ground has not greened up, and people are engaged in open burning as part of the spring clean-up.[37]



Source: Massachusetts Fire Incident Reporting System 2011, p.79:
http://www.mass.gov/eopss/docs/dfs/osfm/firedata/mfirs/2012annualreporttext.pdf

[35] Massachusetts Fire Incident Reporting System 2011, p.13:
http://www.mass.gov/eopss/docs/dfs/osfm/firedata/mfirs/2011-annual-report-text.pdf
[36] Massachusetts Fire Incident Reporting System 2012, p.79:
http://www.mass.gov/eopss/docs/dfs/osfm/firedata/mfirs/2012annualreporttext.pdf
[37] http://www.mass.gov/eopss/agencies/dfs/dfs-press-releases/april-4-2014-state-fire-marshal-urges-caution-pr-.html



Source: http://www.mass.gov/eopss/agencies/dfs/dfs-press-releases/april-4-2014-state-fire-marshal-urges-caution-pr-.html

Location and Extent

The entire Town of Shutesbury is at risk to the effects of wildfires and brushfires, especially where the built environment intersects with the forested landscape. The many forested areas of Town represent some of the Town's most important natural resource areas and open space assets that are vulnerable to wildfires. Franklin County is at a low fire risk, according to MEMA data, except for drought years when the risk may increase to moderate. Forest fires could be a significant factor in the years following a major storm that brings down trees and branches, as happens, for example, after a hurricane or major ice storm.

Between 2001 and 2013, eight brushfires were reported in Shutesbury.[38] This is compared to an average 33 fires per town during the same time period countywide (See Table 3-6). One memorable brushfire mentioned by the EMT occurred approximately 20 years ago on Pratt Corner Road. In 2011, Shelburne Control issued 275 burn permits in Shutesbury. Shutesbury has approximately 15,555 acres of forests, comprising 90% of the Town's total land area, and is therefore at risk of fire.

Lightning can also be a cause of wildfires, brush fires, and structural fires. In June of 2005 severe thunderstorms accompanied by lightning affected portions of western Massachusetts, northeast Massachusetts, and southwest New Hampshire. During the storm, lightning struck the basement of a ranch style house in Deerfield, causing $50,000 of structural damage to the house.[39]

[38] Massachusetts Fire Incident Reporting System (MFIRS), Massachusetts Department of Fire Services.
[39] NOAA National Climate Data Center, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

The EMT reported a significant number of lightning strikes over the years in Shutesbury due to the Town's elevation and topography. Leverett Road and Montague Road have experienced multiple strikes over the years. Twenty-five years ago a garage on West Pelham Road was struck by lighting and there were other structure fires caused by lighting in the distant past. In 2001, there were four lightning strikes reported, one resulting in a medical call. Nine years ago, the Fire Department was hit by lightning and the fume evacuation system was blown out. A Pelham Hill Road underground propane storage tank (UST) with 500 gallons of propane was damaged in a strike on September 29, 2003. Five years ago a strike on Cooleyville Road followed the phone line along the road. More recently, according to NOAA, on July 3, 2014, a house was struck by lightning on Great Pines Drive in Shutesbury, which ignited a fire. There have been numerous lightning strikes over the years that have resulted in damage but have not necessarily been reported to the Fire Department and many that have resulted in structure fires in neighboring towns to which the Fire Department responded to provide mutual aid.

Table 3-6 provides brush fire data for the Town from 2001 to 2013 as reported by the Shutesbury Fire Chief:

Table 3-6: Shutesbury Brushfires 2001-2013

Year	Brush Fire	Illegal burn	Mutual Aid Brush Fire
2001	6	N/A	2
2002	1	N/A	3
2003	4	N/A	2
2004	0	7	3
2005	1	1	1
2006	1	1	6
2007	0	1	7
2008	3	0	1
2009	2	2	3
2010	4	4	9
2011	0	5	2
2012	0	0	4
2013	1	2	1
Totals	**23**	**23**	**44**

Areas of concern, or critical facilities, such as schools and senior housing complexes are important to identify because these populations may need special assistance in times of an emergency caused by wildfire. In Shutesbury, these areas include the Lake Wyola Association Building (peak population 500; Shutesbury Athletic Club (peak population 500); Camp Pinebrook (peak population 200); Morse Hill Recreation Area (peak population 100); Shutesbury Elementary School (peak population 205); and Temenos (peak population 40).

Dam Failures

General Description

Although dams and their associated impoundments provide many benefits to a community, such as water supply, recreation, hydroelectric power generation, and flood control, they also pose a potential risk to lives and property. Dam failure is not a common occurrence but dams do represent a potentially disastrous hazard.

When a dam fails, the potential energy of the stored water behind the dam is instantly released, oftentimes with catastrophic consequences as the water rushes in a torrent downstream flooding an area engineers refer to as an "inundation area." The number of casualties and the amount of property damage will depend upon the timing of the warning provided to downstream residents, the number of people living or working in the inundation area, and the number of structures in the inundation area.

Many dams in Massachusetts were built in the 19th century without the benefit of modern engineering design and construction oversight. Dams can fail because of structural problems due to age and/or lack of proper maintenance. Dam failure can also be the result of structural damage caused by an earthquake or flooding brought on by severe storm events. Dams can also be damaged when beavers place a dam across the spillway, causing water to overtop the dam. This is particularly true if it is an earthen dam and can cause significant flooding.

The Massachusetts Department of Conservation and Recreation (MA DCR) is the agency responsible for regulating dams in the state (M.G.L. Chapter 253, Section 44 and the implementing regulations 302 CMR 10.00). Until 2002, DCR was also responsible for conducting dam inspections, when state law changed to place the burden of inspections on the owners of the dams. In accordance with the new regulations, which went into effect in 2005, dam owners must register, inspect and maintain dams in good operating condition. Owners of High Hazard Potential dams and certain Significant Hazard Potential dams are also required to prepare, maintain and update Emergency Action Plans. State legislation is currently pending that would set up a loan fund to assist owners in inspecting and maintaining their dams.

The state has three hazard classifications for dams:

- *High Hazard Potential*: Dams located where failure or improper operation will likely cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways, or railroads.
- *Significant Hazard Potential*: Dams located where failure or improper operation may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways or railroads or cause interruption of use or service of relatively important facilities.
- *Low Hazard Potential*: Dams located where failure or improper operation may cause minimal property damage to others. Loss of life is not expected.

Owners of dams are required to hire a qualified engineer to inspect and report results using the following inspection schedule:

- Low Hazard Potential dams – 10 years
- Significant Hazard Potential dams – 5 years
- High Hazard Potential dams – 2 years

The time intervals represent the maximum time between inspections. More frequent inspections may be performed at the discretion of the state. Dams and reservoirs licensed and subject to inspection by the Federal Energy Regulatory Commission (FERC) are excluded from the provisions of the state regulations provided that all FERC-approved periodic inspection reports are provided to the DCR. FERC inspections of high and significant hazard projects are conducted on a yearly basis. All other dams are subject to the regulations unless exempted in writing by DCR.

Beaver Dams

Along with manmade dams, failure of beaver dams can cause flooding as well. Alteration of the landscape by beavers is a natural process that creates habitat for shore birds, mammals and rare amphibians. However, beaver ponds can flood structures, roads and utilities, causing costly and potentially dangerous situations. Beaver activity can also pollute drinking water supplies. Mitigation measures suggested by Massachusetts Division of Fish and Wildlife (MassWildlife) and other agencies can help communities and homeowners deal with nature's master builders.

Until 1996, when a ballot initiative passed restricting the practice, Massachusetts residents were permitted to trap beavers. That change in policy caused a spike in the beaver population, which, in turn, led to a sharp increase in complaints about beaver activity and its effects. The law was modified in 2000 so that town Board of Health members could issue emergency trapping permission outside of the usual trapping season. But an increased beaver population, combined with land development reducing beaver habitat, means that humans and beavers continue to clash. Several mitigation measures, when applied thoughtfully, legally and with maintenance measures in mind, can help with beavers' negative effects, while preserving beavers' positive impact on the land.

Several bills have recently been under consideration with the State Legislature which would give individuals and towns additional options when they are having issues with beavers. Under these bills, a special permit could be obtained from the State Department of Fisheries and Wildlife. The bills do not aim to repeal the bill that bans trapping but rather allows the issuing of an emergency permit under the provisions allowed within the laws of the State. The proposed bills also call for the State to begin keeping better records of all permits issued and how many beavers are trapped each year. By 2013, the bills had stalled and no further action.

An increased beaver population, combined with land development reducing beaver habitat, means that humans and beavers continue to clash. Several mitigation measures, when applied thoughtfully, legally and with maintenance measures in mind, can help with beavers' negative effects, while preserving beavers' positive impact on the land.[40]

[40] *Otsego County* (NY) *All Hazards Mitigation Plan*, 2010.

State law makes it illegal for any person to disturb or tear open a beaver dam or beaver lodge without written permission from MassWildlife and the local Conservation Commission or Department of Environmental Protection. Permits are needed to disturb a beaver dam for any reason in Massachusetts. Even dams that cause flooding require permits to be breached.[41]

While trapping beaver can have short-term benefits, the right conditions for beaver habitat will eventually lure new beavers. It may be best to combine trapping with measures that discourage beaver activity that's bad for humans. Techniques used to mitigate the flooding damage caused by beaver include breaching of beaver dams, protecting road culverts with fences or guards, and controlling water levels with water flow devices. All these techniques require a certain degree of effort and regular maintenance to insure water levels that can be tolerated (thereby preserving the positive aspects of the associated wetland). See the MassWildlife publication *The Use of Water Flow Devices and Flooding Problems Caused by Beaver in Massachusetts* for details on these mitigation measures. The following techniques were adapted from that publication.

- Dam breaching is an immediate but very short-term solution to flooding problems caused by beaver. Potato hoes or stone hooks are the best tools for dismantling dams by hand. Shovels and spading forks are ineffective. Good water control is possible if the breach is kept shallow and broad so that the water level falls slowly. Opening a deep breach creates a dangerous situation and may cause serious flooding and erosion downstream. Tractor- or truck-mounted excavators may be used by town, county or state highway employees to remove large amounts of material from beaver dams but care should be taken to avoid downstream flooding. Neighbors should be told where, when, and why a dam excavation is going to be done. If the method is justified and must be used, it is best done in mid-summer when the water level is low.
- Beavers build dams instinctively. When they sense running water, they start to build or repair dams. Culverts, especially ones made out of metal, will amplify the sound of the water rushing through them. Thus, beaver will commonly block road culverts with sticks, mud and rocks. This can cause flooding upstream. Culverts blocked from the inside are difficult to clean and potentially dangerous. The use of meshes and grills, placed on both the upstream and downstream ends of the culvert, can prevent beavers from entering. Several strategies are listed in *The Use of Water Flow Devices and Flooding Problems Caused by Beaver in Massachusetts.*
- Water Level Control Devices (WLCDs) keep beavers away from an intake pipe that lowers the water level of the pond. It's been estimated that only 4.5% of beaver problems in Massachusetts will respond to these devices. Using and maintaining a WLCD in conjunction with trapping young beavers can allow coexistence for years. Several types of WLCDs are available. For construction details, see *The Use of Water Flow Devices and Flooding Problems Caused by Beaver in Massachusetts.*

Location and Extent

In January of 2011, the MA DCR Office of Dam Safety provided information about dams in Shutesbury, as shown on Table 3-7.

[41] Langlois, S.A. and T.A. Decker. 2004. *The Use of Water Flow Devices and Flooding Problems Caused by Beaver in Massachusetts* (Rev. Ed.). MA Division of Fisheries and Wildlife. 18pp.

Table 3-7: MA DCR Office of Dam Safety Data

Dam Name	Hazard Code	Impoundment Name	River	Year Built	E10 - Overall Physical Condition of the Dam	Date of Most Recent Phase I Report	Latest Emergency Inspection Date	Ownership Type	Primary Owner
Atkins Reservoir Dam	High	Atkins Reservoir	Cushman Tributary of Connecticut	1930	FAIR - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to critical parameters.	7/14/10		Municipality or Political subdivision	Town of Amherst, Department of Public Works
Atkins Reservoir Dike	Low	Atkins Reservoir	Adams Brook	1932	FAIR - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to critical parameters.	8/22/06		Municipality or Political subdivision	Town of Amherst, Department of Public Works
Lake Wyola Dam	High	Lake Wyola	Sawmill River	1883	FAIR - Significant operational and maintenance deficiencies, no structural deficiencies. Potential deficiencies exist under unusual loading conditions that may realistically occur. Can be used when uncertainties exist as to critical parameters.	12/7/06	10/28/05	Municipality or Political subdivision	Town of Shutesbury, Board of Selectmen
Dudleyville Pond Dam	Significant	Dudleyville Pond	Tributary of Sawmill River	1900	UNSAFE - Major structural, operational, and maintenance deficiencies exist under normal operating conditions.	11/29/06	4/26/07	Private	Lois Brown

According to data provided by the Office of Dam Safety in January 2011, the Atkins Reservoir Dam, the Atkins Reservoir Dike, and the Lake Wyola Dam were considered to be in fair condition, while the Dudleyville Pond Dam was considered to be unsafe, due to major structural, operational, and maintenance deficiencies under normal operating conditions. According to the EMT, there is now a pond/wetland at this location due to a partial dam breach.

The current Shutesbury eCEMP identifies the Lake Wyola Dam and the Atkins Reservoir Dam as high hazard dams in Shutesbury. The Dudleyville Pond Dam is identified as a significant hazard dam, and the Ames Pond Upper Dam and the Baker Reservoir Dam are classified as low hazard dams in town. The Atkins Reservoir Dam and Dike are owned by the Town of Amherst, the Lake Wyola Dam is owned by the Town of Shutesbury, while the Dudleyville Pond Dam is privately owned. No information was provided by DCR for the Baker Reservoir Dam or the Ames Pond Dam. Repairs were made to the Lake Wyola Dam in 2009. At the time of these repairs, a culvert under Locks Pond Road located approximately 100 feet downstream of the dam spillway was found to be in disrepair. If the dam were to overtop, the culvert may not be capable of conveying all of the flood water, and would put the road at risk of being washed out.

The location of beaver dams deemed by the EMT to be of concern are shown on the Critical Facilities and Infrastructure Map. There are currently seven beaver dams in town that are causing localized flooding and have the potential to cause more major flooding if the dams were to fail (see the Critical Infrastructure and Facilities Map at the end of this section). Primary areas of concern include: the area north of Lake Wyola, Pelham Hill Road, and on Wendell Road on a feeder stream to South Brook.

Potential Mitigation Measures for Dam Failure

A potential action item to help mitigate possible dam failure:

- Identify locations of existing beaver activity and dams that create the potential for flooding and implement controlled breaching of dams, where appropriate, to limit the potential for accidental breaches.
- Engage an engineer to modify the design of the sluice gate at Lake Wyola so that it does not continue to get blocked with debris to limit the potential for future flooding.

Earthquakes

General Description

An earthquake is a sudden, rapid shaking of the ground that is caused by the breaking and shifting of rock beneath the Earth's surface. Earthquakes can occur suddenly, without warning, at any time of the year. New England experiences an average of 30 to 40 earthquakes each year although most are not noticed by people[42]. Ground shaking from earthquakes can rupture gas mains and disrupt other utility service, damage buildings, bridges and roads, and trigger other hazardous events such as landslides, avalanches, flash floods (dam failure) and fires. Un-reinforced masonry buildings, buildings with foundations that rest on filled land or

[42] Northeast States Emergency Consortium Web site: www.nesec.org/hazards/earthquakes.cfm

unconsolidated, unstable soil, and mobile homes not tied to their foundations are at risk during an earthquake[43].

The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Earthquakes with magnitude of about 2.0 or less are usually called microearthquakes; they are not commonly felt by people and are generally recorded only on local seismographs. Events with magnitudes of about 4.5 or greater—there are several thousand such shocks annually—are strong enough to be recorded by sensitive seismographs all over the world. Great earthquakes, such as the 1964 Good Friday earthquake in Alaska, have magnitudes of 8.0 or higher. On the average, one earthquake of such size occurs somewhere in the world each year. The Richter Scale has no upper limit.

It is important to note that the Richter Scale is not used to express damage. An earthquake in a densely populated area which results in many deaths and considerable damage may have the same magnitude as a shock in a remote area that does nothing more than frighten the wildlife. Large-magnitude earthquakes that occur beneath the oceans may not even be felt by humans.[44]

The effect of an earthquake on the Earth's surface is called the intensity. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally, total destruction. Although numerous *intensity scales* have been developed over the last several hundred years to evaluate the effects of earthquakes, the one currently used in the United States is the Modified Mercalli (MM) Intensity Scale. It was developed in 1931 by the American seismologists Harry Wood and Frank Neumann. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects.

The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced at that place.

[43] Federal Emergency Management Agency Web site: www.fema.gov/hazards/earthquakes/quake.shtm.
[44] Adapted from http://earthquake.usgs.gov/learn/topics/richter.php

The **lower** numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The **higher** numbers of the scale are based on observed structural damage. Structural engineers usually contribute information for assigning intensity values of VIII or above.[45] The figure below shows the Modified Mercalli Scale (far left column) and the corresponding Richter Scale magnitude rating (far right column).[46]

Category	Effects	Richter Scale (approximate)
I. Instrumental	Not felt	1-2
II. Just perceptible	Felt by only a few people, especially on upper floors of tall buildings	3
III. Slight	Felt by people lying down, seated on a hard surface, or in the upper stories of tall buildings	3.5
IV. Perceptible	Felt indoors by many, by few outside; dishes and windows rattle	4
V. Rather strong	Generally felt by everyone; sleeping people may be awakened	4.5
VI. Strong	Trees sway, chandeliers swing, bells ring, some damage from falling objects	5
VII. Very strong	General alarm; walls and plaster crack	5.5
VIII. Destructive	Felt in moving vehicles; chimneys collapse; poorly constructed buildings seriously damaged	6
IX. Ruinous	Some houses collapse; pipes break	6.5
X. Disastrous	Obvious ground cracks; railroad tracks bent; some landslides on steep hillsides	7
XI. Very disastrous	Few buildings survive; bridges damaged or destroyed; all services interrupted (electrical, water, sewage, railroad); severe landslides	7.5
XII. Catastrophic	Total destruction; objects thrown into the air; river courses and topography altered	8

Massachusetts introduced earthquake design requirements into their building code in 1975. However, these specifications apply only to new buildings or to extensively modified existing buildings. Buildings, bridges, water supply lines, electrical power lines and facilities built before 1975 may not have been designed to withstand the forces of an earthquake. The seismic standards have also been upgraded with the 1997 revision of the State Building Code.

Location and Extent

Tables 3-8 and 3-9 show historic occurrences of earthquakes in the Northeastern part of the United States. This Northeast States Emergency Consortium data is current as of November 2014, with no new major earthquakes reported. However, occasional minor tremors have been experienced recently in the region. On June 22, 2010 there was a magnitude 5.8 earthquake in Canada which could be felt in Franklin County. No damage was reported, but residents stated they felt the quake and were un-nerved by the experience. On August 23, 2011 an earthquake measuring 5.8 on the Richter scale centered in Virginia was felt throughout the northeast, prompting the evacuation of a number of multi-story buildings in the Franklin County region, but causing no property damage or personal injury.

[45] Adapted from http://earthquake.usgs.gov/learn/topics/mercalli.php
[46] Adapted from http://img.docstoccdn.com/thumb/orig/80153368.png

Table 3-8: Northeast Earthquakes with a Magnitude of 4.2 or more 1924 – 2007

Location	Date	Magnitude
Ossipee, NH	December 20, 1940	5.5
Ossipee, NH	December 24, 1940	5.5
Dover-Foxcroft, ME	December 28, 1947	4.5
Kingston, RI	June 10, 1951	4.6
Portland, ME	April 26, 1957	4.7
Middlebury, VT	April 10, 1962	4.2
Near NH Quebec Border, NH	June 15, 1973	4.8
West of Laconia, NH	Jan. 19, 1982	4.5
Plattsburg, NY	April 20, 2002	5.1
Bar Harbor, ME	October 3, 2006	4.2

Source: Northeast States Emergency Consortium Web site: http://www.nesec.org/hazards/earthquakes.cfm.html.

Table 3-9: Northeast States Record of Historic Earthquakes

State	Years of Record	Number of Earthquakes
Connecticut	1668 - 2007	137
Maine	1766 - 2007	544
Massachusetts	1668 - 2007	355
New Hampshire	1638 - 2007	360
Rhode Island	1776 - 2007	38
New York	1840 - 2007	755
Total Number of Earthquakes within the Northeast states between 1638 and 2007 = 2,403		

Source: Northeast States Emergency Consortium Web site: http://www.nesec.org/hazards/earthquakes.cfm.html.

Massachusetts introduced earthquake design requirements into the state building code in 1975. However, these specifications apply only to new buildings or to extensively modified existing buildings. Existing buildings, bridges, water supply lines, electrical power lines and facilities, etc. have generally not been designed to withstand the forces of an earthquake. The seismic standards have also been upgraded with the 1997 revision of the State Building Code.

Approximately 75 percent of Shutesbury's 942 housing units were built prior to 1970,[47] before earthquake design requirements were instituted in the Massachusetts building code. The entire town is equally at risk to the effects of an earthquake. According to the United States Geological Survey, a fault line extends north-south along the Connecticut River Valley. The fault was originally responsible for the creation of the Connecticut River.

[47] 2008-2012 American Community Survey housing estimates.

Landslides

General Description

Landslides are geological phenomena that include a wide range of ground movement, such as rock falls, failure of slopes and shallow debris flows. They can occur in coastal, mountain, and river edge environments. Landslides occur when the stability of a slope changes from a stable to an unstable condition. A change in the stability of a slope can be caused by a number of factors, acting together or alone. Natural causes of landslides include:

- groundwater pressure acting to destabilize the slope
- loss or absence of vertical vegetative structure, soil nutrients, and soil structure (e.g. after a wildfire)
- erosion of the toe of a slope by rivers
- weakening of a slope through saturation by snowmelt or heavy rains
- earthquakes adding loads to barely-stable slopes
- earthquake-caused liquefaction destabilizing slopes
- volcanic eruptions

Landslides are created by human activities as well, including deforestation, cultivation and construction, which destabilize already fragile slopes. Some human activities that could cause landslides include:

- vibrations from machinery or traffic
- blasting
- earthwork which alters the shape of a slope, or which imposes new loads on an existing slope
- in shallow soils, the removal of deep-rooted vegetation that binds colluvium to bedrock
- construction, agricultural or forestry activities (logging) which change the amount of water which infiltrates the soil.

Location and Extent

The Connecticut River Valley is given a Moderate landslide incidence rating (1.5% to 15% of the area involved) while the remainder of the state is listed as Low landslide incidence (less than 1.5% of the area involved).[48] A typical setting for a landslide might bring to mind the precarious seaside hills in California. However, landslides have occurred much closer to home. According to WWLP News, early in the morning on March 7 of 2011, torrential rains swept away a piece of cemetery into the backyards of homes and nearby streets in Greenfield, MA. The landslide sent silt, mud, and debris sliding down from the Green River Cemetery into homes on nearby Meridian Street. Residents did not hear a thing. A passerby called 911 and alerted authorities that part of the Green River Cemetery had slid down onto Meridian Street. Residents of three homes were evacuated. This area of Greenfield has been in the news before due to other landslides.

[48] U.S. Department of the Interior, U.S. Geological Survey. National Landslide Hazards Mitigation Strategy: A Framework for Loss Reduction. 2000.

The aftermath of the mudslide from the Green River Cemetery included cleanup on a nearby street and bridge.

According to the Greenfield Recorder, state geologists estimated that about 1,500 to 3,000 cubic yards of mud and debris came down into the yards but that no graves were involved. Three inches of rain in Greenfield over a day and a half contributed to the disaster that caused thousands of dollars' worth of damage. The company called in to divert water away from homes below and help clear their yards of some of the mud found that a drainage system that had been installed in 1986 was been plugged and buried by the mudslide. The drainage system was cleaned out and was found to be in good shape and should handle any future rains adequately. The Town indicated that it is the responsibility of the Cemetery board to make sure the system is evaluated and cleared of any silt accumulation on a regular basis.

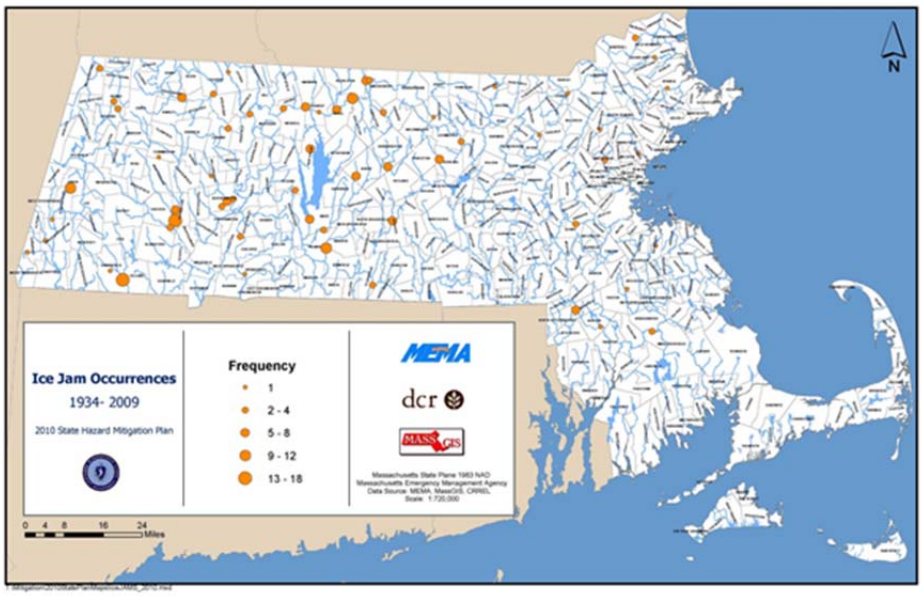
Ice Jams

General Description

Ice jams (or ice dams) occur when water builds up behind a blockage of ice. Ice jams can occur in various ways, but in New England they predominantly form on rivers and streams and mainly threaten infrastructure. When the upstream part of a river thaws first and the ice is carried downstream into the still-frozen part of the watercourse, ice can form an ice dam and flood low lying areas upstream of the jam. Also, once an ice dam breaks apart, the sudden surge of water that breaks through the dam can flood areas downstream of the jam. Ice jams and flooding usually occur in spring; however, they can happen as winter sets in when the downstream reach of a river freezes first. Where floods threaten, the blockage can be removed mechanically.

Location and Extent

According to information in the 2010 Massachusetts State Hazard Mitigation Plan, ice jams have occurred with varying frequency on several rivers in Franklin County, including the Deerfield, Millers, Green, North and South Rivers between 1934-2009 (see map, below). Ice jams occurring in and near Shutesbury could have an impact similar to flooding or dam failure, depending upon the size and impoundment associated with the jam. Historical data from the U.S. Army Cold Regions Research and Engineering Laboratory show that no ice jams have occurred in Shutesbury, which was confirmed by the EMT.



Manmade Hazards[49]

General Description

Most non-natural or manmade hazards fall into two general categories: intentional acts and accidental events, although these categories can overlap. Some of the hazards included in these two categories, as defined by MEMA, consist of intentional acts such as explosive devices, biological and radiological agents, arson and cyberterrorism and accidental events such as nuclear hazards, invasive species, infrastructure failure, industrial and transportation accidents. Accidental events can arise from human activities such as the manufacture, transportation, storage, and use of hazardous materials.

Note: This plan does not address all manmade hazards that could affect Shutesbury. A complete hazards vulnerability analysis was not within the scope of this update. For the purposes of this plan, non-natural hazards that are of an accidental nature were evaluated. They include industrial transportation accidents and industrial accidents in a fixed facility.

[49] Content adapted from Commonwealth of Massachusetts State Hazard Mitigation Plan 2013.

Hazardous Materials Definition

Hazardous materials in various forms can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. Many products containing hazardous chemicals are used and stored in homes routinely. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines. Chemical manufacturers are one source of hazardous materials, but there are many others, including service stations, hospitals, and hazardous materials waste sites. Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials. These substances are most often released as a result of transportation accidents or because of chemical accidents in plants.

A release may occur at a fixed facility or in transit. Communities with a large industrial base may be more inclined to experience a hazardous materials release due to the number of facilities that use such materials in their manufacturing process. Communities with several major roadways may be at a greater risk due to the number and frequency of trucks transporting hazardous materials.

Location and Extent

Industrial Accidents – Transportation

Franklin County transportation systems include road, rail, and air. Accessible and efficient freight transportation plays a vital function in the economy of the region. Most freight and goods being transported to and from Franklin County are by truck; however, a significant amount of freight that moves through the county is being hauled over the three main rail lines. Given that any freight shipped via air needs first to be trucked to an airport outside the region, air transportation is not being evaluated in this plan.

The major trucking corridors in Franklin County are Interstate 91, running north/south, and Route 2, running east/west. These two highways also represent the busiest travel corridors in the region for non-commercial traffic. According to the Franklin County Hazardous Material Emergency Plan (HMEP)[50], approximately 13 to 15 trucks per hour traveling through the region contain hazardous materials. An average of 10 of these vehicles are on Interstate 91. The plan estimates that one or less vehicles carrying hazardous materials travel through Shutesbury every hour along Route 202. The Shutesbury eCEMP also identifies Route 202 as a hazardous transportation route in town.

Safe and efficient transportation routes for trucks to and through the region are important to the region's economy and to the safety of its citizens. The safer the transportation routes are, the less likely a transportation accident will occur. The EMT cited concerns regarding the transportation along local roads like Leverett Road for deliveries of propane and home heating oil. In addition, they raised the issue of potential for hazardous materials from C-5 cargo planes from the Westover Air Base and other small aircraft that travel through the air space above Shutesbury.

[50] Franklin County Local Emergency Planning Committee, Franklin County Hazardous Material Emergency Plan and Maps, 2006. Based on a one-time survey conducted in 2003.

Industrial Accidents – Fixed Facilities

An accidental hazardous material release can occur wherever hazardous materials are manufactured, stored, transported, or used. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas. Those facilities using, manufacturing, or storing toxic chemicals are required to report their locations and the quantities of the chemicals stored on-site to state and local governments. The Toxics Release Inventory (TRI) contains information about more than 650 toxic chemicals that are being used, manufactured, treated, transported, or released into the environment. There are no facilities in Shutesbury that fall within the reporting requirements for the inventory. The Shutesbury eCEMP identifies the following hazardous facilities in Shutesbury (all of which store the materials in above-ground tanks):

Table 3-10: Hazardous Facilities in Shutesbury

Facility	Location	Hazardous Materials
National Grid Substation	491 Pratt Corner Road	Petroleum Insulating Oil; Sulfuric Acid (batteries)
Department of Public Works	59 Leverett Road	Gasoline; Diesel
William W. Clark Excavating	22 Pratt Corner Road	Gasoline; Diesel

Source: Shutesbury electronic Comprehensive Emergency Management Plan.

In the 1960s there was a gasoline leak at the Fire Station that went on for a decade. Clean-up of the hazardous material was started in 2008 and is continuing in 2014 on a fifty-year timetable, although they are close to a temporary solution to the problem.

Hazardous facilities located outside of town boundaries can also be of concern to Shutesbury. The Vermont Yankee nuclear power plant is located on the Connecticut River in Vernon, Vermont, near the Vermont/Massachusetts border, approximately 23 miles from the Shutesbury Town Hall. In January 2010, the facility notified the Vermont Department of Health that samples taken in November 2009 from a ground water monitoring well on site contained tritium. This finding signals an unintended release of radioactive material into the environment. Testing has shown that contaminated groundwater has leaked into the Connecticut River, though tritium levels in the river have remained below the lower limit of detection.[51]

More recently, the 2011 tsunami and earthquake in Japan that damaged a nuclear power plant demonstrates the potential vulnerability of these facilities to natural disasters, and the geographic extent that could be impacted by an accident. The Nuclear Regulatory Commission's recently extended the Vermont Yankee plant's operating license for 20 more years, which was to have expired in March 2012. However, Entergy, the plant's owner, has announced a planned shutdown of the plant as of the end of 2014. One of the outstanding questions regarding the shutdown is whether Entergy will continue to provide emergency preparedness planning activities and funds for surrounding towns after the plant stops operating, but as it continues to be the repository of spent fuel rods for which there is as of yet no federal storage location.

[51] Vermont Department of Health. http://healthvermont.gov/enviro/rad/vt_yankee.aspx

VULNERABILITY ASSESSMENT

Vulnerability Overview

This section presents exposure, damages, loss estimates, population impacts and data deficiencies for each of the hazards addressed in the Hazard Identification and Analysis Section of the Plan. Additionally, an overall vulnerability assessment is provided for each hazard. This analysis is an in-depth look at each hazard in Shutesbury. Coupled with the All Hazards Vulnerability Assessment presented in Table 3-26 on page 71 that prioritizes all the hazards that can impact the town based on probability of occurrence, severity of impact, area of occurrence and preparedness, these findings will support planning efforts based on a better understanding of the potential impacts associated with each hazard and provide a foundation for the mitigation strategy presented in Section 4.

Vulnerability Assessment Methodology

The Vulnerability Assessment is a series of tables that enabled FRCOG staff to determine the vulnerability of Shutesbury to flooding and to calculate the potential costs of flooding to the town.[52] Estimated losses for all other hazard events were also determined, based on damages from past recorded events. The potential implications for vulnerable populations such as senior and low income populations in the event of a hazard are also assessed.

Floods

Hazard Summary

In this section, a vulnerability assessment was prepared to evaluate the potential impact that floods could have on the portions of Shutesbury located within the 100-year floodplain. Floods were chosen for this detailed evaluation because it is a hazard likely to impact the community and the location of the impact can be determined by mapping of areas inundated during severe flood events. Floods can be caused by severe storms, such as hurricanes, nor'easters, and microbursts, as well as ice jams and snow melt. To determine the vulnerability of the town, data was gathered and calculated for the value of residential, commercial, and industrial properties. The damage estimates presented are rough estimates and likely reflect a worst-case scenario. Computing more detailed damage assessments based on assessor's records is a labor-intensive task and beyond the scope of this project.

Data Collected and Used

National weather databases and Town of Shutesbury data were collected and analyzed. Data on historic property damage and loss, and injuries and deaths, was collected for Franklin County from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center website. This data was used to support an evaluation of exposure and potential impacts

[52] These tables were developed to provide towns with a template for calculating and estimating potential losses and costs of flooding. They draw from and integrate the work of other Natural Hazard Mitigation Plans, specifically the Natural Hazard Mitigation Plan for Thurston County, Washington, September 2009, but the tables can be linked to the most recent demographic, land use, and infrastructure information (databases) and automatically calculate and estimate the cost of flooding to each town or region.

associated with this hazard. Available historic data for 1993 through 2013 for Franklin County are presented above in Table 3-1. The average annual property damage in Franklin County due to flooding for those years is $720,860, with no annual crop damage reported. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2013 was also reviewed for information on flooding.

Impact on the Community

Exposure and Loss Estimation

Floods can cause a wide range of issues, from minor nuisance roadway flooding and basement flooding to major impacts such as roadway closures. Specific damages associated with flooding events include the following primary concerns:

- Blockages of roadways or bridges vital to travel and emergency response
- Breaching of dams
- Damaged or destroyed buildings and vehicles
- Damaged building elements and contents, including frozen water pipes, washing machines, dish washing machines and base board heating pipes
- Uprooted trees causing power and utility outages
- Drowning, especially people trapped in cars
- Contamination of drinking water
- Dispersion of hazardous materials
- Interruption of communications and/or transportation systems

Property Damage

Of Shutesbury's total acreage, 233 acres lie within the 100-year floodplain or flood hazard area. There are 27 dwelling units located in the 100-year floodplain. These residential properties are located on 7.4 acres in town. There are no industrial, commercial, or public/institutional uses located in the floodplain, according to 2005 MassGIS Land Use data.

Table 3-11: Number of Dwelling Units and Percent of Total Population Residing in Flood Hazard Area

Total Town Population	Average # of people per household	Number of Dwelling Units in Flood Hazard Area	Estimated Population in Flood Hazard Area	% of total population that reside in the Flood Hazard Area
1,771	2.37	27	64	3.6%

Source: U.S. Census Bureau, 2010 Census and 2008-2012 American Community Survey; 2005 MassGIS Land Use data.

The estimated assessed values of the residential land uses located within the floodplain are displayed in Table 3-12. The total estimated assessed value for residential land uses in the flood hazard area is $3,601,305. (Similar calculations were not possible for commercial or industrial land uses, as no acres in this use category were identified in the 2005 MassGIS Land Use data, although assessment data for these categories is available from the Massachusetts Department of Revenue.) Should a catastrophic flooding event befall Shutesbury, the assessed values of these

structures and facilities would likely be significantly reduced, which in turn could impact the town's tax revenues.

Table 3-12: Estimated Assessed Value of Land Use in Flood Hazard Area

Land Use	Total Acres in Town	Total Assessed Value in 2014	Average Assessed Value Per Acre	Acres In Floodplain	Estimated Assessed Value In Flood Hazard Area
Residential	424.6	$206,637,060	$486,663	7.4	$3,601,305
Commercial	2.9	$1,453,340	$501,152	0	N/A
Industrial	9.6	$515,200	$53,666	0	N/A
Totals	437.1	$208,605,600	—	7.4	**$3,601,305**

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section: http://www.mass.gov/dor/local-officials/municipal-data-and-financial-management/data-bank-reports/property-tax-information.html; 2005 MassGIS Land Use data.

Table 3-12 identifies the estimated assessed value of the residential land uses located in the floodplain in Shutesbury as $3,601,305. The losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a major flooding event would be $36,013, $180,065, $360,131, respectively.

Repetitive Loss Properties

Repetitive loss properties are those for which two or more losses of at least $1,000 each have been paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978. According to MEMA, there are three repetitive loss structures in Franklin County, none of which are located in Shutesbury. See pages 123-125 for more information on NFIP.

Population Impacts

As shown above in Table 3-11, multiplying the 27 dwelling units in the floodplain by Shutesbury's average household size of 2.37, yields an estimate of 64 people, (or 3.6% of Shutesbury's total population), residing in the floodplain who would be at risk in the event of a flood. In particular, the Town should be aware of the potential needs of senior and low income residents who may be physically or financially unable to react and respond to a hazard event and may require additional assistance in the event of a flood. Table 3-13 displays the number of senior and low income residents in Shutesbury. It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table. However the town should be aware of the potential needs of residents within these population segments in the event of a hazard occurrence.

Table 3-13: Senior and Low Income Populations Exposed to Multi-Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (65 years of age and over)	152	8.6%
Low Income (Persons with annual incomes less than $25,000)*	159	9.0%
Total	**311**	**17.7%**

* Low income population was calculated by multiplying U.S. Census 2008-2012 American Community Survey (ACS) Households with Incomes and Benefits of Less than $25,000 (67) by U.S. 2010 Census Average Household Size (2.37).

Source: U.S. Census Bureau, 2010 Census and 2008-2012 American Community Survey.

Overall Vulnerability Assessment

Floods are common in New England, often causing significant impacts to the roads, structures, facilities, utilities, and population of Shutesbury. Existing and future mitigation efforts should continue to be developed and employed that will enable Shutesbury to be prepared for these events when they occur. Particular areas of vulnerability include low-income and elderly populations, trailer homes, and infrastructure such as and the low-lying areas that can be impacted by flooding related to ice jams or rapid snow melt.

Data Deficiencies

In assessing the risks to Shutesbury from flood hazards, the following data deficiencies were identified:

- Lack of available data on the number of vulnerable populations living in households in the floodplain.
- Lack of digital floodplain data to overlay on zoning to determine number of developable lots in the flood hazard area.
- Records of damages to the built and natural environments due to floods in Conway are not consistently maintained. Data often resides with an individual and can be lost if that individual leaves his or her position. A more formal system of data collection and maintenance could be established and would help improve the Town's hazard mitigation planning. Better data could also increase the Town's chance of qualifying for various grants.

Severe Winter Storms

Severe snow and ice storms are common in Shutesbury, often impacting the Towns' roads, structures, facilities, utilities, and population. Existing and future mitigation efforts should continue to be developed and employed that will enable the Town to be prepared for these events.

Hazard Summary

Severe winter storms cause significant concern because they happen often and can be quite severe; they cost residents money; they require snow and ice removal, which can limit access to facilities and can cause health problems; they can cause utility failure and flooding from ice jams; and they put stress on community resources.

Data Collected and Used

National weather databases and Town of Shutesbury data were collected and analyzed. Data on historic property damage and loss, and injuries and deaths, was collected for Franklin County from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center website. This data was used to support an evaluation of exposure and potential impacts associated with this hazard. Available historic data are presented in Table 3-14 below. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2013 was also reviewed for information on severe winter storm hazard data and mitigation measures.

Impact on the Community

Exposure and Loss Estimation

Heavy snowfall coupled with low temperatures often results in increases in traffic accidents; disruptions in transportation, commerce, government, and education; utility outages due to falling trees, branches, and other objects; personal injuries associated with slippery surfaces and freezing temperatures; and numerous other problems. Specific damages associated with severe winter storm (snow) events include the following primary concerns:

- Injuries and fatalities associated with accidents, low temperatures, power loss, falling objects and accidents associated with frozen and slippery surfaces and snow accumulation
- Increases in the frequency and impact of traffic accidents, resulting in personal injuries
- Ice-related damage to trees, building and infrastructure inventory, and utilities (power lines, bridges, substations, etc.)
- Roads damaged through freeze and thaw processes
- Stress on the local shelters and emergency response infrastructure
- Lost productivity that occurs when people cannot go to work, school, or stores due to inclement conditions

New England's climate offers no immunity to the potential damaging effects of severe winter storms. Some minimum damage is anticipated annually, with potential extensive damage occurring about once every 10 years.

Property Damage

As presented in Table 3-14, historic data for severe winter storm (heavy snow) events indicate that between 1993 and 2011, 113 heavy snow events were recorded in Franklin County. An average of 5.9 heavy snow and ice events occur each year, causing an average annual property damage county-wide of just under $4 million.

Table 3-14: Severe Winter Storm Events in Franklin County

Year	# of Winter Storm Events	Annual Property Damage	Annual Crop Damage
2013	0	$0	$0
2012	2	$0	$0
2011	2	$1,010,000	$0
2010	3	$30,000	$0
2009	5	$0	$0
2008	12	$6,020,000	$0
2007	7	$10,000	$0
2006	0	$0	$0
2005	9	$625,000	$0
2004	3	$0	$0
2003	5	$50,000	$0
2002	7	$1,605,000	$0
2001	7	$11,000,000	$0
2000	7	$0	$0

Year	# of Winter Storm Events	Annual Property Damage	Annual Crop Damage
1999	6	$0	$0
1998	3	$0	$0
1997	6	$10,030,000	$0
1996	10	$47,000,000	$0
1995	6	$0	$0
1994	8	$5,050,000	$0
1993	7	$0	$0
# of Years	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
21	**115**	**$3,925,238**	**$0**

Source: NOAA National Climatic Data Center. http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

The December 2008 ice storm greatly impacted Shutesbury and cost the Town roughly $70,000 in overtime, gasoline, shelter expenses, and expenses for hiring the tree removal companies.[53] FEMA reimbursed the Town $64,535 in FY 2009 for the December 2008 ice storm, and an additional $12,292 was received in FY 2011 and FY 2012 from MEMA for the storm.

An April 2007 "nor'easter" brought heavy snow that resulted in a reimbursement of $5,850.21 from MEMA. In February 2013 an historic winter storm deposited 14 to 22 inches of snow across Franklin County, which resulted in a reimbursement to the Town of Shutesbury from MEMA of $7,487.55 in FY 2014.

The entire built environment of Shutesbury is vulnerable to a severe winter storm. Table 3-15 identifies the assessed value of all residential, commercial, and industrial land uses in Town, and the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a severe winter storm.

Table 3-15: Potential Estimated Loss by Land Use

Land Use	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	$206,637,060	$2,066,371	$10,331,853	$20,663,706
Commercial	$1,453,340	$14,533	$72,667	$145,334
Industrial	$515,200	$5,152	$25,760	$51,520
Total	**$208,605,600**	**$2,086,056**	**$10,430,280**	**$20,860,560**

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2014.

Population Impacts

As discussed above, some traffic accidents associated with winter storm events include injuries and in limited cases, deaths. However, the number of injuries and deaths reported for accidents is generally low.

[53] "It was a heck of a week," Janice S. Gray. *Our Town: Tri-annual Community News.* Winter 2009.

Populations considered most vulnerable to severe winter storm impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-13 on page 49 above summarizes the population in Shutesbury aged 65 or over and those living in households with an income below $25,000 per year, which totals 311 persons (or over 17% of the population). It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table.

Overall Vulnerability Assessment

Severe winter storms are common in New England, often causing significant impacts to the roads, structures, facilities, utilities, and population of Shutesbury. Existing and future mitigation efforts should continue to be developed and employed that will enable Shutesbury to be prepared for these events when they occur. The cascade effects of severe winter storms include utility losses, transportation accidents, and flooding. Losses associated with flooding are discussed earlier in this section. Particular areas of vulnerability include low-income and elderly populations, trailer homes, and infrastructure such as roadways and utilities that can be damaged by such storms and the low-lying areas that can be impacted by flooding related to ice jams or rapid snow melt.

Data Deficiencies

In assessing the risks to Shutesbury from severe winter storms, the following data deficiencies were identified:

- Records of damages to the built and natural environments due to severe snow and ice storms in Shutesbury are not consistently maintained, especially for town damages where no reimbursement is being sought or where the damages are largely on private property. Data often resides with an individual and can be lost if that individual leaves his or her position. A more formal system of data collection and maintenance could be established and would help improve the Town's hazard mitigation planning. Better data could also increase the Town's chance of qualifying for various grants.

Hurricanes and Tropical Storms

Hazard Summary

Hurricanes and tropical storms are rare in Shutesbury but could cause severe impacts such as flooding, power outages, flying debris, damage to property and injury and loss of life. Existing and future mitigation efforts should continue to be developed and employed that will enable the Town to be prepared for these events.

Hurricanes or tropical storms can spin off tornados and bring thunderstorms, and high winds, possibly resulting in loss or damage to property. (See Tornados, Microbursts, and Thunderstorms Section Below.) Primarily, hurricanes and tropical storms bring heavy rains that can cause flooding, as was the case with Tropical Storm Irene in August 2011. (See the description of the effects of the storm above in the section on the impacts of flooding on page 15.) In addition,

blown-down trees can result in loss of power, can make it impossible to get to an emergency shelter, and can lead to forest fires in future years as the blown-down wood dries.

Data Collected and Used

National weather databases and Town of Shutesbury data were collected and analyzed. Data on historic property damage and loss, and injuries and deaths, was collected for Franklin County from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center website, and the Spatial Hazard Events and Losses Database (SHELDUS). This data was used to support an evaluation of exposure and potential impacts associated with this hazard. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2013 was also reviewed for information on thunderstorms, hurricanes and tornados hazard data and mitigation measures.

Impact on the Community

Exposure and Loss Estimation

High winds and heavy rain associated with hurricanes and tropical storms can cause damage to utilities, structures, roads, trees (potentially causing vehicle accidents) and injuries and death.

Property Damage

As presented in Table 3-16, historic data for hurricane and tropical storm events indicate one hurricane and 17 tropical storms have been recorded in Franklin County. Hurricane Bob in 1991 caused over $5.5 million in property damage in the county, and over $500,000 in crop damage. In 2011, Tropical Storm Irene caused over $25 million in property damage. In Shutesbury, there were trees on wires around Town as a result of Tropical Storm Irene , but the EMT reports that the impacts were limited due to the tree work that had been done following the 2008 ice storm and the lack of tall structures. However, there were significant enough damages to result in reimbursements to the Town of $1,011.99 from MEMA and $29,673.50 from FEMA. Overall, tropical storms and hurricanes have caused an average annual property damage in Franklin County of just $1.3 million over the last 24 years.

Table 3-16: Hurricane and Tropical Storm Events in Franklin County

Year	# of Hurricane/Tropical Storm Events	Annual Property Damage	Annual Crop Damage
2013	0	$0	$0
2012	0	$0	$0
2011	1	$25,325,000	$0
2010	0	$0	$0
2009	0	$0	$0
2008	0	$0	$0
2007	0	$0	$0
2006	5	$277,861	$0
2005	1	$33,889	$0
2004	1	$37,778	$0
2003	2	$127,381	$0

Year	# of Hurricane/Tropical Storm Events	Annual Property Damage	Annual Crop Damage
2002	0	$0	$0
2001	0	$0	$0
2000	0	$0	$0
1999	1	$7,692	$0
1998	2	$63,269	$0
1997	0	$0	$0
1996	0	$0	$0
1995	1	$0	$0
1994	1	$35,714	$0
1993	0	$0	$0
1992	0	$0	$0
1991	1	$5,555,556	$555,556
1990	2	$7,142	$0
# of Years	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
24	**18**	**$1,373,746**	**$26,455**

Source: Spatial Hazard Events and Losses Database for the United States (SHELDUS): http://webra.cas.sc.edu/hvri/products/sheldus.aspx.
http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=08&endDate_dd=31&endDate_yyyy=2013&eventType=%28Z%29+Tropical+Storm&county=FRANKLIN&zone=WESTERN%2BFRANKLIN&submitbutton=Search&statefips=25%2CMASSACHUSETTS

The entire built environment of Shutesbury is vulnerable to the high winds and/or flooding from a hurricane or tropical storm. Table 3-15 on page 52 identifies the assessed value of all residential, commercial, and industrial land uses in Shutesbury as $208,605,600, and the losses that would result from 1% ($2,086,056), 5% ($10,430,280), and 10% ($20,860,560) damage to this inventory as a result of a hurricane or tropical storm.

Population Impacts

As discussed above, some traffic accidents associated with storm events include injuries and deaths. However, the number of injuries and deaths reported for accidents is generally low.

Populations considered most vulnerable to hurricane and tropical storm impacts in Shutesbury are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-13 on page 49 summarizes the population in Shutesbury aged 65 or over and those living in households with an income below $25,000 per year, which totals 311 persons (or over 17% of the population). It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table.

Overall Vulnerability Assessment

Hurricanes and tropical storms are uncommon in Franklin County, but can cause significant damage when they do occur. Existing and future mitigation efforts should continue to be developed and employed that will enable Shutesbury to be prepared for these events. The cascade effects of severe storms include utility losses and transportation accidents and floods Losses associated with the flood hazard are discussed earlier in this section. Particular areas of vulnerability include low-income and elderly populations, trailer homes, and infrastructure such as roadways and utilities that can be damaged by such storms and the low-lying areas, including valuable farm fields, that can be impacted by floods.

Data Deficiencies

In assessing the risks to Shutesbury from hurricanes and tropical storms, no data deficiencies were identified.

Tornados, Microbursts and Thunderstorms

Hazard Summary

Like hurricanes, tornados and microbursts are relatively rare in Shutesbury but could cause severe impacts such as flooding, power outages, flying debris, damage to property and injury and loss of life. Existing and future mitigation efforts should continue to be developed and employed that will enable the Town to be prepared for these events. Tornados can have devastating effects on infrastructure, property and human health. Striking at random, their conical winds leave trails of devastation, at times more than a mile wide, in their wake. Thunderstorms are common in western Massachusetts and can cause significant damage. Thunderstorms bring strong winds, rain and, at times, hail, potentially causing damage to property, crops and utilities and injuries or deaths to residents. Persistent rain can also cause flooding. Additional data were available for hail and lightning events, and are included in tables 3-19 and 3-20.

Data Collected and Used

National weather databases and Town of Shutesbury data were collected and analyzed. Data on historic property damage and loss, and injuries and deaths, was collected for Franklin County from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center website, and the Spatial Hazard Events and Losses Database (SHELDUS). This data was used to support an evaluation of exposure and potential impacts associated with this hazard. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2013 was also reviewed for information on tornados and microburst hazard data and mitigation measures.

Impact on the Community

Exposure and Loss Estimation

High winds and heavy rain and/or hail associated with tornados and microbursts can cause damage to utilities, structures, roads, trees (potentially causing vehicle accidents) and injuries and death.

Property Damage

As presented in Table 3-17, historic data for tornado events indicate that between 1991 and 2013, 4 tornados were recorded in Franklin County. Over 23 years, tornados have caused an average of $14,130 in property damages yearly.

Table 3-17: Tornado Events in Franklin County

Year	# of Tornado Events	Annual Property Damage	Annual Crop Damage
2013	0	$0	$0
2012	0	$0	$0
2011	0	$0	$0
2010	0	$0	$0
2009	0	$0	$0
2008	0	$0	$0
2007	0	$0	$0
2006	1	$200,000	$0
2005	0	$0	$0
2004	0	$0	$0
2003	0	$0	$0
2002	0	$0	$0
2001	0	$0	$0
2000	0	$0	$0
1999	0	$0	$0
1998	0	$0	$0
1997	2	$100,000	$0
1996	0	$0	$0
1995	0	$0	$0
1994	0	$0	$0
1993	0	$0	$0
1992	1	$25,000	$0
1991	0	$0	$0
# of Years	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
23	**4**	**$14,130**	**$0**

Source: National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center Storm Events Database website: http://www.ncdc.noaa.gov/stormevents/.

Severe thunderstorms, and their associated hail and lightning events brought about significant property wreckage in Franklin County in recent years. Severe thunderstorms, and their associated hail and lightning events brought about significant property wreckage in Franklin County in recent years. However, it is the winds from thunderstorms that consistently cause the worst property damage. Thunderstorms with associated wind damage, 161 of them in the last 23 years, caused an average annual property loss of more than $79,000 and an average annual crop

damage of $5,435 (Table 3-18). It is important to note that each reported thunderstorm wind event is counted in the total, even if they occurred in multiple towns on the same date. Even taking that into consideration, the number of thunderstorms has increased in recent years. In the 1990s, there were an average of 3.8 storms per year, according to NOAA data. From 2000 to 2013, NOAA recorded an average of 9.4 storm events per year, 2.5 times the previous decade. Between 2007 and 2010, 72 storm events were recorded countywide for an average number of 18 storms for those four years. A very strong storm with strong winds moved through the communities of Whately and Sunderland on July 19, 2008, causing a substantial amount of property and crop damage, mostly in the form of fallen trees and downed power lines.

Table 3-18: Thunderstorm Wind Events in Franklin County

Year	# of Thunderstorm Events	Annual Property Damage	Annual Crop Damage
2013	8	$149,000	$0
2012	8	$34,000	$0
2011	9	$77,000	$0
2010	30	$590,500	$0
2009	2	$17,000	$0
2008	21	$602,000	$1,250,000
2007	19	$0	$0
2006	6	$315,000	$0
2005	9	$85,000	$0
2004	4	$30,000	$0
2003	1	$10,000	$0
2002	6	$25,000	$0
2001	5	$0	$0
2000	3	$20,000	$0
1999	5	$0	$0
1998	8	$2,000	$0
1997	7	$10,000	$0
1996	5	$0	$0
1995	3	$0	$0
1994	4	$0	$0
1993	0	$0	$0
1992	2	$0	$0
1991	3	$0	$0
1990	1	$0	$0
# of Years	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
24	**169**	**$81,938**	**$5,208**

Source: National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center Storm Events Database website: http://www.ncdc.noaa.gov/stormevents/. http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=08&endDate_dd=31&endDate_yyyy=2013&eventType=%28C%29+Thunderstorm+Wind&county=FRANKLIN&zone=WESTERN%2BFRANKLIN&submitbutton=Search&statefips=25%2CMASSACHUSETTS

Thunderstorm events with high winds have been reported by NOAA in or near Shutesbury six times since 1991, including strong winds with property damage in July 2014, as shown in Table 3-5 on page 29.

As Table 3-19 shows, 84 hail storms in Franklin County between 1991 and 2013 have caused an average of approximately $217 in property damage per year, and an average of $2,174 of crop damage. The total amount of crop damage during this period resulted from a single incident on June 16, 2008 that caused $50,000 in damage. Pea to marble size hail fell in a swath from Colrain to Shelburne damaging apple and peach orchards from Colrain to Shelburne to Deerfield. An estimated 45 acres of apples and two to three acres of peaches were damaged by the hail. This storm was also accompanied by lightning and thunderstorm winds. It is important to note that each reported hail event is counted in the total, even if they occurred in multiple towns on the same date.

Table 3-19: Hail Events in Franklin County

Year	# of Hail Events	Annual Property Damage	Annual Crop Damage
2013	7	$0	$0
2012	2	$0	$0
2011	9	$0	$0
2010	4	$0	$0
2009	2	$0	$0
2008	14	$0	$50,000
2007	15	$0	$0
2006	0	$0	$0
2005	3	$5,000	$0
2004	2	$0	$0
2003	1	$0	$0
2002	0	$0	$0
2001	3	$0	$0
2000	1	$0	$0
1999	0	$0	$0
1998	9	$0	$0
1997	1	$0	$0
1996	3	$0	$0
1995	4	$0	$0
1994	4	$0	$0
1993	0	$0	$0
1992	0	$0	$0
1991	0	$0	$0
# of Years	**Total # of Events**	**Avg. Annual Property Damage**	**Avg. Annual Crop Damage**
23	**84**	**$217**	**$2,174**

Source: National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center Storm Events Database website:
http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=08&endDate_dd=31&endDate_yyyy=2013&eventType=%28C%29+Hail&county=FRANKLIN&zone=WESTERN%2BFRANKLIN&submitbutton=Search&statefips=25%2CMASSACHUSETTS

Three hail events are reported by NOAA in Shutesbury during the period from 1991 through 2014. On August 3, 2007 nickel size hail was reported as being associated with a line of strong thunderstorms. Hail up to the size of ping pong balls was reported twice in town during the afternoon of August 1, 2011, along with showers and thunderstorms.

Seventeen (17) lightning events (Table 3-20) have caused an average of more than $341,000 in property damage per year over the last 21 years in Franklin County. These events include the lightning strike that occurred in Rowe on August 4, 2012 that resulted in the complete destruction of the Rowe Elementary School, for a property loss with an insurance value of $6,900,000. The average property damage per year during this period excluding that event in 2012 is $13,048. According to NOAA, on July 3, 2014, a house was struck by lightning on Great Pines Drive in Shutesbury which ignited a fire, causing $75,000 in damage.

Table 3-20: Lightning Events in Franklin County

Year	# of Lightning Events	Annual Property Damage	Annual Crop Damage
2014	2	$78,000	$0
2013	3	$48,000	$0
2012	1	$6,900,000	$0
2011	0	$0	$0
2010	1	$15,000	$0
2009	0	$0	$0
2008	1	$10,000	$0
2007	0	$0	$0
2006	0	$0	$0
2005	1	$50,000	$0
2004	1	$35,000	$0
2003	0	$0	$0
2002	1	$15,000	$0
2001	1	$20,000	$0
2000	0	$0	$0
1999	0	$0	$0
1998	0	$0	$0
1997	1	$3,000	$0
1996	0	$0	$0
1995	2	$0	$0
1994	2	$0	$0
# of Years	**Total # of Events**	**Average Annual Property Damage**	**Average Annual Crop Damage**
21	**17**	**$341,619**	**$0**

Source: National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center Storm Events Database website: http://www.ncdc.noaa.gov/stormevents/.

The entire built environment of Shutesbury is vulnerable to the high winds, flooding and other impacts from a tornado, microburst or thunderstorm. Table 3-15 on page 52 identifies the assessed value of all residential, commercial, and industrial land uses in Shutesbury as $208,605,600, and the losses that would result from 1% ($2,086,056), 5% ($10,430,280), and 10% ($20,860,560) damage to this inventory as a result of a hurricane or tropical storm.

Population Impacts

As discussed above, some traffic accidents associated with storm events include injuries and deaths. However, the number of injuries and deaths reported for accidents is generally low.

Populations considered most vulnerable to tornado, thunderstorm and microburst impacts in Shutesbury are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-13 on page 49 summarizes the population in Shutesbury aged 65 or over and those living in households with an income below $25,000 per year, which totals 311 persons (or over 17% of the population). It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table.

Overall Vulnerability Assessment

Thunderstorms are common in New England, and can impact property, crops, utilities and the population of Shutesbury. Tornados and microbursts are less common, but can cause significant damage when they do occur. Existing and future mitigation efforts should continue to be developed and employed that will enable Shutesbury to be prepared for these events. The cascade effects of severe storms include utility losses and transportation accidents and flooding. Losses associated with the flood hazard are discussed earlier in this section. Particular areas of vulnerability include low-income and elderly populations, trailer homes, and infrastructure such as roadways and utilities that can be damaged by such storms and the low-lying areas that can be impacted by flooding.

Data Deficiencies

In assessing the risks to Shutesbury from tornados and microbursts and associated storms events such as thunderstorms, hail and lightning, no data deficiencies were identified.

Wildfires and Brushfires

Hazard Summary

According to data from Massachusetts Fire Incident Reporting System of the Massachusetts Department of Fire Services, the Shutesbury Fire Department responded to 8 brushfires between 2001 and 2013. Wildfires can damage woodlands, homes, utilities and buildings, and could cause injuries or deaths. Existing and future mitigation efforts should continue to be developed and employed that will enable the Town to be prepared for these events.

Burn piles that blaze out of control, lightning strikes in forested land, campfires improperly managed, and arson can cause wildfires. Shutesbury is vulnerable to these conflagrations, especially in times of drought. Fire suppression can be expensive and dangerous for firefighters, and wildfires can threaten wildlife and human habitat and health.

Data Collected and Used

National weather databases and Town of Shutesbury data were collected and analyzed. Data on historic property damage and loss, and injuries and deaths, was collected for Franklin County from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center website. Data from the Massachusetts Department of Fire Services Fire Incident Reporting System (MFIRS) was consulted. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2013 was also reviewed for information on wildfires and brushfires hazard data and mitigation measures.

Impact on the Community

Exposure and Loss Estimation

A major out-of-control wildfire can damage property, utilities and forested land; create smoke that can cause breathing problems; and injure or kill people. Other associated concerns are debris management issues including debris removal and identification of disposal sites.

Property Damage

No property damage, injuries or deaths have been recorded for Shutesbury as a result of wildfires. However, because Shutesbury is heavily wooded, the entire built environment of the Town is vulnerable to a wildfire. Table 3-15 on page 52 identifies the assessed value of all residential, commercial, and industrial land uses in Shutesbury as $208,605,600, and the losses that would result from 1% ($2,086,056), 5% ($10,430,280), and 10% ($20,860,560) damage to this inventory as a result of a hurricane or tropical storm. While not the result of a wildfire, a lightning strike on a house on Great Pines Drive in Shutesbury on July 3, 2014 caused $75,000 in damages.

Population Impacts

Populations considered most vulnerable to wildfire impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-13 on page 49 summarizes the population in Shutesbury aged 65 or over and those living in households with an income below $25,000 per year, which totals 311 persons (or over 17% of the population). It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table.

Overall Vulnerability Assessment

While wildfires have caused minimal damage, injury and loss of life to date in Shutesbury their potential to destroy property and cause injury or death exists. Existing and future mitigation efforts should continue to be developed and employed that will enable Shutesbury to be prepared

for these events when they occur. Wildfires can also cause utility disruption and air-quality problems. Particular areas of vulnerability include low-income and elderly populations.

Data Deficiencies

In assessing the risks to Shutesbury from wildfire hazards, no data deficiencies were identified.

Dam Failures

Hazard Summary

Dams hold back water, and when a dam fails, the potential energy of the stored water behind the dam is instantly released as water rushes in torrent downstream, flooding an area engineers refer to as an "inundation area." The number of casualties and the amount of property damage will depend upon the timing of the warning provided to downstream residents, the number of people living or working in the inundation area, and the number of structures in the inundation area. Existing and future mitigation efforts should continue to be developed and employed that will enable the Town to be prepared for these events.

When a dam fails, huge quantities of water quickly flow downstream. Areas adjacent to a river or stream or on low ground are in danger of being inundated by a large volume of water that could destroy structures, utilities, roadways and bridges, and cause injuries or deaths. Many dams in Massachusetts were built in the 19th century without the benefit of modern engineering design and construction oversight. Dams can fail because of structural problems due to age and/or lack of proper maintenance. Dam failure can also be the result of structural damage caused by an earthquake or flooding brought on by severe storm events.

Data Collected and Used

Limited data are available concerning inundation areas caused by dam failure, as this is considered confidential information and protected data by dam owners. Historical data compiled by the Association of Dam Safety Officials from 2010 showing Dam Failures, Dam Incidents (Near Failures) was consulted.[54] The Commonwealth of Massachusetts State Hazard Mitigation Plan 2013 was also reviewed for information on dam failure hazard data and mitigation measures.

Impact on the Community

Exposure and Loss Estimation

While dam failures are rare, their impacts can be devastating, including loss of property, disruption to infrastructure, and injury and death.

Property Damage

Historic data for dam failure events indicate that no events have been recorded in Franklin County, causing no property damage or population impacts. Structures that lie in the inundation

[54] Association of Dam Safety Officials. (2010). Dam Failures, Dam Incidents (Near Failures). Available online at: http://www.damsafety.org/media/Documents/PDF/US_FailuresIncidents.pdf

area of each of the dams in Shutesbury are vulnerable to a dam failure. Table 3-15 on page 52 identifies the assessed value of all residential, commercial, and industrial land uses in Shutesbury as $208,605,600, and the losses that would result from 1% ($2,086,056), 5% ($10,430,280), and 10% ($20,860,560) damage to this inventory as a result of a dam failure.

Population Impacts

Populations considered most vulnerable to dam failure are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-13 on page 49 summarizes the population in Shutesbury aged 65 or over and those living in households with an income below $25,000 per year, which totals 311 persons (or over 17% of the population). It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table.

Overall Vulnerability Assessment

Dam failures, while rare, can destroy roads, structures, facilities, utilities, and impact the population of Shutesbury. Existing and future mitigation efforts should continue to be developed and employed that will enable Shutesbury to be prepared for these events when they occur. Particular areas of vulnerability include low-income and elderly populations, buildings in the floodplain or inundation areas, and infrastructure such as roadways and utilities that can be damaged by such events.

Data Deficiencies

In assessing the risks to Shutesbury from dam failure hazards, the following data deficiencies were identified:

- Up-to-date data for the location and condition of dams within Shutesbury is difficult to obtain the DCR Office of Dam Safety Legal Department. This plan uses 2011 data.

Earthquakes

Hazard Summary

Earthquakes are rare in Franklin County, however temblors are unpredictable and can cause significant damage to roads, structures, facilities, utilities, and population. Existing and future mitigation efforts should continue to be developed and employed that will enable the Town to be prepared for earthquakes.

While rare in Franklin County, earthquakes have happened in New England. New England experiences an average of 30 to 40 earthquakes each year although most are not noticed by people.[55] Ground shaking from earthquakes can rupture gas mains and disrupt other utility service, damage buildings, bridges and roads, and trigger other hazardous events such as landslides, avalanches, flash floods (dam failure) and fires. Un-reinforced masonry buildings,

[55] Northeast States Emergency Consortium web site: www.nesec.org/hazards/earthquakes.cfm

buildings with foundations that rest on filled land or unconsolidated, unstable soil, and mobile homes not tied to their foundations are at risk during an earthquake.[56]

Data Collected and Used

Data on earthquakes from the Northeast States Emergency Consortium web site was reviewed, as was the FEMA data on earthquake hazards. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2013 was also reviewed for information on earthquake hazard data and mitigation measures.

Impact on the Community

Exposure and Loss Estimation

A major earthquake could cause severe damage to Shutesbury buildings, including older structures that were built before a 1975 law requiring new buildings to withstand earthquakes. In Shutesbury, 75% of the housing stock was built before 1970, according to the U.S. Census' 2008-2012 American Community Survey (ACS).

Property Damage

The entire built environment of Shutesbury is vulnerable to earthquakes. Table 3-15 on page 52 identifies the assessed value of all residential, commercial, and industrial land uses in Shutesbury as $208,605,600, and the losses that would result from 1% ($2,086,056), 5% ($10,430,280), and 10% ($20,860,560) damage to this inventory as a result of an earthquake.

Population Impacts

Populations considered most vulnerable to earthquake impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-13 on page 49 summarizes the population in Shutesbury aged 65 or over and those living in households with an income below $25,000 per year, which totals 311 persons (or over 17% of the population). It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table.

Vulnerability Assessment

Earthquakes, while rare, could cause significant impacts and losses to the roads, structures, facilities, utilities, and population of Shutesbury. Existing and future mitigation efforts should continue to be developed and employed that will enable Shutesbury to be prepared for these events when they occur. Particular areas of vulnerability include low-income and elderly populations, trailer homes and buildings erected before 1970, and infrastructure such as roadways and utilities that could be damaged by earthquakes. According to members of the EMT, no earthquakes have had a significant impact on Shutesbury in the last 20 years. However, in August of 2011 an earthquake centered in Virginia was felt in the Franklin County region, including Shutesbury.

[56] Federal Emergency Management Agency web site: www.fema.gov/hazards/earthquakes/quake.shtm.

Data Deficiencies
In assessing the risks to Shutesbury from earthquakes, no data deficiencies were identified.

Landslides

Hazard Summary

Landslides rarely occur in Franklin County, but one occurred in Greenfield in March of 2011. They have occurred in the eastern part of the state more frequently. Following heavy rains in March 2010, Walpole and Topsfield experienced landslides that destroyed a storage building and closed a portion of Route 1. The Topsfield slide resulted in a tree land on a passing car, but no injuries were reported. Earlier that month, a mudslide at a construction site brought mud within 12 feet of train tracks at the Wellesley Hills station of the Massachusetts Bay Transportation Authority in Wellesley. Landslides are most often caused by heavy rains destabilizing slopes but can have other causes, including clearing land for development, earthquakes, and vibrations from machinery or blasting. Landslides can be dangerous because they are unexpected and fast. They can bury structures with little warning and rescue efforts can be threatened by new slides.

Data Collected and Used

National Oceanic and Atmospheric Administration's National Climatic Data Center website shows no landslide events in Franklin County since 1994, although this category has changed definitions over the years and may not reflect actual events. The ***National Landslide Hazards Mitigation Strategy: A Framework for Loss Reduction***, 2000, from the U.S. Department of the Interior, U.S. Geological Survey was consulted. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2013 was also reviewed for information on landslide hazard data and mitigation measures.

Impact to the Community

Exposure and Loss Estimation
While landslides are rare, their impacts can be devastating, including loss of property, disruption to infrastructure, and injury and death. Continued development, particularly on steep slopes or unstable soils, increases the chances that landslides will be a danger. Other associated concerns are debris management issues including debris removal and identification of disposal sites.

Property Damage
Historic data for landslide events indicate that no landslide events were recorded in Franklin County. Estimates of the cost of the March 7, 2011 landslide in Greenfield are not available. Table 3-15 on page 52 identifies the assessed value of all residential, commercial, and industrial land uses in Shutesbury as $208,605,600, and the losses that would result from 1% ($2,086,056), 5% ($10,430,280), and 10% ($20,860,560) damage to this inventory as a result of a landslide.

Population Impacts
Populations considered most vulnerable to landslide impacts are identified based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Table 3-13 on page 49 summarizes the

population in Shutesbury aged 65 or over and those living in households with an income below $25,000 per year, which totals 311 persons (or over 17% of the population). It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table.

Overall Vulnerability Assessment

Landslides, while rare in Franklin County, can destroy roads, structures, facilities, utilities, and impact the population of Shutesbury. Existing and future mitigation efforts should continue to be developed and employed that will enable Shutesbury to be prepared for these events when they occur. Particular areas of vulnerability include low-income and elderly populations, and buildings, roadways, and utilities near the foot of slopes, especially when slopes are destabilized.

Data Deficiencies

In assessing the risks to Shutesbury from landslides, no data deficiencies were identified.

Ice Jams

Hazard Summary

Ice jams (or ice dams) occur when water builds up behind a blockage of ice. Ice jams can occur in various ways, but in New England they predominantly form on rivers and streams and mainly threaten infrastructure.

When the upstream part of a river thaws first and the ice is carried downstream into the still-frozen part of the watercourse, ice can form an ice dam and flood low lying areas upstream of the jam. Also, once an ice dam breaks apart, the sudden surge of water that breaks through the dam can flood areas downstream of the jam. The resulting flow of water when an ice jam is broken can cause flooding downstream, threatening infrastructure, structures, and roadways.

The structures and people most at risk from an ice jam are those within the floodplain. The estimated assessed value of the residential properties located within the floodplain is $2,956,632.

Data Collected and Used

The Cold Regions Research Laboratory website was consulted. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2013 was also reviewed for information on ice jam hazard data and mitigation measures.

Impact to the Community

Exposure and Loss Estimation

Losses to ice jams include the rising waters along the river or stream that is being dammed, and the rush of water downstream when the dam either melts or is broken up by human intervention. Buildings, roadways and utilities are threatened by ice blockages.

Property Damage

Data on ice jams in Franklin County indicate that no property damage or injuries or deaths occurred as the result of ice jams in the last 20 years. The built environment in the floodplain of Shutesbury is vulnerable to ice jam events. Land uses located in the floodplain are discussed in the flooding section above. Table 3-12 on page 49 identifies the estimated assessed value of the residential land uses located in the floodplain in Shutesbury as $3,601,305. The losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a major flooding event would be $36,013, $180,065, $360,131, respectively.

Population Impact

Populations considered most vulnerable to ice jam impacts are those residing in the floodplain. As shown above in Table 3-11 on page 48, multiplying the 27 dwelling units in the floodplain by Shutesbury's average household size of 2.37, yields an estimate of 64 people, or 3.6% of Shutesbury's total population, residing in the floodplain who would be at risk in the event of an ice jam. In particular, the Town should be aware of the potential needs of senior and low income residents who may be physically or financially unable to react and respond to a hazard event and may require additional assistance in the event of a flood from an ice jam event. Table 3-13 on page 49 summarizes the population in Shutesbury aged 65 or over and those living in households with an income below $25,000 per year, which totals 311 persons (or over 17% of the population). It should be noted that there may be overlap within the two categories, so that the total number of persons exposed may be lower than what is shown in the table.

Overall Vulnerability Assessment

Ice jams occur throughout New England, often causing significant impacts and losses to roads, structures, facilities, utilities, and the population. Existing and future mitigation efforts should continue to be developed and employed that will enable Shutesbury to be prepared for these events when they occur. Particular areas of vulnerability include low-income and elderly populations, trailer homes, and infrastructure such as roadways near rivers and streams and utilities and low-lying areas. According to the members of the Local Multi-Hazard Mitigation EMT, no ice jams have occurred in the last 20 years in Shutesbury.

Data Deficiencies

In assessing the risks to Shutesbury from ice jams, no data deficiencies were identified.

Manmade Hazards

Hazard Summary

Manmade hazards are being assessed at the local level for the first time in this plan update. A preliminary assessment was made only of those manmade hazards of an accidental nature, such as transportation accidents or fixed facility accidents involving hazardous materials. No formal vulnerability assessment was done on manmade hazards.

Data Deficiencies

In assessing the risks to Shutesbury from manmade hazards, no data deficiencies were identified.

HAZARD ANALYSIS METHODOLOGY

In developing Shutesbury's Multi-Hazard Mitigation Plan, the Franklin Regional Council of Governments created the All Hazards Risk Assessment methodology for assessing the risk of natural hazards. The All Hazards Risk Assessment is an interactive table that the Shutesbury Emergency Management Team completed with the FRCOG staff to evaluate all the natural hazards that can impact the town based on frequency of occurrence, severity of impacts, area of occurrence and preparedness. The methodology yields a Weighted Hazard Index, which is a measure of the likelihood of future occurrence for each hazard as well as the potential impacts each hazard may have on the built and natural environments, the population and the infrastructure. The completed table also gives the town an overall understanding of the natural hazards, provides guidance on which hazards the Town may want to focus mitigation efforts on, reaffirms that Shutesbury's planning and preparedness is on track, and shows residents that town departments and agencies are organized in case of a natural disaster. Note that the Assessment does not include manmade hazards, given lack of data assessed for this plan.

In rating the hazards, the EMT considered the following issues for each category:

Issues considered when ranking **probability of occurrence**:

1) Known risk
2) Historical data (previous occurrences)

Issues considered when ranking **severity of impacts** (See Table 3-23 for complete definitions):

1) Building stock
2) Critical facilities
3) Transportation systems
4) Lifeline utility systems
5) Communications systems and networks
6) High potential loss facilities
7) Hazardous material facilities
8) Economic elements
9) Special consideration areas
10) Historic, cultural, and natural resource areas
11) Natural resources

Issues considered when ranking **preparedness**:

1) Status of current plans
2) Training status
3) Availability of backup systems
4) Community resources (equipment, personnel, etc.)

The following rating charts were used to determine the rating for each event.

Table 3-21: Probability of Occurrence Rating Chart

Classification	#	Frequency of Occurrence
Very High	5	Events that occur at least once each year (100% per year)
High	4	Events that occur from once in 2 years to once in 4 years (25% to 50% per year)
Medium	3	Events that occur from once in 5 years to once in 50 years (2% to 20% per year)
Low	2	Events that occur from once in 50 years to once in 100 years (1% to 2% per year)
Very Low	1	Events that occur less frequently than once in 100 years (less than 1% per year)

Table 3-22: Severity of Impacts Rating Chart

Classification	#	Severity of Multiple Impacts
Catastrophic	4	Multiple deaths and injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of facilities for 30 days or more.
Critical	3	Multiple injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 week.
Limited	2	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 day.
Minor	1	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of facilities.

Table 3-23: Severity of Impacts Definitions

Severity of Impact Category	Severity of Impact Category Definitions
Built	Building Stock includes residential, commercial, industrial, and institutional buildings.
Built	Hazardous Material Facilities include facilities housing industrial/hazardous materials, such as corrosives, explosives, flammable materials, radioactive materials, and toxins.
Built	Historic, Cultural, and Natural Resource Areas may include buildings, structures, objects, sites, national and local historic or significant districts, and historical archival storage facilities.
Infrastructure	Critical Facilities are essential to the health and welfare of the whole population and are especially important following hazard events. Since vulnerability is based on service losses as well as building structure integrity and content value, assess the effects on the service function interruption of critical facilities as well as their physical aspects. For purposes of this mitigation planning guidance, critical facilities may include emergency service facilities such as hospitals and other medical facilities, jails and juvenile detention centers, police and fire stations, emergency operations centers, public works facilities, evacuation shelters, schools, and other uses that house special needs populations.

Severity of Impact Category	Severity of Impact Category Definitions
Infrastructure	Transportation Systems include airways (including airports, heliports, etc.), roadways (including highways, bridges, tunnels, roadbeds, overpasses, transfer centers, etc.), railways and public transit (including trackage, tunnels, bridges, rail yards, depots, etc.), and waterways (including canals, locks, seaports, ferries, harbors, dry-docks, piers, etc.).
Infrastructure	Lifeline Utility Systems such as potable water, wastewater, oil, natural gas, electric power, substations, power lines, etc.
Infrastructure	Communications Systems and Networks such as telephones, emergency service radio systems, repeater sites and base stations, television and radio stations, etc.
Natural	Natural Resources include agricultural land, water supply lands, rivers.
Population	High Potential Loss Facilities include facilities that would have a high loss associated with them, such as nuclear power plants or dams.
Population	Economic Elements include major employers, financial centers, and other business or retail districts in the community that could significantly affect the local or regional economy if interrupted.
Population	Special Consideration Areas include areas of high density residential, commercial, institutional, and industrial development that, if damaged, could result in economic and functional losses and in high death tolls and injury rates.

Table 3-24: Area of Occurrence Rating Chart

Classification	#	Percentage of Town Impacted
Large	3	More than 50% of the town affected
Medium	2	10 to 50% of the town affected
Isolated	1	Less than 10% of the town affected

Table 3-25: Preparedness Rating Chart

Classification	#
Poor	3
Fair	2
Good	1

To determine the final hazard index for each hazard, each category was assigned a weight. Probability of Occurrence was given the most weight (45%), followed by Severity of Impacts (30%), Area of Occurrence (15%), and Preparedness (10%). Ratings were entered into a spreadsheet which calculated the weighted hazard index for each hazard. Hazards with higher index scores represent the events most in need of organization focus and resources for emergency planning and mitigation projects.

The All Hazards Vulnerability Assessment can be seen in Table 3-26. The hazards with the highest weighted hazard index identified by the EMT were Tornados, Microbursts, & Thunderstorms, Severe Winter Storms/Ice Storms, and Hurricanes/Tropical Storms.

Table 3-26: Shutesbury All Hazards Vulnerability Assessment

EVENTS	Probability of Occurrence*	POO Weighted Value	Severity of Impacts*				SOI Weighted Value	Area of Occurrence*	Add Weighted Value	Preparedness	Prep. Weighted Value	Weighted Hazard Index
ASSIGNED WEIGHTING FACTOR	45%		30%					15%		10%		
INDEX VALUE	1-5		Built 1-4*	Natural 1-4*	Population 1-4*	Infrastructure 1-4*		1-3		1-3		
NATURAL HAZARDS												
Floods	2	0.9	2	2	1	2	2.1	1	0.15	1	0.1	3.25
Severe Winter Storms/Ice Storms	5	2.25	1	1	1	2	1.5	2	0.3	1	0.1	4.15
Hurricanes/Tropical Storms	3	1.35	2	2	1	2	2.1	2	0.3	1	0.1	3.85
Tornados/Microbursts/ Thunderstorms	5	2.25	1	1	1	2	1.5	2	0.3	1	0.1	4.15
Wild Fires/Brush Fires	4	1.8	1	2	1	1	1.5	1	0.15	1	0.1	3.55
Dam Failures	1	0.45	2	2	2	2	2.4	2	0.3	1	0.1	3.25
Earthquakes	1	0.45	2	2	2	2	2.4	1	0.15	2	0.2	3.2
Landslides	1	0.45	1	1	1	1	1.2	1	0.15	1	0.1	1.9
Ice Jams	1	0.45	1	1	1	1	1.2	1	0.15	1	0.1	1.9

* See rating charts in Tables 3-21 to 3-25.

DEVELOPMENT TRENDS ANALYSIS

In assessing development trends for the Town of Shutesbury—and the impact those trends might have on hazard mitigation—the EMT was asked to evaluate the probability of development in town and areas most likely to be targeted for development. The EMT was also asked about changes in industry, proposed housing and retail development, and any major highway or public transit improvements that might change accessibility to parts of town. Additionally, data such as number of construction permits issued, change in population, current zoning bylaws and the acres of developable land was considered.

Table 3-27: 2010 Census Data: Population Trends

	Census Data			10 Year Trend		20 Year Trend	
Area Name	**1990 Census**	**2000 Census**	**2010 Census Redistricting**	**2000-2010 *Difference***	**2000-2010 *Change***	**1990-2010 *Difference***	**1990-2010 *Change***
Ashfield	1,715	1,800	1,737	-63	-3.5%	22	1.3%
Bernardston	2,048	2,155	2,129	-26	-1.2%	81	4.0%
Buckland	1,928	1,991	1,902	-89	-4.5%	-26	-1.3%
Charlemont	1,249	1,358	1,266	-92	-6.8%	17	1.4%
Colrain	1,757	1,813	1,671	-142	-7.8%	-86	-4.9%
Conway	1,529	1,809	1,897	88	4.9%	368	24.1%
Deerfield	5,018	4,750	5,125	375	7.9%	107	2.1%
Erving	1,372	1,467	1,800	333	22.7%	428	31.2%
Gill	1,583	1,363	1,500	137	10.1%	-83	-5.2%
Greenfield	18,666	18,168	17,456	-712	-3.9%	-1,210	-6.5%
Hawley	317	336	337	1	0.3%	20	6.3%
Heath	716	805	706	-99	-12.3%	-10	-1.4%
Leverett	1785	1663	1,851	188	11.3%	66	3.7%
Leyden	662	772	711	-61	-7.9%	49	7.4%
Monroe	115	93	121	28	30.1%	6	5.2%
Montague	8,316	8,489	8,437	-52	-0.6%	121	1.5%
New Salem	802	929	990	61	6.6%	188	23.4%
Northfield	2,838	2,951	3,032	81	2.7%	194	6.8%
Orange	7,312	7,518	7,839	321	4.3%	527	7.2%
Rowe	378	351	393	42	12.0%	15	4.0%
Shelburne	2,012	2,058	1,893	-165	-8.0%	-119	-5.9%
Shutesbury	1,561	1,810	1,771	-39	-2.2%	210	13.5%
Sunderland	3,399	3,777	3,684	-93	-2.5%	285	8.4%
Warwick	740	750	780	30	4.0%	40	5.4%
Wendell	899	986	848	-138	-14.0%	-51	-5.7%
Whately	1,375	1,573	1,496	-77	-4.9%	121	8.8%
Franklin County	**70,092**	**71,535**	**71,372**	**-163**	**-0.2%**	**1,280**	**1.8%**

Along with the EMT's assessment of development trends, Census data (Table 3-48) was also consulted. According to this data, the total population for 2010 in Shutesbury is 1,771. In 1990 the population was 1,561, then increased to 1,810 in 2000 and then decreasing slightly in 2010. In terms of the 20-year trend, Shutesbury grew 13.5% from 1990 to 2010, compared to all of Franklin County, which grew only 1.8% during the same time period. Shutesbury had the fourth highest population change over the 20 year period out of all of the towns in Franklin County. Population projections by the University of Massachusetts Donohue Institute through 2030 estimate that the population of Shutesbury will continue to decline, with just over 1,500 residents projected in 2030.[57]

The number of new privately-owned residential building permits issued in Shutesbury between 2000 and 2010 totaled 59, according to the U.S. Bureau of Census.[58] The high point during this period was 2006, when 11 building permits were reported. Only 2 (or 0.3%) of town's 758 year-round housing units counted in the 2010 U.S. Census qualify for the Massachusetts Department of Housing and Community Development's Subsidized Housing Inventory (SHI), falling far short of the 10% threshold and leaving the town vulnerable to a proposal for a comprehensive affordable housing development under Chapter 40B.

As discussed in the Vulnerability Assessment Section of this plan, current development in the 233 flood plain acres includes 27 dwelling units on 7.4 acres. There are no commercial, industrial or public/institutional land uses in the floodplain. Given current available GIS data, it is not known how much of the remaining floodplain land is currently developed. An analysis of the percentage of acres in the floodplain and its zoning would rely on estimations. Further GIS analysis beyond the scope of the current project would be necessary to determine the exact number of developable acres in and along the floodplain.

According to the 2012 Draft Open Space Plan, future development in town is limited by the fact that a large percentage of the town is owned by public agencies for conservation, recreation or watershed protection purposes, with most of it permanently protected from development. DCR owns 35.6% (6,183 acres) of the land and water in Shutesbury, including land that is protected as public surface water supply and adjacent watershed for the Quabbin Reservoir. The Shutesbury and Amherst conservation lands together own a total 642 acres or 3.7% of Shutesbury's land. Private properties with permanent restrictions on development equal another 682 acres. The total number of acres under permanent protection equals 7,507 acres (43% of the town's total land area). A total of 6,117 acres or 35% of the town's land is in is in "temporary" protection under the Chapter 61 (forestry), 61A (agriculture) and 61B (recreation) special taxation programs, with the vast majority (31% of the town's land) in Chapter 61 for forestry management. Adding in public and privately owned lands with limited protection, including the Town of Amherst Water Supply (516 acres), 81% of the land in Shutesbury is currently protected from development.[59]

[57] University of Massachusetts Donohue Institute, ***Long-term Population Projections for Massachusetts Regions and Municipalities***, November 2013; alternative projections for Shutesbury using a Cohort Change Ratio (CCR).
[58] Unites States Census Bureau, CenStats Database: http://censtats.census.gov/bldg/bldgprmt.shtml. Available data is no longer broken out my municipality, so only county information is available after 2010.
[59] ***2012 Draft Shutesbury Open Space and Recreation Plan***, Section 5: Inventory of Lands of Conservation and Recreation Interest; pp 72-75.

(See Map 7: Inventory of Lands of Conservation and Recreation Interest, from the 2012 Draft Open Space Plan at the end of this section.)

During the period from 2008 to 2009, Shutesbury adopted two major pieces of legislation pertaining to land use that also impact the town's development potential. The first is the Open Space Design provision of the Shutesbury Zoning Bylaw (Article V). This ordinance created four districts in town – the Forest Conservation District (FC), the Lake Wyola District (LW), the Roadside Residential District (RR) and the Town Center District (TC) as depicted on the town's Zoning Map (see Zoning Map at the end of this section). An important provision of this bylaw relates to the acreage necessary for a residential development and the obligations of a multi-unit development to reserve land to be protected, in perpetuity, under a conservation restriction. Plans for development in the FC must include a minimum of 80% of the property's acreage as protected open space, and a minimum of 65% as protected open space in the other three districts. This creates more permanently-protected open space (although not necessarily open to the public for use), and helps preserve the larger blocks of contiguous forest for wildlife, watershed protection and other environmental benefits. The second important action was the town's enactment of the CPA in 2008, offering a new funding opportunity for town acquisition of important open space and recreation lands.[60]

To the extent that development is anticipated in Shutesbury in the coming decade, it is likely to occur as single-family residential Approval-Not-Required (ANR) development along existing roads, particularly following the 2008 changes to the Zoning Bylaw that created the Roadside Residential (RR) District. The RR District is defined as follows in Section 2.2 of the Zoning Bylaws:

> "The purpose of the Roadside Residential District is to maintain the Town's pattern of rural settlement (outside the TC and LW districts), characterized by large expanses of forested land with residences and small businesses scattered within 500 feet of the centerlines of those existing public roadways that are shown on the Zoning Map within the RR District. This district allows the Town to continue to develop according to this pattern and helps to ensure that development occurs primarily near existing public roads."

[60] Ibid., pp. 71-72.

Critical Facilities & Infrastructure, 2014

Town of Shutesbury

DRAFT

See Inset

AMES HILL

LAKE WYOLA

BEAVERS

DUDLEYVILLE POND

DCR GATE

Quabbin Reservoir

Baker Reservoir

2005 Land Use

- Cropland/Pasture Cemetery, Orchard
- Commercial
- Forest
- Wetland
- Recreation
- Residential
- Industrial
- Mining
- Open Land
- Powerline/Utility, Transportation
- Waste Disposal
- 100 Yr Flood Plain

Evacuation Route

- Primary
- Secondary
- Tertiary
- Local Road

- Localized Flooding
- Shelter
- Gas Station
- Dam
- Tier II Facility
- Fire Station
- DPW
- Transmission Line
- School
- Town Hall
- Culvert
- Critical Culvert
- Public Water Supply
- Communication Tower
- Town Boundary

*Not all items in legend may appear in map

frcog Franklin Regional Council of Governments

0 0.5 1 2 Miles

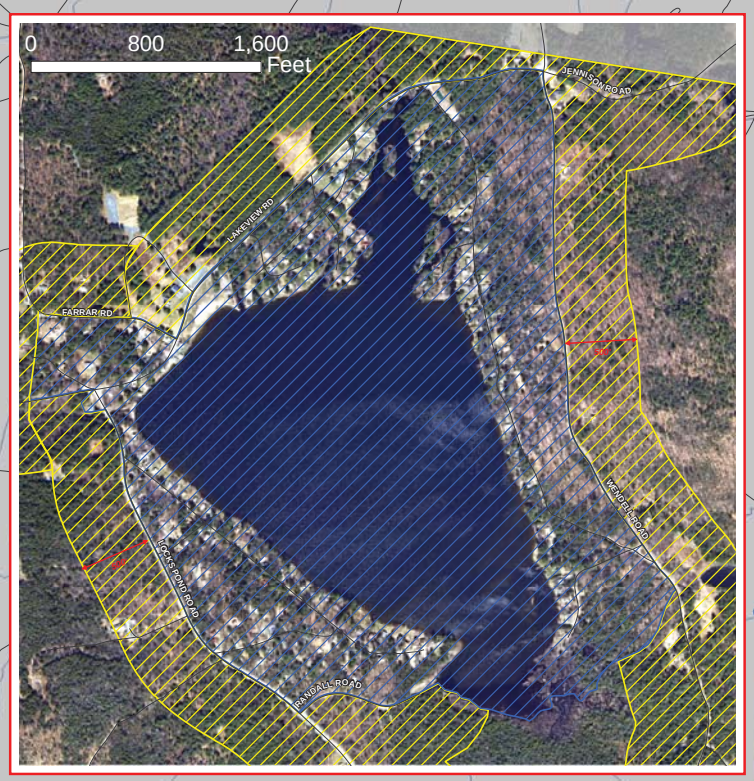
Sources: Map produced by the Franklin Regional Council of Governments Planning Department. GIS data sources include MassDOT, MassGIS and FRCOG. Depicted boundaries are approximate and are intended for planning purposes only, not to be used for survey.

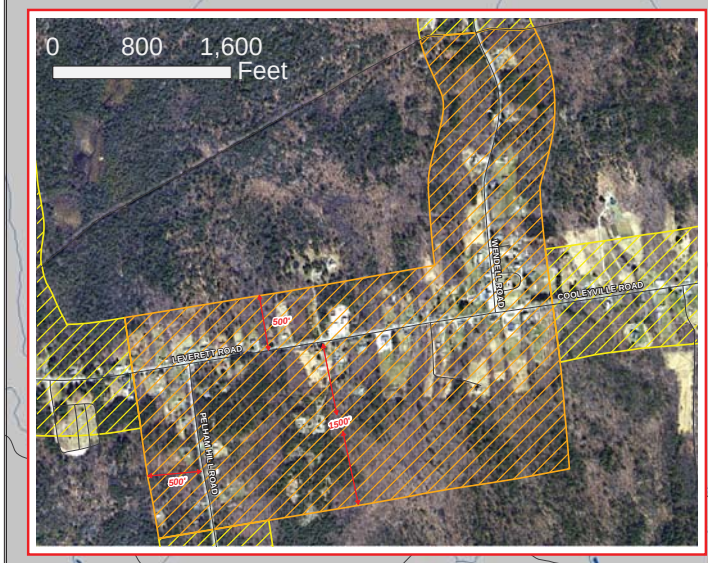
Town of Shutesbury, Franklin County, Ma.

DRAFT

Zoning Map of Shutesbury, Massachusetts

Adopted March 24, 2009





WENDELL

NEW SALEM

AMHERST

N
W
E
S

JENNISON RD
LAKEVIEW RD
FARRAR RD
RANDALL RD
STO WELL RD
WENDELL ROAD
LOCKS POND RD
PLAZA RD
MONTAGUE ROAD
NEW SALEM RD
CORNWELL RD
ONE-THOUSAND FOOT CONSERVATION LINE
ONE-THOUSAND FOOT CONSERVATION LINE
TOWN COMMON ROAD
COOLEYVILLE ROAD
PRESCOTT ROAD
TOWN FARM ROAD
3/10 mile
LEVERETT ROAD
PRATT CORNER RD
LEONARD RD
WEST PELHAM ROAD
PELHAM HILL RD
DANIEL SHAYS HIGHWAY
JUNIA RY HILLS RD
CUSHMAN ROAD
CROSS RD
SAND HILL ROAD
BAKER ROAD
SCHOOLHOUSE ROAD
WHITMANHOOD RD
HIGH POINT DR
500'
600'
1500'

Legend

- River, Stream
- Water
- Road
- Parcel Boundary

Zoning District

- Forest Conservation District (FC)
- Roadside Residential District (RR)
- Town Center District (TC)
- Lake Wyola District (LW)

0 875 1,750 3,500 5,250 7,000 Feet

FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS
Main Office: 413-774-3167
425 Main Street
Greenfield, Massachusetts 01301

Map Sources:

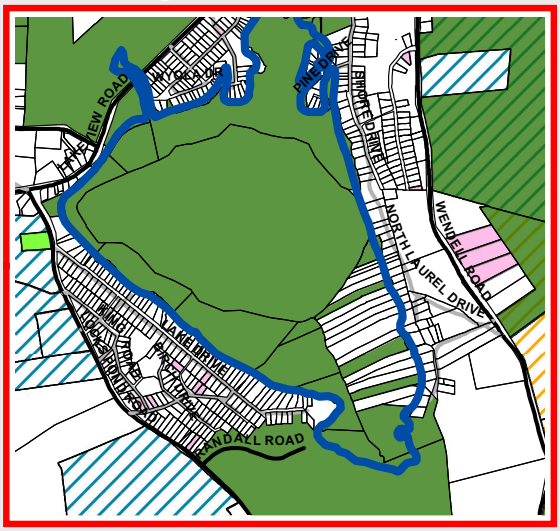
Map Produced by the Franklin Regional Council of Governments Planning Department. GIS data sources include the FRCOG Planning Department, the Massachusetts Highway Department and MassGIS. Digital Data obtained from MassGIS represent the efforts of the Massachusetts Executive Office of Environmental Affairs and its agencies to record information from the sources cited in the associated documentation. EOEA maintains an ongoing program to record and correct errors in the GIS data that are brought to or as to the implied validity of any uses of the GIS data. EOEA maintains records regarding all methods used to collect and process these digital data and will provide this information on request. Executive Office of Affairs, MassGIS EOEA Data Center, 251 Causeway St., Suite 900, Boston, MA, 617-626-1000.
Note: Depicted boundaries are approximate and are intended for planning purposes only.

Proposed zoning provided by town of Shutesbury and digitized by FRCOG Planning Staff.
Parcel data provided by town of Shutesbury assessors department.
Road, water and town boundary data provided by MassGIS.

map composed by Ryan Clary, FRCOG Planning Dept.:\\fcfc-fs_projects\shut_zoning\a_projects\official_shut_zoning.mxd

Town of Shutesbury Open Space Plan

Map 7 Inventory of Lands of Conservation & Recreation Interest



Legend

- Major Waterbodies
- Private Road
- Mass DOT Road
- Town Accepted Road
- DCR Road
- Parcels

Open Space

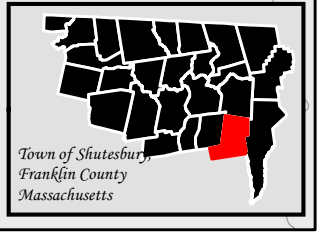
- Open Space with Limited Protection
- Open Space with Permanent Protection
- Unprotected Town Land

Temporary Protection

- Chapter 61: Forestry
- Chapter 61A: Agriculture
- Chapter 61B: Recreation

Sources: Map produced by the Franklin Regional Council of Governments Planning Department. GIS data sources include MassDOT, MassGIS, FRCOG, and Town of Shutesbury Open Space Committee. Depicted boundaries are approximate and are intended for planning purposes only, not to be used for survey.

0 0.5 1 2 Miles



Town of Shutesbury
Franklin County
Massachusetts

4 –MITIGATION STRATEGIES

This section of the Hazard Mitigation Plan is the long-term blueprint for reducing the potential losses identified in the risk assessment.

CURRENT MITIGATION STRATEGIES

Floods

The Critical Facilities & Infrastructure Map for the Town of Shutesbury shows the 100-year flood zone identified by FEMA flood maps. The 100-year flood zone is the area that will be covered by water as a result of a flood that has a 1% chance of occurring in any given year.

The major floods recorded in Shutesbury during the 20th and 21st centuries have been the result of rainfall alone or rainfall combined with snowmelt. One of the goals of this Multi-Hazard Mitigation Plan is to evaluate all of the Town's existing policies and practices related to hazards and identify potential gaps in protection.

Management Plans

The Comprehensive Emergency Management (CEM) Plan for Shutesbury lists the following generic mitigation measures for flood planning:

- Identify areas in the community that are flood prone and define methods to minimize the risk. Review National Flood Insurance Maps.
- Disseminate emergency public information and instructions concerning flood preparedness and safety.
- Strict adherence should be paid to land use and building codes, (e.g., Wetlands Protection Act), and new construction should not be built in flood prone areas.
- Ensure that flood control works are in good operating condition at all times.
- Natural water storage areas should be preserved.
- Maintain plans for managing all flood emergency response activities including addressing potentially hazardous dams.

The Comprehensive Emergency Management (CEM) Plan for Shutesbury lists the following generic preparedness and response measures for floods:

- Place emergency operations center (EOC) personnel on standby during stage of flood 'watch' and monitor NWS/New England River Forecast Center reports.
- Ensure that public warning systems are working properly and broadcast any information that is needed at this time.
- Review mutual aid agreements.
- Monitor levels of local bodies of water.
- Arrange for all evacuation and sheltering procedures to be ready for activation when needed.

- Carry out, or assist in carrying out needed flood-proofing measures such as sand bag placement, etc.
- Regulate operation of flood control works such as flood gates.
- Notify all emergency management related groups that will assist with flood response activities to be ready in case of flood 'warning.'
- Broadcast warning/notification of flood emergency.
- Coordinate traffic control and proceed with evacuation of affected populations as appropriate.
- Open and staff shelters and reception centers.
- Undertake, or continue to carry out flood proofing measures.
- Dispatch search and rescue teams and emergency medical teams.

Evacuation Options

The majority of land in the 100-year floodplain in Shutesbury is along Lake Wyola, the West Branch of the Swift River, Dudleyville Pond, and the Atkins Reservoir. Baker Road is also identified in the 2014 eCEMP as a flood prone area. Most of the residential development in Town is located outside the 100-year floodplain. The Shutesbury eCEMP has recently been updated to reflect the designation of the Shutesbury Elementary School as a Mass Care Shelter in Town, since it now has a generator large enough to run the critical areas of the facility that would be needed to use it as a shelter, including the kitchen and bathrooms. The Lake Wyola Association Building is also listed as a Mass Care Shelter, but it does not have a generator. The following are the flood evacuation routes listed in the eCEMP:

- From Center of Town, West bound on Leverett Road into Leverett.
- From Center of Town Eastbound on Cooleyville Road to Prescott Road, East to Rte 202. Then North or South as needed.
- Wendell Road North to Locks Pond Road, Locks pond Road to Lakeview Road. West bound to North Leverett and Rte 63, or East bound Pelham Hill Road South Through Pelham to Rte 202 South.

The Town of Shutesbury faces potential flood hazards from the 100-year floodplain, localized flooding, and inundation due to dam failures. Emergency management personnel should assess existing floodplain and dam failure data to determine an appropriate evacuation plan.

Flood Control Structures

FEMA has identified no flood control structures within the Town of Shutesbury. Floods on the Connecticut River and portions of its major tributaries that are prone to backwater effects are controlled by nine flood control reservoirs located upstream in Massachusetts, New Hampshire, and Vermont.

Land Use Regulations that Mitigate Impacts from Flooding

The Town of Shutesbury has adopted several land use regulations that serve to limit or regulate development in floodplains, to manage stormwater runoff, and to protect groundwater and wetland resources, the latter of which often provide important flood storage capacity. Relevant

sections of these regulations are provided in Appendix B and summarized and evaluated in Table 4-1.

River and Stream Protection

The Town of Shutesbury follows the standards established by the Wetlands Protection Act (M.G.L. Chapter 131, Section 40).

Shutesbury Open Space and Recreation Plan

The 2012 draft Shutesbury Open Space and Recreation Plan identifies the resources critical to the Town's future welfare and devises procedures to protect them in a Seven-Year Action Plan. People live in Shutesbury because they like its rural, small town character. According to the 2006 Open Space and Recreation Survey, results indicate that the town's low density rural character, together with its forests, wetlands, clean air and water, and tree-lined streets were important factors in deciding to live in Shutesbury.

National Flood Insurance Program

The Town of Shutesbury has filed an application in October 2014 to join the National Flood Insurance Program, having adopted a new Floodplain Overlay District Bylaw in November 2012. The Town's floodplain management program consists of regular enforcement of the relevant sections of the State Building Code (780 CMR) and the Massachusetts Wetlands Protection Regulations (310 CMR 10.00). See pages 123-125 for more information on NFIP.

Table 4-1: Existing Flood Hazard Mitigation Measures in Shutesbury

Type of Existing or Proposed Flood Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
Floodplain Overlay District				
Zoning Bylaws **Section 8.9 Floodplain Overlay District** (See also below under Zoning Bylaws)	The purposes of the Floodplain Overlay District are to: 1. Ensure public safety through reducing the threats to life and personal injury; 2. Eliminate new hazards to emergency response officials; 3. Prevent the occurrence of public emergencies resulting from a reduction in water quality, contamination, and/or pollution due to flooding; 4. Avoid the loss of utility services which if damaged by flooding would disrupt or shut down the utility network and impact regions of the community beyond the site of flooding; 5. Reduce costs associated with the response and cleanup of flooding conditions; 6. Reduce damage to public and private	See Shutesbury Flood Insurance Rate Map (FIRM) dated June 18, 1980	Limited	None

Type of Existing or Proposed Flood Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
	property resulting from flooding waters.			
Subdivision Rules and Regulations				
Section IV: Definitive Plan		Entire Town	Somewhat effective for controlling impacts from stormwater runoff.	None
Section IV.B: Filing Procedures	Requires that the plans be prepared by a registered engineer or registered land surveyor.		Somewhat effective for mitigating or preventing localized flooding of roads and other infrastructure.	
Section IV.C: Contents	Plans must include water courses, one hundred year flood plains, wetlands, ponds, marshes, rock outcrop, ground water conditions, depth to groundwater, storm drainage system with rim elevations together with surface elevations of all waterways within subdivision, etc.			
Section IV.D: Performance Guarantee				
Section IV.E: Suitability of the Land	2. Wetlands Protection Act No activity of any kind subject to regulation under the Massachusetts Wetlands Protection Act or any local wetlands by-law may be carried out unless approved in accordance with that Act and the by-law.			
Section V: Design Standards		Entire Town	Somewhat effective for controlling impacts from stormwater runoff.	None
Section V.J.2 Storm Sewers	f. Proper drainage design includes appropriate storm lines and channels to accommodate properties "upstream" and appropriate structures to preclude "downstream" damage to adjacent properties. h. Peak stream flows and run-off at the boundaries of the subdivision development in a 25-year storm shall be no higher following development than prior to development.			

Type of Existing or Proposed Flood Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
Section VI: Required Improvements Section VI.F: Utilities Section VI.I Groundwater Drainage Section VI.J Retaining Walls Section VI.L Trees & Plantings	All gas, telephone, electricity, cable antenna, television, and other utility lines hall be installed underground. If located within a one hundred year flood plain, transformers, switching equipment, and all other components shall be flood proofed and approved by a registered engineer. As construction progresses, unforeseen groundwater conditions may be encountered which require additional subdrains or curtain drains. Retaining walls shall be installed where deemed necessary. 3. Bank Plantings a. All cut or fill bankings that tend to wash or erode shall be planted with suitable, well-rooted, and low-growing plantings. 5. The central portion of a permanent dead-end street should be landscaped. 6. Grass Strips. All cleared areas of a right-of-way not to be planted with groundcover plantings . . . shall be seeded with lawn grass seed.	Entire Town	Somewhat effective for controlling impacts from stormwater runoff.	None
Section VIII: Development Impact Statement	All subdivision applications shall be required to submit a detailed development impact statement (DIS). The DIS includes detailed assessments of the probable impacts of the proposed project on circulations systems, support systems, natural conditions, design factors, its environmental impact, its relationship to existing plans, and its phasing schedule.	Entire Town	Somewhat effective for mitigating or preventing localized flooding of roads and other infrastructure.	None
Zoning Bylaws				
Article II: Establishment of Districts		Entire Town	Effective	None

Type of Existing or Proposed Flood Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
Section 2.2: Purpose of Land Use Districts	2.2-1 FC: The purpose of the Forest Conservation District is to preserve large areas of contiguous forest land shown on the Zoning Map as lying more than 500 feet from the centerlines of existing public roadways in order to maintain commercial forestry as a viable agricultural activity and to protect watersheds, recreational land, natural resources, and wildlife habitat (including BioMap Core Habitat and Estimated Habitat of Rare Wildlife designated by the Commonwealth of Massachusetts). The FC District is also intended to protect substandard rural roads from the traffic that would result from overdevelopment on interior land, while allowing limited development consistent with maintaining the rural density and character of Shutesbury. 2.2-2 RR: The purpose of the Roadside Residential District is to maintain the Town's pattern of rural settlement (outside the TC and LW districts), characterized by large expanses of forested land with residences and small businesses scattered within 500 feet of the centerlines of those existing public roadways that are shown on the Zoning Map within the RR District. This district allows the Town to continue to develop according to this pattern and helps to ensure that development occurs primarily near existing public roads.			
Article III Zoning Districts: Use Regulations Section 3.2 Prohibited Uses in All Districts	The following uses, structures, and activities shall be prohibited, unless state or federal law provides otherwise: 3.2-1 Proposed uses of land which create excessive traffic congestion, land erosion, or are hazardous, injurious, noxious, detrimental or offensive. 3.2-2 Trailer or mobile home parks, facilities for the handling, storage, or	Entire Town	Effective	None

Type of Existing or Proposed Flood Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
	disposal of hazardous waste, and commercial junk yards, landfills, and refuse disposal areas. 3.2-3 An individual trailer or mobile home used as a dwelling, except in certain specified circumstances. 3.2-4 Signs or floodlights which constitute a hazard to pedestrian or vehicular traffic because of the intensity or direction of their illumination. 3.2-5 The commercial removal of stones from a stone wall, old field pile, or pre-existing cellar hole from any parcel for the purpose of transporting the stones out of Shutesbury for sale elsewhere.			
Article V: Open Space Design <u>Section 5.1: Purpose And Applicability</u>	<u>5.1-1 Purpose</u> The primary purpose of this Section is to preserve the open space resources of Shutesbury as identified in the Master Plan, especially large contiguous blocks of forested back-land that must be maintained as large-acreage holdings in order to remain economically viable for commercial forestry. This is necessary for the continuation of forestry as a significant resource-based local agricultural activity and for the protection of the Town's water resources and other unique environmental assets. This section is also intended to foster compact development patterns using flexible regulations for density and lot dimensions and to promote and encourage creativity in neighborhood design. The Town wishes to encourage the use of Open Space Design because Open Space Design results in the preservation of contiguous open space and important environmental resources, while allowing design flexibility. Open Space Design reduces development impacts on farmland, forests, wildlife habitats, large tracts of contiguous open space, environmentally sensitive areas, steep slopes, hilltops, and historically significant areas. To encourage this type of development, Open	Entire Town	Effective	None

Type of Existing or Proposed Flood Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
	Space Design is allowed by right, subject only to the requirements of the Regulations Governing the Subdivision of Land. An Open Space Design that does not require approval as a subdivision is allowed by right subject to Site Plan approval by the Planning Board. In order to encourage small subdivisions to follow Open Space Design principles, there is no minimum parcel size or number of lots required for an Open Space Design. 5.1-2 Applicability A. An Open Space Design may be proposed anywhere in Shutesbury, including the TC district. Within the FC, RR, and LW District, all subdivisions shall comply with the Open Space Design provisions, unless the Planning Board allows a development that deviates from the requirements by Special Permit.			
Section 5.2: Development Impact Statement And Conservation Analysis	An applicant must present sufficient information on the environmental and open space resources for the Board to make such determination. The required information shall be provided in the form of a Development Impact Statement, including a "conservation analysis" as described in Subsection IX of Section VIII of the Subdivision Regulations. 5.2-1: Conservation Analysis and Findings D. The Planning Board's conservation findings shall be incorporated into its decision to approve, approve with conditions, or deny an application. The conservation findings shall show land to be permanently preserved by a conservation restriction, as well as recommended conservation uses, ownership, and management guidelines for such land. The conservation findings shall also indicate preferred locations for development if the Plan is denied based upon such findings. 5.2-2 Minimum Preserved Open Space The Plan shall show that at least the			

Type of Existing or Proposed Flood Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
	percentages of the total acreage listed below will be preserved by conservation restriction, based upon the conservation findings. FC District: minimum of 80% RR, LW, TC Districts: minimum of 65%			
Article VIII: Supplementary Regulations <u>Section 8.1: Clearing, Excavation, Filling, and Grading</u>	8.1-1 Clearing, excavation, filling, and grading necessary for the construction of a structure or accessory uses for which a Building Permit has been issued shall be permitted, provided that it is in full compliance with applicable wetland regulations, does not adversely affect natural drainage or structural safety of buildings or lands, cause erosion, sedimentation, or contamination of groundwater or surface water, or create any noxious condition or hazard to public health or safety. Burial or storage of stumps resulting from the cutting of trees shall not be visible from a public road.	Entire Town	Effective	None
<u>Section 8.3: Rural Siting Principles</u>	<u>8.3-1 Standards for Land Development</u> The standards shall apply to the siting of all uses and structures that are in Open Space Designs or subject to Site Plan or Special Permit approval. They include , wherever feasible, retaining and reusing existing old farm/woods roads and lanes rather than constructing new roads or driveways.			
<u>Section 8.5: Regulations for Specific Uses and Accessory Uses</u>	<u>8.5-2 Non-Residential Uses</u> Non-residential uses, identified as Business Uses and Community Uses in the Use Table in §3.1-1, shall comply with following standards, including that the use must not cause or contribute to any erosion of land or increase surface water drainage from the lot. <u>8.5-5 Soil Mining</u> The Special Permit granting authority shall impose conditions to:			

Type of Existing or Proposed Flood Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
Section 8.9: Floodplain Overlay District	D. Protect groundwater resources, by: 1. Establishing through on-site investigations and soil observations the elevation of the seasonal high groundwater elevation. 2. Maintaining a minimum separation of four feet between the estimated seasonal high groundwater elevation and the bottom of pit excavation. F. Contain and control stormwater runoff on-site. The off-site discharge of runoff from land disturbing activities in excess of one acre requires an EPA permit under the federal NPDES program. (See above at beginning of chart)	Limited	Effective	None
Article IX: Site Plan Review And Special Permits Section 9.1: Site Plan Review When No Special Permit Is Required	9.1-1 Submission Requirements 1. The following scaled and dimensioned information for both existing conditions and proposed improvements: . . . topography including contours; wetlands, waterbodies, watercourses, and FEMA 100-year floodplains; soil types; vegetation; farmland; trails; structures; and unique natural site features; . . . landscaping features including screening, fencing, and plantings; open space or recreational areas; lighting; natural and man-made drainage infrastructure; vehicular circulation; signs; building plans and elevations; clearing and grading limits; and other information required by the approving board. 2. The applicant shall also submit the following additional information: measures to prevent flooding, increased runoff, changes in groundwater levels, and pollution of surface water and groundwater; design features which will integrate the proposed development into the existing landscape, maintain	Entire Town	Effective	None

Type of Existing or Proposed Flood Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
	neighborhood character, enhance aesthetic assets and screen objectionable features from neighbors and roadways; and control measures to prevent erosion and sedimentation during and after construction and to specify the sequence of grading and construction activities, location of temporary erosion and sedimentation control measures, and final stabilization of the site. 9.1-2 Review Criteria The following criteria shall be considered by the approving board in evaluating the Site Plan and related information submitted as part of the application: F. Protection of the supply and quality of groundwater and surface water and natural resources and ecosystems. H. Avoidance of adverse impacts of stormwater runoff from the site. Drainage shall recharge ground water to the extent practical, and surface waters flowing off-site shall not adversely affect drainage on adjacent properties or roads. K. Integration of the project into the existing terrain and surrounding landscape by minimizing impacts on wetlands, steep slopes, and hilltops; protecting visual amenities and scenic views; preserving unique natural or historical features; minimizing tree, vegetation, and soil removal; minimizing grade changes, and integrating development with the surrounding neighborhood in a manner that is consistent with the prevailing pattern, design, and scale of development and that protects historic structures and features.			
Section 9.2: Special Permits	9.2-2 Review Criteria B. Specific Findings In order to approve a Special Permit, the SPGA shall also make specific written findings that the proposed use, with or without appropriate conditions: 7. Will not cause significant environmental damage due to flooding,			

Type of Existing or Proposed Flood Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
	wetland loss, habitat or ecosystem disturbance, or damage to valuable trees. 8. Will not cause other significant adverse environmental effects, including but not limited to: a. Pollution of surface water or groundwater; b. Inadequate water supply to meet the anticipated demand of the proposed activity or use or reduction of water supply to other properties; c. Destruction of important wildlife habitats and damage to wetlands or forest ecology; d. Noise and air pollution; f. Damage to streams or lakes; g. Construction which unnecessarily damages the visual amenities of the site and which is not in harmony with the landscape type; h. Unnecessary decreases in agricultural or forestry use or potential productivity of land; i. Erosion resulting from or caused by development.			
Other Protections				
State Building Code	The Town of Shutesbury has adopted the Massachusetts State Building Code.	Entire Town	Effective	None

Severe Winter Storms

Winter storms can be especially challenging for emergency management personnel even though the duration and amount of expected amount of snowfall has usually been forecast. The Massachusetts Emergency Management Agency (MEMA) serves as the primary coordinating entity in the statewide management of all types of winter storms and monitors the National Weather Service (NWS) alerting systems during periods when winter storms are expected.

Management Plans

The eCEMP for Shutesbury lists the following generic mitigation measures for severe winter storms:

- Develop and disseminate emergency public information concerning winter storms, especially material that instructs individuals and families how to stock their homes, prepare their vehicles, and take care of themselves during a severe winter storm.
- As it is almost guaranteed that winter storms will occur annually in Massachusetts, local government bodies should give special consideration to budgeting fiscal resources with snow management in mind.
- Maintain plans for managing all winter storm emergency response activities.

To the extent that some of the damages from a winter storm can be caused by flooding, all of the flood protection mitigation measures described in Table 4-1 can also be considered as mitigation measures for severe snowstorms/ice storms.

The eCEMP for Shutesbury lists the following generic preparedness and response measures for severe winter storms:

- Ensure that warning/notification and communications systems are in readiness.
- Ensure that appropriate equipment and supplies, (especially snow removal equipment), are in place and in good working order.
- Review mutual aid agreements.
- Designate suitable shelters throughout the community and make their locations known to the public.
- Implement public information procedures during storm 'warning' stage.
- Prepare for possible evacuation and sheltering of some populations impacted by the storm (especially the elderly and special needs).
- Broadcast storm warning/notification information and instructions.
- Conduct evacuation, reception and sheltering activities.
- If appropriate, activate media center. Refer to Resource Manual for media center information.
- Dispatch search and rescue and emergency medical teams.
- Take measures to guard against further danger from power failure, downed trees and utility lines, ice, traffic problems, etc.
- Close roads and/or limit access to certain areas if appropriate.
- Provide assistance to homebound populations needing heat, food and other necessities.
- Provide rescue and sheltering for stranded/lost individuals.

Restrictions on Development

There are no restrictions on development that are directly related to severe winter storms. The Town of Shutesbury Zoning Bylaws provide general regulations for erosion control in its criteria for the review of Site Plans and Special Permit applications and its Subdivision Rules and Regulations sets design standards for storm drainage (Section V.J-2, Storm Sewers) and required improvements such as underground utilities (Section VI.F: Utilities) which, although not specified as weather hazard mitigation, can serve to minimize the potential for accidents in the event of severe winter storms. These regulations are included in Appendix B and summarized and evaluated in Table 4-2.

Other Mitigation Measures

Severe snowstorms or ice storms can often result in a small or widespread loss of electrical service. Following is a potential mitigation measure to address this problem:

> Review and update regulations to facilitate and seek out potential funding sources for undergrounding of utilities along main roads in the Town.

State Building Code

For new or recently built structures, the primary protection against snow-related damage is construction according to the State Building Code, which addresses designing buildings to withstand snowloads. The Town of Shutesbury is a member of the Franklin County Cooperative Building Inspection Program.

Table 4-2: Existing Severe Winter Storm Mitigation Measures in Shutesbury

Type of Existing or Proposed Winter Storm Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
Subdivision Rules and Regulations				
Section V: Design Standards Section V.J.2 Storm Sewers	f. Proper drainage design includes appropriate storm lines and channels to accommodate properties "upstream" and appropriate structures to preclude "downstream" damage to adjacent properties. h. Peak stream flows and run-off at the boundaries of the subdivision development in a 25-year storm shall be no higher following development than prior to development. .	Entire Town	Somewhat effective	None
Article VI: Required Improvements for Approved Subdivisions Section VI.F: Utilities	All gas, telephone, electricity, cable antenna, television, and other utility lines hall be installed underground. If located within a one hundred year flood plain, transformers, switching equipment, and all other components shall be flood proofed and approved by a registered engineer.	Entire Town	Somewhat effective	None

Type of Existing or Proposed Winter Storm Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
Zoning Bylaws				
Article IX: Site Plan Review And Special Permits Section 9.1: Site Plan Review When No Special Permit Is Required	1-1 Submission Requirements 1. The following scaled and dimensioned information for both existing conditions and proposed improvements: . . . topography including contours; wetlands, waterbodies, watercourses, and FEMA 100-year floodplains; soil types; vegetation; farmland; trails; structures; and unique natural site features; . . . landscaping features including screening, fencing, and plantings; open space or recreational areas; lighting; natural and man-made drainage infrastructure; vehicular circulation; signs; building plans and elevations; clearing and grading limits; and other information required by the approving board. 2. The applicant shall also submit the following additional information: measures to prevent flooding, increased runoff, changes in groundwater levels, and pollution of surface water and groundwater; design features which will integrate the proposed development into the existing landscape, maintain neighborhood character, enhance aesthetic assets and screen objectionable features from neighbors and roadways; and control measures to prevent erosion and sedimentation during and after construction and to specify the sequence of grading and construction activities, location of temporary erosion and sedimentation control measures, and final stabilization of the site. 9.1-2 Review Criteria The following criteria shall be considered by the approving board in evaluating the Site Plan and related information submitted as part of the application: F. Protection of the supply and quality of	Entire Town	Somewhat effective	None

Type of Existing or Proposed Winter Storm Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
	groundwater and surface water and natural resources and ecosystems. H. Avoidance of adverse impacts of stormwater runoff from the site. Drainage shall recharge ground water to the extent practical, and surface waters flowing off-site shall not adversely affect drainage on adjacent properties or roads. K. Integration of the project into the existing terrain and surrounding landscape by minimizing impacts on wetlands, steep slopes, and hilltops; protecting visual amenities and scenic views; preserving unique natural or historical features; minimizing tree, vegetation, and soil removal; minimizing grade changes, and integrating development with the surrounding neighborhood in a manner that is consistent with the prevailing pattern, design, and scale of development and that protects historic structures and features.			
Section 9.2: Special Permits	9.2-2 Review Criteria B. Specific Findings In order to approve a Special Permit, the SPGA shall also make specific written findings that the proposed use, with or without appropriate conditions: 7. Will not cause significant environmental damage due to flooding, wetland loss, habitat or ecosystem disturbance, or damage to valuable trees. 8. Will not cause other significant adverse environmental effects, including but not limited to: a. Pollution of surface water or groundwater; b. Inadequate water supply to meet the anticipated demand of the proposed activity or use or reduction of water supply to other properties; c. Destruction of important wildlife habitats and damage to wetlands or forest ecology; d. Noise and air pollution; f. Damage to streams or lakes;			

Type of Existing or Proposed Winter Storm Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
	g. Construction which unnecessarily damages the visual amenities of the site and which is not in harmony with the landscape type; h. Unnecessary decreases in agricultural or forestry use or potential productivity of land; i. Erosion resulting from or caused by development.			
Other Protections				
State Building Code	The Town of Shutesbury has adopted the Massachusetts State Building Code.	Entire Town	Effective	None

Hurricanes and Tropical Storms

Of all the natural disasters that could potentially impact Shutesbury, hurricanes and tropical storms provide the most lead warning time because of the relative ease in predicting the storm's track and potential landfall. MEMA assumes "standby status" when a hurricane's location is 35 degrees North Latitude (Cape Hatteras) and "alert status" when the storm reaches 40 degrees north Latitude (Long Island). The flooding associated with hurricanes and tropical storms can be a major source of damage to buildings, infrastructure and a potential threat to human lives. Therefore, all of the flood protection mitigation measures described in Table 4-1 can also be considered hurricane mitigation measures. High winds that oftentimes accompany hurricanes can also damage buildings and infrastructure.

Management Plans

The eCEMP for Shutesbury includes the following generic mitigation measures for hurricane and tropical storms planning and response:

- Develop and disseminate emergency public information and instructions concerning hurricane preparedness and safety.
- Community leaders should ensure that Shutesbury is enrolled in the National Flood Insurance Program. See pages 123-125 for more information on NFIP.
- Develop and enforce local building codes to enhance structural resistance to high winds and flooding. Build new construction in areas that are not vulnerable to direct hurricane effects.
- Maintain plans for managing all hurricane emergency response activities.

The eCEMP for Shutesbury includes the following generic preparedness and response measures for hurricanes and tropical storms:

- Ensure that warning/notification systems and equipment is ready for use at the 'hurricane warning' stage.
- Review mutual aid agreements.
- Designate suitable wind and flood resistant shelters in the community and make their locations known to the public.
- Prepare for coordination of evacuation from potentially impacted areas including alternate transportation systems and locations of special needs facilities.
- Activate warning/notification systems to inform public of protective measures to be taken, including evacuation where appropriate.
- Conduct evacuation of affected populations.
- Open and staff shelters and reception centers.
- Dispatch search and rescue and emergency medical teams.
- Activate mutual aid activities.
- Take measures to guard against further danger from downed trees and utility lines, debris

Evacuation Options

The Shutesbury eCEMP has recently been updated to reflect the designation of the Shutesbury Elementary School as a Mass Care Shelter in Town, since it now has a generator large enough to run the critical areas of the facility that would be needed to use it as a shelter, including the kitchen and bathrooms.

Restrictions on Development

The Town of Shutesbury's Zoning Bylaws and Subdivision Regulations place few restrictions on developments that are wind-related. The Subdivision Regulations require the utilities be located underground if feasible. The Town of Shutesbury Zoning Bylaws regulate wireless communication facilities (Article VIII, section 8.7), which are allowed only by Special Permit. According to the Town of Shutesbury's Zoning Bylaws, mobile home parks are not permitted in the town, and individual mobile homes are permitted only in very limited circumstances and only for specified time periods.

State Building Code

For new or recently built structures, the primary protection against wind-related damage is construction according to the State Building Code, which addresses designing buildings to withstand high winds.

Table 4-3: Existing Hurricanes and Tropical Storms Hazard Mitigation Measures

Type of Existing or Proposed Hurricane Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
Subdivision Rules and Regulations				
Article VI: Required Improvements		Entire Town	Somewhat effective	None

Type of Existing or Proposed Hurricane Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
for Approved Subdivisions Section VI.F: Utilities	All gas, telephone, electricity, cable antenna, television, and other utility lines hall be installed underground. If located within a one hundred year flood plain, transformers, switching equipment, and all other components shall be flood proofed and approved by a registered engineer.			
Zoning Bylaws				
Article III: Zoning Districts: Use Regulation Section 3.2: Prohibited Uses in All Districts	3.2-2 Trailer or mobile home parks, facilities for the handling, storage, or disposal of hazardous waste, and commercial junk yards, landfills, and refuse disposal areas. 3.2-3 An individual trailer or mobile home used as a dwelling, except: A. An individual trailer or mobile home occupied as an accessory structure to a dwelling for a maximum of fourteen (14) days per year; provided that : 1. Adequate and lawful means are provided for health and safety, including written permission by the Board of Health, and 2. During periods exceeding fourteen (14) days when such trailer or mobile home is not occupied, it shall either be removed from the premises or stored with no occupants or other use, indoors or outdoors in the rear yard of a dwelling at least twenty (20) feet from the rear and side lot lines. B. An individual trailer or mobile home occupied for a maximum of eighteen (18) months during the reconstruction of a dwelling on the same property which was destroyed by fire or other catastrophe, provided that a valid Building Permit has been issued for such reconstruction; C. Temporary use, not to exceed one year, of a camping vehicle as an on-	Entire Town	Effective	None

Type of Existing or Proposed Hurricane Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
	premises field office or residence during the construction period of a project (including a single-family residence) with Board of Health approval. An extension of the one-year limitation may be allowed by Special Permit from the Zoning Board of Appeals. D. An individual trailer or mobile home used in a commercial campground or recreation area in compliance with the requirements of Section 8.5-4.			
Article VIII: Supplementary Regulations <u>Section 8.7: Wireless Communication Facilities</u>	<u>8.7-1 Purpose and Intent</u> The purpose of this Section is to establish standards for siting wireless telecommunication towers and facilities in Shutesbury. The intent of this Section is to: A. Encourage the location of wireless communication devices on pre-existing structures so as to minimize the total number of towers and visual impact upon the community; B. Require the co-location of new and existing tower sites thereby reducing the need for new facilities; C. Locate towers and facilities, to the extent possible, in areas where adverse environmental, historic, and visual impact to the community and adjacent property is minimal; D. Enhance the ability of providers of telecommunications services to provide such services to the community effectively and efficiently; and E. Make available wireless telecommunications tower locations on a preferential basis to local municipal agencies on the same financial terms as commercial providers.	Entire Town	Effective	None
Other Protections				
State Building Code	The Town of Shutesbury has adopted the Massachusetts State Building Code.	Entire Town	Effective	None

Tornados, Microbursts and Thunderstorms

Worcester County and areas just to its west, including portions of Franklin County, have been dubbed the "tornado alley" of the state because the majority of significant tornados in Massachusetts's weather history have occurred in that region. According to the Institute for Business and Home Safety, the wind speeds in most tornados are at or below design speeds that are used in current building codes.[61] Like earthquakes, the location and extent of potential damaging impacts of a tornado are completely unpredictable. Most damage from tornados– and associated storm events including thunderstorms, hail and lightning–comes from high winds that can fell trees and electrical wires, generate hurtling debris and, possibly, hail. Since the 1950s, there have been over twenty tornados that have touched down in Franklin County.

Management Plans

The eCEMP for Shutesbury includes the following generic mitigation measures for tornado, thunderstorm, and microburst planning and response:

- Develop and disseminate emergency public information and instructions concerning tornado safety, especially guidance regarding in-home protection and evacuation procedures, and locations of public shelters.
- Strict adherence should be paid to building code regulations for all new construction.
- Maintain plans for managing tornado response activities. Refer to the non-institutionalized, special needs and transportation resources listed in the *Resource Manual*.

The eCEMP for Shutesbury includes the following generic preparedness and response measures for tornados and microbursts:

- Designate appropriate shelter space in the community that could potentially withstand tornado impact.
- Periodically test and exercise tornado response plans.
- Put emergency management on standby at tornado 'watch' stage.
- At tornado 'warning' stage, broadcast public warning/notification safety instructions and status reports.
- Conduct evacuation, reception and sheltering services to victims.
- Dispatch search and rescue and emergency medical teams.
- Activate mutual aid agreements.
- Take measures to guard against further injury from such dangers as ruptured gas lines, downed trees and utility lines, debris, etc.
- Acquire needed emergency food, water fuel and medical supplies.
- Take measures relating to the identification and disposition of remains of the deceased.

Evacuation Plans

The Shutesbury eCEMP has recently been updated to reflect the designation of the Shutesbury Elementary School as a Mass Care Shelter in Town, since it now has a generator large enough to

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run the critical areas of the facility that would be needed to use it as a shelter, including the kitchen and bathrooms.

Zoning

See Hurricanes and Tropical Storms, previous section.

State Building Code

See Hurricanes and Tropical Storms, previous section.

Note: Table for Existing Tornado, Microburst and Thunderstorm Mitigation Measures is not shown as it is the same as Table 4-3: Existing Hurricanes and Tropical Storms Hazard Mitigation Measures in previous section.

Wildfires and Brushfires

Franklin County has approximately 356,174 acres of forested land, which accounts for 77% of total land area. Forest fires are therefore a potentially significant issue. Ninety percent of Shutesbury is forested, so nearly the entire Town is therefore at risk of fire.

Management Plans and Regulatory Measures

The Shutesbury eCEMP includes the following generic mitigation measures for wildfire planning and response:

- Promote fire safety measures such as fire-safe landscaping and construction practices to the public and business communities.

The Shutesbury eCEMP includes the following generic preparedness and response measures for wildfires:

- Restrict outside burning etc. based on moisture levels, fuels supply conditions such as drought.
- Identify high vulnerability or problem areas.
- Utilize mutual aid, including the State Fire Mobilization Plan, as needed.

Burn Permits

In 2011, Shelburne Control issued 275 burn permits in Shutesbury. Specific burn permit guidelines are established by the state, such as the burning season and the time when a burn may begin on a given day. It may be beneficial for the state to change some of their regulations to prevent wildfires and brushfires. Currently, the burning season extends from January 15th to May 1st. If the burning season were to start in November or December and end in April, this would allow for a longer season during the months found to be, traditionally, the least dry in Massachusetts. Currently, residents may only burn between 10 a.m. and 4 p.m. If state guidelines were changed to allow for an earlier start time, this would allow for most of the burning to be conducted in the morning before winds traditionally increase.

Subdivision Review

The Subdivision Regulations require that the Definitive Plan include information about the size and location of all fire hydrants, pump, and water lines between hydrants and pumps, and source(s) of water for fire fighting (Section IV.C-12). In addition, §V.K-2. Fire Hydrants, addresses the specific requirements for providing adequate protection.

The Shutesbury Zoning Bylaws require that fire protection measures are taken into account in the review criteria for Site Plan Review and Special Permit applications.

Restrictions on Development

There are currently no restrictions on development that are based on the need to mitigate the hazards of wildfires/brushfires.

Table 4-4: Existing Wildfire/Brushfire Hazard Mitigation Measures

Type of Existing or Proposed Fire Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
Burn Permits				
Public Education/ Outreach	The fire department does not have a public education/outreach program.	Entire town.	Not effective.	Develop and distribute an educational pamphlet on fire safety and prevention.
Subdivision Rules and Regulations				
Section IV: Definitive Plan <u>Section IV.C: Contents</u>	<u>Section IV.C-12:</u> Size and location of all fire hydrants, pump, and water lines between hydrants and pumps, and source(s) of water for fire fighting.	Entire Town	Somewhat effective	None
Section V: Design Standards <u>Section V.K: Water Supply</u>	<u>Section V.K-2, Fire Hydrants</u>: a. Minimum distance from the buildings (except for the pump house as provided in this Section V.J.2) shall be forty (40) feet. b. Maximum distance between hydrants shall be eight hundred (800) feet measured along the access route, provided, however, that at least one hydrant shall be located on each street. c. Minimum size of hydrant branch is six	Entire Town	Somewhat effective	None

Type of Existing or Proposed Fire Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
	(6) inches ID (inside diameter). d. Hydrants shall be supplied with water by a well or other water source (such as a pond within the subdivision with and all-weather way for access) provided by the subdivider, with pipes between hydrants and a pump capable of supplying to the hydrants one thousand six hundred (1600) gallons per minute for a period of at least twenty-four (24) hours. The pump and associated equipment shall be housed in a pump house with insulation and heating sufficient to protect the pump from freezing at temperatures down to -25 degrees Fahrenheit (-31.6 degrees Centigrade). One hydrant shall be located at the pump house. e. Maximum distance from any structure to a hydrant shall be 500 feet measured along the street.			
Zoning Bylaws				
Article IX: Site Plan Review And Special Permits Section 9.1: Site Plan Review When No Special Permit Is Required Section 9.2: Special Permits	9.1-2 Review Criteria The following criteria shall be considered by the approving board in evaluating the Site Plan and related information submitted as part of the application: E. Provision of adequate parking pursuant to Section 8.2, adequate and safe vehicular and pedestrian circulation, and accessibility for fire, police, and emergency vehicles. Section 9.2-2: Review Criteria B. Specific Findings In order to approve a Special Permit, the SPGA shall also make specific written findings that the proposed use, with or without appropriate conditions: 3. Is accessible and serviceable by fire, police, and other emergency vehicles.	Entire Town	Somewhat effective	None

Earthquakes

Although there are five mapped seismological faults in Massachusetts, there is no discernable pattern of previous earthquakes along these faults nor is there a reliable way to predict future earthquakes along these faults or in any other areas of the state. Consequently, earthquakes are arguably the most difficult natural hazard to plan for. Most buildings and structures in the state were constructed without specific earthquake resistant design features.

Management Plans

The Shutesbury eCEMP lists the following generic mitigation measures for earthquakes:

- Community leaders in cooperation with Emergency Management Personnel should obtain local geological information and identify and assess structures and land areas that are especially vulnerable to earthquake impact and define methods to minimize the risk.
- Strict adherence should be paid to land use and earthquake resistant building codes for all new construction.
- Periodic evaluation, repair, and/or improvement should be made to older public structures.
- Emergency earthquake public information and instructions should be developed and disseminated.
- Earthquake drills should be held in schools, businesses, special care facilities and other public gathering places.

The Shutesbury eCEMP lists the following generic preparedness and response measures for earthquakes:

- Earthquake response plans should be maintained and ready for immediate use.
- All equipment, supplies and facilities that would be needed for management of an earthquake occurrence should be maintained for readiness.
- Emergency management personnel should receive periodic training in earthquake response.
- If the designated EOC is in a building that would probably not withstand earthquake impact, another building should be chosen for an earthquake EOC.
- Mass Care shelters for earthquake victims should be pre-designated in structures that would be most likely to withstand earthquake impact.
- It is assumed that all special needs facilities could be affected to some extent by earthquake effects therefore preparedness measures should be in place to address the needs of all facilities listed in the Resource Manual.
- Most likely the entire population of the community will be affected by a seismic event. Estimate the maximum peak population affected, considering peak tourism, special event populations, and work hours.
- EOC will be activated and response will immediately be engaged to address any and all earthquake effects.
- Emergency warning/notification information and instructions will be broadcast to the public.
- Search and rescue and emergency medical teams will be dispatched.

- Firefighters will address fires/explosions and HAZMAT incidents.
- Law enforcement personnel will coordinate evacuation and traffic control as well as protecting critical facilities and conducting surveillance against criminal activities.
- Reception centers will be opened and staffed.
- Animal control measures will be taken.
- Immediate life-threatening hazards will be addressed such as broken gas lines, or downed utility wires.
- Emergency food, water and fuel will be acquired.
- Activate mutual aid.
- Measures will be taken by the chief medical examiner relating to identification and disposition of remains of the deceased.

Evacuation Options

The Shutesbury eCEMP has recently been updated to reflect the designation of the Shutesbury Elementary School as a Mass Care Shelter in Town, since it now has a generator large enough to run the critical areas of the facility that would be needed to use it as a shelter, including the kitchen and bathrooms.

State Building Code

State and local building inspectors are guided by regulations put forth in the Massachusetts State Building Code. The first edition of the Massachusetts State Building Code went into effect on January 1, 1975 and included specific earthquake resistant design standards. These seismic requirements for new construction have been revised and updated over the years and are part of the current edition of the Massachusetts State Building Code (780 CMR). Given that most structures in Massachusetts were built before 1975, many buildings and structures do not have specific earthquake resistant design features. Approximately 75 percent of Shutesbury's 942 housing units were built prior to 1970, before earthquake design requirements were instituted in the Massachusetts building code. In addition, built areas underlain by artificial fill, sandy or clay soils are particularly vulnerable to damage during an earthquake.

Restrictions on Development

There are no seismic-related restrictions on development.

Table 4-5: Existing Earthquake Hazard Mitigation Measures

Type of Existing or Proposed Earthquake Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
State Building Code				
	The Town of Shutesbury has adopted the State Building Code. Building inspection services are provided to the Town of Shutesbury by the Franklin County Cooperative Inspection Program (FCCIP).	Entire Town but applies to new construction only.	Effective for new buildings or substantial renovations of existing buildings only.	None

Type of Existing or Proposed Earthquake Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
Debris Management Plan				
	A 2014 -Franklin County Debris Management Plan has been developed by the FRCOG has been reviewed by MassDEP is in the process of being revised to incorporate comments received from MEMA, prior to being submitted to FEMA for acceptance.	Entire Town.	Will be effective when completed.	Work with the FRCOG and the REPC in updating and implementing the 2014 Franklin County Debris Management Plan

Dam Failures

The only mitigation measures in place are the state regulations that control the construction and inspection of dams. The Shutesbury eCEMP states that there are three categories of dam failure or overspill and that action should be taken according to hazard rating:

Type 1: Slowly developing condition

- Activate EOC;
- Activate all communication networks and establish 24-hour communications with Command Post.
- Release public information;
- Notify the following:
  - MEMA region headquarters
  - American Red Cross
  - downstream communities;
- Review plans for evacuation and sheltering
  - Evacuation
    - Routes
    - Notification
  - Sheltering
    - Availability and capacity
    - Food, supplies and equipment
    - Shelter owners and managers
    - Other communities (if out of Town sheltering is required)
- Require 'stand by' status of designated emergency response forces.

Type 2: Rapidly developing condition

- Establish 24-hour communication from the damsite to EOC;
- Assemble, brief and assign specific responsibilities to emergency response forces;
- Release public information;
- Obtain and prepare required vehicles/equipment for movement; and,
- Prepare to issue warning.

Type 3: Practically instantaneous failure

- Issue warning;
- Commence immediate evacuation;
- Commit required resources to support evacuation;
- Activate shelters or coordinate activation of shelters located outside the community;
- Notify:
  - MEMA region headquarters
  - American Red Cross
- Initiate other measures as required to protect lives and property.

Management Plans and Regulatory Measures

The Shutesbury eCEMP contains the following generic mitigation measures for dam failure:

- Develop and conduct public education programs concerning dam hazards.
- Maintain up-to-date plans to deal with threat and actual occurrence of dam overspill or failure.
- Emergency management and other local government agencies should familiarize themselves with technical data and other information pertinent to the dams that impact Shutesbury. This should include determining the probable extent and seriousness of the effect to downstream areas.
- Dams should be inspected periodically and monitored regularly.
- Repairs should be attended to promptly.
- As much as is possible burdens on faulty dams should be lessened through stream re-channeling.
- Identify dam owners.
- Determine minimum notification time for downstream areas.

The Shutesbury eCEMP contains the following generic preparedness and response measures for dam failure:

- Pre-place adequate warning/notification systems in areas potentially vulnerable to dam failure effects.
- Develop procedures for monitoring dam site conditions at first sign of any irregularity that could precipitate dam failure.
- Identify special needs populations, evacuation routes and shelters for dam failure response.
- Have sandbags, sand and other items to reinforce dam structure or flood proof flood prone areas.
- Disseminate warning/notification of imminent or occurring dam failure.
- Coordinate evacuation and sheltering of affected populations.
- Dispatch search and rescue teams.
- Coordinate evacuation and sheltering of affected populations.
- Activate mutual aid if needed.
- Acquire additional needed supplies not already in place, such as earthmoving machinery.
- Establish incident command post as close to affected area as safely possible.

- Provide security for evacuated public and private property.

The current Shutesbury eCEMP identifies the Lake Wyola Dam and the Atkins Reservoir Dam as high hazard dams in Shutesbury. The Dudleyville Pond Dam is identified as a significant hazard dam, and the Ames Pond Upper Dam and the Baker Reservoir Dam are classified as low hazard dams in town.

Permits Required for New Dam Construction

Massachusetts State Law (M.G.L. Chapter 253 Section 45) regulates the construction of new dams. A permit must be obtained from the Department of Conservation and Recreation (DCR) before construction can begin. One of the permit requirements is that all local approvals or permits must be obtained.

Dam Inspections

The DCR requires that dams rated as Low Hazard Potential be inspected every ten (10) years, dams rated as Significant Hazard Potential be inspected every five (5) years, and dams rated as High Hazard Potential be inspected every two (2) years. Owners of dams are responsible for hiring a qualified engineer to inspect their dams and report the results to the DCR. Owners of High Hazard Potential dams and certain Significant Hazard Potential dams are also required to prepare, maintain, and update Emergency Action Plans. Potential problems may arise if the ownership of a dam is unknown or contested. Additionally, the cost of hiring an engineer to inspect a dam or to prepare an Emergency Action Plan may be prohibitive for some owners.

Zoning

There is no mention made regarding the construction of new dams in the Town of Shutesbury's Zoning Bylaws or Subdivision Regulations.

Restrictions on Development

There are no Town restrictions on dam locations. The DCR issues permits for new dams and does have the authority to deny a permit if it is determined that the design and/or location of the dam is not acceptable.

Table 4-6: Existing Dam Failure Hazard Mitigation Measures

Type of Existing or Proposed Dam Failure Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
Permits				
	State law requires a permit for the construction of any dam.	Entire Town	Effective. Ensures dams are adequately designed.	None

Type of Existing or Proposed Dam Failure Protection	Description	Area Covered	Effectiveness	2014 Potential Action Items
Inspections				
	DCR has an inspection schedule that is based on the hazard rating of the dam (low, significant, high hazard). FERC requires Emergency Action Plans for all high hazard dams it oversees.	Entire Town	Effective. Owners of High Hazard Potential and certain Significant Hazard Potential dams are also responsible for preparing Emergency Action Plans.	Map dams and inundation areas
Evacuation Plans				
	Comprehensive evacuation plans would ensure the safety of the citizens in the event of dam failure.	Inundation areas in Town.	Not Effective. The preparation of inundation mapping and evacuation plans is expensive for owners of dams.	Owners of High Hazard Potential dams should prepare inundation area mapping and up to date evacuation plans in cooperation with the Town.

See also Table 4-1: Existing Flood Hazard Mitigation Measures.

Landslides

Regulating land use and development to avoid construction on steep slopes and ensuring that construction does not reduce slope stability is one way to mitigate the hazard potential of landslides. The mitigation measures for landslides were found to be the same as for Floods.
Please see Table 4-1: Existing Flood Hazard Mitigation Measures for a summary of the above Land Use Regulations and Appendix B for relevant sections of the Land Use Regulations.

Ice Jams

The most common hazard associated with ice jams is flooding upstream of the ice jam. Therefore strategies to mitigate flooding are also appropriate for mitigating the impacts of ice jams. Please see the Current Mitigation Strategies for Flooding section above and refer to Table 4-1: Existing Flood Hazard Mitigation Measures, as well as Appendix B for the relevant sections of the Town's land use regulations.

Manmade Hazards

Timely, informative and accurate notification of a hazardous material emergency is critical for an effective emergency response and for the safety and protection of Shutesbury's citizens. With the frequency of transportation of hazardous materials via local roadways and Route 202, the possibility exists of a catastrophic accident or spill. Strategies to plan for the evacuation of residents and for the cleanup of any chemical spill are key to hazard mitigation.

Management Plans and Regulatory Measures

The following are generic preparedness and response measures for manmade hazards listed in the Shutesbury eCEMP, specifically hazardous materials emergencies:

- The immediate notification of the community emergency coordinator and the State is required when a release of an extremely hazardous substance or hazardous chemical in an amount above the Reportable Quantity (RQ) occurs. Specific information is required by the notification such as chemical name, method of release, health effects, medical attention and protective actions.
- The Hazardous Materials Release Report Form must be used in the event of the release of a hazardous substance
- Both local and State response personnel, including the DEP must be notified immediately of a release. The local point of contact is the local fire department through the 911 dispatch Center.

Evacuation Options

Evacuation of an incident site could be required upon the recommendation of the on-scene commander. The routes of evacuation and staging areas for the evacuees will be determined by the Incident Commander. Once the incident site has been evacuated, law enforcement officials will support expanded evacuation if required. The necessity for additional evacuation will be determined by the Incident Commander.

FUTURE MITIGATION STRATEGIES

Hazard Mitigation Goal Statements and Action Plan

As part of the multi-hazards mitigation planning process undertaken by the Shutesbury Emergency Management Team, existing gaps in protection and possible deficiencies were identified and discussed. The EMT then developed general goal statements and mitigation action items that, when implemented, will help to reduce risks and future damages from multiple hazards. The goal statements, action items, Town department(s) responsible for implementation, and the proposed timeframe for implementation for each category of hazard are described below. Additional action items identified by the EMT that were categorized as preparedness or response actions are presented in Table 4-11 for the benefit of the community.

2014 Action Plan

Prioritization of Hazards

The EMT examined the results of the All Hazards Vulnerability Assessment completed by the EMT (see Section 3) and used the results to prioritize the identified hazards.

The All Hazards Vulnerability Assessment is an interactive table that the EMT completed with the FRCOG staff to evaluate the natural hazards that can impact the town based on probability of occurrence, severity of impacts, area of occurrence and preparedness. The completed table gives the town an overall understanding of the natural hazards, provides guidance on which hazards the Town may want to focus mitigation efforts on, reaffirms that Shutesbury's planning and preparedness is on track, and shows residents that town departments and agencies are organized in case of a natural disaster. Those hazards receiving the highest Weighted Hazard Index number were assigned the highest priority, as shown in Tables 4-7 and 4-8.

Table 4-7: Weighted Hazard Index Priority Level

Weighted Hazard Index	Priority Level
> 3.50	High
2.50 – 4.00	Medium
< 2.50	Low

Table 4-8: Hazard Priority Level Rating

Natural Hazard	Weighted Hazard Index	Priority Level
Tornados, Microbursts, Thunderstorms	4.15	High
Severe Winter Storms/Ice Storms	4.15	High
Hurricanes/Tropical Storms	3.85	High
Floods	3.25	Medium
Dam Failures	3.25	Medium

Natural Hazard	Weighted Hazard Index	Priority Level
Earthquake	3.20	Medium
Wild Fires/Brush Fires	2.65	Medium
Landslides	1.90	Low
Ice Jams	1.90	Low

Identification of Most Important Hazards

To identify the hazards most important to the Town of Shutesbury and to develop a range of mitigation actions for the most important hazards, the EMT discussed the hazard prioritization information (Table 4-8), assessed which hazards most often impact Western Massachusetts and Shutesbury and considered the results of the Risk Assessment (Section 3). The EMT also discussed damages from recent hazard events and determined that the hazards most important to Shutesbury are hurricanes/tropical storms, severe winter storms/ ice storms, tornados/microbursts/thunderstorms, and wildfires/brush fires.

In addition, the EMT realized that some Action Items could mitigate several hazards and thus created a category labeled "Multiple Hazards". This category of Multiple Hazards is among the hazards considered most important to the town.

Table 4-9: Hazards Most Important to Shutesbury

Natural Hazard	Priority Level from Weighted Hazard Index	Hazard Most Important to Shutesbury
Hurricanes/Tropical Storms	High	✓
Tornados, Microbursts, Thunderstorms	High	✓
Severe Winter Storms/Ice Storms	High	✓
Wild Fires/Brush Fires	Medium	✓
Floods	Medium	
Dam Failures	Medium	
Earthquake	Medium	
Landslides	Low	
Ice Jams	Low	
Multiple Hazards	Not Applicable	✓
Manmade Hazards	Not Applicable	

With respect to Manmade Hazards, the EMT evaluated the potential for transportation hazardous materials accidents as quite high. However, no formal vulnerability assessment was done for manmade hazards due to the lack of available data to use in an appropriate assessment model.

Goal Statements and Action Items

As part of the multi-hazards mitigation planning process undertaken by the EMT, existing gaps in protection and possible deficiencies were identified and discussed. The EMT then developed general goal statements and action items that, when implemented, will help to reduce risks and future damages from multiple hazards, including the hazards most important to Shutesbury.

Prioritization of Action Items

The EMT worked to prioritize the mitigation Action Items for the hazards identified as the most important to Shutesbury. For most, if not all, of the Action Items, project costs are not specifically known so only a generalized estimate could be used during the prioritization process. Due to the lack of detailed cost information for the mitigation Action Items, a more detailed prioritization process such as STAPLEE could not be used. However, Action Items may be reprioritized by the town once a cost is developed and a Benefit Cost Analysis is conducted on specific projects.

The EMT used a qualitative ranking system of High, Medium or Low to prioritize the mitigation Action Items for the hazards most important to Shutesbury.

High	71-100 points
Medium	31-70 points
Low	0-30 points

The ranking system consists of the following criteria, each assigned a points value. The maximum number of points = 100:

1. What are the anticipated benefits (including avoided costs such as loss of life and the costs incurred to repair damaged infrastructure, buildings and natural resources) from the implementation of the action item to the town's population (10 points), infrastructure (10 points), and to the built (10 points) and natural environment (10 points)?

2. Can the town provide the necessary maintenance (future costs that must be included in the town's budget) when the mitigation measure is completed? Yes (10 points); No (0 points).

3. Does the town have the technical and administrative capability (staff costs and in-kind costs of volunteer boards and committee members) to carry out the mitigation measures? Yes (10 points); No (0 points).

4. Based on the evaluation of the above criteria, do the costs (if known or can be reasonably estimated) seem reasonable when considering the size of the problem and likely benefits from mitigation? Yes (20 points); No (0 points).

5. Is there political support and public support to implement the mitigation measures? Yes (20 points); No (0 points).

Even when the political will exists to implement the Action Items, the fact remains that Shutesbury is a small town that relies heavily on a small number of paid staff, many of whom have multiple responsibilities, and a dedicated group of volunteers who serve on town boards. However, some Action Items, when implemented by Town staff and volunteers, result in a large benefit to the community for a relatively small cost.

For larger construction projects, the town has limited funds to hire consultants and engineers to assist them with implementation. For these projects, the Town may seek assistance through the Franklin Regional Council of Governments (FRCOG). Limited technical assistance is available from the FRCOG. However, the availability of FRCOG staff can be constrained by the availability of grant funding.

The 2014 Shutesbury Multi-Hazard Mitigation Prioritized Action Plan is shown in Table 4-10. Potential funding sources for mitigation action items are listed in Table 4-10. Other potential funding sources are listed in Table 5-1 on pages 129-131 of this document. The town should request assistance from MEMA and/or FRCOG to explore which of these funding sources might supplement or replace town funding for the mitigation action items in Table 4-10. When Town funds are listed as a source to fund hazard mitigation projects or activities, either in part (match) or in full, these funds would be obtained from the town's "general fund".

The timeframe for implementation of the action items on both tables are listed as Year 0-1, which is the first year following plan adoption, and subsequent years after plan adoption through the 5 year life of the plan (Year 2, Year 3, Year 4 and Year 5). The EMT recognized that many mitigation action items have a timeframe that is ongoing due to either funding constraints that delay complete implementation and/or the action item should be implemented each of the five years of the plan, if possible. Therefore, a category of Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate was added.

Table 4-10: 2014 Shutesbury Multi-Hazard Mitigation Prioritized Action Plan

Note: The priority for implementation of each Action Item is ranked as High, Medium, or Low.

Most Important Hazards	Mitigation Action Item	Responsible Department/ Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Status	Priority for Implementation
✓	**MULTIPLE HAZARDS** ***Goal*: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to natural and other hazards.**						
	To improve household disaster preparedness, disseminate information to residents via the Town website and the community newsletter on where to find emergency information, what to include in a 'home survival kit,' how to prepare homes and other structures to withstand flooding and high winds, and the proper evacuation procedures to follow during a disaster.	EMD, Fire Department, Town Administrator	B,P,I	Town, Volunteers	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	New Action Item.	High
	Implement a formal system of data collection and maintenance which would help improve the Town's hazard mitigation planning and increase the Town's chances of qualifying for various grants.	Town Administrator, Highway Department, Fire Department, EMD	B, N, P, I	Town, Volunteers	Year 5	New Action Item.	High
✓	**TORNADOS, MICROBURSTS, & THUNDERSTORMS** ***Goal*: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to high winds associated with tornados.** (See also wind-related Action Items for Hurricanes and Tropical Storms, and flood-related Action Items for Floods)						
	Enforce the State Building Code and provide training to the Building Inspector/FCCIP, as needed, to ensure new buildings are designed and constructed to reduce the risk of damage from high winds. Encourage the construction of new homes with basements, crawl spaces, or safe rooms to provide shelter during a hurricane or other storm event with high winds by providing information to prospective homeowners about structural designs that protect inhabitants from the effects of high winds.	FCCIP	B, P	Town	Year 3	New Action Item.	High
	Remove trees from West Cemetery on Leverett Road that present a hazard in order to mitigate damage from a wind storm.	Tree Warden, Town Administrator, Highway Department, Conservation Commission, EMD, Historical Commission	B, N, P, I	Town, CPA funds	Year 5	New Action Item.	Medium
✓	**SEVERE WINTER STORMS/ICE STORMS** ***Goal*: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to severe winter storms.** (See also wind-related Action Items for Hurricanes and Tropical Storms, and flood-related Action Items for Floods)						
	Develop and maintain a list of areas where repetitive power outages occur. Meet with National Grid to discuss future potential opportunities to underground existing utility lines in priority locations on the list. Work with National Grid to identify funding sources and to develop funding applications as needed.	Select Board, Town Administrator, EMD, National Grid Highway Department	B, N, P, I	Town, National Grid	Year 5	New Action Item.	Low

Most Important Hazards	Mitigation Action Item	Responsible Department/ Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Status	Priority for Implementation
	Engage a structural engineer to inspect the roof of the elementary school to determine what additional repairs are required for it to be able to withstand the potential weight of snow loads from severe winter storms and then seek funding to complete the repairs.	EMD, Town Administrator, FCCIP	B,P,I	Town, MEMA/FEMA,	Year 2	New Action Item.	High
	Identify priority areas for tree maintenance near utility lines in town and submit the list to National Grid for inclusion in its five-year action plan, which includes regular tree maintenance to reduce the number of limbs near overhead power lines, to reduce risk to infrastructure from severe winter storms. Meet bi-annually with the utility to ensure priority areas are included in the plan.	EMD, Select Board, Highway Department, National Grid	B, N, P, I	Town, National Grid	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	New Action Item.	High
✓	**HURRICANES AND TROPICAL STORMS** ***Goal*: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to high winds associated with hurricanes and tropical storms.*** (The Action Items listed under Floods below address the flooding that can result from a hurricane or tropical storm. Listed below are Action Items to address the potential damage from the high winds associated with hurricanes and tropical storms.)						
	Increase existing shelter capacity and capabilities, particularly in regard to storage space for supplies.	Town Administrator, EMD	P	Town, Volunteers, DCR	Year 3	New Action Item.	High
	Replace the Locks Pond Road culvert with one that would be capable of conveying the design spillway flood of the Lake Wyola Dam.	Select Board, Highway Department, Conservation Commission	B,N,P,I	Town, MEMA/FEMA, Transportation bonds, MassDOT Chapter 90 Program, MassWorks Infra-structure Program	Year 5	New Action Item	High
✓	**WILDFIRES AND BRUSH FIRES** ***Goal*: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to wildfires/brushfires.***						
	Assess and create water supply for fire prevention and identify methods for increasing storage capacity for fire prevention to mitigate impact to the built environment and forest resources.	Fire Department, EMD	B, N, P, I	Town	Year 4	New Action Item.	Medium
	Educate homeowners about general fire safety by publishing regular informational items on the Town website and in the community newsletter.	Fire Department	B, N, P	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	New Action Item.	Medium
	Attend a forum with DCR staff foresters for Town officials and private landowners to discuss forest management practices and forest cutting plans on State-owned and private forest lands.	Conservation Commission, Planning Board, Fire Departments, Tree Warden	B, N, P	Town, US Forest Service, DCR	Year 2	New Action Item.	Low

Most Important Hazards	Mitigation Action Item	Responsible Department/ Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Status	Priority for Implementation
	FLOODS ***Goal*: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to flooding.**						
	Using Assessors' data and other available information, expand and update the Vulnerability Assessment for properties located within the 100-year floodplain, including information on property and crop damages, if available.	Planning Board, Board of Assessors	B, P	Town, Volunteers	Year 1	New Action Item.	High
	Upgrade culverts and bridges throughout town to increase their size and/or capacity and to minimize or repair damage from hazard events and beaver activity.	Highway Department	B,N,P,I	Town, MEMA/FEMA, Transportation bonds, MassDOT Chapter 90 Program, MassWorks Infrastructure Program	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	New Action Item.	High
	Implement a public education program for private well owners about proper construction methods and periodic inspections and testing to guard against contamination resulting from the infiltration of stormwater.	Board of Health	B,N,P,I	Town, MassDEP	Year 2	New Action Item	High
	Hire an engineer to conduct a hydraulic analysis to provide prioritized recommendations for construction projects to mitigate damage from flood events in the following key areas of concern: • Baker Road culvert; • Wendell Road culvert north of Locks Pond Road; • Ames Brook culvert on Wendell Road.	Select Board, Highway Department, Conservation Commission	B,N,P,I	Town, MEMA/FEMA, Transportation bonds, MassDOT Chapter 90 Program, MassWorks Infrastructure Program	Year 4	New Action Item	Medium
	DAM FAILURES ***Goal*: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to dam failures.** (See also Action Items for Floods)						
	Engage an engineer to modify the design of the sluice gate at Lake Wyola so that it does not continue to get blocked with debris to limit the potential for future flooding.	EMD, Select Board, Highway Department, Conservation Commission, Dam Keeper	B,N,P,I	Town, MEMA/FEMA, Transportation bonds, MassDOT Chapter 90 Program, MassWorks Infra-structure Program	Year 2	New Action Item	High
	Review operations of the Lake Wyola Dam and appurtenant structures to ensure that they are operating at maximum efficiency and make changes as necessary.	EMD, Select Board, Highway Department, Conservation Commission, Dam Keeper	B,N,P,I	Town, MEMA/FEMA, Transportation bonds, MassDOT Chapter 90 Program, MassWorks Infra-structure Program	Year 3	New Action Item	Medium

Most Important Hazards	Mitigation Action Item	Responsible Department/ Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Status	Priority for Implementation
	Identify locations of existing beaver activity and dams that create the potential for flooding and implement controlled breaching of dams, where appropriate, to limit the potential for accidental breaches.	Town Administrator, Highway Department, EMD, Board of Health, Dam Keeper	B, N, P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5), as appropriate.	New Action Item.	Medium
	EARTHQUAKES ***Goal*: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to earthquakes.**						
	Ensure Compliance with the Massachusetts State Building Code. Provide training to the Building Inspector/FCCIP, as needed, to ensure that all new construction complies with the appropriate seismic requirements of the State Building Code. Participate in trainings offered by FEMA's National Earthquake Technical Assistance Program (NETAP). NETAP is designed to help state, local, and tribal governments obtain the knowledge, tools, and support that they need to plan and implement effective earthquake mitigation strategies.	FCCIP, EMD	B, P, I	Town	Year 5	New Action Item.	Low
	ICE JAMS ***Goal*: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to ice jams.**						
	See the Flood Section of this Action Plan for other items that are related to both flooding and ice jams.	N/A	N/A	N/A	N/A	N/A	N/A

NATIONAL FLOOD INSURANCE PROGRAM COMPLIANCE

The U.S. Congress established the National Flood Insurance Program (NFIP) in 1968, with the passage of the National Flood Insurance Act of 1968. "For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, seawalls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses, nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

"In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection."[62]

The State of Massachusetts, through its local communities,[63] complies with the NFIP in part by enforcing the Wetlands Protection Act (WPA), which helps restrict development in flood-prone areas, enforcing the State Building Code, which regulates building specifications and additional related zoning bylaws, such as a floodplain overlay district. At the local level, Shutesbury's compliance with the NFIP, when it is approved as a member town, will be enforced through the Conservation Commission, Building Code, floodplain regulations, and the Zoning Bylaws and Subdivision Regulations related to flooding. While the local building code cannot be more restrictive than the state Building Code, the local Conservation Commission can restrict development above and beyond the requirements in the WPA. The ability of the Conservation Commission to further regulate development in flood prone areas could be a crucial tool in flood mitigation.

The Town of Shutesbury has filed an application in October 2014 to join the National Flood Insurance Program, having adopted a new Floodplain Overlay District Bylaw in November 2012.

NFIP Community Rating System (CRS)[64]

The town is not a member of the NFIP Community Rating System, which entitles policyholders to a discount on flood insurance premiums. The Community Rating System is a part of NFIP and provides incentives and tools to further these goals. The goals of the CRS are to recognize, encourage, and reward, by the use of flood insurance premium adjustments, community and state activities beyond the minimum required by the NFIP that:

- Reduce flood damage to insurable property,
- Strengthen and support the insurance aspects of the NFIP, and
- Encourage a comprehensive approach to floodplain management.

[62] http://www.fema.gov/library/viewRecord.do?id=1404

[63] Massachusetts is a Home Rule state, the local communities have significant power and authority to implement state regulations and many towns adopt their own wetland and floodplain regulations that are more stringent than state requirements.

[64] http://training.fema.gov/EMIWeb/CRS/

The Community Rating System reduces flood insurance premiums to reflect what a community does above and beyond the National Flood Insurance Program's (NFIP) minimum standards for floodplain regulation. The objective of the CRS is to reward communities for what they are doing, as well as to provide an incentive for new flood protection activities. It provides lower insurance premiums under the National Flood Insurance Program. The premium reduction is in the form of a CRS Class, similar to the classifications used for fire insurance. For example, a Class 1 provides a 45% premium reduction while a Class 10 provides no reduction. The CRS Class is based on the floodplain management activities a community implements. In many cases, these are activities already implemented by the community, the state, or a regional agency. The more activities implemented, the better the CRS class.

Benefits of participating in the Community Rating System:

- Money stays in the community instead of being spent on insurance premiums.
- Every time residents pay their insurance premiums, they are reminded that the community is working to protect them from flood losses, even during dry years.
- The activities credited by the CRS provide direct benefits to the community, including:
    - Enhanced public safety,
    - Reduction in damage to property and public infrastructure,
    - Avoidance of economic disruption and losses,
    - Reduction of human suffering, and
    - Protection of the environment.
- Local flood programs will be better organized and more formal.
- The community can evaluate the effectiveness of its flood program against a nationally recognized benchmark.
- Technical assistance in designing and implementing some activities is available at no charge.
- The community will have an added incentive to maintain its flood programs over the years.
- The public information activities will build a knowledgeable constituency interested in supporting and improving flood protection measures.

Costs to the local government to participate in the Community Rating System:

- The community must designate a CRS Coordinator who prepares the application papers and works with FEMA and the Insurance Services Office (ISO) during the verification visit.
- Each year the community must recertify that it is continuing to implement its activities. It must provide copies of relevant materials (e.g., permit records).
- The community must maintain elevation certificates, permit records, and old Flood Insurance Rate Maps forever.
- The community must maintain other records of its activities for five years, or until the next ISO verification visit, whichever comes sooner.

Community Rating System Process

One of the actions that Shutesbury could take to improve their CRS rating (and subsequently lower their premiums) is to develop a CRS plan, once they have joined the NFIP. The CRS 10-

step planning process provides additional points for activities that communities can take during their planning process that go above the minimum described below, thus possibly lowering insurance rates. At a minimum, an *approved* multi-hazard mitigation plan that addresses floods could qualify for CRS credit. Although communities are not required to participate in CRS in order to receive approval of a Local Multi-Hazard Mitigation Plan, FEMA encourages jurisdictions to integrate the CRS planning steps into their multi-hazard mitigation plans.

Credit is provided for preparing, adopting, implementing, evaluating, and updating a comprehensive floodplain management plan or repetitive loss area analyses. The Community Rating System does not specify what must be in a plan, but it only credits plans that have been prepared and kept updated according to CRS standard planning process. Credit is also provided for implementing a habitat conservation plan.

Community Rating System Credit Points[65]

A total of up to 359 points are provided for three elements. Up to 294 points are provided for adopting and implementing a floodplain management plan (FMP) that was developed using the following standard planning process. There must be some credit for each of the 10 planning steps:

Table 4-12: CRSC Standard Planning Process Steps

Step	Maximum Points
• Organize to prepare the plan	10
• Involve the public	85
• Coordinate with other agencies	25
• Assess the hazard	20
• Assess the problem	35
• Set goals	2
• Review possible activities	30
• Draft an action plan	70
• Adopt the plan	2
• Implement, evaluate, and revise	15

Up to 50 additional points are provided for conducting repetitive loss area analyses (RLAA) and up to additional 15 points are provided for adopting and implementing a Habitat Conservation Plan (HCP). More information is available at http://www.fema.gov/business/nfip/crs.shtm. A copy of the "Local Official's Guide to Saving Lives, Preventing Property Damage, and Reducing the Cost of Flood Insurance" can be downloaded at http://www.fema.gov/library.

[65] FEMA Local Multi-Hazard Mitigation Planning Guidance, July 1, 2008.

5 – PLAN ADOPTION & MAINTENANCE

PLAN ADOPTION

The Franklin Regional Council of Governments (FRCOG) provided support to the Shutesbury Emergency Management Team (EMT) as they underwent the planning process. Town officials such as the Emergency Management Director, Town Clerk, and Town Administrator were invaluable resources to the FRCOG and provided background and policy information and municipal documents, which were crucial to facilitating completion of the plan.

When the preliminary draft of the Shutesbury Multi-Hazard Mitigation Plan was completed, copies were disseminated to the Shutesbury EMT for comment and approval. The EMT was comprised of representatives of Town boards and departments who bear the responsibility for implementing the action items and recommendations of the completed plan (see the list of EMT members on the front cover).

Copies of the Final Review Draft of the Multi-Hazard Mitigation Plan for the Town of Shutesbury were distributed to Town boards and officials, Planning Boards and EMDs in surrounding towns, public school committees and superintendents, large landowners in town, and other stakeholders. Copies were made available at the Town Hall and the M.N. Spear Memorial Library and a copy of the plan was also posted on the town website for public review. Once reviewed and approved by MEMA, the plan was sent to the Federal Emergency Management Agency (FEMA) for their approval. FEMA approved the plan on [INSERT DATE] and on [INSERT DATE] the Shutesbury Board of Selectmen voted to adopt the plan (see Appendix C).

PLAN MAINTENANCE PROCESS

The implementation of the Shutesbury Multi-Hazard Mitigation Plan will begin following its approval by MEMA and FEMA and formal adoption by the Shutesbury Board of Selectmen. Specific Town departments and boards will be responsible for ensuring the development of policies, bylaw revisions, and programs as described in Table 4-9: 2014 Shutesbury Multi-Hazard Mitigation Prioritized Action Plan. The Shutesbury Emergency Management Team will oversee the implementation of the plan.

Monitoring, Evaluating, and Updating the Plan

The measure of success of the Shutesbury Multi-Hazard Mitigation Plan will be the number of identified mitigation strategies implemented. In order for the Town to become more disaster resilient and better equipped to respond to natural disasters, there must be a coordinated effort between elected officials, appointed bodies, Town employees, regional and state agencies involved in disaster mitigation, and the general public.

Implementation Schedule

Annual Meetings

The Shutesbury Emergency Management Team will meet on an annual basis or as needed (i.e., following a natural or other disaster) to monitor the progress of implementation, evaluate the

success or failure of implemented recommendations, and brainstorm for strategies to remove obstacles to implementation. Following these discussions, it is anticipated that the EMT may decide to reassign the roles and responsibilities for implementing mitigation strategies to different Town departments and/or revise the goals and objectives contained in the plan. At a minimum, the EMT will review and update the plan every five years. The meetings of the EMT will be organized and facilitated by the Shutesbury Town Administrator and the Emergency Management Director.

Bi-Annual Progress Report

The Emergency Management Director will prepare and distribute a biannual progress report in years two and four of the plan. The progress report will be distributed to all of the local implementation group members and other interested local stakeholders. The progress report 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, as needed, to the local hazard mitigation plan. The Emergency Management Director and the EMT will have primary responsibility for tracking progress and updating the plan.

Five-Year Update Preparation

During the fourth year after initial plan adoption, the Emergency Management Director will convene the EMT to begin preparations 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 annual meetings and the biannual progress reports to identify the needs and priorities for the plan update.

Updated Local Hazard Mitigation Plan – Preparation and Adoption

FEMA's approval of this plan is valid for five years, by which time an updated plan must be approved by FEMA in order to maintain the town's approved plan status and its eligibility for FEMA mitigation grants. Because of the time required to secure a planning grant, prepare an updated plan, and complete the approval and adoption of an updated plan, the local Hazard Mitigation Planning Team should begin the process by the end of Year 3. This will help the town avoid a lapse in its approved plan status and grant eligibility when the current plan expires.

The EMT may decide to undertake the update themselves, request assistance from the Franklin Regional Council of Governments, or hire another consultant. However the EMT decides to proceed, the group will need to review the current FEMA hazard mitigation plan guidelines for any changes. The updated Monroe Multi-Hazard Mitigation Plan will be forwarded to MEMA and to FEMA for approval.

As is the case with many Franklin County towns, Shutesbury's government relies on a few public servants filling many roles, upon citizen volunteers and upon limited budgets. As such, implementation of the recommendations of this plan could be a challenge to the EMT. As the EMT meets regularly to assess progress, it should strive to identify shortfalls in staffing and funding and other issues which may hinder Plan implementation. The EMT should seek technical assistance from the Franklin Regional Council of Governments to help alleviate some of the staffing shortfalls. The EMT could also seek assistance and funding from such sources as are listed in Table 5-1.

Table 5-1: Potential Funding Sources for Hazard Mitigation Plan Implementation

Program	Type of Assistance	Availability	Managing Agency	Funding Source
National Flood Insurance Program	Pre-disaster insurance	Any time (pre & post disaster)	DCR Flood Hazard Management Program	Property Owner, FEMA
Community Assistance Program	State funds to provide assistance to communities in complying with NFIP requirements	Annually	DCR	FEMA/NFIP
Community Rating System (Part of the NFIP)	Flood insurance discounts	Any time (pre & post disaster)	DCR Flood Hazard Management Program	Property Owner
Flood Mitigation Assistance Program	Cost share grants for pre-disaster planning & projects	Annual pre-disaster grant program	MEMA	75% FEMA/ 25% non-federal
Hazard Mitigation Grant Program	Post-disaster cost-share Grants	Post disaster program	MEMA	75% FEMA/ 25% non-federal
Pre-Disaster Mitigation Program	National, competitive grant program for projects & planning	Annual, pre-disaster mitigation program	MEMA	75% FEMA/ 25% non-federal
Severe Repetitive Loss	For SRL structures insured under the NFIP.	Annual	MEMA	Authorized up to $40 million for each fiscal year 2005 through 2009
Small Business Administration Mitigation Loans	Pre- and post- disaster loans to qualified applicants	Ongoing	MEMA	Small Business Administration
Public Assistance	Post-disaster aid to state and local governments	Post Disaster	MEMA	FEMA/ plus a non-federal share
Dam Safety Program	Provides funding to state to promote dam safety through emergency action plans and exercises	Annual	DCR	FEMA
Homeland Security Grants	Multiple grant sources provide funding for homeland security activities, including THIRA development, planning, and training at the state and local levels	Annual	MEMA	DOJ, DHS, FEMA
National Fire Plan	Provides pre-disaster funds for wildfire mitigation and planning for all-hazards.	Annual	DCR	U.S. Land Management Agencies

Program	Type of Assistance	Availability	Managing Agency	Funding Source
Clean Water Act Section 319 Grants	Provides grants for wide variety of activities related to non-point source pollution runoff mitigation	Annual	MassDEP	EPA
Economic Development Administration Grants and Investment	Provides grants for community construction projects, including mitigation activities	Annual	Massachusetts Office of Business Development	U.S. Department of Commerce, Economic Development Administration
Emergency Watershed Protection	Provides funding and technical assistance for emergency measures, e.g., floodplain easements in impaired watersheds	Annual	DCR	USDA NRCS
Forest Land Enhancement Program	Provides educational, technical, and financial assistance to help landowners implement sustainable forest management objectives.	Annual	DCR	U.S. Forest Service
Housing and Urban Development	Provides various grant programs related to safe-housing initiatives	Annual	Department of Housing and Community Development	U.S. Dept. of Housing and Urban Development
Reclamation and Development Grants Program	Provides funding for water-related projects, studies, etc.	Annual	MassDEP and others	EPA
National Wildlife Wetland Refuge System	Provides funding for acquisition of lands into federal wildlife refuge system	Annual	U.S. Fish and Wildlife Service	U.S. Fish and Wildlife Service
North American Wetland Conservation Fund	Provides funding for wetland conservation projects	Annual	U.S. Fish and Wildlife Service	U.S. Fish and Wildlife Service
Rural Development Grants	Provides grants and loans for infrastructure and public safety development and enhancement in rural areas	Annual	Department of Housing and Community Development	USDA, Rural Development
Rural Fire Assistance Grants	Funds fire mitigation activities in rural communities	Annual	DCR	National Interagency Fire Center
Chapter 90 Program	Funds maintaining, repairing, improving and constructing town and county ways and bridges which qualify under the State Aid Highway Guidelines	Annual	Mass DOT	State Transportation Bond

Program	Type of Assistance	Availability	Managing Agency	Funding Source
2013 MassWorks Infrastructure Program	Funds targeted investments in infrastructure such as roadways, streetscapes, water, and sewer	Annual	Executive Office of Housing and Economic Development (EOHED),	State Appropriation-Section 11 of Chapter 238 of the Acts of 2012
Accelerated Bridge Program	Funds bridge rehabilitation, replacement, preservation, maintenance, painting and cleaning projects	Rolling basis (bridges are pre-selected)	MassDOT and DCR	State Appropriation - Chapter 233 of the Acts of 2008
Dam, Levee and Coastal Infrastructure Repair and Removal Program	Funds grants and loans for the repair and removal of dams, levees, seawalls, and other forms of inland and coastal flood control.	Annual	Executive Office of Energy and Environmental Affairs (EEA)	State Revolving Loan
Conservation Partnership	Funds assist not-for-profit corporations in acquiring land and interests in lands suitable for conservation or recreation.	Annual	Executive Office of Energy and Environmental Affairs (EEA)	Executive Office of Energy and Environmental Affairs (EEA)
PARC - Parkland Acquisitions and Renovations for Communities	Provides grant assistance to cities and towns to acquire parkland, develop new parks, or renovate existing outdoor public recreation facilities (formerly the Urban Self-Help Program).	Annual	Executive Office of Energy and Environmental Affairs (EEA)	State Appropriations
Other Sources: www.grants.gov a source for federal government grants www.grants.com a source for private funding opportunities www.epa.gov/ogd/grants/funding_opportunities U.S. Environmental Protection Agency www.corporateservices.noaa.gov/grantsonline National Oceanic and Atmospheric Administration www.mass.gov/eea/agencies/massdep/water/grants/watersheds-water-quality.html for 604b and s.319 grants				

Incorporating the Plan into Existing Planning Mechanisms

Upon approval of the Shutesbury Multi-Hazard Mitigation Plan by FEMA, the EMT will provide all interested parties and implementing departments with a copy of the plan, with emphasis on Table 4-10: 2014 Shutesbury Multi-Hazard Mitigation Prioritized Action Plan. The EMT should also consider initiating a discussion with each department on how the plan can be integrated into that department's ongoing work. At a minimum, the plan should be distributed to and reviewed with the following entities:

- Fire Department
- Emergency Management Director
- Police Department
- Public Works / Highway Department
- Planning Board
- Zoning Board of Appeals

- Conservation Commission
- Franklin County Regional Emergency Planning Committee
- Building Inspector/FCCIP
- Select Board

Some possible planning mechanisms for incorporating the Shutesbury Multi-Hazard Mitigation Plan into existing planning mechanisms to the fullest extent possible could include:

- Incorporation of relevant Hazard Mitigation information into the Open Space and Recreation Plan. There are opportunities to discuss findings of the hazard mitigation plan and incorporate them into Environmental Inventory and Analysis section of the OSRP and to include appropriate action items from the hazard mitigation plan in the OSRP Action Plan.
- Any future development of master plans and scenic byway plans could incorporate relevant material from this plan into sections such as the Natural Resources section and any action plans
- When the Final Draft Multi-Hazard Mitigation Plan for the Town of Shutesbury is distributed to the Town boards for their review, a letter asking each board to endorse any action item that lists that board as a responsible party would help to encourage completion of action items.
- The Planning Board could include discussions of the Hazard Mitigation Plan Action Items in one meeting annually and assess progress. Current Subdivision Rules and Regulations and Zoning Bylaws should be reviewed and revised by the EMT, Planning Board and Select Board based upon the recommendations of this plan. Model bylaws are available from the FRCOG to help assist in the modification of Shutesbury's current Bylaws.

Continued Public Involvement

The Town of Shutesbury is dedicated to continued public involvement in the hazard mitigation planning and review process. During all phases of plan maintenance, the public will have the opportunity to provide feedback. The 2014 Plan will be maintained and available for review on the Town website through 2019. Individuals will have an opportunity to submit comments for the Plan update at any time. Any public meetings of the EMT will be publicized. This will provide the public an opportunity to express their concerns, opinions, or ideas about any updates/changes that are proposed to the Plan.

6 – APPENDICES

Appendix A: Public Participation Process

Appendix B: Relevant Sections of Land Use Regulations

Subdivision Regulations
Zoning Bylaws

Appendix C: FEMA Approval and Board of Selectman Adoption of 2014 Multi-Hazard Mitigation Plan

TO BE ADDED LATER