

THE TOWN OF GILL

MULTI-HAZARD MITIGATION PLAN



FEMA Review DRAFT

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Prepared by:

The Gill Natural Hazards Mitigation Planning Committee

David Hastings, Police Chief

Gene Beaubien, Fire Chief/Emergency Management Director

Mick LaClaire, Highway Department

John Ward, Selectboard

Ray Purington, Administrative Assistant

And

The Franklin Regional Council of Governments

Peggy Sloan, Director of Planning & Development

Kimberly Noake MacPhee, P.G., Land Use & Natural Resources Program Manager

Alyssa Larose, Land Use Planner

Gretchen Johnson, Planning Grant Administrator

Ryan Clary, GIS Specialist

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**Town of Gill
Multi-Hazard Mitigation Plan**

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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. 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 Gill and the Franklin Regional Council of Governments, make mitigation a proactive process. Pre-disaster planning emphasizes actions that can be taken before a natural 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 Local Natural 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 have adopted 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.

PLANNING PROCESS

The natural hazard mitigation planning process for the Town of Gill included the following tasks:

- Review of the Gill 2004 Local Natural Hazards Mitigation Plan, assessment of relevancy of existing materials, status of action items and addition of new materials based upon MEMA recommendations and Committee input.
- Identification of the natural hazards that may impact the community, and past occurrences of hazards at the local or regional level.
- Conduct 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.

- Identification and assessment of 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 hazard areas like floodplains, and wetlands;
 - Implementing recommendations in planning documents including Stormwater Management Plans, Master Plans, Open Space and Recreation Plans, and Emergency/Evacuation Plans that address the impacts of natural hazards; and
 - Requiring or encouraging the use of specific structural requirements for new buildings such as buried utilities, flood-proofed structures, and lightning grounding systems.
- Identification of deficiencies in the current strategies and establishing goals for updating, revising or adopting new strategies.
- Identification of specific projects that will mitigate the risk to public safety and damages to infrastructure from natural hazards.
- Adoption and implementation of the final Natural Hazards Mitigation Plan.

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

- Providing an opportunity for the public to comment on the plan during the drafting or prior to the approval of the plan. The plan update and public meetings were advertised in the Greenfield Recorder and on the Town website. Meetings were also posted at the Town Hall and at other designated public notice buildings. Public meetings were held at the Gill Fire Station on December 1, 2010, and February 22, 2012. Agendas and sign-ins from each meeting are located in the Appendix. The plan was revised after each meeting to incorporate input and comments from the Committee and stakeholders who attended the meetings. The final draft of the plan was made available on the Town website and at the Town Hall for public review.
- 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. In particular, representatives from the Northfield Mount Hermon School in Gill attended both meetings of the Multi-Hazard Mitigation Committee, and a representative from the Northfield Mountain pumped storage hydroelectric facility attended the second Committee meeting. Written and verbal invitations were sent to these stakeholders. Letters and correspondence are included in the Appendix.
- Reviewing and incorporating, where appropriate, existing plans, studies, reports and technical information. Plans reviewed and incorporated include the 2011 Gill Comprehensive Emergency Management Plan, 2011 Gill Open Space and Recreation Plan, and the 2004 Gill Community Development 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 Gill Natural Hazard Mitigation Planning Committee, which includes representatives of the Fire Department, Police Department, Highway Department, Selectboard, and the Administrative Assistant.

PLAN UPDATES AND CHANGES

As indicated above in the Planning Process section, changes and updates were made to this Plan based upon MEMA recommendations and committee input. The following sections of the 2011 plan were added to and/or substantially updated:

- **Section 2: Local Profile**
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2 – LOCAL PROFILE

COMMUNITY SETTING

The Town of Gill is a picturesque community with abundant natural features and a beautiful rural landscape with rolling hills, river valley vistas, and pastoral agricultural land. The Town is bordered by the Fall River to the west and the Connecticut River along the east and south. Parallel to the Connecticut River along the southern part of Town is Route 2, also known as the Mohawk Trail, a designated scenic byway.

Gill has a population of 1,500 people according to the 2010 U.S. Census. The predominant type of housing unit in Gill is single-family units, however, there are some multi-unit structures as well, including the Stoughton Village senior housing complex. According to the 2000 U.S. Census, of the 560 households in Gill, 86% of them were single-family homes. As for the age of the housing stock in 2000, it was reported that 44% of the housing units were built after 1970. The overall demographics in Gill indicate higher household incomes and lower poverty rates in comparison to other towns in the region.

The major employer located in the town is the Northfield Mount Hermon School, a private secondary educational institution. The School generally enrolls over 600 students at its campus. Other employers include the various farming operations throughout Town, the Kuzmeskus bus company on Main Road, and several relatively small retail stores along the western portion of Route 2.

According to 2005 land use data provided by MassGIS, the total land area of the Town of Gill is approximately 9,478 acres. Roughly 472 acres, or 5%, of the land area is residential. Most residential development in Gill has occurred along the scenic rural roads of Town, except, however, for the dense residential village area of Riverside, located along the Connecticut River. Approximately 60% or 5,730 acres of the land is classified as forest. Cropland, pastureland, orchards, and nurseries represent 18% of the total land area or 1,692 acres.

INFRASTRUCTURE

The term infrastructure includes the basic public utility and transportation networks in a community. The types and degrees of use and function of the infrastructure in Gill vary.

Roads and Highways

Route 2 has been a primary transportation corridor through Gill since its days as a significant Native American trail and trading stop along the Connecticut River. Today, the average daily traffic count on Route 2 is over 12,800 vehicles.¹ As the most significant transportation feature

¹ The average daily traffic count in 2007 according to MassDOT.

in Gill, Route 2 is also the Commonwealth's primary northern tier east-west corridor that connects the northern Boston metropolitan area to the Berkshires and New York. Other major north-south transportation corridors are easily connected to in nearby communities, including Interstate 91 in Greenfield, and Routes 10 and 63 in Northfield. Within Gill, there are some limitations of the transportation system due to the rural character of the road network. The road network in the Town of Gill is comprised of both paved and gravel surfaced roadways. As of 2009, the Town of Gill was responsible for maintenance of 38.69 miles of roadway, of which 28.7 miles were paved. MassHighway was responsible for 3.94 miles of roadway in Gill, including Route 2, Route 10, and the Gill-Montague Bridge.

Rail

There are no rail facilities located in Gill. However, rail lines do operate in the neighboring towns of Northfield and Bernardston.

Aviation

There are no aviation facilities located in Gill. The closest airport, the Turners Falls Municipal Airport, is located in the neighboring town of Montague.

Public Transportation

As for public transportation services, the Franklin Regional Transit Authority offers a fixed bus route connecting Greenfield and Athol (with further connections to Gardner). The route makes several stops throughout the weekday in the Riverside area of Gill. An additional transit service provided by the Franklin Regional Transit Authority to Gill residents is the demand-response transportation services for the elderly and disabled residents within their jurisdiction.

Public Drinking Water Supply & Sewer Service

There are two individual public water suppliers in the Town of Gill. They include the Gill Elementary School on Boyle Road and the Barton Cove Campground on Barton Cove Road.

There are two areas within Gill that have water supply and sewer treatment systems. The Gill campus of the Northfield Mount Hermon School has both a water supply system and a sewage system. In addition, the Riverside neighborhood and western Route 2 area near Turners Falls and Greenfield is served by the Riverside Water District that has water supplied from the Town of Greenfield. Sewerage for the same area is contracted by the Town with the Montague Wastewater Treatment Facility. The remaining households of Gill have individual private wells and septic systems.

Telecommunications

Telephone and other telecommunications services are provided to Gill through the central office switch in Turners Falls. The most widely accessible form of telecommunications broadband service for Gill residents is cable broadband through the cable television provider, Comcast. However, some Gill residents and businesses may have purchased satellite-based telecommunications services. Gill has limited access to DSL through the telephone network

because of the distance from the Turners Falls central office switch, where the equipment is located to provide such services.

Cellular telecommunications service is available in most areas of Gill, but is not available throughout all areas of Town. The Town of Gill has zoning bylaws to regulate the locating of wireless communication towers. Currently there is one cell tower in Gill.

NATURAL RESOURCES

Gill may be characterized as a rural farming community with rising hills and deep river valleys. The natural resources of Gill include abundant open space, and access to outdoor recreational opportunities offered by the Connecticut and Fall Rivers.

Terrain & Topography

As described in the 2011 *Gill Open Space and Recreation Plan*, Gill's landscape character is one of rolling hills, river terraces, farmlands, and upland forests. The town's topography is a result of glacial deposition and river erosion. Gill's terrain varies greatly in slope from level floodplains to steep river valley terraces. Elevations in Gill range from 150 feet at the junction of the Fall and Connecticut Rivers to 816 feet at the top of Pisgah Mountain. Unsorted glacial deposits of soil and rocks, or drumlins, are present throughout Gill's landscape. A fault line, inactive for more than 140 million years, is located along the French King Gorge at the border of Gill and Erving. Other significant geologic features include the plunge pools at Barton Cove, the falls at the Turners Falls Dam, and glacial eskers at the Town Forest.

Water Resources

The Town of Gill is bordered by the Fall River to the west, and the Connecticut River to the south and east. The Connecticut River separates Gill from the towns of Montague, Erving and Northfield, while the Fall River separates Gill from the towns of Greenfield and Bernardston. Additional water resources in Gill include Ashuela Brook, Dry Brook, Otter Brook and other smaller streams and brooks. Other water bodies include Shadow Lake on the Northfield Mount Hermon Campus, Otter Pond located between Dole Road and Hoeshop Road, and an unnamed pond near Mountain Road on Pisgah Mountain.

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 the Northridge earthquake in California, Hurricane Katrina in New Orleans, or floods in the Midwest. Closer to home, the June 1, 2011 tornado, which ripped through Springfield, Monson and other towns in Hamden and Worcester Counties, caused injuries, loss of life and widespread damages to historic properties. 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.²

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. The 2011 Gill Comprehensive Emergency Management (CEM) Plan identifies the Memorial Chapel, Old Riverside School, and Slate Memorial Library as historical buildings in Gill that would be difficult or impossible to replace if destroyed.

Table 2-1: 2011 Gill CEM Plan Cultural Resources

Resource Name	Location	Type
Memorial Chapel	28 Mt. Hermon Road	Historical Building
Old Riverside School	Route 2	Historical Building
Slate Memorial Library	332 Main Road	Historical Building; Library

Source: 2011 Gill CEM Plan

The Gill Town Hall and the Center Cemetery were also identified by the committee as cultural and historic resources that may be vulnerable to natural hazards. Groundwater seepage in the basement of the Town Hall places town records that are stored there at risk of being destroyed. The Center Cemetery is at risk of erosion along one slope, which could result in the loss of graves.

The 2011 Gill Open Space and Recreation Plan lists the following as historical resources in Gill:

- Gill Center
- Northfield Mount Hermon Campus
- Mohawk Trail Scenic Byway
- Riverside Archeological District (National Register of Historic Places)
- Bascom Hollow
- French King Bridge
- Water power mill sites
- Methodist Church
- Old Bridge Crossing Remnants
- Cemeteries
- Factory Hollow (formerly the main road to Greenfield)
- Capt. Turner Monument

² 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 on page 68.

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. In Gill, the identified critical facilities include the Town Hall, Gill Public Safety Building (which houses the Police Department, Fire Department, and Department of Public Works), the sewer pump station in Riverside, Oak Ridge Golf Club, Barton Cove Campground, Schuetzen Verein off of Route 2, the Gill Elementary School, the Giving Tree School, Northfield Mount Hermon School, and Stoughton Place senior housing.

Natural Hazard Emergency Shelters

The Comprehensive Emergency Management (CEM) Plan for Gill was last updated in September 2011 by town officials and the Massachusetts Emergency Management Agency. The document "outlines an emergency management program for planning and response to potential emergency or disaster situations," which includes emergency shelters to accommodate victims of natural hazards. The plan identifies the Gill Elementary School and the Turners Falls High School, located in neighboring Montague, as designated shelters. Shelters are not identified for specific hazards. The Gill Elementary School does not have a back-up generator or showers on-site. The Turners Falls High School does have a back-up generator, but is located across the Connecticut River, a potential barrier to accessing the shelter during severe flooding events. The Town does not have a formal agreement with the Turners Falls High School to use the facility as a shelter.

The Town is interested in designating another shelter within the Town to increase its sheltering capacity. The Northfield Mount Hermon School is one possibility. The school is in the process of putting in a campus-wide generator that will power all buildings during an outage. Additionally, the campus has multiple buildings, and could have a separate building designated as a community shelter during an emergency. The Town should collaborate with NMH staff to determine the feasibility of designating the school as a shelter, and execute a Memorandum of Understanding with the school if it is deemed feasible. The Committee 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), and access to back up utilities.

According to the 2011 CEM Plan, the Town uses bullhorns/loudspeakers, Emergency Alert System (EAS), Radio and TV, and the siren on the Northfield Mount Hermon Campus to notify residents of emergency conditions and to provide instructions. Additionally, the Town uses its website and email to alert residents. A Reverse-911 system is available, but the database of phone numbers is dated and incomplete. Social media websites are being explored as a notification option.

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3 – RISK ASSESSMENT

HAZARD IDENTIFICATION AND PROFILE

Historical research, conversations with local officials and emergency management personnel, available hazard mapping and other weather-related databases were used to identify the natural hazards which are most likely to have an impact on the Town of Gill.

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 Gill. These hazards are no more likely to occur in Gill 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.³ For more information on these hazards, please refer to the recently updated Massachusetts State Hazard Mitigation Plan (2013).⁴

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.

³ Adapted from the 2010 Massachusetts State Hazard Mitigation Plan.

⁴ <http://www.mass.gov/eopss/agencies/mema/hazard-mitigation/planning/planning-and-the-state-hazard-mitigation-plan.html>

FLOODING

General Description

The average annual precipitation for Gill and surrounding areas in northwestern Massachusetts is 44 inches⁵. There are three major types of storms that bring precipitation to Gill. 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. Another type of flooding experienced in the area is known locally as *backwater flooding* due to ice jams on the Connecticut River and other rivers in the regions. Flooding events related to dam failure is addressed in another section of this text. 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 the most costly natural hazard 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

⁵ Massachusetts Department of Conservation and Recreation 2009 precipitation data, <http://www.mass.gov/dcr/watersupply/rainfall/index.htm>.

development occurred in floodplains because of their scenic qualities and proximity to the water. Although periodic flooding of a floodplain area is a natural occurrence, past and current development and alteration of these areas ensures that flooding will continue to be a costly and frequent hazard.

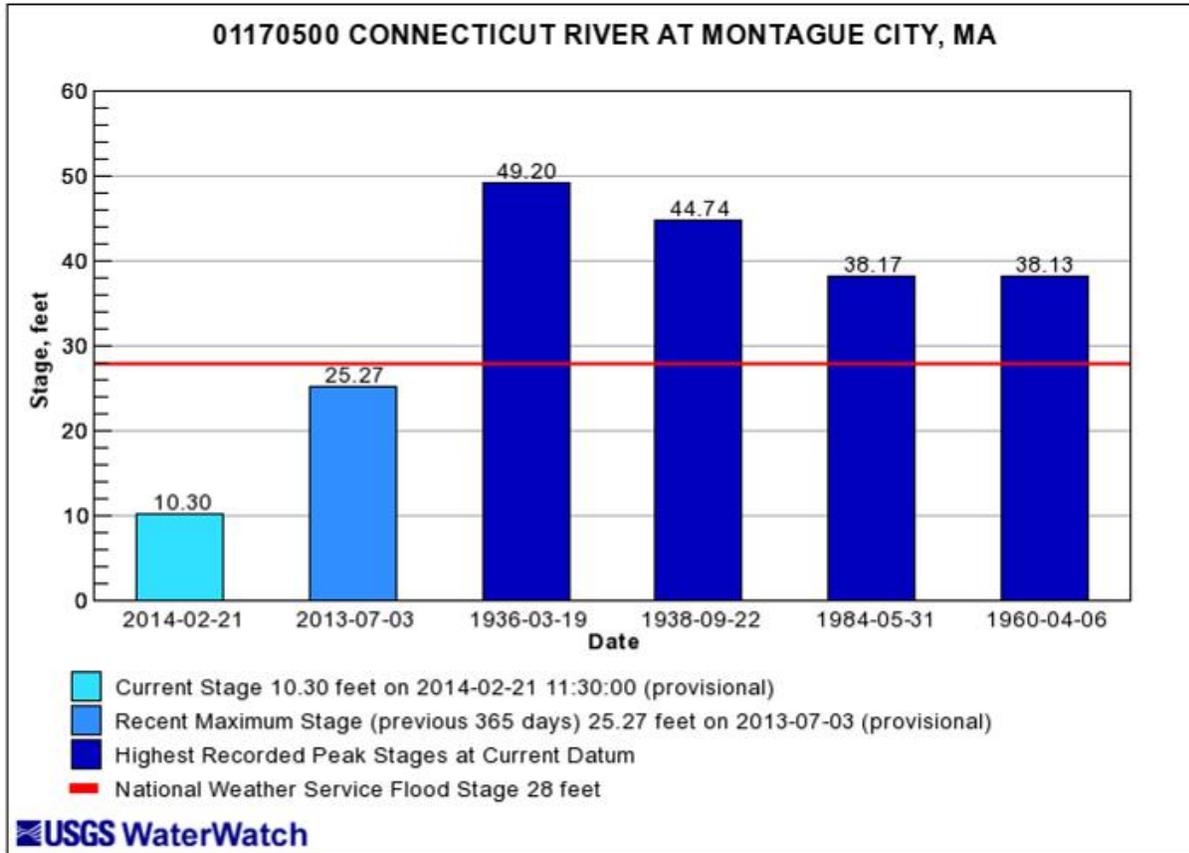
Fluvial erosion hazard (FEH) zones are areas along rivers and streams that are susceptible to bank erosion caused by flash flooding. Any area within a mapped FEH zone is considered susceptible to bank erosion during a single severe flood or after many years of slow channel migration. While the areas 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), the FIRMs 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. 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.⁶

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. Some of the tributaries to these rivers which are prone to flooding include the Green River and the Sawmill River. The Connecticut River flows along the eastern and southern border of Gill. Flooding poses a significant threat to life and public health and can cause severe property damage.

Data from the USGS gage on the Connecticut River near Montague City in Montague, MA is shown below. This gage is downstream of the Town of Gill. The graph shows the highest recorded peak stages, including four instances in recent history when flooding exceeded the flood stage of 28 feet. The most recent of these events was in 1984. Gage data was downloaded on February 21, 2014.

⁶ *Ammonoosuc River Fluvial Erosion Hazard Map for Littleton, NH*. Field Geology Services, 2010.



Source: http://waterwatch.usgs.gov/index.php?r=ma&id=ww_flood

Table 3-1 shows occurrences of flooding in Franklin County since 1993 from NOAA data that is current through 2013. No flooding events in Gill were listed in the database for this time period.

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

Year	# of Flood Events	Annual Property Damage	Annual Crop Damage
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://www4.ncdc.noaa.gov>
http://www.ncdc.noaa.gov/stormevents/listevents.jsp?beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1996&endDate_mm=06&endDate_dd=30&endDate_yyyy=2013&eventType=%28C%29+Flood&county=FRANKLIN&zone=ALL&submitbutton=Search&statefips=25%2CMASSACHUSETTS#

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 9.92 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 Barack 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.

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 the cost of all local public damage statewide. At the writing of this plan, these are very rough preliminary estimates of the total cost of the storm. More detailed numbers will become available as FEMA analyzes the particular damage in each town. Gill largely avoided damage from Tropical Storm Irene.

In Gill there are approximately 583 acres within the 100 year floodplain. The 2011 Gill Comprehensive Emergency Management Plan identifies the Riverside section of Gill as a flood prone area in Town.

During the construction of the Northfield Mountain Pumped Storage Project, the dam at Turners Falls was raised to accommodate a power generating facility. A 2,500-acre lower reservoir, known as the Turners Falls Power Pool, was created behind the dam. The Turners Falls Power Pool is a 22-mile long reach of the Connecticut River between the Turners Falls Dam located in Gill and Montague and the Vernon Dam in Vernon, Vermont.

The hydrodynamics of the Turners Falls Power Pool are primarily controlled by the three hydroelectric generating facilities: Turners Falls, Vernon, and the Northfield Mountain Pumped Storage Project. The joint operations of the Turners Falls facility and the Northfield Mountain Pumped Storage Project have resulted in larger and faster pool fluctuations, which have

significantly changed the daily regime of this reach of the Connecticut River. Typical pool fluctuations average 3.5 feet per day at the dam. Much higher pool fluctuations, on the order of 9-10.5 feet at the dam, may occur over the course of the weekly pump/release cycle. The banks of non-cohesive, alluvial sand and silt, which dominate the Turners Falls Power Pool section of the Connecticut River, typically exceed twenty (20) feet in height. Erosive forces have destabilized many sections of bank resulting in slumping and mass wasting of large sections of bank and the loss of trees and other riparian vegetation on the top of the banks. Since 1996, a variety of bioengineering techniques have been used to stabilize over 10,000 feet of eroding river banks in the power pool, including locations in Gill. The multi-phase project is being implemented through a collaboration of FirstLight Power Resources, the Franklin Regional Council of Governments, the Massachusetts Department of Environmental Protection, and other local and regional stakeholders.⁷

As part of the river bank stabilization project, a 2007 Fluvial Geomorphology Study of a reach of the river in the Gill area recommended the use of large woody debris (LWD) to protect eroding river bank along a 1,200 foot long stretch. The LWD would preserve existing beaches and promote the development of new beaches by trapping fine sediment. The beaches help to dissipate the erosive forces of water level fluctuations caused by the operation of the Northfield Mountain Project and boat wakes. The initial bank stabilization project was installed in 2009 and will continue to be monitored. A Tri-State Connecticut River Targeted Watershed Initiative virtual tour of the site can be found at http://www.cesd.umass.edu/twi/TWI_Projects.⁸

In 2009, spring runoff and abnormally high amounts of rainfall caused elevated levels of coliform bacteria in the Gill Elementary School drinking well. The Massachusetts Department of Environmental Protection (DEP) tracked the levels in the well for a period. The well is shallow, making it vulnerable to contamination from flooding. If coliform levels rise again in the well, the DEP may require the Town to install a chlorination system for the well.

Other recent flood damage in town includes the Bascom Road bridge abutment, which was severely damaged from flooding during a major rain storm in 2007. The bridge was rendered unusable due to the damage. Additionally, a brook in the Riverside neighborhood regularly floods a basement of a residence, which the Town has to pump out. The resident is exploring the option of a dry well to resolve the problem.

One area of potential concern is the water main laid on an old bridge that travels over the Fall River, which supplies the Riverside neighborhood and western area of Route 2 near Turners Falls with drinking water from Greenfield. If the bridge and main were damaged or destroyed due to flooding on the Fall River, the areas served would be without drinking water for an unknown amount of time.

Potential Mitigation Measures for Flooding

Potential projects to help mitigate the effects of flooding include:

⁷ Ibid.

⁸ 2011 Gill Open Space and Recreation Plan. Text developed by the Natural Resources Program of the Franklin Regional Council of Governments Planning Department, for the Final Project Report for the Connecticut River Watershed Restoration Phase II.

- Continue to cut brush immediately around bridge abutments and culverts to reduce the opportunity for snags.
- Develop and maintain a list of specific addresses within the 50- and 100-year floodplains for use by the EOC.
- Investigate the potential for beaver activity around the wellhead of the Gill Elementary School, which could be contributing to the high coliform levels in the well.
- Investigate whether the water main crossing the Fall River could be placed underground. Develop agreements with surrounding towns to supply back-up drinking water in the event the water main was damaged by flooding.

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, telephone 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 water lines and fire sprinkler pipes to rupture and disrupt the delivery of drinking water and cause extensive property damage. Loss of power also means loss of water for residences on private wells. Additionally fuel for generators can become scarce during prolonged outages.

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.⁹ 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.¹⁰ 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.¹¹ 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.¹²

⁹ <http://w1.weather.gov/glossary/index.php?letter=b>

¹⁰ <http://www.britannica.com/EBchecked/topic/69478/blizzard>

¹¹ <http://w1.weather.gov/glossary/index.php?letter=f>

¹² <http://w1.weather.gov/glossary/index.php?letter=h>

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.¹³ 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.¹⁴

Location and Extent

Franklin County regularly experiences severe winter storm events between the months of December and April. 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.¹⁵ The NCDC web site has more detailed information about each of the listed storms. Eleven 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 twelve recent severe winter disasters and other events that have led to Presidential Disaster or Emergency Declarations in Massachusetts.

Table 3-2: Presidential Disaster Declarations Impacting Franklin County, 1993-2013

Disaster Name	Date of Event	Declared Areas	Disaster #/ Type of Assistance	Federal Share Disbursed
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. The cost share is 75% federal and 25% local.	FEMA-3165-EM (PA)	\$21,065,441
Snowstorm	February 2003	All 14 Counties. The cost share is 75% federal and 25% local.	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
Severe Winter Storm	December 2008	Berkshire, Bristol, Essex, Franklin, Hampden,	FEMA-3296-EM-MA	\$66,509,713

¹³ <http://w1.weather.gov/glossary/index.php?letter=s>

¹⁴ <http://w1.weather.gov/glossary/index.php?letter=i>

¹⁵ <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>

Disaster Name	Date of Event	Declared Areas	Disaster #/ Type of Assistance	Federal Share Disbursed
		Hampshire, Middlesex, Suffolk, and Worcester *(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 Winter Storm and Snowstorm	January 2011	Berkshire, Essex, Hampshire, Middlesex, Norfolk, Suffolk and Hampden Counties	FEMA-1959-DR (PA)	\$1,050,102
Tropical Storm Irene	August 27-29, 2011	Berkshire, Franklin, Hampden, Hampshire, Norfolk, Bristol, Plymouth, Barnstable, Martha's Vineyard, and Nantucket Counties	FEMA-4028-DR	\$26,620,515
Severe Storm and Snowstorm	October 2011	Berkshire, Franklin, Hampden, Hampshire, Middlesex, and Worcester Counties	FEMA-4051-DR (PA)	\$71,927,443 (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.

<http://www.fema.gov/disasters/grid/year> Accessed September 16, 2013.

Although ice storms occur much less frequently than snow storms (4 out of 115 in the NCDC database), their impact can be devastating. A December 2008 ice storm deposited half an inch of ice 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. Road travel was treacherous. Many homes, mainly in the western part of the county, were without power for weeks. 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. The storm prompted a Major Disaster Declaration for Public Assistance for Franklin County and indirectly caused the death of a utility worker. FEMA distributed \$50 million to the Commonwealth, part of an \$80 million grant to northeastern states affected by the storm. Gill was not severely impacted by the 2008 ice storm. Expenses for the town, which included routine emergency procedures and some debris clearing, amounted to \$13,548.

On October 29, 2011, an early snow storm brought over a foot of snow in some areas of the county. In lower elevations, the snow was heavier and caused many tree limbs, most of which still held their leaves, to break and fall. Power outages were widespread across New England, and lasted over a week in a few places in the Connecticut River valley. In Gill, 100% of the town lost electricity. As of the morning of November 3, 2011, there were still an estimated 1 – 10% of

electric customers without power in town, according to the Western Massachusetts Electric Company. According to an article in *The Recorder* on November 1, 2011, Boyle Road, Ben Hale Road, and Hoe Shop Road remained closed on the Monday after the storm, with various other roads remaining blocked due to downed tree limbs and wires, including: Main Road, closed at the town common due to a downed wire; River Road at the intersection with Barney Hale Road; Pisgah Mountain Road at the intersection with Route 2; and South Cross Road at the intersection with Green Hill Road. In addition the traffic light at the intersection of Route 2 and Main Road was without power. A regional shelter was opened at the Turners Falls High School in Montague. Gill residents who could not drive themselves to the shelter could contact the Franklin Regional Transit Authority for a free ride to the shelter.¹⁶ Due to the widespread and prolonged power outages in town and the region, access to fuel for generators became scarce following the storm. Costs incurred by the Town for the storm are currently being determined, but are estimated to approach \$50,000.

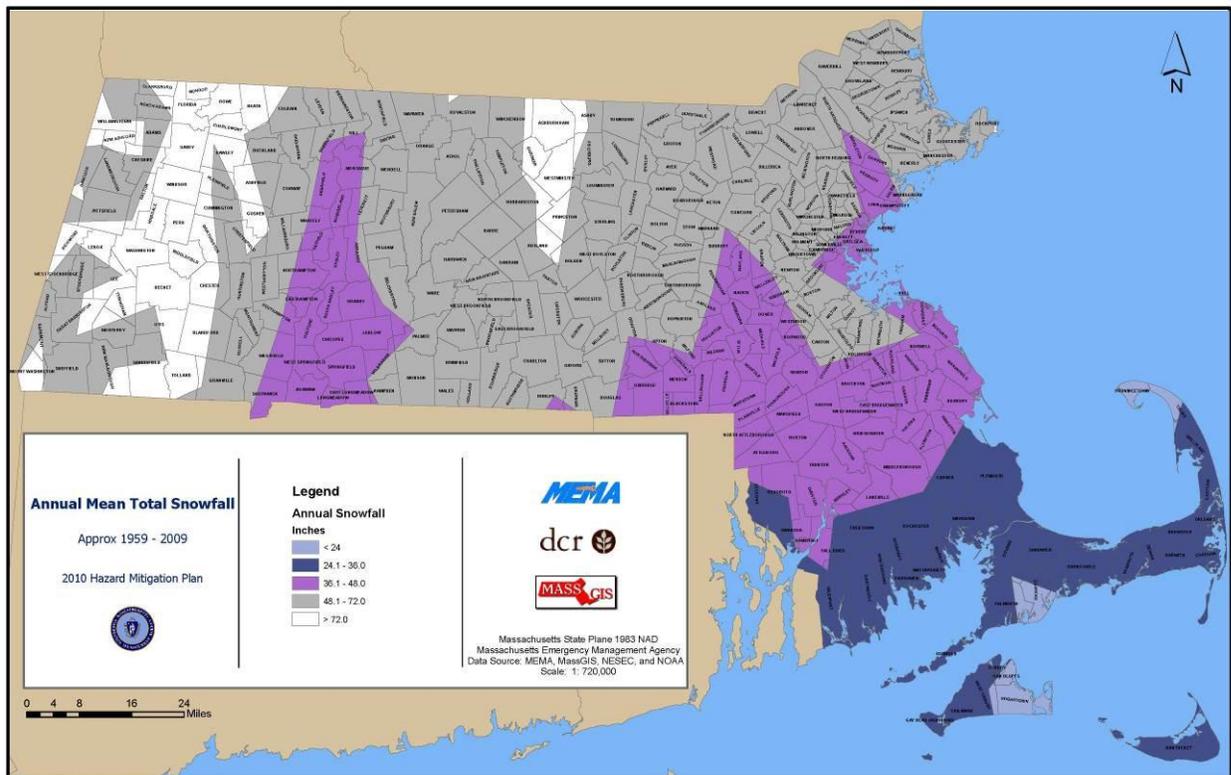
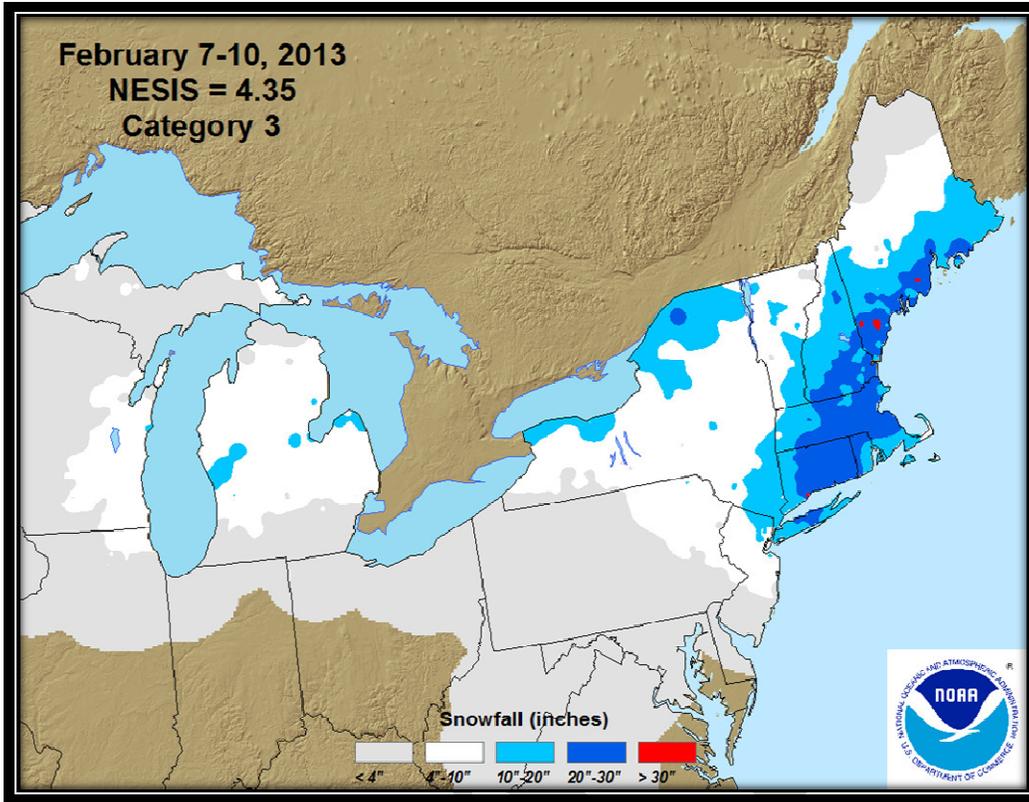
Not all severe winter storms result in Presidential Disaster Declarations or Emergency Declarations although damage to property and infrastructure, fatalities, and interruptions to critical services and businesses can occur as a result of these events. The Northeast Snowfall Impact Scale (NESIS) developed 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, Crippling, Major, Significant, and Notable. 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.¹⁷ 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.¹⁸ Because of the rural nature of the county, a storm classified as Extreme or Crippling for the affected area may not 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 entire Town of Gill is at risk to the impacts of severe winter storms. The 2010 Massachusetts State Hazard Mitigation Plan includes 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 southern portion of the Town of Gill is 36.1-48 inches while the higher elevations in the northern part of the town receive 48.1-72 inches.

¹⁶ "100 Percent of Gill Still Without Power." *The Recorder*, November 1, 2011.

¹⁷ <http://www.ncdc.noaa.gov/snow-and-ice/nesis.php>

¹⁸ <http://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis>



Potential Mitigation Measures for Severe Winter Storms

- Wire all town-owned building with transfer switches for portable generators.
- Continue program of tree maintenance & trimming along roads. Make efforts to have the State do a similar program along its highways in Gill (Route 2 and Route 10).
- Develop regional plan to insure reliable access to fuel during extended power outages.
- Formalize shelter agreements; identify in-town locations for emergency shelters.

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.¹⁹ Tropical storms, defined as having sustained winds from 34-73 mph, have also resulted in high winds and damages in Franklin County.

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>

¹⁹ National Weather Service National Hurricane Center: <http://www.nhc.noaa.gov/aboutsshws.php> .

Location and Extent

In Massachusetts, major hurricanes occurred in 1904, 1938, 1954, 1955, 1960, 1976, 1985 and 1991.²⁰ 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 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.²¹ The last hurricane to make landfall in New England was Hurricane Bob, a weak category 2 hurricane, in August 1991. In Franklin County, Hurricane Bob caused roughly \$5,555,556 in property and crop damages.²² 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

Local wind damage estimates for hurricanes and tropical storms was not available for Gill. The entire Town of Gill is at risk to the effects of hurricanes and tropical storms.

During the writing of this plan, Tropical Storm Irene caused significant damage throughout Franklin County, which was declared a disaster area by President Obama a little over a week after the storm. The major impacts of the storm came from heavy rains and flooding (see the Flooding section for more information). Wind gusts did cause power outages in parts of the county. Power outages in Gill affected less than 5% of the town, and lasted less than two hours for most. One exception was the Northfield Mount Hermon campus, which lost power for 4-5 hours, a significant amount of time for the school to be without power.

The 2011 Gill CEM Plan identifies the radio tower at the Fire Station as vulnerable to hurricanes and tropical storms.

Potential Mitigation Measures for Hurricanes and Tropical Storms

- Wire all town-owned building with transfer switches for portable generators
- Continue program of tree maintenance & trimming along roads. Make efforts to have the State do a similar program along its highways in Gill.
- Develop regional plan to insure reliable access to fuel during extended power outages
- Formalize shelter agreements; identify in-town locations for emergency shelters.

²⁰ <http://www.nhc.noaa.gov/aboutsshws.php>

²¹ <http://www.erh.noaa.gov/box/hurricane/hurricane1938.shtml>

²² Spatial Hazard Events and Losses Database (SHELDUS), <http://webra.cas.sc.edu/hvri/>

²³ Ibid.

²⁴ Hazards & Vulnerability Research Institute (2013). The Spatial Hazard Events and Losses Database for the United States, Version 12.0 [Online Database]. Columbia, SC: University of South Carolina. Available from <http://www.sheldus.org>

TORNADOS

General Description

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 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. 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.).

	F-0: (Light Damage) Chimneys are damaged, tree branches are broken, shallow-rooted trees are toppled.
	F-1: (Moderate Damage) Roof surfaces are peeled off, windows are broken, some tree trunks are snapped, unanchored manufactured homes are overturned, attached garages may be destroyed.
	F-2: (Considerable Damage) Roof structures are damaged, manufactured homes are destroyed, debris becomes airborne (missiles are generated), large trees are snapped or uprooted.
	F-3: (Severe Damage) Roofs and some walls are torn from structures, some small buildings are destroyed, non-reinforced masonry buildings are destroyed, most trees in forest are uprooted.
	F-4: (Devastating Damage) Well-constructed houses are destroyed, some structures are lifted from foundations and blown some distance, cars are blown some distance, large debris becomes airborne.
	F-5: (Incredible Damage) Strong frame houses are lifted from foundations, reinforced concrete structures are damaged, automobile-sized debris becomes airborne, trees are completely debarked.

Location and Extent

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

Since 1996, three tornadoes have been reported in Franklin County, in the towns of Heath (1997), Charlemont (1997), and Wendell (2006). See Table 3-3. The July 2006 tornado in Wendell was rated F2 (Strong) on the Fujita Scale with winds estimated near 155 mph.

“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. In 2009, a gustnado destroyed a tobacco barn and downed trees in the neighboring 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.

Table 3-3: Tornadoes in Franklin County 1996 - 2013

Date	Location	Hazard Type	Injuries	Fatalities	Property Damage	Crop Damage	Remarks
7/3/1997	Heath	Tornado	0	0	\$ 50,000		
7/3/1997	Charlemont	Tornado	0	0	\$ 50,000		
7/11/2006	Wendell	Tornado	0	0	\$ 200,000		F2 Tornado; winds estimated near 155 mph

Source: NOAA National Climate Data Center

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+Tornado&county=FRANKLIN&zone=ALL&submitbutton=Search&statefips=25%2CMASSACHUSETTS

Within Massachusetts, tornadoes have occurred most frequently in Worcester County and in communities west of Worcester. However three tornadoes touched down in the Springfield area on June 1, 2011, causing significant damage to the built and natural environment and resulting in three deaths. No tornadoes have impacted Gill in recent years according to the Committee. However, the entire town of Gill can be impacted equally by a tornado.

Potential Mitigation Measures for Tornadoes

- Wire all town-owned buildings with transfer switches for portable generators.
- Continue program of tree maintenance & trimming along roads. Make efforts to have the State do a similar program along its highways in Gill (Route 2 and Route 10).
- Develop regional plan to insure reliable access to fuel during extended power outages.
- Formalize shelter agreements; identify in-town locations for emergency shelters.
- The Northfield Mount Hermon School should work to identify a back-up drinking water supply for its campus in the event of a power outage.

MICROBURSTS AND THUNDERSTORMS

General Description

The category of Microbursts and Thunderstorms includes associated storm effects including hail and lightning. Damaging winds due to severe thunderstorms and microbursts are common in western Massachusetts and can cause significant damage. 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.²⁵ A microburst is a downdraft (sinking air) in a thunderstorm that is less than 2.5 miles in scale. Some microbursts can pose a threat to life and property, but all microbursts pose a significant threat to aviation. Although microbursts are not as widely recognized as tornadoes, they can cause comparable, and in some cases, worse damage than some tornadoes. In fact, wind speeds as high as 150 mph are possible in extreme microburst

²⁵ <http://www.erh.noaa.gov/box/sevwxdef.html>

cases. There are a handful of factors that cause microbursts to develop, including mid-level dry air entrainment, cooling beneath the thunderstorm cloud base, sublimation (occurs when the cloud base is above the freezing level), and the existence of rain and/or hail within the thunderstorm (i.e. precipitation loading).²⁶

Location and Extent

The entire town of Gill can be impacted by microbursts or strong thunderstorm winds. According to data supplied by the National Oceanic and Atmospheric Administration’s (NOAA) National Climatic Data Center, from December 2006 – October 2013, Gill experienced five microburst (or “thunderstorm wind”) events (see Table 3-4). All five events caused property damage, ranging from \$5,000 to \$20,000. Damages were largely caused by downed telephone wires and trees. In July 2008, a microburst resulted in a tree falling on a trailer home. Two microbursts in May 2010 caused prolonged power outages in Gill. On May 26, 2010, strong thunderstorm winds caused damages throughout the Connecticut River Valley with numerous trees and wires down and widespread power outages. The storm resulted in a total of \$20,000 in damages in Gill, and caused power outages at the Northfield Mount Hermon School that resulted in the loss of the public drinking water well fields and well pumps for three days. The school does not have a back-up power source for the system, and does not have a back-up drinking water supply. Luckily the outage occurred shortly after school year ended and no students were living on campus. No hail or lightning events were reported in Gill from 1996 – 2013, according to the NOAA database.

Table 3-4: Microburst (Thunderstorm Wind) Events in Gill, 1996 – 2013

Date	Type	Property Damage	Crop Damage	Excerpts from storm details for Gill only
12/1/2006	Thunderstorm Wind	\$15,000	\$0	Telephone poles and wires were downed on West Gill Road.
7/27/2008	Thunderstorm Wind	\$8,000	\$0	Trees and wires were downed by thunderstorm winds. One of these trees landed on a trailer home.
8/6/2008	Thunderstorm Wind	\$5,000	\$0	Trees and wires were downed by thunderstorm winds.
5/26/2010	Thunderstorm Wind	\$20,000	\$0	Trees and wires were downed by thunderstorm winds resulting in power outages.
10/7/2013	Thunderstorm Wind	\$10,000	\$0	Trees and wires on West Gill Road and Center Road were downed by thunderstorm winds.

Source: NOAA National Climate Data Center
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+Tornado&county=FRANKLIN&zone=ALL&submitbutton=Search&statefips=25%2CMASSACHUSETTS

Potential Mitigation Measures for Microbursts and Thunderstorms

- Wire all town-owned buildings with transfer switches for portable generators.
- Continue program of tree maintenance & trimming along roads. Make efforts to have the State do a similar program along its highways in Gill (Route 2 and Route 10).
- Develop regional plan to insure reliable access to fuel during extended power outages.
- Formalize shelter agreements; identify in-town locations for emergency shelters.

²⁶ <http://www.srh.noaa.gov/ama/?n=microbursts>

- The Northfield Mount Hermon School should work to identify a back-up drinking water supply for its campus in the event of a power outage.

WILDFIRES AND BRUSHFIRES

General Description

According to FEMA, there are three different classes of wildland fires: *surface fires*, *ground fires* and *crown fires*.²⁷ The most common type of wildland fire is a surface fire which burns slowly along the floor of a forest, killing or damaging trees. A ground fire burns on or below the forest floor and is usually started by lightning. Crown fires move quickly by jumping along the tops of trees. A crown fire may spread rapidly, especially under windy conditions.

While wildland fires may have not been a significant problem for Gill, 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. Once the 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.

Location and Extent

The Town of Gill Fire Department responded to 17 brush fires between 2004 and 2010 according to the Massachusetts Fire Incident Reporting System. This is compared to an average of 20 fires per town during the same time countywide (Table 3-5). Gill has approximately 5,730 acres of forest, and is therefore at risk for fire. In 2010, 350 burn permits were issued in Gill according to Shelburne Control. These fires may be started on residential lots to clear grass, leaves, brush and other woody debris and become a problem when the homeowner can no longer control them. Other types of fires may be started by campground visitors, or others.

Table 3-5: Massachusetts Fire Incident Reporting System – Brushfires 2004-2010

Department	Total # of Brush Fires	2004	2005	2006	2007	2008	2009	2010
Bernardston	47	5	14	7	5	8	5	3
Charlemont	15	3	1	0	8	1	2	0
Colrain	13	3	1	0	3	0	1	5
Conway	29	4	5	5	3	4	4	4
Deerfield	26	6	5		1	4	7	3
Erving	10	4	2	1	0	3	0	0
Gill	17	0	1	7	4	1	1	3
Greenfield	51	0	1	4	11	13	6	16
Hawley	2	0	0	2	0	0	0	0
Heath	8	1	1	0	0	2	2	2
Leverett	11	1	1	3	5	0	1	0
Leyden	3	1	0	0	2	0	0	0
Montague Center	49	3	8	10	7	1	9	11

²⁷ FEMA, “Fact Sheet: Wildland Fires,” September 1993.

Department	Total # of Brush Fires	2004	2005	2006	2007	2008	2009	2010
New Salem	23	0	0	3	5	1	5	9
Northfield	1	0	0	0	0	1	0	0
Orange	36	4	3	3	9	0	6	11
Shelburne Center	13	4	2	5	2	0	0	0
Shelburne Falls	7	0	0	1	4	1	1	0
Shutesbury	6	0	1	0	0	1	2	2
South Deerfield	21	4	2	3	5	2	2	3
Sunderland	22	4	6	6	0	1	0	5
Turners Falls	45	8	5	4	7	1	4	16
Warwick	5	2	1	1	0	0	0	1
Wendell	10	0	0	6	2	0	1	1
Whately	28	6	7	6	1	3	0	5
Total	498	63	67	77	84	48	59	100

Source: Massachusetts Fire Incident Reporting System.

Since 2010 there have been no significant brush or wildfires in Gill. 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. In Gill, these areas include the Stoughton Place senior housing complex, the Gill Elementary School, the Giving Tree School, Four Winds School, and the Mountain Road School. These areas are shown on the Critical Facilities, Infrastructure, 2005 Land Use & Natural Hazards map for the Town of Gill. In addition, the Northfield Mount Hermon School and Barton Cove campground may also be areas considered critical facilities because of the potential need for community assistance in time of emergency and/or special communication efforts. Currently the campground has an existing radio communication system with the Northfield Mountain recreation facility for notification in times of emergency.

Potential Mitigation Measures for Wildfires and Brushfires

- Continue offering fire education in the Town newsletter and on the Town website.
- Use ongoing care in issuing burn permits.
- The Fire Department should continue to maintain access to existing water sources.
- A copy of all forest cutting plans submitted to the Conservation Commission should be distributed to the Fire Department. The plans include the location of wood roads and access trails that could be used in the event of a wildfire.

DAM FAILURE

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.

The Massachusetts Department of Conservation and Recreation (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 but then state law was changed to place the responsibility and cost for 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. All other dams are subject to the regulations unless exempted in writing by DCR.

There are several programs available to owners of dams to assist with repair or removal of dams on their property. The Natural Resources Conservation Service (NRCS), a program of the U.S.

Department of Agriculture, offers two funding opportunities for qualifying private landowners to cover part of the cost of establishing and maintaining conservation practices that enhance and improve wildlife habitat and restore natural ecosystems, including dam removal or repair. Additionally, the Massachusetts Department of Fish and Game (DFG) Riverways Program works with dam owners (both public and private) to remove failing or unnecessary dams on rivers with high habitat value and where there is community support. Riverways provides (1) technical assistance (2) technical services from pre-approved consulting firms and/or, (3) funding. Riverways works closely with Conservation Commissions, DEP and other permitting agencies to make sure dam removal projects are consistent with state and federal laws and regulations.²⁸

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.

In 2011, a bill is under consideration with the State Legislators which would give individuals and towns an additional option when they are having issues with beavers. Under this new bill, a special permit could be obtained from the State Department of Fisheries and Wildlife. The bill does 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 bill also calls for the State to begin keeping better records of all permits issued and how many beavers are trapped each year.

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.²⁹

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.³⁰

²⁸ For more information on these programs and other available funding sources, see www.ma.nrcs.usda.gov and <http://www.mass.gov/dfwele/der/riverways/resources/riverfactsheets.htm>.

²⁹ *Otsego County (NY) All Hazards Mitigation Plan*, 2010.

³⁰ 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.

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

There is no specific data for Gill because according to the DCR Office of Dam Safety and the 2011 Gill CEM Plan, there are no man-made dams in Gill. The Turners Falls Dam, however, is located both in Gill and Montague, southwest of the Gill-Montague Bridge over the Connecticut River. The Connecticut River serves as the boundary that separates the towns of Gill and Montague. The Turners Falls Dam is classified as a *High Hazard Potential* dam by the MA DCR Office of Dam Safety. The Owner and Caretaker of the dam is SUEZ Energy North America, the parent company of FirstLight Power Resources. Town officials have on file the Emergency Action Plan for the Turners Falls Dam. According to the inundation maps of the

Emergency Action Plan, there are no areas of Gill that would be impacted by the failure of this dam.

The fire pond on the Northfield Mount Hermon campus has a dam with a low hazard rating, according to school officials. This dam has been registered with the DCR Office of Dam Safety, but has not been inspected. The School is planning on completing some work on the dam, including installing a new outlet structure, in conjunction with putting in a new water line.

Northfield Mountain Pumped Storage Project located east of Gill in Erving is owned and maintained by FirstLight Power Resources of Hartford, Connecticut. The Emergency Action Plan for this facility was produced by FirstLight Power Resources and includes inundation maps for the Northfield Main Dam and the Northwest Dike of the Northfield Mountain Reservoir in Erving. Both the Dam and the Dike are classified as *Significant Hazard Potential* dams by the DCR Office of Dam Safety. According to inundation maps included in the Emergency Action Plan, if the Dike were to fail, floodplain areas in Gill along the Connecticut River south of Four Mile Brook in Northfield would be impacted. No additional areas, outside of the floodplain were identified as being significantly impacted.

Upon failure of the dike, residents would have approximately 36 minutes to 1 hour and 24 minutes before flooding. However, according to these maps, if the Dam failed, the floodplain and additional areas in Gill along the Connecticut River south of the Millers River would be impacted. In particular residences and businesses located in the Riverside residential neighborhood would be greatly impacted. Upon failure, residents would have approximately 39 to 48 minutes before flooding. There is currently no flood warning siren in the Riverside neighborhood. FirstLight has implemented a reverse call system for residences within the inundation area of the dam or dike, which would send a message to registered phone numbers within minutes of a failure.

The Harriman Dam located in Whitingham, VT stores waters from Lake Whitingham, the head source of the Deerfield River. According to the Emergency Action Plan produced by TransCanada, the Town of Gill is included on the inundation maps. However, according to these maps, the only area of Gill identified to be impacted by flooding if dam failure were to occur is the Fall River outlet area. No residential or commercial structures are found in this area.

Of additional concern is the Moore Dam, also owned by TransCanada and located on the Connecticut River in the towns of Littleton, New Hampshire, and Waterford, Vermont, approximately 158 miles upstream from Gill. According to the Emergency Action Plan, flooding caused by a failure of the dam would reach Gill within 23 hours. Under Probable Maximum Flood conditions, flood waters would inundate a section of Munns Ferry Road and the area surrounding the intersection of River Road and Pisgah Mountain Road.

Additional dams found upstream on the Connecticut River in neighboring states may pose a hazard to the Town of Gill. Some publicly owned reservoirs and dams that are located upstream of Gill include the Vernon Dam, Townshend Lake and North Springfield Lake in Vermont, and Surry Mountain Lake and Otter Brook Lake in New Hampshire³¹.

³¹ New England River Basins Commission, The River's Reach, December 1976.

On the Northfield Mount Hermon campus, beavers have dammed up the Dry Brook, causing two main problems: contamination of the school's water supply, and flooding of a field used for agriculture, thereby damaging crops and removing topsoil. The school has spent approximately \$2,000 so far on beaver removal in the area. In addition, the utility department at the school monitors the area on a monthly basis. In August 2011, flooding from Tropical Storm Irene damaged a beaver deceiver in the area. The school is working with the U.S. Department of Agriculture with the hopes of receiving funding to replace the device. Overall the beaver problem in this area will require ongoing maintenance, monitoring, and the removal of beavers. The school anticipates spending roughly \$1,000 a year in these efforts.

Beaver activity has caused property damage in a number of places throughout town (identified on the Critical Facilities and Infrastructure map). The largest problem caused by beavers is flooding of farmland. The Town has explored the option of trapping and removing beavers from certain areas, but found the process to be too cumbersome. Residents can make specific requests to have beavers removed from their land.

The Town of Gill has not been impacted by a dam breach in recent history.

Potential Mitigation Measures for Dam Failure

- Develop a beaver management plan that identifies locations of existing and potential beaver activity, the extent of flooding caused at each location, and possible solutions. The plan should prioritize projects in the locations that require intervention.
- Investigate with FirstLight Power Resources the potential for installing a flood warning siren in the Riverside neighborhood. Ensure that new residents in the Riverside neighborhood are aware of the reverse call system and are given information on how to register.
- Investigate the potential for beaver activity around the wellhead of the Gill Elementary School, which could be contributing to the high coliform levels in the well.

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.³² 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. Unreinforced masonry buildings, 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.³³

³² Northeast States Emergency Consortium web site: www.nesec.org/hazards/earthquakes.cfm

³³ Federal Emergency Management Agency web site: www.fema.gov/hazards/earthquakes/quake.shtm.

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.³⁴

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.

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

³⁴ Adapted from <http://earthquake.usgs.gov/learn/topics/richter.php>

above.³⁵ The figure below shows the Modified Mercalli Scale (far left column) and the corresponding Richter Scale magnitude rating (far right column).³⁶

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

Location and Extent

Tables 3-6 and 3-7 show historic occurrences of earthquakes in the Northeastern part of the United States. This Northeast States Emergency Consortium data is current as of December 2013. A NOAA data query for earthquake events in Franklin County between the years 1996 and 2013 turned up no events.³⁷

Table 3-6: 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: www.nesec.org/hazards/earthquakes.cfm.

³⁵ Adapted from <http://earthquake.usgs.gov/learn/topics/mercalli.php>

³⁶ Adapted from <http://img.docstoccdn.com/thumb/orig/80153368.png>

³⁷ <http://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=25%2CMASSACHUSETTS>

Table 3-7: New England 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
Vermont	1843 - 2007	73
New York	1840 - 2007	755
<i>Total Number of Earthquakes within the Northeast states between 1638 and 2007 = 2,403.</i>		

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

Massachusetts introduced earthquake design requirements into its 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.

In the Town of Gill, 314 housing units, or 56% housing in town, were built before 1970 (according to the 2000 U.S. Census). According to the United States Geological Survey, a fault line extends north-south along the Connecticut River Valley, passing just east of Gill. The fault was originally responsible for the creation of the Connecticut River. The Town of Gill has not been impacted by the effects of an earthquake. The entire Town is vulnerable to the impacts of an earthquake.

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:

- 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

Landslides in New England occur along highways where rock cuts have been made or along river corridors where the river bank collapses due to erosion that undercuts the shore. 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).³⁸

In Gill, the banks along the Connecticut River are susceptible to slumping and mass wasting as a result of erosion and bank destabilization. More detail is provided in the Flooding section. No other areas of Gill have experienced a landslide in recent history.

ICE JAMS

General Description

Ice jams (or ice dam) occur when water builds up behind a blockage of ice. Ice dams 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).

³⁸ U.S. Department of the Interior, U.S. Geological Survey. National Landslide Hazards Mitigation Strategy: A Framework for Loss Reduction. 2000.

According to data from the U.S. Army Cold Regions Research and Engineering Laboratory,³⁹ no ice jams have been reported in Gill. Ice jams on the Connecticut River have occurred south of Town in the past (Table 3-8).

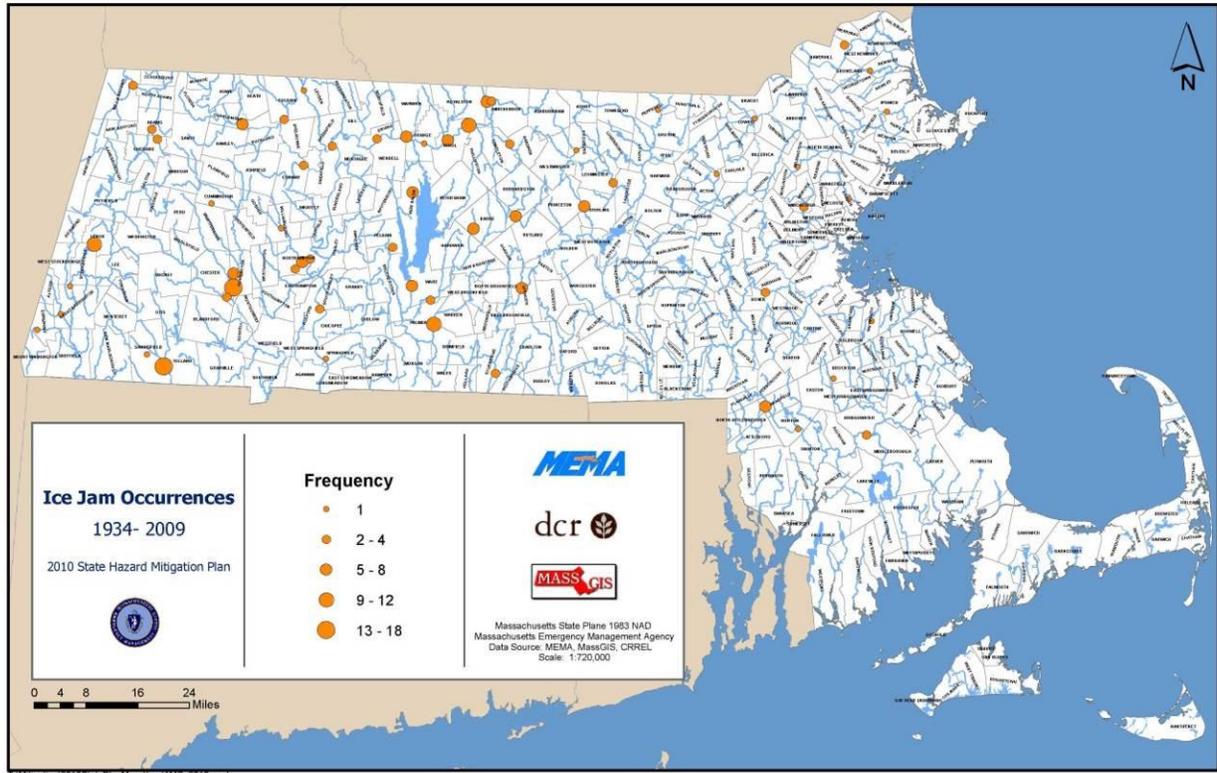


Table 3-8: Past Ice Jams on the Connecticut River

Date	Type	Town	Description or other information
01/24/1957	unknown	Montague City	Maximum annual gage height of 23.78 feet. Discharge 36,000 cfs
03/01/1947	Break-Up	Springfield	Weather Bureau reports ice jam upstream from gage Connecticut River at Springfield on March 1 (stage 4.5 ft) and 2, 1947 (stage 4.2 ft). Gage datum 37.3 ft MSL, flood stage 20 ft.
03/10/1946	unknown	Montague City	Maximum annual gage height of 27.41. Discharge "about" 71,000 cfs
03/01/1946	Break-Up	Northampton	As reported by The Hartford Courant on 03/12/46, "The Connecticut River crested at the 18-foot level in Hartford about 7 p.m. Monday and by 8 p.m. had subsided to 17.5 feet as freeze-up gripped the whole Connecticut Valley and reduced the danger of a spring flood. Waters were receding at Northampton, Mass, despite an ice jam there.
12/21/1945	unknown	Holyoke	Stage 2.7 ft. Gage datum 97.47 ft, flood stage 9 ft. NWSFO/NERFC flood stage 19 ft.
03/13/1936	unknown	Northampton	Gigantic ice jam in the Connecticut River, with ice piled 18 to 20 feet high at spots. This put terrific pressure on the Boston and Maine railroad embankment bordering the river and at one point a bulge was noticeable.
03/13/1936	Break-Up	Holyoke	Nearly the entire flow of the swollen river was diverted across the inner part of the Hockanum Meadows, where it threatened to establish a new channel. This diverted stream returned to its normal channel near Mount Tom Junction when the huge ice barrier broke during the evening of March

³⁹ www.crrel.usace.army.mil

Date	Type	Town	Description or other information
			15, floated downstream at a rate of more than 6 miles per hour, and passed over the Holyoke dam at a stage of 9.5 feet above the crest. The battering of the great ice blocks was thought to have removed 5-8 feet of the granite crest of the dam for over three-fourths of its 1,020-foot length. When the normal channel was rid of the ice jam, the main current of the swollen river reoccupied it. Most of the damage to agricultural land was done by local deep scour, strong river-bank corrosion, which was at some places accompanied by removal of many tons of material, and deposition elsewhere of appreciable thicknesses of rather coarse sediment. A tremendous amount of damage was done in thickly settled areas by the battering of large objects carried by the flood waters, by deposition of silt in and around buildings, and by the wetting of their interiors

Source: U.S. Army Cold Regions Research and Engineering Laboratory, 2009.

MANMADE HAZARDS

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.

This plan does not address all manmade hazards that could affect Franklin County. A complete hazards vulnerability analysis was not within the scope of this update. For the purposes of the 2011 plan, non-natural hazards that are of an accidental nature were evaluated. They include industrial transportation accidents and industrial accidents in a fixed facility.

Hazardous Materials General Description

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. Other active truck routes in the region include Routes 5/10, Route 47, Route 116, Route 63, and Route 112. According to the Franklin County Hazardous Material Emergency Plan⁴⁰ (HMEP), approximately 13 to 15 trucks per hour traveling through the region contain hazardous materials (Table 3-9). Most of these trucks are on Interstate 91. However, approximately 2 vehicles per hour travel along Route 2, and 1 or 0 vehicles per hour travel along Route 10, both routes passing through Gill. In addition, the 2010 Gill CEM Plan identifies Main Road as a hazardous transportation route.

The HMEP also identifies the hazardous materials being carried on highways. On Route 2, which runs through Gill, the hazardous materials regularly carried on trucks carrying these materials include:

- Gasoline
- Fuel oil
- Kerosene
- Liquefied petroleum gas
- Propane
- Sodium aluminate
- Sulfuric acid
- NOS liquids 3082

Safe and efficient transportation routes for trucks traveling 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.

⁴⁰ Franklin County Regional Emergency Planning Committee, Franklin County Hazardous Material Emergency Plan and Maps, 2006. Based on a one-time survey conducted in 2003.

Table 3-9: Estimated Levels of Hazardous Material Transported on Franklin County Roadways

Roadway	Number of Tank or Van Trucks Carrying Hazardous Materials per hour
Interstate 91	10
Route 2	2
Other major roadways (<i>Routes 5/10, 63, 47, 116, 202, 8A, 78, 122, 142, and 2A</i>)	1 or 0

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

Franklin County has approximately 93 route miles of railroad. The major freight rail yard in the region is the East Deerfield Rail run by Pan Am Systems (formerly Guilford Transportation Industries). Table 3-10 shows it was estimated that there are 100 to 130 train cars with hazardous materials passing through the region each day. The study also found that up to 500 rail cars were stopped at the East Deerfield Rail Yard at any given time, with 20 to 50 of them containing hazardous materials. No rail lines pass through the Town of Gill.

Table 3-10: Estimated Level of Hazardous Material Transport on Franklin County Train Lines

Train Line	Trains per Day (General Merchandise)	Average Number of Cars per Train	Avg. Number of Cars per Train with Hazardous Waste
Main Freight Line, Pan Am Systems	10 to 24	50	4
Connecticut River Line, Pan Am Systems	2 to 3	30	2
East Deerfield Rail Yard, Pan Am Systems	10 to 15 trains passing through yard	n/a	2 to 5
New England Central	2	60	5

Source: 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 Environmental Protection Agency’s Toxics Release Inventory (TRI) contains information about more than 650 toxic chemicals that are being used, manufactured, treated, transported, or released into the environment.

Gill does not have any facilities listed on the Toxic Release Inventory. However Gill’s 2010 Comprehensive Emergency Management (CEM) Plan identifies facilities in Town containing hazardous materials (Table 3-11).

Table 3-11: Hazardous Facilities in Gill

Hazardous Facility	Location	Description of Hazard
F. M. Kuzmeskus	52 Main Road	Diesel Fuel, Gasoline
NMH Water Treatment Plant	28 Mt. Hermon Road	Chlorine, Salt Shed
NMH McCollum Arena	11 Mt. Hermon Road	Ammonia
NMH Stanley Ward Power Plant	21A Mt. Hermon Road	Oil

Hazardous Facility	Location	Description of Hazard
Gill DPW	196C Main Road	Diesel Fuel
Gill Mobil Station	23 French King Highway	Gasoline, Diesel Fuel

Source: 2010 Gill Comprehensive Emergency Management Plan.

In addition to the above facilities, many farmers store agricultural chemicals on their properties. Given that much farmland is located in or near floodplains and their adjacent water bodies, the potential for an accidental hazardous materials spill to impact water quality is present. This plan does not include an in-depth evaluation of hazardous materials as they relate to farming. In many cases, farmers do use and store pesticides, herbicides and fertilizers on their property. And in most cases, farmers are utilizing best management practices in the use and storage of agricultural chemicals and have undergone any required training and licensing if they are applying these chemicals to the land. Despite training and best management practices, an accidental release of hazardous materials can occur and potentially threaten human health and the environment. One approach that the Town could take to help prepare for a hazardous materials spill on a farm would be to become familiar with the types and quantities of chemicals stored on site at the larger farms. This would assist first responders in being adequately prepared to protect human health and prevent contamination of the environment in the event of a major spill or other accidental release of hazardous materials.

Hazardous facilities located outside of town boundaries can also be of concern to Gill. The Vermont Yankee nuclear power plant is located on the Connecticut River in Vernon, Vermont, near the Vermont/Massachusetts border, approximately 9.5 miles from Gill center. 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.⁴¹

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 future operation of the Vermont Yankee power plant is currently unclear. The Nuclear Regulatory Commissions recently extended the plant’s operating license for 20 more years, which expires in March 2012. Gill officials should continue to stay abreast of proper evacuation procedures in the event of an accident at the Vermont Yankee nuclear power plant.

Because parts of Gill falls within a ten mile radius of Vermont Yankee, the Town’s emergency personnel have participated in regular trainings that evaluate shelters, evacuation procedures, traffic control, and what equipment and materials would be needed in the event of an accident at the plant. In addition the Town has a nuclear planning document that is updated regularly. These trainings help the Town to be better prepared for a nuclear event, and also serve as a basis for dealing with other emergencies.

⁴¹ Vermont Department of Health. http://healthvermont.gov/enviro/rad/vt_yankee.aspx

RISK ASSESSMENT METHODOLOGY

In updating Gill's Natural Hazard Mitigation Plan, the Franklin Regional Council of Governments developed the All Hazards Risk Assessment methodology for assessing the risk of natural hazards. The All Hazards Risk Assessment is an interactive table that the Gill Natural Hazard Mitigation Planning (NHMP) Committee completed with the FRCOG staff to evaluate all the natural hazards that can impact the town based on probability 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 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 Gill's planning and preparedness is on track, and shows residents that town departments and agencies are organized in case of a natural disaster.

In rating the hazards, the committee 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:

- 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 3-12: Probability of Occurrence Rating Chart

Classification	#	Probability 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 3-13: Severity of Impacts Rating Chart

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

Table 3-14: 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.
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.

Severity of Impact Category	Severity of Impact Category Definitions
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 3-15: Area of Occurrence Rating Chart

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

Table 3-16: Preparedness Rating Chart

Classification	#
<i>Poor</i>	3
<i>Fair</i>	2
<i>Good</i>	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. The Weighted Hazard Index represents the probability of occurrence of future events. Hazards with higher index scores represent the events most in need of organization focus and resources for emergency planning and mitigation projects.

The results of the All Hazards Vulnerability Assessment can be seen in Table 3-17. The hazards receiving a Weighted Hazard Index of 5 or more are – in order of vulnerability – Flooding (7.1), Severe Winter Storms (6.3), Microbursts (6.2), and Dam Failure (5.7).

The committee felt that flooding, severe winter storms, and microbursts occur at least once every year, with impacts ranging from limited to catastrophic. While the occurrence of dam failure is rated as very low, the severity of impacts for a potential dam failure are rated as catastrophic. The committee felt that the town’s level of preparedness for floods is fair, while the level of preparedness for severe winter storms, microbursts, and dam failure is currently poor.

The committee rated the severity of impacts from all other hazards as minor. Earthquakes, hurricanes and tropical storms, and wildfire and brushfire, were rated as occurring anywhere from once in five years to once in fifty years. The committee feels the town is well-prepared for wildfires and brushfires, and poorly prepared for earthquakes and hurricanes and tropical storms. Tornados, ice jams, and landslides were rated as occurring less frequently than once in 100 years.

In general the Town feels that it must rely on a high level of volunteerism during a large-scale emergency event, as there is limited staffing to respond in such an event.

Table 3-17: Gill All Hazards Vulnerability Assessment

EVENTS	Probability of Occurrence*	POO Weighted Value	Severity of Impacts*				SOI Weighted Value	Area of Occurrence*	AOO 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												
Flooding	5	2.25	4	3	4	4	4.5	1	0.15	2	0.2	7.1
Severe Winter Storms	5	2.25	2	3	2	4	3.3	3	0.45	3	0.3	6.3
Microbursts	5	2.25	3	3	2	3	3.3	2	0.3	3	0.3	6.2
Dam Failure	1	0.45	4	4	4	4	4.8	1	0.15	3	0.3	5.7
Earthquakes	3	1.35	1	1	1	1	1.2	3	0.45	3	0.3	3.3
Hurricanes and Tropical Storms	3	1.35	1	1	1	1	1.2	2	0.3	3	0.3	3.2
Wildfires and Brushfires	3	1.35	1	1	1	1	1.2	1	0.15	1	0.1	2.8
Tornados	1	0.45	1	1	1	1	1.2	2	0.3	3	0.3	2.3
Ice Jams	1	0.45	1	1	1	1	1.2	1	0.15	2	0.2	2.0
Landslides	1	0.45	1	1	1	1	1.2	1	0.15	1	0.1	1.9

* See Tables 3-10 through 3-14 for definitions.

Note: This assessment does not include manmade hazards due to the lack of data assessed for this plan.

VULNERABILITY ASSESSMENT

Vulnerability Overview

This section presents exposure, damages, loss estimates, population impacts and data deficiencies for each of the hazards addressed in the Natural Hazard Identification and Profile 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 Gill. Coupled with the All Hazards Vulnerability Assessment from the previous section, 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 5.

Vulnerability Assessment Methodology

The Vulnerability Assessment is a series of tables that enabled FRCOG staff to determine the vulnerability of Gill to flooding and to calculate the potential costs of flooding to the town.⁴² Estimated losses for all other hazard event were also determined, based on damages from past recorded events. The potential implications for senior and low income populations in the event of a hazard are also assessed.

FLOODING

Hazard Summary

In this section, a vulnerability assessment was prepared to evaluate the potential impact that flooding could have on the portions of Gill located within the 100-year floodplain. Flooding was chosen for this detailed evaluation because it is a natural hazard likely to impact the community and the location of the impact can be determined by mapping of areas inundated during severe flooding events. Flooding 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 Gill 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. Additional information on past flooding events and damage estimates was also provided by the committee. This data was used to support an evaluation of exposure and potential impacts

⁴² 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 are presented in Table 3-1. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 was also reviewed for information on flooding.

Impact on the Community

Exposure and Loss Estimation

Flooding 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
- 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

There are approximately 583 acres in the 100-year floodplain in Gill. Table 3-18 displays the number of dwelling units and the estimated population living in the floodplain in Gill. According to 2005 MassGIS Land Use data there are seven dwelling units located in the floodplain. Using this number and Gill’s average household size as of the 2010 U.S. Census, it is estimated that 18 people, or 1.2% of Gill’s total population, resides in the floodplain.

Table 3-18: Number of Dwelling Units and Percent of Total Population Residing in the Flood Hazard Area

Gill Total Population	Average per Household Population	# of Dwelling Units in Flood Hazard Area	Estimated Population in Flood Hazard Area	% of Total Population Residing in Flood Hazard Area
1,500	2.64	7	18	1.2%

Source: 2010 U.S. Census; 2005 MassGIS Land Use data.

Table 3-19 shows the amount of commercial, industrial, and public/institutional land uses located in town and within the floodplain. There is virtually no commercial and industrial land that lies within the floodplain. There is only 1.37 acres of public or institutional land uses located within the floodplain in Gill, accounting for less than 1% of the acreage in Town devoted to these uses.

Table 3-19: Acres of Commercial, Industrial, and Public/Institutional Land Use Within the Flood Hazard Area

Land Use	Total Acres in Gill	Acres in Flood Hazard Area	% of Total Acres in Flood Hazard Area
Commercial	38.82	.05	>1%
Industrial	0	0	0%
Public/Institutional	148.14	1.37	>1%

Source: 2005 MassGIS Land Use data.

The average assessed values of the residential, commercial, and industrial land uses located within the floodplain are displayed in Table 3-20. The total average assessed value for these three land uses within the floodplain is \$2,850,380. Should a catastrophic flooding event befall Gill, the cost of repairs to public property would be a concern, and the general ability of taxpayers to pay their taxes would become a greater concern than it currently is during the budget process.

Table 3-20: Average Assessed Value of Land Use in Flood Hazard Area

Land Use	Total Acres in Town	Total Assessed Value	Average Assessed Value Per Acre	Acres In Floodplain	Average Assessed Value In Floodplain
Residential	472.34	\$123,213,587	\$260,858	10.87	\$2,835,525
Commercial	38.82	\$11,533,772	\$297,109	0.05	\$14,855
Industrial	0	\$10,340,700	\$0	0	\$0

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010; 2005 MassGIS Land Use data.

Table 3-21 takes the assessed value of residential, commercial or industrial land uses in the floodplain and shows the loss estimate if 1%, 5% or 10% if the property is damaged.

Table 3-21: Potential Estimated Loss by Land Use

Land Use	Average Assessed Value in Floodplain	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	\$2,835,525	\$28,355	\$141,776	\$283,553
Commercial	\$14,855	\$149	\$743	\$1,486
Industrial	\$0	\$0	\$0	\$0
Total	\$2,850,380	\$28,504	\$142,519	\$285,038

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

Table 3-22 lists significant structures that fall within the floodplain in Gill. The sewer pump station on Riverview Drive in the Riverside neighborhood of Gill is located within the Connecticut River floodplain. The assessment value for the pump station according to the Gill Assessor, is \$23,000. Table 3-23 lists the estimated value of the contents of the different classes of buildings and facilities. The value is presented as a percentage of the replacement value of the building and the class of structure. The percentages vary for certain classes because the

replacement cost of the contents is different from institution to business to service. The pump station falls under the Government General Service class. Therefore the total building value for the pump station would be estimated to be \$46,000. However the Committee feels that this is very low, and that if the building and the equipment inside were completely damaged by flooding, the cost would be at least \$500,000, as a conservative estimate.

The wastewater treatment plant for the Northfield Mount Hermon School is also located adjacent to the Connecticut River and the floodplain. The school estimates that it would cost a total of \$12,000,000 to replace the plant if it were destroyed by flooding.

In addition to these facilities, a water main that carries drinking water from Greenfield to the Riverside neighborhood in Gill travels over the Fall River, and is potentially vulnerable to damage from flooding. While assessment information is not available for this infrastructure, the cost for replacing the main, and for supplying back-up drinking water to affected residents for an extended period of time, could be considerable.

Table 3-22: Significant Structures Located within the Floodplain in Gill

Structure	Building Structure Value in Flood Hazard Area	Building Contents Value in Flood Hazard Area (%)	Total Building Value in Flood Hazard Area
Sewer Pump Station	N/A	N/A	\$500,000*
Northfield Mount Hermon Wastewater Treatment Plant	N/A	N/A	\$12,000,000

Source: Gill Assessor’s Records, 2011

* The Committee feels this is a conservative estimate for the value of the building and contents.

Table 3-23: Estimates of Building Contents by Class

Occupancy Class	Contents Value % (as a percentage of building replacement value)
Residential (including temporary lodging, dormitory, and nursing homes)	50%
Commercial (including retail, wholesale, professional, services, financial, entertainment & recreation)	100%
Commercial (including hospital and medical office/clinic)	150%
Commercial Parking	50%
Industrial (including heavy, light technology)	150%
Agriculture	100%
Religion/Non-Profit	100%
Government Emergency Response	150%
Government General Services	100%
Education Schools/Libraries	100%
Education Colleges/Universities	150%

Source: Natural Hazard Mitigation Plan for Thurston County, Washington, September 2009.

Table 3-24 presents 1%, 5%, and 10% damage loss estimates for the structures identified in table 3-20 in the event of a flood. A flood damaging 10% of all structures would cause an estimated \$1,250,000 in damages.

Table 3-24: Potential Estimated Loss for Buildings in Flood Hazard Area

Structure	Total Building Value in or Adjacent to Floodplain	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Sewer Pump Station	\$500,000	\$5,000	\$25,000	\$50,000
Northfield Mount Hermon Wastewater Treatment Plant	\$12,000,000	\$120,000	\$600,000	\$1,200,000
Total	\$12,500,000	\$125,000	\$625,000	\$1,250,000

Source: Gill Assessor’s Records, Northfield Mount Hermon staff input.

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 Gill. See page 126 for more information on the NFIP.

Population Impacts

The Town should be aware that senior and low income segments of Gill’s population may be more vulnerable to flooding events due to a number of factors. Senior and low income populations may be physically or financially unable to react and respond to a hazard event and require additional assistance. Access to information about the hazard event may be lacking, as well as access to transportation in the case of an evacuation. The location and construction quality of housing can also pose a significant risk. Table 3-25 displays the number of senior and low income residents in Gill. 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 3-25: Senior and Low Income Populations in Gill Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	207	13.8%
Low Income (Persons with annual incomes less than \$25,000)*	222	14.8%
Total	429**	28.6%

*Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than \$25,000 (84) by 2010 U.S. Census Average Household Size (2.64).

** There may be overlap within the Senior and Low Income categories, so that the total number of persons exposed may be lower than what is shown in the table.

Source: 2010 U.S. Census, 2005-2009 American Community Survey.

Overall Vulnerability Assessment

Flooding is common in New England, often causing significant impacts to the roads, structures, facilities, utilities, and population of Gill. Existing and future mitigation efforts should continue to be developed and employed that will enable Gill 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 bridges 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 Gill 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.
- Data for the location and condition of non-FERC regulated dams within Gill provided by the DCR Office of Dam Safety Legal Department was incomplete. This plan uses 2005 data.
- The towns of Franklin County rely on farming as one of its income sources. Little data exists on localized crop damage due to flooding.

SEVERE WINTER STORMS

Severe snow and ice storms are common in Gill, 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 Gill 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 3-26.

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, including 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, which result 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

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. The NCDC web site has more detailed information about each of the listed storms. An average of 5 such events occurs each year. Over 21 years, winter storms have caused an average of \$3.9 million in damages per year in Franklin County.

Table 3-26: Severe Winter Storms in Franklin County (Heavy Snow/Ice)

Year	# of Heavy Snow/Ice Events	Annual Property Damage	Annual Crop Damage
2013	0	\$0	\$0
2012	2	\$0	\$0
2011	2	\$1.01 million	\$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
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>

Table 3-27 provides damages from two recent winter storm events in Gill, resulting in estimated annual property damage of \$50,000 and \$13,548.

Table 3-27: Severe Heavy Winter Storm Events in Gill

Year	# of Severe Winter Storms	Annual Property Damage	Annual Crop Damage
2011	1	\$50,000*	unknown
2008	1	\$13,548	unknown

Source: Committee input.

* Estimated damages from the October 2011 snow storm.

The entire built environment of Gill is vulnerable to a severe winter storm. Table 3-28 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a severe winter storm.

Table 3-28: Potential Estimated Loss by Land Use

Land Use	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	\$123,213,587	\$1,232,136	\$6,160,378	\$12,321,359
Commercial	\$11,533,772	\$115,338	\$576,689	\$1,153,377
Industrial	\$10,340,700	\$103,407	\$517,035	\$1,034,070
Total	\$145,088,059	\$1,450,881	\$7,254,103	\$14,508,806

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

Population Impacts

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

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 3-29 summarizes the population in Gill over the age of 65 or living in households with an income below \$25,000 per year.

Table 3-29: Senior and Low Income Populations in Gill Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	207	13.8%
Low Income (Persons with annual incomes less than \$25,000)*	222	14.8%
Total	429**	28.6%

*Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than \$25,000 (84) by 2010 U.S. Census Average Household Size (2.64).

** There may be overlap within the Senior and Low Income categories, so that the total number of persons exposed may be lower than what is shown in the table.

Source: 2010 U.S. Census, 2005-2009 American Community Survey.

Overall Vulnerability Assessment

Severe winter storms are common in New England, often causing significant impacts to the roads, structures, facilities, utilities, and population of Gill. Existing and future mitigation efforts should continue to be developed and employed that will enable Gill 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 Gill from severe winter storms, the following data deficiencies were identified:

- The towns of Franklin County rely on farming for one of its income sources. Little data exists on localized crop damage due to these hazards.

HURRICANES AND TROPICAL STORMS

Hazard Summary

Hurricanes and tropical storms can cause severe impacts such as flooding, road washouts, 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, high winds and, in coastal areas, storm surges in the sea, possibly resulting in beach erosion and loss or damage to property (see Tornado and Microburst section, below). Inland, hurricanes mainly bring heavy rains that can cause flooding.

Data Collected and Used

National weather databases and Town of Gill 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. Available historic data for Franklin County are presented in Table 3-30.

Impact on the Community

Exposure and Loss Estimation

High winds and heavy rain and/or hail 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 3-30, historic data for hurricane and tropical storm events indicate one hurricane and 17 tropical storms have been recorded in Franklin County since 1990. 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. Overall, tropical storms and hurricanes have caused an average annual property damage of just \$1.3 million over the last 24 years. Data from this source was only provided on a County level.

Table 3-30: 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
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%20FRANKLIN&submitButton=Search&statefips=25%20MASSACHUSETTS

The entire built environment of Gill is vulnerable to the high winds and/or flooding from a hurricane or tropical storm. Table 3-31 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of an extreme wind and rain storm.

Table 3-31: Potential Estimated Loss by Land Use

Land Use	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	\$123,213,587	\$1,232,136	\$6,160,378	\$12,321,359
Commercial	\$11,533,772	\$115,338	\$576,689	\$1,153,377
Industrial	\$10,340,700	\$103,407	\$517,035	\$1,034,070
Total	\$145,088,059	\$1,450,881	\$7,254,103	\$14,508,806

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

Population Impacts

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

Populations considered most vulnerable to hurricane and tornado 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 3-32 summarizes the population over the age of 65 or living in households with an income below \$25,000 per year.

Table 3-32: Senior and Low Income Populations in Gill Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	207	13.8%
Low Income (Persons with annual incomes less than \$25,000)*	222	14.8%
Total	429**	28.6%

*Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than \$25,000 (84) by 2010 U.S. Census Average Household Size (2.64).

** There may be overlap within the Senior and Low Income categories, so that the total number of persons exposed may be lower than what is shown in the table.

Source: 2010 U.S. Census, 2005-2009 American Community Survey.

Overall Vulnerability Assessment

Hurricanes and tropical storms, while uncommon, have the potential to cause severe damage. Existing and future mitigation efforts should continue to be developed and employed that will enable Gill to be prepared for these events when they occur. 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 Gill from hurricanes and tropical storms, the following data deficiencies were identified:

- The towns of Franklin County rely on farming for one of its income sources. Little data exists on localized crop damage due to these hazards.

TORNADOS

Hazard Summary

Tornados are rare in Gill 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.

Data Collected and Used

National weather databases and Town of Gill 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 2010 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 3-33, 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 3-33: 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

Year	# of Tornado Events	Annual Property Damage	Annual Crop Damage
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/>.
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+Tornado&county=FRANKLIN&zone=WESTERN%20FRANKLIN&submitbutton=Search&statefips=25%20MASSACHUSETTS

No tornados have been recorded in Gill. The entire built environment of Gill is vulnerable to the high winds and/or flooding from a tornado. Table 3-34 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of an extreme wind and rain storm.

Table 3-34: Potential Estimated Loss by Land Use

Land Use	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	\$123,213,587	\$1,232,136	\$6,160,378	\$12,321,359
Commercial	\$11,533,772	\$115,338	\$576,689	\$1,153,377
Industrial	\$10,340,700	\$103,407	\$517,035	\$1,034,070
Total	\$145,088,059	\$1,450,881	\$7,254,103	\$14,508,806

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

Population Impacts

Some traffic accidents associated with storm events include injuries and in limited cases, deaths. Populations considered most vulnerable to tornado and microburst 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 3-35 summarizes the population over the age of 65 or living in households with an income below \$25,000 per year.

Table 3-35: Senior and Low Income Populations in Gill Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	207	13.8%
Low Income (Persons with annual incomes less than \$25,000)*	222	14.8%
Total	429**	28.6%

*Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than \$25,000 (84) by 2010 U.S. Census Average Household Size (2.64).

** There may be overlap within the Senior and Low Income categories, so that the total number of persons exposed may be lower than what is shown in the table.

Source: 2010 U.S. Census, 2005-2009 American Community Survey.

Overall Vulnerability Assessment

Tornados, while not common, have the potential to cause severe damage. Existing and future mitigation efforts should continue to be developed and employed that will enable Gill to be prepared for these events when they occur. 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 Gill from tornados, the following data deficiencies were identified:

- The towns of Franklin County rely on farming for one of its income sources. Little data exists on localized crop damage due to these hazards.

MICROBURSTS AND THUNDERSTORMS

Hazard Summary

Microbursts and thunderstorms are common in western Massachusetts and can cause significant damage. Additional data were available for hail and lightning events, and are included in tables 3-37 and 3-38. Hail and lightning are events generally associated with thunderstorms.

Data Collected and Used

National weather databases and Town of Gill 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 2010 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 and lightning associated with microbursts and thunderstorms can cause damage to utilities, structures, roads, trees (potentially causing vehicle accidents) and injuries and death.

Property Damage

Microbursts (“thunderstorm wind”) events and severe thunderstorms and their associated hail and lightning events, brought about significant property damage. However, it is typically the winds from thunderstorms that consistently cause the worst property damage. Thunderstorms with associated wind damage, 169 of them in the last 24 years, caused an average annual property loss of more than \$81,938 and an average annual crop damage of \$5,208 (Table 3-36). 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 was an average of 3.8 storms per year, according to NOAA data. From 2000 to 2012, NOAA recorded an average of 9.5 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.

Thunderstorm wind events have been reported in or near Gill five times since 1996, causing anywhere from \$5,000 to \$20,000 in property damages. ***See the Microburst and Thunderstorm section in the Hazard Identification and Profile section for more information on these events.***

Table 3-36: 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	Avg. Annual Property Damage	Avg. 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

As Table 3-37 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. No hail events were reported in Gill.

Table 3-37: 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	Average Annual Property Damage	Average 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/>
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%20FRANKLIN&submitbutton=Search&statefips=25%20MASSACHUSETTS

Fifteen (15) lightning events (Table 3-38) have caused an average of more than \$354,800 in property damage per year over the last 20 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 \$9,800. No lightning events were recorded in Gill.

Table 3-38: Lightning Events in Franklin County

Year	# of Lightning Events	Annual Property Damage	Annual Crop Damage
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
20	15	\$354,800	\$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 Gill is vulnerable to the high winds and/or flooding from a microburst or severe thunderstorm. Table 3-39 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of an extreme wind and rain storm.

Table 3-39: Potential Estimated Loss by Land Use

Land Use	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	\$123,213,587	\$1,232,136	\$6,160,378	\$12,321,359
Commercial	\$11,533,772	\$115,338	\$576,689	\$1,153,377
Industrial	\$10,340,700	\$103,407	\$517,035	\$1,034,070
Total	\$145,088,059	\$1,450,881	\$7,254,103	\$14,508,806

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

Population Impacts

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

Populations considered most vulnerable to microburst and severe thunderstorm 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 3-40 summarizes the population over the age of 65 or living in households with an income below \$25,000 per year.

Table 3-40: Senior and Low Income Populations in Gill Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	207	13.8%
Low Income (Persons with annual incomes less than \$25,000)*	222	14.8%
Total	429**	28.6%

*Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than \$25,000 (84) by 2010 U.S. Census Average Household Size (2.64).

** There may be overlap within the Senior and Low Income categories, so that the total number of persons exposed may be lower than what is shown in the table.

Source: 2010 U.S. Census, 2005-2009 American Community Survey.

Overall Vulnerability Assessment

Thunderstorms and microbursts are common in New England, often causing significant impacts and losses to the roads, structures, facilities, utilities, and population of Gill. Existing and future mitigation efforts should continue to be developed and employed that will enable Gill to be prepared for these events when they occur. 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 Gill from microbursts and thunderstorms, the following data deficiencies were identified:

- The towns of Franklin County rely on farming for one of its income sources. Little data exists on localized crop damage due to these hazards.

WILDFIRES AND BRUSHFIRES

Hazard Summary

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. Gill 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 Gill 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 this website shows no wildfires have occurred in or impacted Franklin County in the last 20 years. According to data from Massachusetts Fire Incident Reporting System of the Massachusetts Department of Fire Services, the Gill Fire Department responded to 14 wildfires between 2004 and 2009. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 was also reviewed for information on wildland fires 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.

Property Damage

No property damage, injuries or deaths have been recorded for Gill’s 14 brushfires between 2004 and 2009. Since 2009 no additional damages have been recorded.

Because Gill is heavily wooded, the entire built environment of the Town is vulnerable to a wildfire. Table 3-41 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a wildfire.

Table 3-41: Potential Estimated Loss by Land Use

Land Use	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	\$123,213,587	\$1,232,136	\$6,160,378	\$12,321,359
Commercial	\$11,533,772	\$115,338	\$576,689	\$1,153,377
Industrial	\$10,340,700	\$103,407	\$517,035	\$1,034,070
Total	\$145,088,059	\$1,450,881	\$7,254,103	\$14,508,806

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

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 3-42 summarizes the population over the age of 65 or living in households with an income below \$25,000 per year.

Table 3-42: Senior and Low Income Populations in Gill Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	207	13.8%
Low Income (Persons with annual incomes less than \$25,000)*	222	14.8%
Total	429**	28.6%

*Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than \$25,000 (84) by 2010 U.S. Census Average Household Size (2.64).

** There may be overlap within the Senior and Low Income categories, so that the total number of persons exposed may be lower than what is shown in the table.

Source: 2010 U.S. Census, 2005-2009 American Community Survey.

Overall Vulnerability Assessment

While wildfires have caused minimal damage, injury and loss of life to date in Gill, 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 Gill 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 Gill from wildfire hazards, the following data deficiencies were identified:

- The towns of Franklin County rely on farming for one of its income sources. Little data exists on localized crop damage due to wildfires.

DAM FAILURE

Hazard Summary

The failure of a dam upstream from Gill could have devastating effects on the Town. Dams that straddle the Connecticut could impact Gill, should they fail. 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

Data from the National Oceanic and Atmospheric Administration’s National Climatic Data Center website shows no dam failures have occurred in or impacted Franklin County in the last 20 years. According to the members of the Local Natural Hazard Mitigation Team, no dam failures have occurred in Gill in the last 20 years.

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 between 1993 and 2013, no events were recorded in Franklin County, causing no property damage or population impacts.

Structures that lie in the inundation area of Gill are most vulnerable to a dam failure. Table 3-43 identifies the building type and valuation for all residential, commercial, and industrial land uses within the floodplain in Gill, as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a dam failure. It should be noted that the inundation areas for different dam failure scenarios in Gill are geographically larger than the floodplain, and therefore would encompass more land use value than what is shown in the table. However, determining the amount of residential, commercial, and industrial land uses within the inundations area was beyond the scope of this project.

Table 3-43: Potential Estimated Loss by Land Use Category in the Floodplain

Land Use	Average Assessed Value in Floodplain	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	\$2,835,525	\$28,355	\$141,776	\$283,553
Commercial	\$14,855	\$149	\$743	\$1,486
Industrial	\$0	\$0	\$0	\$0
Total	\$2,850,380	\$28,504	\$142,519	\$285,038

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

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 3-44 summarizes the population over the age of 65 or living in households with an income below \$25,000 per year. As noted in the flooding section above, approximately 18 people reside within the floodplain in Gill. It is unknown how many people live within the dam inundation areas in town, and further, how many of those people fall within the senior or low income categories.

Table 3-44: Senior and Low Income Populations in Gill Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	207	13.8%
Low Income (Persons with annual incomes less than \$25,000)*	222	14.8%
Total	429**	28.6%

*Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than \$25,000 (84) by 2010 U.S. Census Average Household Size (2.64).

** There may be overlap within the Senior and Low Income categories, so that the total number of persons exposed may be lower than what is shown in the table.

Source: 2010 U.S. Census, 2005-2009 American Community Survey.

Overall Vulnerability Assessment

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

Data Deficiencies

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

- Data for the location and condition of dams within Gill provided by the DCR Office of Dam Safety Legal Department was incomplete. This plan uses 2005 data.
- It is unknown how many people live within the dam inundation areas in town.
- The number of vulnerable populations living within the dam inundation areas in town is unknown.

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.

New England experiences an average of 30 to 40 earthquakes each year although most are not noticed by people.⁴³ 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,

⁴³ 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.⁴⁴

Data Collected and Used

The National Oceanic and Atmospheric Administration recorded no earthquakes for Franklin County in the last 20 years. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 was also reviewed for information on earthquake hazard data and mitigation measures.

Exposure and Loss Estimation

A major earthquake could cause severe damage to Gill buildings, including older structures that were built before the 1975 law requiring new buildings to withstand earthquakes.

Property Damage

Historic data for earthquake events indicate that between 1991 and 2007, no earthquakes were recorded in Franklin County during this period, causing no damage to property.⁴⁵

If a major earthquake were to occur, the entire built environment of Gill would be vulnerable. Table 3-45 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a severe earthquake.

Table 3-45: Potential Estimated Loss by Land Use

Land Use	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	\$123,213,587	\$1,232,136	\$6,160,378	\$12,321,359
Commercial	\$11,533,772	\$115,338	\$576,689	\$1,153,377
Industrial	\$10,340,700	\$103,407	\$517,035	\$1,034,070
Total	\$145,088,059	\$1,450,881	\$7,254,103	\$14,508,806

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

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 3-46 summarizes the population over the age of 65 or living in households with an income below \$25,000 per year.

Table 3-46: Senior and Low Income Populations in Gill Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	207	13.8%
Low Income (Persons with annual incomes less than \$25,000)*	222	14.8%
Total	429**	28.6%

⁴⁴ Federal Emergency Management Agency web site: www.fema.gov/hazards/earthquakes/quake.shtm.

⁴⁵ NOAA National Climatic Data Center. <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms>

*Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than \$25,000 (84) by 2010 U.S. Census Average Household Size (2.64).

** There may be overlap within the Senior and Low Income categories, so that the total number of persons exposed may be lower than what is shown in the table.

Source: 2010 U.S. Census, 2005-2009 American Community Survey.

Overall Vulnerability Assessment

Earthquakes, while rare, could cause significant impacts and losses to the roads, structures, facilities, utilities, and population of Gill. Existing and future mitigation efforts should continue to be developed and employed that will enable Gill 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 1975, and infrastructure such as roadways and utilities that could be damaged by earthquakes.

Data Deficiencies

In assessing the risks to Gill from earthquakes, no data deficiencies were identified.

LANDSLIDES

Hazard Summary

Landslides rarely occur in Franklin County but have occurred in the eastern part of the state: 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 saw 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 for the last 20 years. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 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 increases the chances that landslides will be a danger.

Property Damage

Historic data for landslide events indicate that between 1993 and 2013, no landslide events were recorded in Franklin County.

Table 3-47 identifies the building type and valuation of this inventory as well as the losses that would result from 1%, 5%, and 10% damage to this inventory as a result of a massive landslide.

Table 3-47: Potential Estimated Loss by Land Use

Land Use	Total Assessed Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	\$123,213,587	\$1,232,136	\$6,160,378	\$12,321,359
Commercial	\$11,533,772	\$115,338	\$576,689	\$1,153,377
Industrial	\$10,340,700	\$103,407	\$517,035	\$1,034,070
Total	\$145,088,059	\$1,450,881	\$7,254,103	\$14,508,806

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

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 3-48 summarizes the population over the age of 65 or living in households with an income below \$25,000 per year.

Table 3-48: Senior and Low Income Populations in Gill Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	207	13.8%
Low Income (Persons with annual incomes less than \$25,000)*	222	14.8%
Total	429**	28.6%

*Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than \$25,000 (84) by 2010 U.S. Census Average Household Size (2.64).

** There may be overlap within the Senior and Low Income categories, so that the total number of persons exposed may be lower than what is shown in the table.

Source: 2010 U.S. Census, 2005-2009 American Community Survey.

Overall Vulnerability Assessment

Landslides, while rare in Franklin County, can destroy roads, structures, facilities, utilities, and impact the population of Gill. Existing and future mitigation efforts should continue to be developed and employed that will enable Gill 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 Gill 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.

Data Collected and Used

The National Oceanic and Atmospheric Administration’s National Climatic Data Center website shows no ice jam events or damage in Gill over the last 20 years. Data from the U.S. Army Cold Regions Research and Engineering Laboratory also shows no ice dams occurring in Gill. The Commonwealth of Massachusetts State Hazard Mitigation Plan 2010 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. The structures and people most at risk from an ice jam are those within the floodplain.

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. Structures located within the floodplain in Gill are most at risk of being damaged by an ice jam. The average assessed values of the residential, commercial, and industrial land uses located within the floodplain are displayed in Table 3-49, along with 1%, 5%, and 10% loss estimates. The total average assessed value for these three land uses within the floodplain is \$2,850,380. If 10% of this inventory were destroyed in a flood, the damages would amount to approximately \$285,038.

Table 3-49: Potential Estimated Loss by Land Use Category

Land Use	Average Assessed Value in Floodplain	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	\$2,835,525	\$28,355	\$141,776	\$283,553
Commercial	\$14,855	\$149	\$743	\$1,486
Industrial	\$0	\$0	\$0	\$0
Total	\$2,850,380	\$28,504	\$142,519	\$285,038

Source: Massachusetts Department of Revenue - Division of Local Services, Municipal Databank/Local Aid Section 2010.

Population Impacts

Populations considered most vulnerable to ice jam 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 3-50 summarizes the population over the age of 65 or living in households with an income below \$25,000 per year.

Table 3-50: Senior and Low Income Populations in Gill Exposed to Natural Hazard Events

Population Category	Number of Persons Exposed	Percentage of Total Population
Senior (Over 65 years of age)	207	13.8%
Low Income (Persons with annual incomes less than \$25,000)*	222	14.8%
Total	429**	28.6%

*Low income population was calculated by multiplying 2005-2009 American Community Survey Households with Incomes of Less than \$25,000 (84) by 2010 U.S. Census Average Household Size (2.64).

** There may be overlap within the Senior and Low Income categories, so that the total number of persons exposed may be lower than what is shown in the table.

Source: 2010 U.S. Census, 2005-2009 American Community Survey.

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 Gill 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.

Data Deficiencies

In assessing the risks to Gill 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, however the potential for accidents, the unknown impact of such accidents and the lack of well-analyzed data make this hazard a high priority on the Action Plan.

Data Deficiencies

- Need to research available models and data requirements to adequately evaluate the potential impact of hazardous accidents in Gill, including impacts on drinking water supply and on public health.

DEVELOPMENT TRENDS ANALYSIS

In assessing development trends for the Town of Gill, and the impact those trends might have on hazard mitigation, the Committee was asked to evaluate the probability of development in town and areas most likely to be targeted for development. The Committee 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 the number of construction permits issued, change in population, current zoning bylaws and the acres of developable land was considered.

Gill's land use patterns include: the Riverside neighborhood area located between Route 2 and the Connecticut River; Gill Center, the Town's primary village area and center of civic life; the campus of the Northfield Mount Hermon School in the northern section of Town; scattered single family homes along roads throughout Town; and working farm and forest lands that still blanket the mostly rural community.

The Connecticut River forms the eastern and southern border of Town. The Connecticut River floodplain continues to be utilized by farms for growing dairy-related crops. Commercial properties are located primarily along Route 2, and on Main Road close to where it intersects Route 2. This trend began in the early part of the 20th Century following the designation of Route 2 as the Mohawk Trail Scenic Auto Route.

In the 1970s and 1980s, the population of Gill increased by 44 percent. In the late 1980s, Gill experienced a reduction in the number of dairy farms due to a federal buy-out program of dairy herds to control pricing. Over the last century, Gill saw a reduction in the number of dairy farms and an increase in the development of residential uses outside of the historic village centers.

Gill's Community Development Plan (2004) included a parcel-level analysis to identify undeveloped and underutilized properties that could support additional commercial development near the Route 2-Main Road intersection. The parcel-level analysis was initiated by the Town of Gill to examine options for diversifying the town's tax base and promoting additional commercial activity in this area. This area of Gill serves as the primary gateway to Route 2, and to Turners Falls via the Gill- Montague Bridge. The analysis found two vacant parcels that had the best potential for new development and fourteen other parcels with the best potential for redevelopment. Following this analysis, in 2006 the Town approved the creation of a new village district for this area, in order to encourage commercial development in the district over other locations in town, and to help preserve rural areas and the scenic character of the Mohawk Trail.

Northfield Mount Hermon School is the largest landholder in town, owning approximately 640 acres, and the largest employer in the town. Originally with campuses in both Northfield and Gill, the school vacated most of its Northfield campus in 2005 to consolidate facilities onto the Gill campus. The facilities in Gill have been expanded to serve the increased population of students on the one campus. The school will likely continue to be a significant economic presence in the community.

As noted earlier, Gill's population according to the 2010 U.S. Census is 1,500 people, a 10% increase since the 2000 U.S. Census figure of 1,363. According to data gathered by municipal officials in the Town of Gill, however, the town had a population of 1,620 in the year 2000. Gill municipal officials believe the U.S. Census figure is inaccurate due to miscalculation of staff and faculty housing on the Northfield Mount Hermon campus as well as to a shared zip code with Turners Falls. Between 2000 and 2009, 42 building permits were issued for new single family homes in Gill, according to the U.S. Census.

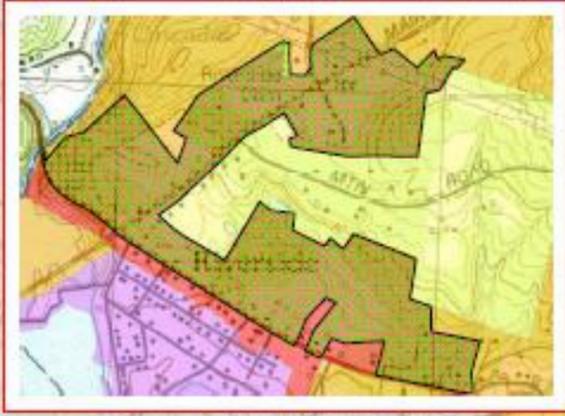
There are approximately 583 acres in the floodplain in Gill, comprising 6 percent of the total land area in Town. The floodplain is narrow along the Fall River on the western side of Town, and along the Connecticut River in the south. The floodplain widens in several areas along the Connecticut River on the eastern side of town, encompassing mostly cropland and some forest and residential land uses. The areas along Dry Brook and Otter Brook in the north central part of Town are also located within the 100-year floodplain zone. The floodplains along these brooks include agricultural and forest land as well as some residential areas.

The Gill Zoning Bylaws include a Floodplain Overlay District that restricts development within the 100-year floodplain to uses that will not increase flood levels during a 100-year flood event. Uses that are encouraged within the overlay district include agriculture, forestry and nursery uses, outdoor recreation, conservation of water, plants, and wildlife, wildlife management areas, temporary non-residential structures related to recreational or agricultural uses, and buildings existing before the adoption of the Floodplain Regulations.

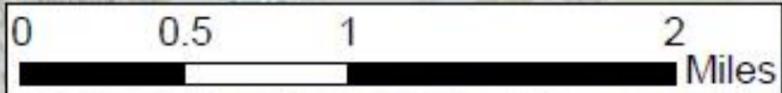
The 2004 Gill Natural Hazard Mitigation Plan included build-out estimates based on current zoning. This plan update counts structures that appear in 2005 land use maps, the most recent data available. A better system for tracking development in the floodplain not only in Gill but in other Franklin County towns should be developed. Data currently is not available for such analysis.

Solar Overlay District Map Town of Gill

August 24, 2011



- Town Boundary
- Zoning Districts**
- Residential
- Residential Agricultural
- Village Commercial
- Village Residential
- Solar Overlay District



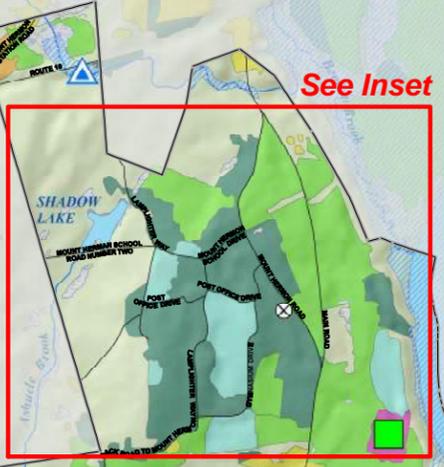
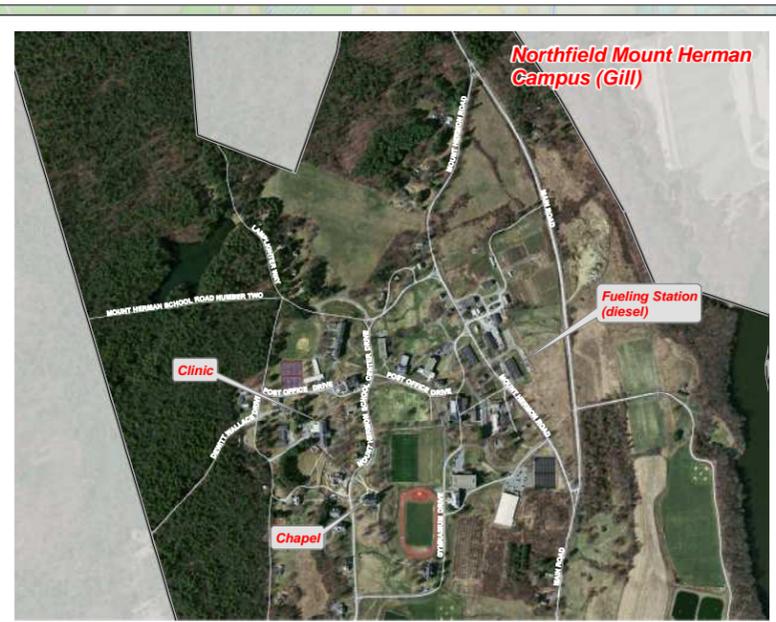
FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS
Main Office: 413-776-3187
425 Main Street
Greenfield, Massachusetts 01301

Source: Map produced by the Franklin Regional Council of Governments Planning Department. GIS data sources include Microsoft, Microsoft and USGS. Digitized boundaries and other information are intended for planning purposes only, and should not be used for survey.

Map compiled by Ryan Gilly, PHCCO Planning Dept, 11/07. File: project\gis\zoning\gill\zoning_gill.mxd

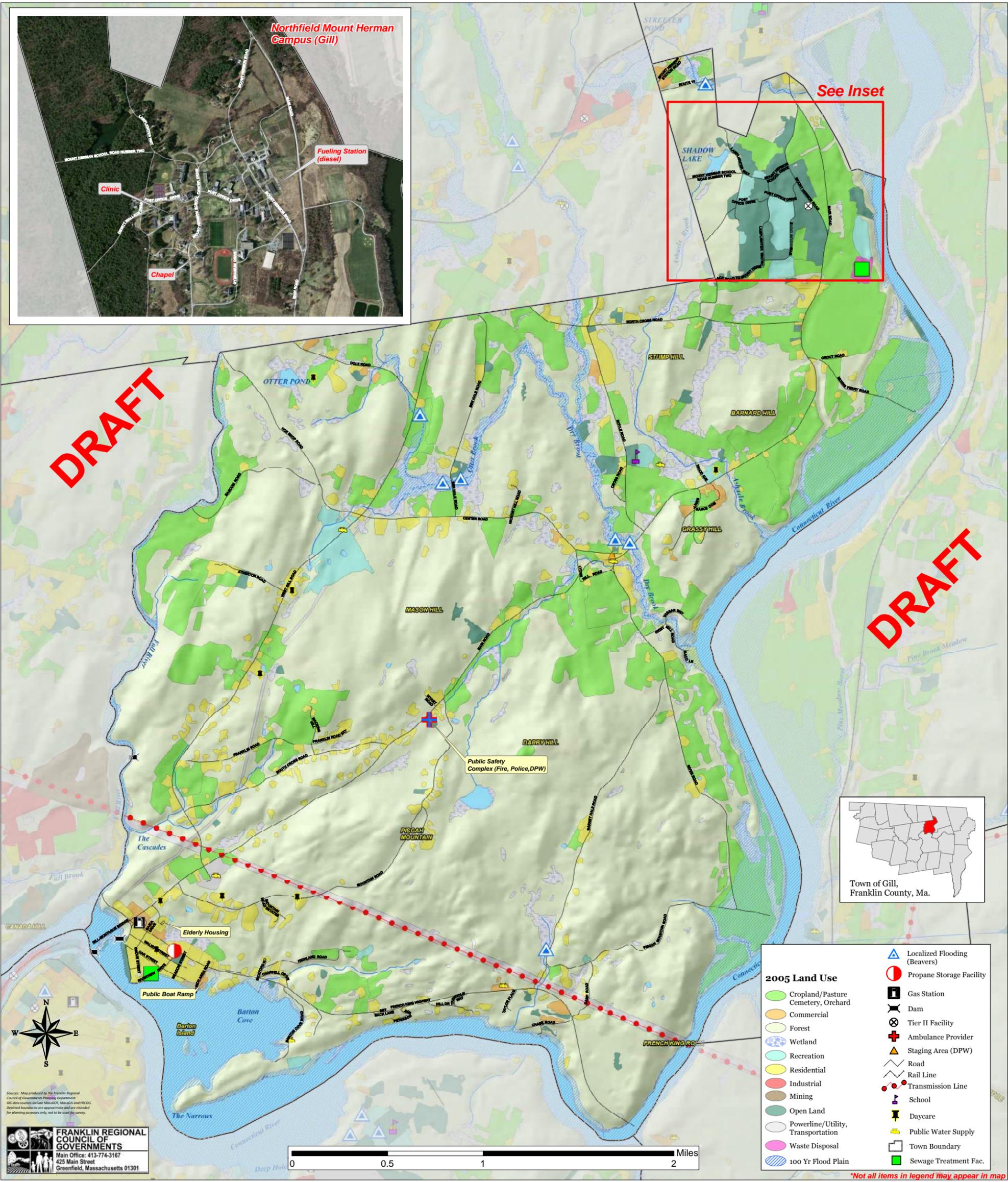
Critical Facilities & Infrastructure, 2012

Town of Gill



DRAFT

DRAFT



2005 Land Use		Facilities & Infrastructure	
	Cropland/Pasture Cemetery, Orchard		Localized Flooding (Beavers)
	Commercial		Propane Storage Facility
	Forest		Gas Station
	Wetland		Dam
	Recreation		Tier II Facility
	Residential		Ambulance Provider
	Industrial		Staging Area (DPW)
	Mining		Road
	Open Land		Rail Line
	Powerline/Utility, Transportation		Transmission Line
	Waste Disposal		School
	100 Yr Flood Plain		Daycare
			Public Water Supply
			Town Boundary
			Sewage Treatment Fac.

*Not all items in legend may appear in map

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 425 Main Street
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Source: Map produced by the Franklin Regional Council of Governments Planning Department. GIS data sources include MassDOT, Massachusetts FRCCG. Depicted boundaries are approximate and are intended for planning purposes only, not to be used for survey.

4 – MITIGATION STRATEGY

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

CURRENT MITIGATION STRATEGIES

FLOODING

The Critical Facilities and Infrastructure Map for the Town of Gill 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 by a flood that has a 1% chance of occurring in any given year. The map also shows the areas in Town that are subject to localized flooding problems, according to input from the committee. According to the FEMA flood map information, most of the Town is not within the floodplain, due to the Town's elevated topography. The areas within the floodplain are largely comprised of cropland or forest.

The major floods recorded in the Franklin County area during the 20th century have been the result of rainfall alone or rainfall combined with snowmelt, or hurricanes. One of the goals of this Natural Hazards Mitigation Plan is to evaluate all of the Town's existing policies and practices related to natural hazards and identify potential gaps in protection.

Management Plans

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

- 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.
- Community leaders should ensure that Gill is enrolled in the National Flood Insurance Program.
- 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 works⁴⁶ are in good operating condition at all times.
- Natural water storage areas⁴⁷ should be preserved.

⁴⁶ Refers to manmade levees, dikes and dams. This definition includes dams not specifically constructed for flood control.

⁴⁷ Refers to ponds, lakes, vernal ponds and other such bodies of water. Wetlands are not included in this definition.

- Maintain plans for managing all flood emergency response activities including addressing potentially hazardous dams.

The Comprehensive Emergency Management (CEM) Plan for Gill 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.

Flood Control Structures

The Town of Gill has no flood control structures within its corporate boundaries. However, along the southwestern border of Gill is the Turners Falls Dam, which is technically located in the Town of Montague. Located on the Connecticut River, southwest of the Gill-Montague Bridge, the Turners Falls Dam is owned and maintained by the SUEZ Energy North America. Generally, 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 Gill has adopted regulations for a Floodplain District in their zoning bylaws⁴⁸ for the following purposes:

- To ensure public safety through reducing the threats to life and personal injury;
- To eliminate new hazards to emergency response officials;
- To prevent the occurrence of public emergencies resulting from water quality, contamination, and pollution due to flooding;
- To 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;
- To eliminate costs associated with the response and clean up of flooding conditions; and
- To reduce damage to public and private property resulting from flooding waters.

The purpose and intent of the Town of Gill’s zoning regulations is to promote “the health, safety, convenience, and general welfare of the inhabitants of the Town of Gill, and to conserve the value of land and buildings, including the conservation of natural resources and the prevention of blight and pollution of the environment and to protect the community from any use adversely effecting its water resources.” Elements of these regulations are detailed in Appendix 1 and summarized and evaluated in Table 4-1.

Zoning Bylaws (See Appendix 1 for complete language)

- Section 15: Floodplain Regulations
- Section 6: Conservation Development
- Section 2D: Special Permit Guidelines
- Section 24: Site Plan Review
- Section 8: Logging Operations
- Section 9: Earth Removal Operations

Subdivision Rules and Regulations (See Appendix 1 for complete language)

The Subdivision Rules and Regulations contain provisions within Section 3: Design Standards that mitigate the potential for flooding, including:

- Section 3-33: Storm Drainage
- Section 3-341: Water Supply & Sewage Disposal
- Section 3-35: Open Spaces
- Section 3-36: Protection of Natural Features

In addition, the Flood Plain Regulations (Section 15 of the Zoning Bylaws) requires base flood elevation data to be required for subdivision proposals or other developments of greater than 50 lots or 5 acres, whichever is the lesser, within unnumbered A zones of the FIRM.

⁴⁸ Town of Gill Zoning Bylaws, effective on May 4, 2009.

Open Space and Natural Resource Planning

Efforts in the Town of Gill over the last decade have resulted in the creation of municipal plans that are useful for flood hazard mitigation purposes. The Town of Gill Community Development Plan completed in June 2004 includes maps of water resources, developed land, critical habitats, protected open space and infrastructure. The Plan highlights the importance of balancing future development with the preservation of the community's natural and scenic resources. Specific strategies like supporting the utilization of the Agricultural Protection Restriction program or encouraging future development in areas with existing infrastructure and resources (thus avoiding sprawl), were some recommendations identified. The preservation of open space and farm land will provide flood storage capacity which reduces the amount of impervious surfaces in an area, as well as other benefits not directly related to natural hazard mitigation.

An update to the Gill Open Space and Recreation Plan was completed in 2012. The intent of the document is not to address hazard mitigation or flood control in a direct or comprehensive way. However, it inventories the natural features and environments in the town, many of which, such as wetlands, aquifer recharge areas, farms, rivers, streams, and brooks, include floodplain areas.

National Flood Insurance Program

The Town of Gill participates in the National Flood Insurance Program (NFIP) through the Federal Emergency Management Agency. As of November 2013, there were four (4) policies in effect in Gill for a total of \$1,200,000 worth of insurance. The Town of Gill is not identified by NFIP with an assigned Community Rating System (CRS) class. The CRS is a voluntary program for NFIP participating communities. The CRS provides incentives for communities "to go beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding."⁴⁹ Communities participating in the CRS entitle policy-holders to a discount on flood insurance premiums. The exact discount is related to the CRS class number achieved based on the steps the town has taken to control flood losses. More information including instructions and applications is available at <http://www.fema.gov/business/nfip/crs.shtm>. See page 126 for more information on the NFIP.

State Building Code

For new or recently built structures, the primary protection against flood damage is construction according to the State Building Code. The Town of Gill is a member of the Franklin County Cooperative Building Inspection Program, which provides building inspection services.

Emergency Shelters

The Comprehensive Emergency Management (CEM) Plan for Gill identifies the Gill Elementary School and the Turners Falls High School, located in Montague, as shelters to be used to accommodate victims of natural hazards. It does not spell out which shelter should be used for which specific hazard. The Gill Elementary School has a shelter capacity of 200 people, and does not have a backup generator on site. The Turners Falls High School is located in Montague,

⁴⁹ National Flood Insurance Program, <http://bsa.nfipstat.com/reports/1011.htm#MAT>, <http://bsa.nfipstat.com/reports/1040.htm#25>

on the other side of the Connecticut and Millers Rivers. Overall the committee feels that shelter capacity in Town is limited. The Northfield Mount Hermon School could be a potential shelter site for the town. According to school officials, it would be possible to open a shelter for residents in a building separated from the rest of the school population. This would provide the town with another shelter option within town borders. Additionally, Northfield Mount Hermon is in the process of purchasing a back-up generator that would power all buildings on campus in the event of a power outage.

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Table 4-1: Existing Flood Hazard Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness	2014 Needed Changes	Status
Zoning Bylaws					
Floodplain Regulations	Permitted uses are allowed if they do not require structures, fill or storage of materials.	Special Flood Hazard Areas (Zone A and A1-30) to indicate the 100-year floodplain.	Effective for controlling new development within the 100-year floodplain.	Consider prohibiting all new development within the 100-year floodplain.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
Special Permit Guidelines	Regulations include the protection of the natural environment and the potential impacts on surface and ground water as considerations when determining the issuance of a special permit.	Areas identified on the Zoning Map.	Effective for mitigating the potential for localized flooding for specific parcels.	Include in the Special Permit Guidelines, the potential impact on flooding as one of the “other considerations.”	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
Logging Operations & Earth Removal Operations	Regulates logging operations to remove slash from within 50 feet of highway or waterway; and beyond 50 feet slash may not exceed 3 feet in height.	Entire town.	Potentially effective for preventing flooding by keeping debris away from waterways. However these bylaws do not specifically address the potential for localized flooding that soil removal can cause.	Add reducing or eliminating the potential for localized flooding events as a part of the purpose of the bylaws. Require mitigation of potential impacts from flooding.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
	Regulates the removal of soil, loam, sand & gravel through the Special Permit process.	Entire town.	Not effective for controlling localized flooding. These bylaws do not specifically address the potential for localized flooding that soil removal can cause.	Add reducing or eliminating the potential for localized flooding events as a part of the purpose of the bylaws. Require mitigation of potential impacts from flooding.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.

Type of Existing Protection	Description	Area Covered	Effectiveness	2014 Needed Changes	Status
Site Plan Review	Project proponent must submit information regarding disposal of sewage and refuse and the protection of surface and ground water	Required for all commercial, industrial, office, multiple dwelling residential, municipal, institutional, utility, fraternal or recreational purpose proposals that require a permit.	Effective for protection water supply. Using natural design features effective in preventing flooding and uncontrolled stormwater runoff, if implemented.	Include in the Purpose section of the bylaw, to prevent flooding and increased runoff as an area of concern.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
	Project proponent is encouraged to use existing natural landscape and maintain vegetation.	Required for all commercial, industrial, office, multiple dwelling residential, municipal, institutional, utility, fraternal or recreational purpose proposals that require a permit.	Effective for protection water supply. Using natural design features effective in preventing flooding and uncontrolled stormwater runoff, if implemented.	Include in the Purpose section of the bylaw, to prevent flooding and increased runoff as an area of concern.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
Subdivision Rules and Regulations					
	Requires that subdivision design includes adequate provisions for storm drainage and for the protection of the water supply and sewer disposal.	Areas of town identified on the Zoning Map for Residential Development.	Effective for controlling impacts from stormwater runoff.	Consider creating a “Purpose Section” to the Subdivision Regulations, which includes flood prevention and mitigation.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
	Encourages use of open	Areas of town identified on the	Effective for mitigating or preventing localized	Consider creating a “Purpose Section” to the Subdivision	Recommended in 2004 plan. Not yet

Type of Existing Protection	Description	Area Covered	Effectiveness	2014 Needed Changes	Status
	space & natural features.	Zoning Map for Residential Development.	flooding of roads and other infrastructure.	Regulations, which includes flood prevention and mitigation.	accomplished. Still Relevant.
Other Protections					
Open Space and Natural Resource Planning	Inventories natural features and promotes natural resource preservation in the town, including areas in the floodplain; such as wetlands, aquifer recharge areas, farms and open space, rivers, streams and brooks.	Entire town.	Effective in identifying sensitive resource areas, including floodplains. Encourages open space and farm preservation to provide flood storage capacity.	None.	An update to the Open Space and Recreation Plan was completed in 2011.
Participation in the National Flood Insurance Program	As of November 2013, there were 4 homeowners with flood insurance policies.	Areas identified by the FEMA maps.	Effective.	None.	
State Building Code	The Town of Gill has adopted the Massachusetts State Building Code.	Entire town.	Effective.	None.	
Emergency Shelters	The Gill CEM Plan identifies the Gill Elementary School and the Turners Falls High School (located in Montague) as shelters.	Entire town.	Limited. Gill Elementary School does not have a backup power supply or on-site showers. Shelter capacity within the Town is limited.	Obtain a backup power supply for the Gill Elementary School. Identify other shelters within Town.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
				Develop formal agreements with the Northfield Mount Hermon school to use a facility on their campus as a shelter during an emergency.	New recommendation. The Town and the School have begun preliminary discussions.

SEVERE WINTER STORMS

Winter storms can be especially challenging for Emergency Management personnel because, although the storm has usually been forecast and schools and businesses may close, emergency services must still be able to access residents, hospitals, and accident sites. The Massachusetts Emergency Management Agency (MEMA) serves as the primary coordinating entity in the state-wide management of all types of winter storms and monitors the National Weather Service alerting systems during periods when winter storms are expected.⁵⁰

Management Plans

The CEM Plan for Gill lists the following generic mitigation measures for severe winter storms:

- Develop and disseminate emergency public information concerning winter storms, especially material which 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 CEM Plan for Gill 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.

⁵⁰ Comprehensive Emergency Management Plan for the Town of Gill, December 1999.

- 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. Neither the Zoning Bylaws nor Subdivision Regulations make any comment about severe winter storms. The Subdivision Regulations require that utilities be placed underground in new developments to mitigate the potential for electric and telephone services being impacted by the combination of high winds and ice.

The design and construction of new roadways and driveways may impact how ice forms at their intersection. For example, a driveway with a steep grade and inadequate design to address runoff may facilitate the pooling of water and formation of ice at the point where it intersects with the public roadway. This situation may cause traffic accidents. Some communities have also adopted formal regulations for driveway openings or curb cuts. These regulations incorporate grade and drainage design to reduce the possibility for ice formation at the roadway and driveway intersection. Presently, the Gill Highway Superintendent is required to sign off on any building permit that requires a curb cut. At that time, the Highway Superintendent determines if a culvert or other run off mitigation is needed and what the minimum requirements are. If formal regulations were enacted to address new driveways and curb cuts in Gill, they would need to consider the Town's steep topography and growth pattern.

In Gill, the only formal regulation in the town zoning bylaws or subdivision regulations that addresses driveway grades is in Section 2G of the Zoning Bylaws. Since the last Natural Hazard Mitigation Plan, the Town has revised these regulations to state that common driveways may not exceed a grade greater than 8%. Previously the maximum grade for common driveways was 12%. Additionally, since the last plan, the Subdivision Regulations have been revised to include design standards that limit the grade of new roadways to 8%.

Other Mitigation Measures

Severe snowstorms or ice storms can often result in a small or widespread loss of electrical service. It is important for critical facilities to have back up generators available to provide electrical service in times of emergency. Water and wastewater systems facilities are important to have electricity to maintain operations to prevent public health issues from occurring. The Riverside Water Pump Station serving the Riverside residential neighborhood has a back up generator. Facilities serving the Northfield Mount Hermon School's campus include the water

pump station (which is actually located in the Town of Bernardston, but serves the Gill campus) and the wastewater treatment plant. The water pump station does not have a back up generator, while the wastewater treatment plant does have one. The water pump station has “first serve” status with the electric utility company in times of emergency. The School is planning to locate a generator at the station once specific electrical issues are resolved at the site. In addition, the School has a plan to develop a whole new drinking water system, with new wells situated closer to the school. The new system would have a back-up power supply, and the existing drinking water source would serve as a back-up to the new source.⁵¹

Two of the three shelters identified in the Gill CEM Plan have back up generators. Both the Gill Public Safety Complex (which houses the municipal police, fire and highway departments and is also identified as a shelter) and the Cutler Science Building at the Northfield Mount Hermon School have back up generators. The third shelter for Gill residents to use in times of emergency, the Gill Elementary School, is not equipped with a standby power source.

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. The Town of Gill is a member of the Franklin County Cooperative Building Inspection Program, which provides building inspection services.

Emergency Shelters

The Comprehensive Emergency Management (CEM) Plan for Gill identifies the Gill Elementary School and the Turners Falls High School, located in Montague, as shelters to be used to accommodate victims of natural hazards. It does not spell out which shelter should be used for which specific hazard. The Gill Elementary School has a shelter capacity of 200 people, and does not have a backup generator on site. The Turners Falls High School is located in Montague, on the other side of the Connecticut and Millers Rivers. Overall the committee feels that shelter capacity in Town is limited. The Northfield Mount Hermon School could be a potential shelter site for the town. According to school officials, it would be possible to open a shelter for residents in a building separated from the rest of the school population. This would provide the town with another shelter option within town borders. Additionally, Northfield Mount Hermon is in the process of purchasing a back-up generator that would power all buildings on campus in the event of a power outage.

⁵¹ Communication with Bill Pachalis, Chief Engineer, Plant Facilities Department at Northfield Mount Hermon School, March 2012.

Table 4-2: Existing Severe Snowstorms/Ice Storms Hazard Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness	2014 Needed Changes	Status
Zoning Bylaws					
Common Driveway Regulations	Zoning Bylaws require a Special Permit to create common driveways, which determines that they are to be no greater than 12% in grade.	Entire town.	Moderate.	Consider revising new common driveway design standards to reduce the steep grade of new common driveways.	Recommended in 2004 plan. Accomplished. The regulations now limit common driveways to an 8% grade.
Subdivision Regulations					
Roadway Design Standards	Current Subdivision Regulations do not include specifications regarding grade for new road construction.	Entire town.	Not effective.	New roadway design standards should include grade limitations.	Recommended in 2004 plan. Accomplished. New roadways cannot exceed a grade of 8%.
Curb Cut Regulations	There is no formal design standard regulation for new driveway openings or curb cuts.	Entire town.	Not effective.	Consider developing formal regulations for new driveway openings or curb cuts that include grade and design standards, and also takes into consideration the topography and growth pattern of the Town.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
Other Protections					
Standby Power Generators	The Riverside Pump Station, the NMH wastewater treatment facility, the Gill Public Safety Complex, and the NMH Cutler Science Building each have standby power	Entire town.	Effective.	Equip Town-owned building with back-up power generation capabilities. The NMH pump station and the Gill Elementary School (shelter) need standby power generators. Other town buildings (Town Hall, Library, Riverside Municipal Building) are not wired for portable	Recommended in 2004 plan. Not yet accomplished. Still Relevant.

Type of Existing Protection	Description	Area Covered	Effectiveness	2014 Needed Changes	Status
	generators.			generators to provide heat (and prevent freeze up) during extended outages.	
State Building Code	The Town of Gill has adopted the Massachusetts State Building Code.	Entire town.	Effective.	None.	
Emergency Shelters	The Gill CEM Plan identifies the Gill Elementary School and the Turners Falls High School (located in Montague) as shelters.	Entire town.	Limited. Gill Elementary School does not have a backup power supply or on-site showers. Shelter capacity within the Town is limited.	Obtain a backup power supply for the Gill Elementary School. Identify other shelters within Town.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
				Develop formal agreements with the Northfield Mount Hermon school to use a facility on their campus as a shelter during an emergency.	New recommendation. The Town and the School have begun preliminary discussions.

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HURRICANES AND TROPICAL STORMS

Of all the natural disasters that could potentially impact Gill, 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).⁵² 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 and tropical storm mitigation measures. High winds that oftentimes accompany hurricanes and tropical storms can also damage buildings and infrastructure.

Management Plans

The CEM Plan for Gill lists the following generic mitigation measures for hurricane planning and response:

- Develop and disseminate emergency public information and instructions concerning hurricane preparedness and safety.
- Community leaders should ensure that Gill is enrolled in the National Flood Insurance Program.
- 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 CEM Plan for Gill includes the following generic preparedness and response measures for hurricanes:

- 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, etc.

⁵² Comprehensive Emergency Management Plan for the Town of Gill, December 1999.

Evacuation Options

The Gill CEM Plan lists Route 2 and Main Road as hurricane evacuation routes.

Zoning Bylaws

- Section 16: Wireless Communications
- Section 2C: Table of Use Regulations, Trailer Park or Mobile Home

Restrictions on Development

The only restrictions on development that are wind-related are the provisions in the zoning bylaw related to the location of wireless communications facilities. In addition, trailer park or mobile homes, which can be susceptible to catastrophic damage during high wind events, are allowed by special permit in the Residential and Residential-Agricultural zoned areas in Gill. Beginning in 1974, the U.S. Department of Housing and Urban Development (HUD) requires the manufacturers of mobile homes to meet specifications to withstand high winds, such as provisions for support and anchoring systems.⁵³

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. The Town of Gill is a member of the Franklin County Cooperative Building Inspection Program, which provides building inspection services.

Emergency Shelters

The Comprehensive Emergency Management (CEM) Plan for Gill identifies the Gill Elementary School and the Turners Falls High School, located in Montague, as shelters to be used to accommodate victims of natural hazards. It does not spell out which shelter should be used for which specific hazard. The Gill Elementary School has a shelter capacity of 200 people, and does not have a backup generator on site. The Turners Falls High School is located in Montague, on the other side of the Connecticut and Millers Rivers. Overall the committee feels that shelter capacity in Town is limited. The Northfield Mount Hermon School could be a potential shelter site for the town. According to school officials, it would be possible to open a shelter for residents in a building separated from the rest of the school population. This would provide the town with another shelter option within town borders. Additionally, Northfield Mount Hermon is in the process of purchasing a back-up generator that would power all buildings on campus in the event of a power outage.

⁵³ United States Code - Title 42, Section Number 5401

Table 4-3: Existing Hurricane and Tropical Storm Hazard Mitigation Measures (Wind-related)

Type of Existing Protection	Description	Area Covered	Effectiveness	2014 Needed Changes	Status
Zoning Bylaws					
Wireless Communications Facilities	Process requires an application submitted according to Special Permit and Site Plan Review guidelines, which addresses many use restrictions.	Entire town.	Effective.	Add safety and prevention of wind-related damage as a stated purpose. Include request for information from project proponent specifying mitigation measures due to potential wind-related damage. Address “fall zone” setbacks.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
Trailer and Mobile Homes	Town of Gill requires a Special Permit for the use of trailer or mobile homes.	Residential and Residential-Agricultural Zoning Districts.	Effective, if tie-downs implemented.	Ensure that mobile homes are tied down to reducing the damaging impacts of high winds.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
Other Protections					
State Building Code	The Town of Gill has adopted the Massachusetts State Building Code.	Entire town.	Effective.	None.	
Emergency Shelters	The Gill CEM Plan identifies the Gill Elementary School and the Turners Falls High School (located in Montague) as shelters.	Entire town.	Limited. Gill Elementary School does not have a backup power supply or on-site showers. Shelter capacity within the Town is limited.	Obtain a backup power supply for the Gill Elementary School. Identify other shelters within Town.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
				Develop formal agreements with the Northfield Mount Hermon school to use a facility on their campus as a shelter during an emergency.	New recommendation. The Town and the School have begun preliminary discussions.

TORNADOS, MICROBURSTS, AND THUNDERSTORMS

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.⁵⁴ However, structures built before the building code was enacted in 1975 may not be able to withstand these winds. In addition, it is important for buildings to have a safe place for people to take refuge during a tornado, such as a secure interior room or, preferably, a below ground level space like a cellar.

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 which 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 Gill CEM Plan lists the following generic mitigation measures for tornado 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 CEM Plan for Gill includes the following generic preparedness and response measures for tornados:

- 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.

⁵⁴ Institute for Business & Home Safety. www.ibhs.org.

- Acquire needed emergency food, water fuel and medical supplies.
- Take measures relating to the identification and disposition of remains of the deceased.

Zoning (See Appendix 1 for complete language)

- Section 16: Wireless Communications
- Section 2C: Table of Use Regulations, Trailer Park or Mobile Home

Restrictions on Development

The only restrictions on development that are wind-related are the provisions in the zoning bylaw related to the location of wireless communications facilities. In addition, trailer park or mobile homes, which can be susceptible to catastrophic damage during high wind events, are allowed by special permit in the Residential and Residential-Agricultural zoned areas in Gill. Beginning in 1974, the U.S. Department of Housing and Urban Development (HUD) requires the manufacturers of mobile homes to meet specifications to withstand high winds, such as provisions for support and anchoring systems.⁵⁵

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 adequately addresses designing buildings to withstand high winds. The Town of Gill is a member of the Franklin County Cooperative Building Inspection Program, which provides building inspection services.

Note: The Table for Existing Tornado and Microburst Mitigation Measures is not shown as it is the same as Table 4-3: Existing Hurricane and Tropical Storm Hazard Mitigation Measures in previous section.

Emergency Shelters

The Comprehensive Emergency Management (CEM) Plan for Gill identifies the Gill Elementary School and the Turners Falls High School, located in Montague, as shelters to be used to accommodate victims of natural hazards. It does not spell out which shelter should be used for which specific hazard. The Gill Elementary School has a shelter capacity of 200 people, and does not have a backup generator on site. The Turners Falls High School is located in Montague, on the other side of the Connecticut and Millers Rivers. Overall the committee feels that shelter capacity in Town is limited. The Northfield Mount Hermon School could be a potential shelter site for the town. According to school officials, it would be possible to open a shelter for residents in a building separated from the rest of the school population. This would provide the town with another shelter option within town borders. Additionally, Northfield Mount Hermon is in the process of purchasing a back-up generator that would power all buildings on campus in the event of a power outage.

⁵⁵ United States Code - Title 42, Section Number 5401

WILDFIRES AND BRUSHFIRE

Wildfires and brushfires could impact a large portion of Gill because so many acres in town are forested or in agricultural use. On average, the Gill Fire Department responds to less than three (3) brush fires each year. Generally, these fires involve grass, mulch or other debris being burned by a homeowner. The last major fire in Gill was on Pisgah Mountain in the 1950s. Pisgah Mountain remains an area of concern with respect to fire. Pisgah Mountain is heavily wooded and difficult to access. Unattended brush fires and illegally set fires in this and other remote areas are a concern.

Management Plans and Regulatory Measures

The CEM Plan for Gill 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 CEM Plan for Gill 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

The Town of Gill requires a permit for the outdoor burning of leaves on residential property. Burn permits are issued by the Massachusetts State Police through the Shelburne Dispatch Center. In 2009, 296 burn permits were issued for locations in Gill. To receive the burn permit, applicants must complete an online application or contact the Shelburne Dispatch Center either in person or over the phone. During this process, the applicant is read the State Law which includes guidelines for when and where the burn may be conducted as well as fire safety tips provided by the Center. 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 help 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 am and 4 pm. 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

According to the Subdivision Regulations' Planning Board Procedure for a Subdivision (Section 4), the Planning Board will submit a copy of the Definitive Plan from the developer to the Fire Department for review. It is important for the Fire Department to review subdivision plans to ensure that their trucks will have adequate access and that the water supply is adequate for fire-fighting purposes.

Public Education/Outreach

The Gill Fire Department conducts education programs annually in October during Fire Prevention Week for children attending the Elementary School as well as the private preschools in Gill. Programs are tailored to the specific age group being instructed, and are held either at the Fire Station or in the classroom, depending on the exercise to be implemented.

Restrictions on Development

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

Forest Fire Control

The Town of Gill is located in District 9 of the Massachusetts Division of Forest & Parks' Bureau of Forest Fire Control. The mission of this Bureau is "the protection of the Commonwealth of Massachusetts 3.5 million acres of state, public, and private forested land."⁵⁶ The District 9 Fire Control headquarters is at the Erving State Forest and serves the Franklin County area. Part of the work of the district is to oversee the three fire look-out towers in the district, which are located in Sunderland, Shelburne, and Warwick. According to local officials, Pisgah Mountain in Gill is visible from the fire tower network. However, staffing of these fire towers has been reduced over the years due to budget constraints.

Fire Suppression

Dry hydrants are a simple system that facilitates fire fighters access to water in lakes, ponds and other water bodies. The creation and maintenance of these dry hydrants will allow fire fighters to have a more efficient resource to suppress fires in areas without traditional hydrants, such as in more forested areas with less dense populations. Dry hydrants are found on public and private property, and are inspected twice a year by the Gill Fire Department. The Shadow Lake dry hydrant, located on western edge of the Northfield Mount Hermon School's campus, has been out of service for a few years. The repair or replacement of this dry hydrant would assist with fire suppression should it occur in the adjacent forest or on the campus. The School is planning on replacing the dry hydrant at Shadow Lake by 2015 as part of the development of a new drinking water system on campus. In addition to repairing or replacing of non-operational existing dry hydrants, the potential for new dry hydrants in areas where wildfire is likely should be examined.

⁵⁶ Massachusetts Bureau of Forest Fire Control website: <http://www.mass.gov/dem/programs/firecont/2fireint.htm>

Emergency Shelters

The Comprehensive Emergency Management (CEM) Plan for Gill identifies the Gill Elementary School and the Turners Falls High School, located in Montague, as shelters to be used to accommodate victims of natural hazards. It does not spell out which shelter should be used for which specific hazard. The Gill Elementary School has a shelter capacity of 200 people, and does not have a backup generator on site. The Turners Falls High School is located in Montague, on the other side of the Connecticut and Millers Rivers. Overall the committee feels that shelter capacity in Town is limited. The Northfield Mount Hermon School could be a potential shelter site for the town. According to school officials, it would be possible to open a shelter for residents in a building separated from the rest of the school population. This would provide the town with another shelter option within town borders. Additionally, Northfield Mount Hermon is in the process of purchasing a back-up generator that would power all buildings on campus in the event of a power outage.

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

Type of Existing Protection	Description	Area Covered	Effectiveness	2014 Needed Changes	Status
Burn Permits	For residents to obtain a burn permit, State guidelines are followed, which includes the provision to applicants.	Entire town.	Effective.	Recommend changes to the State guidelines, such as changing the months of the burning season and allowing for an earlier start time.	Recommended in 2004 plan. Not yet accomplished. Still Relevant
Subdivision Review	The relevant municipal boards and departments review proposed subdivision plans.	Entire town.	Effective, but should be modified to ensure compliance.	Specifically include a review by the Fire Department of submitted subdivision plans.	Accomplished. The Planning Board submits the definitive plan to the Fire Department for review.
Public Education/ Outreach	Educational programs conducted by the Gill Fire Department for students at the Elementary School and preschools in Gill.	Entire town.	Effective.	None.	
Fire Towers	The regional fire tower network is able to see Pisgah Mountain.	Pisgah Mountain.	Effective.	None.	
Dry Hydrant	The Shadow Lake dry hydrant is no longer in service.	Shadow Lake area	Ineffective.	Repair or replace Shadow Lake dry hydrant.	Not yet accomplished. The School is planning on replacing the dry hydrant by 2015.
Emergency Shelters	The Gill CEM Plan identifies the Gill Elementary School and the Turners Falls High School (located in Montague) as shelters.	Entire town.	Limited. Gill Elementary School does not have a backup power supply or on-site showers. Shelter capacity within the Town is limited.	Obtain a backup power supply for the Gill Elementary School. Identify other shelters within Town.	Recommended in 2004 plan. Not yet accomplished. Still Relevant
				Develop formal agreements with the Northfield Mount Hermon school to use a facility on their campus as a shelter during an emergency.	New recommendation. The Town and the School have begun preliminary discussions.

DAM FAILURE

The only mitigation measures in place are the State regulations that control the construction and inspection of dams.

Management Plans and Regulatory Measures

The Gill CEM Plan 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 overflow or failure.
- Emergency management and other local government agencies should familiarize themselves with technical data and other information pertinent to the dams that impact Gill. 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 Gill CEM Plan 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 CEM Plan 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.

Zoning

There is no specific mention made regarding the construction of new dams in the Town of Gill's Floodplain Regulations (Section 15). However, the language regarding encroachment and the erection of structures in the Floodplain Regulations would indicate that a Special Permit would be required.

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.

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 are inspected within specific time frames according to their hazard rating. There are no dams identified by DCR as being in Gill. The dams that would cause the most damage to people and property in Gill, if they failed, are located in neighboring communities or states. The Turners Falls Dam in Gill and Montague is rated a High Hazard dam which is to be inspected every two years. The Northfield Main Dam and Northwest Dike of the Northfield Mountain Pump Storage Facility in Erving are both rated Significant Hazard dams which are to be inspected every five years.

There are several programs available to owners of dams to assist with repair or removal of dams on their property. The Natural Resources Conservation Service (NRCS), a program of the U.S. Department of Agriculture, offers two funding opportunities for qualifying private landowners to

cover part of the cost of establishing and maintaining conservation practices that enhance and improve wildlife habitat and restore natural ecosystems, including dam removal or repair. Additionally, the Massachusetts Department of Fish and Game (DFG) Riverways Program works with dam owners (both public and private) to remove failing or unnecessary dams on rivers with high habitat value and where there is community support. Riverways provides (1) technical assistance (2) technical services from pre-approved consulting firms and/or, (3) funding. Riverways works closely with Conservation Commissions, DEP and other permitting agencies to make sure dam removal projects are consistent with state and federal laws and regulations.⁵⁷

Emergency Planning

The Federal Energy Regulatory Commission (FERC) requires an Emergency Action Plan to be created for licensing of hydropower facilities. The primary purpose of an Emergency Action Plan is “to provide operating and mobilization and notification procedures to be followed in the case of an emergency” (such as a sudden release of water caused by a natural disaster or accident).⁵⁸ The plans include warning system information and inundation maps. The Town of Gill is included in the Emergency Action Plans for the Turners Falls Dam located in Montague and which borders Gill, for the Northwest Dike and Northfield Main Dam associated with the Northfield Mountain Pump Storage Facility in Erving, and for the Harriman Dam located in Whitingham, Vermont. According to the plan for the Turners Falls Dam, no areas of Gill are identified as being impacted by a dam failure. If the Northwest Dike failed, the floodplain along the Connecticut River south of Four Mile Brook would be impacted. If the Northfield Main Dam failed, areas in the Riverside residential neighborhood would be impacted in addition to the floodplain area along the Connecticut River south of the Millers River. If the Harriman Dam were to fail, the only impact to Gill would be water backed up the inlet of the Falls River where it meets the Connecticut River.

Gill also falls within the inundation area for the Moore Dam, owned by TransCanada and located on the Connecticut River in the towns of Littleton, New Hampshire, and Waterford, Vermont, approximately 158 miles upstream from Gill. According to the Emergency Action Plan, flooding caused by a failure of the dam would reach Gill within 23 hours. Under Probable Maximum Flood conditions, flood waters would inundate a section of Munns Ferry Road and the area surrounding the intersection of River Road and Pisgah Mountain Road.

Additional dams found upstream on the Connecticut River in neighboring states may pose a hazard to the Town of Gill. Some publicly owned reservoirs and dams that are located upstream of Gill include Townshend Lake and North Springfield Lake in Vermont, and Surry Mountain Lake and Otter Brook Lake in New Hampshire. Hazard ratings and Emergency Action Plans for these structures are not available at this time.

⁵⁷ For more information on these programs and other available funding sources, see www.ma.nrcs.usda.gov and <http://www.mass.gov/dfwele/der/riverways/resources/riverfactsheets.htm>.

⁵⁸ FERC’s Division of Dam Safety and Inspections Operating Manual: <http://www.ferc.gov/industries/hydropower/safety.asp>

Emergency Notification

The Town obtained Reverse 911 in February 2011 as a way to notify residents of the need to evacuate or other emergency information. A more complete database of contact information is needed to maximize the effectiveness.

Emergency Shelters

The Comprehensive Emergency Management (CEM) Plan for Gill identifies the Gill Elementary School and the Turners Falls High School, located in Montague, as shelters to be used to accommodate victims of natural hazards. It does not spell out which shelter should be used for which specific hazard. The Gill Elementary School has a shelter capacity of 200 people, and does not have a backup generator on site. The Turners Falls High School is located in Montague, on the other side of the Connecticut and Millers Rivers. If a dam failure caused flooding on either of these rivers, this shelter may become inaccessible. Overall the committee feels that shelter capacity in Town is limited. The Northfield Mount Hermon School could be a potential shelter site for the town. According to school officials, it would be possible to open a shelter for residents in a building separated from the rest of the school population. This would provide the town with another shelter option within town borders. Additionally, Northfield Mount Hermon is in the process of purchasing a back-up generator that would power all buildings on campus in the event of a power outage.

Table 4-6: Existing Dam Failure Hazard Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness	2014 Needed Changes	Status
Floodplain Regulations	Special Permit is required for structures, including dams, in the Floodplain District.	Floodplain District.	Effective.	None.	
Permits required for new dam construction	State law requires a permit for the construction of any dam.	Entire town.	Effective. Ensures dams are adequately designed.	None.	
Emergency Action Plans	FERC requires Emergency Action Plans for the Harriman Dam and the Turners Falls Dam.	Entire town.	Effective.	Copies of additional Emergency Action Plans that may impact Gill need to be identified. Obtain a copy of the Moore Dam Emergency Action Plan from TransCanada.	Gill is included in the Emergency Action Plan for the Moore Dam, located on the Connecticut River in New Hampshire.
Emergency Shelters	The Gill CEM Plan identifies the Gill Elementary School and the Turners Falls High School (located in Montague) as shelters.	Entire town.	Limited. Gill Elementary School does not have a backup power supply or on-site showers. Shelter capacity within the Town is limited.	Obtain a backup power supply for the Gill Elementary School. Identify other shelters within Town.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
				Develop formal agreements with the Northfield Mount Hermon school to use a facility on their campus as a shelter during an emergency.	New recommendation. The Town and the School have begun preliminary discussions.

EARTHQUAKES

There are five mapped seismological faults in Massachusetts, which includes fault lines in Gill. However with earthquakes, 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. However, the 8th Edition of the Massachusetts State Building Code incorporates seismic requirements for new construction. Built areas underlain by artificial fill, sandy or clay soils are particularly vulnerable to damage during an earthquake.

Earthquakes can involve several potentially devastating secondary effects including:

- The collapse of buildings, bridges, roads, dams, and other vital structures;
- Rupture of utility pipelines;
- Flooding caused by dam failure;
- Landslides;
- Major transportation accidents, (railroad, chain highway crashes, aircraft, and marine);
- Extended power outage;
- Fire and/or explosion;
- HAZMAT accident; and,
- Water contamination.

Management Plans

The Gill CEM Plan lists five generic earthquake mitigation measures, including:

- 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 Gill CEM Plan also 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.

State Building Code

The Town of Gill is a member of the Franklin County Cooperative Building Inspection Program, which provides Gill's building inspection services. 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, 8th Edition of the Massachusetts State Building Code. Given that most structures in Massachusetts were built before 1975, it may be assumed that many of these buildings and structures were not built with these specific earthquake resistant design features. In the Town of Gill, 56% of the housing was built before 1970 (according to the 2000 U.S. Census). It is also important to note, that the earthquake resistant design standards are the minimum standards for the structure to pass the State Building Code. It does not indicate that the structure will be perfectly safe in earthquake conditions. In addition, built areas underlain by artificial fill, sandy or clay soils are particularly vulnerable to damage during an earthquake.

Emergency Shelters

It is important to know when the three emergency shelters in Gill were built to determine if they may or may not have constructed using earthquake resistant design standards. The Gill Elementary School was originally constructed in the 1950s. However, some classrooms have been added on to the structure since that time. It is unknown how many people may be accommodated by these classrooms at a given time. There is no standby power source at this shelter. The Cutler Science Building on the Northfield Mount Hermon School's Campus is designated as a reception center in the CEM Plan, and was constructed after 1975, but features significant amounts of glass in its structure. A back up generator is on site as a standby power source. Another reception center identified in the Gill CEM Plan is the Gill Public Safety Complex which has portions of the structure built after 1975, and has a back up generator. However, due to the size of the Complex, it could not accommodate many residents. Additionally, the Complex houses the Fire, Highway, and Police Department personnel and equipment.

Restrictions on Development

There are no seismic-related restrictions on development.

Table 4-5: Existing Earthquake Hazard Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness	2014 Needed Changes	Status
State Building Code	The Town of Gill has adopted the 8 th Edition of the State Building Code.	Entire Town but applies to new construction only.	Effective for new buildings only.	Identify public structures and shelters built before 1975, and evaluate if repair or improvements are needed to mitigate potential damage. If significant improvements are needed, alternative shelters may need to be identified.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.
Emergency Shelters	The Gill CEM Plan identifies the Gill Elementary School and the Turners Falls High School (located in Montague) as shelters.	Entire town.	Limited. Gill Elementary School does not have a backup power supply or on-site showers. Shelter capacity within the Town is limited.	Obtain a backup power supply for the Gill Elementary School. Identify other shelters within Town that have been built since 1975.	Recommended in 2004 plan. Not yet accomplished. Still Relevant.

LANDSLIDES

Landslides occur when a slope or slopes become destabilized for a number of reasons including heavy rains, vibrations from an earthquake, or construction. A moving wall of mud can bury whatever is in its path. Recently a landslide occurred in Greenfield, causing extensive damage to several homes. 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).⁵⁹

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. Most of 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 Land Use Regulations that help to mitigate landslides, and Appendix 1 for detailed Land Use Regulations.

⁵⁹ U.S. Department of the Interior, U.S. Geological Survey. National Landslide Hazards Mitigation Strategy: A Framework for Loss Reduction. 2000.

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 Current Mitigation Strategies for Flooding section and refer to Table 4-1: Existing Flood Hazard Mitigation Measures as well as Appendix A for complete language for same measures.

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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 Gill's citizens. With the frequency of transportation of hazardous materials along routes through town, 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 Town CEM Plan, 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

Goal Statements and Action Items

As part of the natural hazards mitigation planning process undertaken by the Gill Natural Hazards Planning Committee, existing gaps in protection and possible deficiencies were identified and discussed. The Committee then developed general goal statements and recommended action items that, when implemented, will help to reduce risks and future damages from natural hazards. The goal statements, action items, town department(s) responsible for implementation, and the proposed timeframe and priority for implementation for each category of natural hazard are described below. There are also several general action items that were developed.

2014 Action Plan

Prioritization of Hazards

The Committee prioritized Mitigation Action Items by examining the results of the All Hazards Vulnerability Assessment completed by the Committee (see Table 3-17). The All Hazards Vulnerability Assessment is an interactive table that the Committee completed with the FRCOG staff to evaluate all 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 Gill’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. Hazards were rated as follows:

Table 4-6: Weighted Hazard Index Priority Level

Weighted Hazard Index	Priority Level
> 5.0	High
3.0 – 4.99	Medium
< 3.0	Low

Table 4-7: Hazard Priority Level Rating

Natural Hazard	Weighted Hazard Index	Priority Level
Floods	7.1	High
Severe Winter Storms	6.3	High
Microbursts	6.2	High
Dam Failure	5.7	High
Earthquakes	3.3	Medium
Hurricanes & Tropical Storms	3.2	Medium
Wildfires & Brushfires	2.8	Low

Natural Hazard	Weighted Hazard Index	Priority Level
Tornados	2.3	Low
Ice Jams	2.0	Low
Landslides	1.9	Low

Identification of Most Important Hazards

To identify the hazards most important to the Town of Gill and to develop a range of mitigation actions for the most important hazards, the Committee discussed the hazard prioritization information (Table 4-7), assessed which hazards most often impact Gill and Western Massachusetts and considered the results of the Risk Assessment (Section 3). The Committee also discussed damages from recent hazard events, and determined that the hazards most important to Gill are Floods, Severe Winter Storms, Microbursts (including severe thunderstorms and wind related events), and Dam Failure.

In addition, the Committee realized that some Action Items could mitigate several hazards and thus created a category labeled “Multiple Hazards.” This category is considered important given the Action Item’s association with more than one hazard.

Table 4-8: Hazards Most Important to Gill

Hazard	Weighted Hazard Index Priority Level	Hazards Most Important to Gill
Floods	High	✓
Severe Winter Storms	High	✓
Microbursts	High	✓
Dam Failure	High	✓
Earthquakes	Medium	
Hurricanes & Tropical Storms	Medium	
Wildfires & Brushfires	Low	
Tornados	Low	
Ice Jams	Low	
Landslides	Low	
Manmade Hazards	Not Applicable	✓
Multiple Hazards	Not Applicable	✓

With respect to Manmade Hazards, the Committee evaluated the potential for fixed facility and 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. The consensus of the Committee was that the potential for these types of manmade hazards to occur, the unknown impact of such accidents on the town’s

population, infrastructure, and the natural and built environment, and the lack of available and well-analyzed data make this hazard important to the town and the implementation of associated Action Items a high priority, although it was not assigned a Weighted Hazard Index Priority Level Rating.

Goal Statements and Action Items

Action items from the 2004 plan were evaluated by the Committee and, if still relevant, were carried forward to the 2014 plan, with some modifications where necessary. Those action items that have been completed since the last plan are listed below in the following table. Most of the 2005 action items were identified as preparedness or response actions and were, therefore, separated from the mitigation action items in the 2014 plan and added to any new preparedness or response actions identified by the Committee for the plan update (see Table 4-11).

Table 4-9: 2004 Action Items Completed:

Action Item	Responsible Department / Board	Estimated Completion Date	Status
Work with Shelburne Control Dispatch and other communities to investigate the feasibility of a Reverse 911 system for the Town of Gill. Develop a preliminary project proposal and cost estimate.	Police Department, Fire Department, Highway Department	August 2008	The Town of Gill has acquired a Reverse 911 system.
Complete the Town of Gill Open Space & Recreation Plan, with special attention to floodplain areas.	Open Space Committee, Franklin Regional Council of Governments	December 2005	An update to the Gill Open Space and Recreation Plan was completed in 2012.
Review and update the Subdivision Regulations. Special consideration should be given to requiring that new utilities be placed underground.	Planning Board	June 2007	The Subdivision Regulations were revised in May 2009. New utilities are now required to be placed underground.
Review and update Section 16 of the Gill Zoning Bylaw that regulates wireless communication facilities. Consider adding “safety” and “the prevention of wind-related damage” as one of the purposes of the bylaw.	Planning Board	June 2006	“Safety” has been added to the purpose of the Wireless Communications section of the Zoning Bylaws.

Note: Many other action items from 2004 have been begun and/or were updated and carried over to the 2014 plan. See Tables 4-10 and 4-11.

Prioritization of Action Items

The Committee worked to prioritize the mitigation Action Items for the hazards identified as the most important to Gill. 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 Committee used a qualitative ranking system of High, Medium or Low to prioritize the mitigation Action Items for the hazards most important to Gill.

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).

For larger construction projects, the town has limited funds to hire consultants and engineers to assist them with implementation. For these projects, the Town will seek assistance through the Franklin Regional Council of Governments (FRCOG) or other funding sources such as those listed in Table 5-1 of this document. Limited technical assistance is available from the FRCOG. However, the availability of FRCOG staff can be constrained by the availability of grant funding.

The final 2014 Gill Multi-Hazards 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 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, typically these funds would be obtained from the town’s “general fund”.

The timeframe for implementation of the mitigation action items 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 Committee 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.

The 2004 Gill Local Natural Hazards Mitigation Plan did not prioritize Action Items, so it is not possible to evaluate any change in priorities since the last plan. The 2014 action plan is prioritized so in future updates to the plan it will be possible to document any changes in priorities. The 2004 planning process did include a vulnerability assessment that rated hazards according to the risk to the Town from each hazard (the 2004 plan did not evaluate landslides or ice jams). The methodology of the 2004 assessment differs greatly from the methodology used in the 2014 All Hazards Vulnerability Assessment, making it difficult to compare the two.

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Table 4-10: 2014 Gill Local Multi-Hazards Mitigation Prioritized Action Plan

✓ - Hazard Identified as Most Important to Gill	Action Item	Responsible Department / Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Priority for Implementation / Status
MULTIPLE HAZARDS - Goal Statement: To provide adequate shelter, water, food and basic first aid to displaced residents in the event of a natural disaster; To provide adequate notification and information regarding evacuation procedures, etc., to residents in the event of a natural disaster.						
✓	Develop and implement a record management plan to digitize and/ or duplicate important records housed in the Town Hall and other town facilities to mitigate the potential loss of information from a hazard event.	Select Board, Administrative Assistant, Emergency Management Director, Historical Commission, Library Director, Town Clerk	P	Town, Pre-Disaster Mitigation Program	Year 2	High / New Action Item.
	Utilize existing emergency preparedness outreach materials on westernready.gov and other sources to disseminate information through the Town newsletter, the Town website, and at the Town Hall, Library, and local events on what to include in a 'home survival kit,' how to prepare homes and other structures to withstand flooding and high winds, the proper evacuation procedures to follow during a natural disaster, and how to access information during an emergency. Review materials annually and update as needed.	Police Department, Fire Department, Highway Department, Town Administrative Assistant	P	Town, WRHSAC	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	High / Carried over from 2004 plan. Not completed due to lack of staffing capacity. The Western Regional Homeland Security Advisory Council (WRHSAC) developed the Western MA Ready public outreach campaign in 2010, with the development of a website and distribution of 50,000 emergency preparedness brochures to EMDs and municipal officials for local distribution in all four western MA counties. The Town will utilize this source to develop a customized brochure for Gill.
MANMADE HAZARDS – Goal Statement: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to manmade hazards.						
✓	Collaborate with the Regional Emergency Planning Committee (REPC) to research appropriate vulnerability assessment models for fixed facility and transportation hazardous materials accidents, collect relevant data, and populate model to further prioritize manmade hazard action items.	Emergency Management Director, Franklin County REPC, FRCOG	B, N, P, I	FEMA	Year 4	Medium / New Action Item.
WEIGHTED HAZARD INDEX ≥ 5.0						
FLOODS – Goal Statement: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to flooding.						
✓	Seek technical assistance to develop a culvert and bridge maintenance plan that identifies infrastructure susceptible to flooding, and document replacement or rehabilitation needs. Prioritize projects and seek funding for implementation. Special attention should be made to the status of the North Cross Road bridge.	Highway Department, Conservation Commission	B, I	FRCOG Local Technical Assistance, Town, Flood Mitigation Assistance Program, MassWorks	Year 3	High / Modified from 2004 plan. The Town currently monitors culverts and bridges and replaces or rehabilitates them as needed. A plan and prioritized project list will assist with funding applications and long term maintenance. The Town will seek assistance from the FRCOG to develop a template for the plan.
	To reduce the risk of flooding and damage to infrastructure, cut brush immediately surrounding bridge abutments and culverts to ensure an unobstructed flow of water.	Highway Department	B, N, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	High / New Action Item.
	Seek funding and technical assistance to investigate whether there is beaver activity occurring near the wellhead of the Gill Elementary School, and if it is contributing to the high coliform levels in the well. Determine mitigation actions to address the contamination and seek funding to implement.	Select Board, Town Administrative Assistant, Conservation Commission, Gill Elementary School	P	Town, Gill-Montague Regional School District, MassDEP S.319 Grants	Year 1	High / New Action Item.
	Seek funding and technical assistance to determine the vulnerability of the water main crossing the Fall River of being damaged due to flooding, and investigate options for mitigating the potential for damage and the resulting loss of drinking water to the Riverside neighborhood. Develop agreements with suppliers or surrounding towns to supply back-up drinking water in the event that water main is damaged.	Select Board, Riverside Water District Commission, Greenfield Department of Public Works, MassDOT	P, I	Flood Mitigation Assistance Program, USDA Rural Development, MassWorks	Year 2	High / New Action Item.

✓ - Hazard Identified as Most Important to Gill	Action Item	Responsible Department / Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Priority for Implementation / Status
	To reduce the risk of flooding and damage to the built environment, seek technical assistance to review and update the Floodplain Regulations. Special consideration should be given to further restricting or eliminating new development within the 100-year floodplain.	Planning Board	B, N, P, I	Town, Volunteers, FRCOG Local Technical Assistance	Year 3	Medium / Carried over from 2004 plan. Not started due to lack of funding and staffing capacity. The FRCOG has a model floodplain bylaw that can be consulted.
	To reduce the risk of flooding and damage to infrastructure from uncontrolled stormwater runoff, add the reduction or elimination of the potential for localized flooding as part of the Purpose Section to the Zoning Bylaw. In addition, flooding mitigation measures may be included as another "consideration" for the issuance of a Special Permit.	Planning Board	B, N, P, I	Town, Volunteers, FRCOG Local Technical Assistance	Year 3	Medium / Carried over from 2004 plan, not yet started due to lack of funding and staffing capacity. The Town will seek technical assistance from the FRCOG.
	To reduce the risk of flooding and damage to infrastructure from uncontrolled stormwater runoff, create a Purpose Section of the Subdivision Regulations and include flood prevention and mitigation.	Planning Board	B, N, P, I	Town, Volunteers, FRCOG Local Technical Assistance	Year 3	Medium / Carried over from 2004 plan, not yet started due to lack of funding and staffing capacity. The Town will seek technical assistance from the FRCOG.
	Conduct a community discussion about adopting the Community Preservation Act (CPA) to provide funding for local and regional, watershed-wide open space protection efforts, particularly in floodplain areas.	Planning Board, Select Board, Open Space Planning Committee	N	Town, Volunteers, CPA	Year 4	Medium / Modified from 2004 plan. An update to the Town of Gill Open Space and Recreation Plan was completed in 2011. Protection of land is dependent upon funding and is an ongoing process. The CPA could provide a steady source of funding for open space protection projects.
SEVERE WINTER STORMS – Goal Statement: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to severe winter storms.						
✓	To reduce the risk to property and infrastructure during severe winter storm events, identify priority areas for tree maintenance near utility lines in town and submit the list to WMECO for inclusion in its five-year action plan, which includes regular tree maintenance to reduce the number of limbs near overhead power lines. Meet bi-annually with the utility to ensure priority areas are included in the plan.	Highway Department, WMECO	P, I	Town, WMECO	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	High / New Action Item. According to the Committee, Western Massachusetts Electric Company has been good at keeping up with tree maintenance near power lines in town. Initiating regular meetings with the utility will ensure this work continues and can address new problem areas as they emerge.
	To reduce the risk to property and infrastructure during severe winter storm events, ensure adequate funding and staffing to continue the program of tree maintenance and trimming along Town roads by the Highway Department.	Highway Department	P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	High / New Action Item.
	To reduce the risk to property and infrastructure during severe winter storm events, work with the State to implement a tree maintenance and trimming program along State-owned Route 2 and Route 10 in Gill. Establish bi-annual meetings with MassDOT to review and revise the program as necessary.	Select Board, Highway Department, MassDOT	P, I	Town, MassDOT	Year 2	High / New Action Item. According to the Committee, the State has not been effective at maintaining trees along State Route 2 and Route 10, resulting in power outages and road blockages.
	To reduce the risk to property, infrastructure, and the population, seek technical assistance to develop regulations for new driveway openings and curb cuts, including grade and design standards, taking into consideration the topography and growth pattern of the Town.	Planning Board, Highway Department	P, I	Town, FRCOG Local Technical Assistance	Year 3	Medium / Carried over from 2004 Plan, not yet started due to lack of funding and staffing capacity.
MICROBURSTS – Goal Statement: 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 microbursts.						
✓	To reduce the risk to property and infrastructure during high wind events, identify priority areas for tree maintenance near utility lines in town and submit the list to WMECO for inclusion in its five-year action plan, which includes regular tree maintenance to reduce the number of limbs near overhead power lines. Meet bi-annually with the utility to ensure priority areas are included in the plan.	Highway Department, WMECO	P, I	Town, WMECO	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	High / New Action Item. According to the Committee, Western Massachusetts Electric Company has been good at keeping up with tree maintenance near power lines in town. Initiating regular meetings with the utility will ensure this work continues and can address new problem areas as they emerge.

✓ - Hazard Identified as Most Important to Gill	Action Item	Responsible Department / Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Priority for Implementation / Status
	To reduce the risk to property and infrastructure during high wind events, ensure adequate funding and staffing to continue the program of tree maintenance and trimming along Town roads by the Highway Department.	Highway Department	P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	High / New Action Item.
	To reduce the risk to property and infrastructure during high wind events, work with the State to implement a tree maintenance and trimming program along State-owned Route 2 and Route 10 in Gill. Establish bi-annual meetings with MassDOT to review and revise the program as necessary.	Select Board, Highway Department, MassDOT	P, I	Town, MassDOT	Year 2	High / New Action Item. According to the Committee, the State has not been effective at maintaining trees along State Route 2 and Route 10, resulting in power outages and road blockages.
	Utilize Community Development Block Grant (CDBG) funding for home rehabilitation work for low to moderate income households to bring existing homes up to code and better withstand high wind events. Work with the HRA to develop and distribute a brochure to publicize the program at the Town Hall, public events, and through the Town newsletter and website.	Select Board, Franklin County Regional Housing and Redevelopment Authority	B, P	CDBG, Town, HRA	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	High / New Action Item. The Town has an agreement with the Franklin County Regional Housing and Redevelopment Authority (HRA) to run the program on a yearly basis when funding is available. Funds are currently not available to run the program in Gill for 2014.
DAM FAILURE – Goal Statement: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to dam failure.						
✓	Install a flood warning siren in the Riverside neighborhood. Set up a system to provide new residents in the Riverside neighborhood information about the reverse call system operated by Northfield Mountain, and how to register.	Select Board, Town Administrative Assistant, Northfield Mountain	P	Town, FirstLight Power Resources, DCR Dam Safety Program	Year 2	Medium / New Action Item. FirstLight Power Resources utilizes a reverse call system to notify residents and businesses within dam inundation zones of the need to evacuate. The list of phone numbers needs to be kept up-to-date to be effective.
	Develop a beaver management plan that identifies locations of existing and potential beaver activity, the extent of flooding caused at each location, and solutions to mitigate impacts. Prioritize projects in the locations that require intervention, and seek funding to implement.	Select Board, Town Administrative Assistant, Highway Department, Conservation Commission	B, N, I	Town, MassDEP	Year 3	Medium / New Action Item.
WEIGHTED HAZARD INDEX 3.0 – 4.9						
EARTHQUAKE – Goal Statement: To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to earthquakes.						
	Seek funding to hire an engineer to determine retrofitting measures for municipal buildings (such as the Town Hall) and emergency shelters to better withstand the impacts from an earthquake. Prioritize projects and seek funding to implement.	Building Inspector, Emergency Management Director, Select Board	B, P	Town	Year 4	Medium / Carried over from 2004 plan, not yet started due to lack of funding and staffing capacity.
HURRICANES AND TROPICAL STORMS – Goal Statement: 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.						
	Utilize Community Development Block Grant (CDBG) funding for home rehabilitation work for low to moderate income households to bring existing homes up to code and better withstand high wind events. Work with the HRA to develop and distribute a brochure to publicize the program at the Town Hall, public events, and through the Town newsletter and website.	Select Board, Franklin County Regional Housing and Redevelopment Authority	B, P	CDBG, Town, HRA	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	High / New Action Item. The Town has an agreement with the Franklin County Regional Housing and Redevelopment Authority (HRA) to run the program on a yearly basis when funding is available. Funds are currently not available to run the program in Gill for 2014.
	Seek technical assistance to revise the Special Permit requirements to include tying trailers and mobile homes down to reduce damage impacts from high winds.	Planning Board	P, B	Town, FRCOG Local Technical Assistance	Year 4	Medium / Carried over from 2004 plan. Not yet started due to lack of funding and staffing capacity.

✓ - Hazard Identified as Most Important to Gill	Action Item	Responsible Department / Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Priority for Implementation / Status
WEIGHTED HAZARD INDEX < 3.0						
WILDFIRES AND BRUSHFIRES – Goal Statement: To minimize the loss of life, damage to property, infrastructure and natural resources, and the disruption of governmental services and general business activities due to wildfires and brushfires.						
	Seek funding and technical assistance to develop educational materials and conduct outreach to landowners to encourage forest stewardship practices that produce more stable, successional forested landscapes and which reduce the risk of fire hazards. Distribute these materials via the Town website, Town newsletter, and Conservation Commission.	Conservation Commission, Fire Department, Mass DCR	B, N, P, I	Town, Forest Land Enhancement Program, Rural Fire Assistance, National Fire Plan	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	Medium / Carried over from 2004 plan, not yet started due to lack of funding and staffing capacity.
	Review annually and update as needed existing materials to educate homeowners about the risk of wildfires and brushfires and how to reduce the risk by adopting general fire safety techniques. Distribute via the Town website, newsletter, and when issuing burn permits.	Fire Department, Shelburne Control	B, N, P, I	Town, Rural Fire Assistance	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	High / Carried over from 2004 plan. The Town offers fire education in the Town newsletter and on the Town website. Shelburne Control provides guidance on fire safety when issuing burn permits. Current materials should be reviewed and updated.
	Set up a system so that copies of all forest cutting plans submitted to the Conservation Commission are distributed to the Fire Department. The Fire Department should note the location of any wood roads or access trails identified on the plans, which could be used to access a wildfire or emergency.	Conservation Commission, Fire Department	B, N, P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	Medium / New Action Item. The Fire Department does not always receive copies of cutting plans. Having cutting plans ahead of time will allow for a faster response to an emergency in the woods.
	Maintain Fire Department vehicle access to existing water sources to reduce the risk of damage to the natural and built environment in the event of a wildfire or brushfire. Document and map water resources in town used for fire suppression, and identify areas in need of maintenance. Review annually.	Fire Department	B, N, P, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	Medium / New Action Item.
	Seek funding to increase the staff of the Fire Department’s inspection and safety unit.	Fire Department	B, N, P, I	Town, Rural Fire Assistance	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	Low / Carried over from 2004 plan, not yet started due to lack of funding and staffing capacity.
	Repair or replace the dry hydrant at Shadow Lake.	Highway Department, Fire Department, Emergency Management Director, Northfield Mount Hermon School Officials	B, N, P, I	Pre-Disaster Mitigation Program, Town, Northfield Mount Hermon School	Year 2	Low / Carried over from 2004 plan. Not completed. The Northfield Mount Hermon School is planning on replacing the dry hydrant as part of installing a new drinking water supply system in 2015.
TORNADOS – Goal Statement: To minimize the loss of life, damage to property, infrastructure and natural resources, and the disruption of governmental services and general business activities due to high winds associated with tornados.						
	Utilize Community Development Block Grant (CDBG) funding for home rehabilitation work for low to moderate income households to bring existing homes up to code and better withstand high wind events. Work with the HRA to develop and distribute a brochure to publicize the program at the Town Hall, public events, and through the Town newsletter and website.	Select Board, Franklin County Regional Housing and Redevelopment Authority	B, P	CDBG, Town, HRA	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	High / New Action Item. The Town has an agreement with the Franklin County Regional Housing and Redevelopment Authority (HRA) to run the program on a yearly basis when funding is available. Funds are currently not available to run the program in Gill for 2014.
	Seek technical assistance to revise the Special Permit requirements to include tying trailers and mobile homes down to reduce damage impacts from high winds.	Planning Board	P, B	Town, FRCOG Local Technical Assistance	Year 4	Medium / Carried over from 2004 plan. Not yet started due to lack of funding and staffing capacity.

✓ - Hazard Identified as Most Important to Gill	Action Item	Responsible Department / Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Priority for Implementation / Status
ICE JAMS – Goal Statement: To minimize the loss of life, damage to property, infrastructure and natural resources, and the disruption of governmental services and general business activities due to ice jams and associated flooding.						
	Identify and document locations along rivers and streams in town where ice jams have the potential to form, and monitor annually.	Emergency Management Director, Highway Department	B, N, I	Town	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	Low / New Action Item. Gill has not experienced an ice jam in the last 20 years.
LANDSLIDES – Goal Statement: To minimize the loss of life, damage to property, infrastructure and natural resources, and the disruption of governmental services and general business activities due to landslides.						
	Through participation in the Connecticut River Streambank Erosion Committee, seek funding to continue to implement bank stabilization measures along the Connecticut River to reduce damages to the natural and built environment from landslides associated with flooding events.	Select Board, Conservation Commission	B, N, P, I	Town, Volunteers, MA DEP Section 319 grant	Year 0-1, to be reviewed annually and implemented in subsequent years (Years 2-5) as appropriate	Medium / New Action Item. Since 1996, bioengineering techniques have been used in areas along the Connecticut River in Gill to stabilize eroding banks. Funding is still needed for additional projects.
	Review mapping of areas along the Connecticut River in Gill that are prone to landslides and seek technical assistance to revise land use regulations to limit development in these areas.	Planning Board, Conservation Commission	B, N, P, I	Town, FRCOG Local Technical Assistance	Year 5	Low / New Action Item.

Table 4-11: Gill Multi-Hazard Preparedness and Response Plan

Note: Action Items highlighted in light green are considered to have a relatively small cost compared to the benefit realized from implementation.

Action Item	Responsible Department / Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Status
MULTIPLE HAZARDS					
Identify <u>existing</u> shelters located outside of the 100 year floodplain that are equipped with an auxiliary power supply and are earthquake resistant. (For example, only the newer classroom addition of the Gill Elementary School was built after earthquake resistant design standards were created in the State Building Code and currently no auxiliary power supply is available.) Disseminate this information to appropriate town departments.	Emergency Management Director, Building Inspector	P	Town		Carried over from 2004 plan.
Equip the Gill Elementary School with an auxiliary power supply. Equip all town-owned buildings with transfer switches for portable generators.	Emergency Management Director, Building Inspector	P	Town		New Action Item.
Develop formal agreements with the Northfield Mount Hermon school to use a facility on their campus as a shelter during an emergency.	Emergency Management Director, Building Inspector, Board of Health, Northfield Mount Hermon School	P	Town	2014	New Action Item.
Formalize shelter agreements between the town's of Montague and Greenfield for use of their shelters during large-scale events.	Emergency Management Director, Select Board, Franklin County Regional Emergency Planning Committee (REPC), Franklin Regional Council of Governments (FRCOG)	P	Town, Western Region Homeland Security Advisory Council (WRHSAC)	2014	New Action Item. The Franklin County REPC, in cooperation with the FRCOG and WRHSAC, is developing a regional sheltering plan that will include an MOU template to be executed between towns for use of identified regional shelters. The plan is scheduled to be completed in July 2012.
Inventory supplies at existing shelters. Establish MOUs with local or neighboring vendors for supplying shelters with potable water, food and first aid supplies in the event of a natural disaster. (For example, potential resources include dining services and the O'Connor Health Center of the Northfield Mount Hermon School.)	Highway Department, Police Department, Fire Department, Emergency Management Director	P	Town	2015	Carried over from 2004 plan. The Northfield Mount Hermon School has been identified by the committee as a potential new shelter. The school has back-up food and water supplies.

Action Item	Responsible Department / Board	Benefits What Areas Primarily? Built (B), Natural (N), Population (P), Infrastructure (I)	Potential Funding Source	Estimated Completion Date	Status
Develop a regional plan to insure reliable access to fuel for generators during extended power outages.	Emergency Management Director, Franklin County REPC, FRCOG	P, B	Town, FEMA	2015	New Action Item.
Create, maintain, and train a volunteer base for assisting town emergency management staff during and after emergencies. Encourage Gill residents to join the Franklin County Citizen Emergency Response Team (CERT) or Medical Reserve Corps (MRC).	Emergency Management Director, Fire Department, Police Department, Board of Health	B, N, P, I	Town, Volunteers, MEMA, Massachusetts Department of Public Health (DPH), FRCOG	2014, to continue annually over the next five years.	New Action Item.
Include an annual insert in the Town newsletter with important emergency phone numbers, radio stations, and websites.	Emergency Management Director, Police Department, Fire Department, Highway Department, Town Administrative Assistant	P	Town	2014, to continue annually over the next five years.	New Action Item.
Investigate using social media, such as Facebook and Twitter, for communicating information with the public during and after an emergency.	Emergency Management Director, Police Department, Fire Department, Highway Department, Town Administrative Assistant	P	Town	2014	New Action Item.
MANMADE HAZARDS					
Continue to participate in training and exercises for hazardous material spill events in a fixed structure or in a transportation setting.	Emergency Management Director, Police Department, Fire Department, Franklin County REPC, FRCOG	B, N, P, I	MEMA, FRCOG	2014, to continue annually over the next five years.	New Action Item.
FLOODS					
Develop and maintain a list of addresses within the 50 and 100 year floodplain for use by the Emergency Operating Center (EOC).	Emergency Management Director, Franklin Regional Council of Governments	B, P	Town	2015	New Action Item. As part of the update to the Multi-Hazard Mitigation Plan, critical facilities within or adjacent to the 100-year floodplain were identified. This action will build on the information already collected.
Update evacuation procedures for inundation areas from dam failures for the flood prone areas in town (identified on the map). Particular attention should be paid to residents that may be in need of special assistance.	Fire Department, Police Department	P	Town	2014, to continue annually over the next five years.	Carried over from 2004 plan.
Coordinate with state and regional agencies to identify a location(s) for the temporary storage of contaminated/ hazardous flood debris.	Emergency Management Director, Franklin County Regional Emergency Planning Committee (REPC)	B, N, P, I	Town	2014, to continue annually over the next five years.	Carried over from 2004 plan. Town officials coordinated with the Town of Montague and FirstLight Power Resources before Tropical Storm Irene to arrange for a location for storm debris.
DAM FAILURE					
The Town and the Northfield Mountain Facility should coordinate efforts to ensure that appropriate municipal officials and departments are properly informed of potential impacts to the Town of a dam failure.	Select Board, Emergency Management Director, Police Department, Fire Department, Planning Board	B, N, P, I	Town	2014, to continue annually over the next five years.	New Action Item. Emergency Action Plans and inundation mapping for the Northfield Mountain Facility have been distributed to the Town. FirstLight Power Resources will be conducting an emergency drill for the Northfield Mountain Facility within the next year.
Review the recently updated Emergency Action Plan for the TransCanada dams upstream of Gill on the Connecticut River and Deerfield River. Revise evacuation plans according to any changes in expected inundation areas in Gill.	Select Board, Emergency Management Director, Police Department, Fire Department, Planning Board	B, N, P, I	Town	2014	New Action Item. TransCanada distributed updated EAPs for its Connecticut and Deerfield River facilities in January 2012, which include new inundation mapping.

National Flood Insurance Program Compliance

The Town of Gill participates in the National Flood Insurance Program. The goals of the National Flood Insurance Program (NFIP) are to provide flood insurance to property owners, to encourage flood loss reduction activities by communities, and to save taxpayers' money.

As of November 2013, there were four policies in effect in Gill for a total of \$1,200,000 worth of insurance.

*NFIP Community Rating System (CRS)*⁶⁰

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.

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.

⁶⁰ <http://training.fema.gov/EMIWeb/CRS/>

- 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 Gill can take to improve their CRS rating (and subsequently lower their premiums) is to develop a CRS plan. 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 Natural Hazards 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*⁶¹

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:

Step	Maximum Points
• Organize to prepare the plan	10
• Involve the public	85
• Coordinate with other agencies	25

⁶¹ FEMA Local Multi-Hazard Mitigation Planning Guidance, July 1, 2008.

Step	Maximum Points
• 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” is including in the Appendix of this plan or can be downloaded at <http://www.fema.gov/library>.

DRAFT

5 – PLAN ADOPTION & MAINTENANCE

PLAN ADOPTION

The Franklin Regional Council of Governments (FRCOG) provided support to the Gill Multi-Hazard Mitigation Planning Committee as they underwent the planning process. Town officials such as the Emergency Management Director and Town Administrative Assistant proved invaluable resources to the FRCOG by providing background and policy information and municipal documents which were crucial to facilitating completion of the plan.

When the preliminary draft of the Multi-Hazard Mitigation Plan was completed, copies were disseminated to the Gill Multi-Hazard Mitigation Planning Committee for comment and approval. The Committee was comprised of representatives of Town boards and departments who bear the responsibility for implementing the action items and recommendations of the completed plan. The committee was asked to submit any further comments before the final draft was submitted to the Gill Select Board. The committee met on several occasions to provide comments and feedback to the FRCOG.

Copies of the Draft Multi-Hazard Mitigation Plan for the Town of Gill were distributed to town boards and posted on the municipal website (www.gillmass.org) for review and comment. Once reviewed and approved by MEMA, the plan was sent to the Federal Emergency Management Agency (FEMA) for their approval. On [REDACTED], the Select Board voted to adopt the plan.

PLAN MAINTENANCE PROCESS

The implementation of the Gill Local Natural Hazard Mitigation Plan will begin following its formal adoption by the Gill Select Board, MEMA and FEMA. As mentioned previously, work has begun on several of the mitigation strategies identified in Chapter 5 of this Plan. Specific Town Departments will be responsible for ensuring the development of policies, bylaw revisions, and programs as described in Chapter 5. The Gill Natural Hazards Planning Committee will oversee Plan implementation.

Monitoring, Evaluating and Updating the Plan

The measure of success of the Gill Local 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 Gill Multi-Hazard Planning Committee will meet on an annual basis or as needed (i.e., following a natural 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 committee 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. Annual meetings of the committee will be organized and facilitated by 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 Gill Multi-Hazard Planning Committee will have primary responsibility for tracking progress and updating the plan.

Five-Year Update Preparation

During the third year after initial plan adoption, the Emergency Management Director will convene the Committee 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 Committee 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 Committee may decide to undertake the update themselves, request assistance from the Franklin Regional Council of Governments, or hire another consultant. However the Committee decides to proceed, the group will need to review the current FEMA hazard mitigation plan guidelines for any changes. The updated Gill Multi-Hazard Mitigation Plan will be forwarded to MEMA and to FEMA for approval.

As is the case with many Franklin County towns, Gill's government relies on 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 Committee. As the Committee meets regularly to assess progress, it should strive to identify shortfalls in staffing and funding and other issues which may hinder Plan implementation. The Committee should seek technical assistance from the Franklin Regional Council of Governments to help alleviate some of the

staffing shortfalls. The Committee 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

Program	Type of Assistance	Availability	Managing Agency	Funding Source
National Fire Plan	Provides pre-disaster funds for wildfire mitigation and planning for all-hazards.	Annual	DCR	U.S. Land Management Agencies
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

Program	Type of Assistance	Availability	Managing Agency	Funding Source
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
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 Gill Multi-Hazard Mitigation Plan by MEMA, the Committee will provide all interested parties and implementing departments with a copy of the plan. The committee 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
- Board of Selectmen
- Northfield Mount Hermon School
- FirstLight / Northfield Mountain Hydroelectric Project

Below is a list of several possible planning mechanisms that could benefit from integration of elements of the 2014 Local Multi-Hazard Mitigation Plan, including:

- Any future updates of the *Connecticut River Scenic Farm Byway Corridor Management Plan* and the *Mohawk Trail Scenic Byway Corridor Management Plan* could incorporate relevant material from this plan into sections such as the Natural Resources section and any action plans.
- When the Final Draft Local Multi-Hazard Mitigation Plan for the Town of Gill 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.
- Each of the Town boards and departments responsible for implementing actions listed in the Action Plan could include discussions of the action items they are responsible for in one meeting annually and assess their progress and report back to the Committee.
- The Planning Board could review the town's current Subdivision Rules and Regulations and Zoning Bylaws and consider the recommended revisions listed in this plan. Model bylaws and other technical assistance are available from the FRCOG to help the Planning Board update the town's current bylaws, as appropriate.

Continued Public Involvement

The Town of Gill 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 Committee 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 1: ZONING BYLAWS AND SUBDIVISION REGULATIONS

ZONING BYLAWS

Floodplain Regulations

Gill’s zoning bylaws establish a Floodplain District, which is an overlay district to all other districts. The district includes all special flood hazard areas designated on the Gill, Massachusetts Flood Insurance Rate Map (FIRM) and the Flood Boundary & Floodway Map.⁶² Both maps indicate the 100-year regulatory floodplain.

The zoning bylaws state that “all development in the district, including structural and non-structural activities, whether permitted by right or special permit must be in compliance with Chapter 131, Section 40 of the Massachusetts General Laws and with the following:

- Section of the Massachusetts State Building Code which addresses floodplain and coastal high hazard areas (currently 780 CMR 2102.0, “Flood Resistant Construction”);
- Wetlands Protection Regulations, Department of Environmental Protection (DEP) (currently 310 CMR 10.00);
- Inland Wetlands Restriction, DEP (currently 302 CMR 6.00);
- Minimum Requirements for the Subsurface Disposal of Sanitary Sewage, DEP (currently 310 CMR 15, Title 5).

The regulations also state that any variances from the provisions and requirements of the referenced state regulations may only be granted in accordance with the required variance procedures of these state guidelines.

Other use regulations prohibit in the regulatory floodway any encroachments that would result in an increase in flood levels within the community during the occurrence of the base flood discharge. All subdivision proposals are to be reviewed to assure that proposals minimize flood damage, all allow public utilities and facilities to be located and constructed to minimize or eliminate flood damage, and to ensure adequate drainage is provided to reduce exposure to flood hazards.

Article V of the Flood Plain Regulations state that permitted uses of low flood damage potential and causing no obstructions to flood flows are encouraged, provided that they are permitted in

⁶² Both maps were issued by the Federal Emergency Management Agency (FEMA). The Gill, Massachusetts FIRM was issued by FEMA for the administration of the National Flood Insurance Program (NFIP) and was dated June 18, 1980 as Zone A, A1-30. The FEMA Flood Boundary & Floodway Map was dated June 18, 1980. The exact boundaries of the district may be defined by the 100-year base flood elevations show on the FIRM and further defined by the Flood Insurance Study booklet (dated December 1979).

the underlying district and they do not require structures, fill or storage of materials or equipment. The permitted uses according to the Flood Plain Regulations specifically include:

- Agricultural uses such as farming, grazing, truck farming, horticulture, etc.
- Forestry and nursery uses.
- Outdoor recreational uses, including fishing, boating, play areas, etc.
- Conservation of water, plants, and wildlife.
- Wildlife management areas, foot, bicycle, and/or horse paths.
- Temporary non-residential structures used in connection with fishing, growing harvesting, storage, or sale of crops raised on the premises.
- Buildings lawfully existing prior to the adoption of these provisions.

Special Permit Guidelines

The Special Permit Guidelines (Section 2C) of the Zoning Bylaws states that “considerations include the protection of the natural environment and the potential impact on surface and ground water, amongst other considerations” when considering a use that requires a special permit in a district.

Logging Operations & Earth Removal Operations

Any disturbance of the land and existing topography has the potential to aggravate existing flooding problems or create new flooding potential. Due to this potential, the Zoning Bylaws include special regulations regarding logging operations (Section 8) and earth removal operations (Section 9). The regulations require that logging operations remove “all ‘slash’ (branches or other residue from timber cutting) from within 50 feet of highway or waterway, and beyond 50 feet, slash may not be more than 3 feet in height.” In times of flooding, slash or similar debris could exacerbate the damage done by becoming flotsam or creating unstable damming situations.

Regulations regarding earth removal operations state that “no soil, loam, sand, gravel, stone or other earth materials shall be removed, unless an exempt operation or is done pursuant to a special permit.” Specific exempt operations are explained in the bylaws. While specific flood prevention or mitigation regulations are not stated in the regulations, by requiring a special permit the Zoning Board of Appeals will take consideration any potential impacts the activity may have on surface and ground water.

Site Plan Review

The Site Plan Review text (Section 24) of the Zoning Bylaws specifically mentions the protection of ground and water supplies as part of its purpose. This relates to potential flood hazards due to the detrimental impact flooding could have on the water supply in times of emergency. The standards of review include:

- The adequacy of the methods of disposal of sewage and refuse and the protection from the pollution of surface and ground water. This includes the minimizing the erosion of soil both during and after construction.

- The applicant’s efforts to integrate the existing landscape through design features such as vegetative buffers, and retention of open space and agricultural land.
- Minimization of the area over which existing vegetation is to be removed. Where tree removal is required, special attention is to be given to the planting of replacement trees.
- The potential impact on surface or ground water supplies and steps taken to protect these resources.

Wireless Communications

Section 16 of the Gill Zoning Bylaw regulates wireless communications facilities that might be prone to damage from high winds. The bylaw requires project proponents to complete the process for a special permit and site plan review with the Planning Board. In addition, the project proponent must receive a building permit from the Franklin County Cooperative Building Inspection Program before a facility can be erected. The character of the bylaw emphasizes aesthetic and public health issues but not public safety in natural hazard emergencies.

The bylaw dictates the minimum distance the tower must be in relation to other structures. However, there is no statement that specifies mitigation measures for wind-related damage, such as the identification of a “fall zone” for the structure in relation to roads and utilities, which is of critical importance in times of emergency. While there is a height limit to the tower in relation to existing terrain and a description of the technical specifications is required, there is no special request for information about anchoring and supporting the structure and about how the structure will respond in excessive high winds. In addition, the bylaw does not prohibit the construction of wireless communications facilities within flood-prone areas.

SUBDIVISION RULES AND REGULATIONS

Gill’s Subdivision Rules and Regulations were first adopted on March 5, 1973 and significantly updated on August 13, 2009, for “all plans, whether ‘subdivision’ within the meaning of the law or not, must have either approval as a subdivision or endorsement that they do not require approval before they will be accepted for recording at the Region of Deeds or registration at the Land Court.”

The Subdivision Rules and Regulations contain provisions within Section 3: Design Standards that mitigate the potential for flooding, including:

- Section 3-33: Storm Drainage. Storm drainage system shall be designed based on good engineering practice, using a 20-year storm basis for storm sewer design, a 50-year storm basis for culverts. No storm sewers shall be under 12 inch diameter, and no catch basins shall be used as manholes.
- Section 3-341: Water Supply & Sewage Disposal. No Definitive Plan shall be approved by the Planning Board unless evidence satisfactory to the Board is presented that adequate provision will be made for supply of water and disposal of sewage for each lot in the subdivision which is to be built.

- Section 3-35: Open Spaces. The Planning Board may require the plan to show a park or parks suitably located for playground or recreation purposes, or for providing light and air, if not unreasonable in area in relation to the area of the land being subdivided and the prospective uses of such land.
- Section 3-36: Protection of Natural Features. Due regard shall be shown for all natural features, such as trees, water courses, scenic points, historic spots, inland wetlands, and similar community assets, which if preserved, will add attractiveness and value to the subdivision.

In addition, the Flood Plain Regulations (Section 15 of the Zoning Bylaws) requires base flood elevation data to be required for subdivision proposals or other developments of greater than 50 lots or 5 acres, whichever is the lesser, within unnumbered A zones of the FIRM.

DRAFT

APPENDIX 2: GILL SELECT BOARD APPROVAL MEMORANDUM

TOWN OF GILL
MASSACHUSETTS



CERTIFICATE OF ADOPTION

Town of Gill, MASSACHUSETTS

BOARD OF SELECTMEN

**A RESOLUTION ADOPTING THE Town of Gill
HAZARD MITIGATION PLAN**

WHEREAS, the Town of Gill established a Committee to prepare the Hazard Mitigation plan; and

WHEREAS, the Town of Gill Hazard Mitigation Plan contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Gill, and

WHEREAS, a duly-noticed public meeting was held by the BOARD OF SELECTMEN on , 20 , and

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

NOW, THEREFORE BE IT RESOLVED that the Town of Gill BOARD OF SELECTMEN, adopts the Hazard Mitigation Plan, in accordance with M.G.L. c. 40.

ADOPTED AND SIGNED this Month Day, 20

**APPENDIX 3: MEETING MINUTES, SIGN-IN SHEETS, AND
CORRESPONDENCE**

MEETING NOTICE AND AGENDA

**Town of Gill
Local Natural Hazards Mitigation Planning Committee Meeting
Gill Fire Station
December 1, 2010
2:00 – 4:00 p.m.**

1. Introductions – Name and Title (2:00 p.m.)
2. Overview of the 2010 planning process from MEMA and the changes to the Gill Natural Hazards Mitigation Plan – Kimberly Noake MacPhee, FRCOG (2:10 p.m.)
3. Review of Risk Assessment for Gill – Gretchen Johnson, FRCOG (2:40 p.m.)
4. Review of Potential Mitigation Strategies and projects for Gill – Gretchen Johnson, FRCOG (3:10 p.m.)
5. Review of Draft Critical Facilities Map – Gretchen Johnson, FRCOG (3:30 p.m.)
6. Next Steps (3:45 p.m.)

MEMA Natural Hazards Mitigation Project
Gill Meeting
 Attendance Sheet for Wednesday, December 1, 2010

Please print clearly

<u>Name</u>	<u>Mailing Address and E-Mail Address</u>	<u>Affiliation/Representing</u>
Kimberly MacPhee	natres@frcog.org	FRCOG
Ray Purington	administrator@gillmass.org	Town of Gill
Gene Boaubien	firedept@gillmass.org	Gill Fire Chief / EMD
DAVID HASTINGS	chief@gillmass.org	Police
MICK LACLAIRE	Highway@gillmass.org	Highway DEPT
John Ward	johnward@hotmail.com	Selectboard
Trina Learned	tlearned@nmhschool.org	Natshold Mt. Hermon
PAUL BARTLETT	PBARTLETT@NMHSCHOOL.ORG	NMH School



**Local Multi-Hazard Mitigation Planning Committee
Gill Fire Department Training Room
196A Main Road
February 22, 2012
3:00 – 5:00 p.m.**

1. Introductions – Ray Purington, Gill Selectboard Administrative Assistant (3:00 p.m.)
2. Review of the Committee Memo and collection of remaining information – Committee and Alyssa Larose, FRCOG (3:05 p.m.)
3. Review of Section 4: Current Mitigation Measures tables – Committee and Alyssa Larose, FRCOG (3:30 p.m.)
4. Review of Section 4: 2012 Action Plan – Committee and Alyssa Larose, FRCOG (4:00 p.m.)
5. Review of Draft Critical Facilities Map – Committee and Alyssa Larose, FRCOG (4:45 p.m.)
6. Next Steps (4:55 p.m.)
7. Other business as may arise after the agenda has been posted

MEMA Multi-Hazards Mitigation Project
Gill Meeting
 Attendance Sheet for Wednesday, February 22, 2012

<u>Name</u>	<u>Email Address/Phone</u>	<u>Affiliation</u>
Chuck Mominie	Charles.Mominie@GDFSUBS-NA.COM	Northfield Mtn.
Gene Beaubien	GMBDAR@comcast.net	Gill Emp of Fire
Ray Punnigton	administrator@gillmass.org	Gill Admin Asst.
DAVID HASTINGS	chick@gillmass.org	Gill-Chief of Police
Tina Learned	tlearned@nashschool.org	Northfield Mt Hse.
Mick LaClaine	highway@gillmass.org	Gill Dpw
Alyssa Larose	alarose@proos.org	FRCOG



TOWN OF GILL

M A S S A C H U S E T T S



www.gillmass.org

November 23, 2010

Ms. Trina Learned
Director of Facilities
Northfield Mount Hermon School
1 Lamplighter Way
Gill, MA 01354

Dear Ms. Learned,

The Town of Gill is currently working with the Franklin Regional Council of Governments (FRCOG) Planning Department to update its Local Natural Hazards Mitigation Plan, last completed in 2004. A Local Natural Hazards Mitigation Planning Committee has been created for the purpose of updating the plan, and is comprised of the Gill Emergency Management Director, Fire Chief, Police Chief, Highway Superintendent, and Administrative Assistant. Due to the presence of the Northfield Mount Hermon School in Gill, the Committee would be interested in your feedback on the plan. A meeting with the Committee and FRCOG staff has been scheduled for Wednesday, December 1st, at 2:00pm in the Training Room at the Gill Fire Station. You are invited to attend this meeting.

Sincerely,

Ray Purington
Administrative Assistant

Cc: Gretchen Johnson, FRCOG

Gill Local Natural Hazards Mitigation Plan—Draft Update Review Tasks

Information needed:

Dates (2004-2010) and cost estimates for:

- Flood damage on Bascom Road Bridge
- Flood damage on North Cross Bridge
- May 2010 Microburst
- Major winter storm damage
- Any other natural disasters that the Committee feels should be included in the report.

Status and Update on the Action Items in Chapter 5

Critical Facilities Map

- Review updated map and provide suggestions for revisions, if any.

Possible Action Items:

- Mitigation suggestions for Beaver problems – updated culverts, fencing, protect water supplies, etc.
- Purchase generator for Elementary School in case it is needed as a shelter
- Protect the shallow well that feeds to elementary school from pollution from beavers

The format of the action items in the plan is, for example:

Action Item: Educate homeowners about general fire safety when issuing burn permits.
Responsible Department: Fire Department
Proposed Completion Date: On-going

Please send any information, comments or questions to:

Gretchen Johnson, 413-774 1194 x100, planning@frcog.org or FRCOG Planning Dept., 278, Main Street, 4th Floor, Greenfield, MA 01301 Attn: Gretchen Johnson

Gill Local Natural Hazards Mitigation Plan—Draft Update Review Tasks June 2011

Please review the plan and provide information on any of the following items that you can. The items are highlighted in yellow within the text of the draft plan. Items highlighted in blue are for FRCOG staff to follow up on.

Information needed:

Section 2: Community Profile

P. 8 Cultural Resources

- What natural hazards is the Town Hall particularly vulnerable to – flooding?

Section 3: Risk Assessment

Dates and cost estimates for:

- Flood damage on Bascom Road Bridge
- Flood damage on North Cross Bridge
- Connor Brook - \$4,000 repair – need more details about what was repaired, what caused the problem, etc.
- May 2010 Microburst
- Major winter storm damage
- Any other natural disasters that the Committee feels should be included in the report.

p.56-57 Development Trends Analysis

- This is a new section, please review for accuracy

Section 4: Mitigation Strategy

P. 56-93 Existing Mitigation Measures

- Review the existing mitigation measures tables and fill in the “Accomplished/Still Relevant” and “2011 Potential Changes” columns.

P. 94-102 Future Mitigation Measures

- Update the status of the Action Items in the 2011 Action Plan.
- Add any new action items.

Possible New Action Items:

- Mitigation suggestions for Beaver problems – updated culverts, fencing, protect water supplies, etc.
- Purchase generator for Elementary School in case it is needed as a shelter
- Protect the shallow well that feeds to elementary school from pollution from beavers

Gill Local Natural Hazards Mitigation Plan—Draft Update Review Tasks January 2012

Please review the plan and provide information on any of the following items that you can. The items are highlighted in yellow within the text of the draft plan. Items highlighted in blue are for FRCOG staff to follow up on.

Information needed:

Section 2: Community Profile

P. 8 Cultural Resources

- What natural hazards is the Town Hall particularly vulnerable to – flooding?

P. 9 Critical Facilities

- Review the list of critical facilities and revise as necessary

P. 9 Shelters

- Are there any plans for equipping the Gill Elementary School with back-up power capabilities?
- Does the town have a formal agreement with the Turners Falls High School to use it as a shelter?
- Review methods of public warning/notification and revise as necessary.

Section 3: Risk Assessment

Dates and cost estimates for:

- Flood damage on Bascom Road Bridge
- Flood damage on North Cross Bridge
- Connor Brook - \$4,000 repair – need more details about what was repaired, what caused the problem, etc.
- May 2010 Microburst
- Any major winter storm damage [ice storm?]
- Any other natural disasters that the Committee feels should be included in the report.

P. 27 Manmade Hazards: Does Gill have an evacuation plan for manmade hazard events?

P. 34 Structures in the floodplain: is the Town aware of any significant structures located in the floodplain?

p. 48 Wildfires and brushfires: were there any reported property damages or personal injury from wildfires and brushfires since 2003?

p.56-57 Development Trends Analysis

- This is a new section, please review for accuracy

Section 4: Mitigation Strategy

P. 56-93 Existing Mitigation Measures

- Review the existing mitigation measures tables and fill in the “Accomplished/Still Relevant” and “2011 Potential Changes” columns.

P. 94-102 Future Mitigation Measures

- Does the committee feel that Manmade Hazard mitigation action items should be considered a high priority?
- Update the status of the Action Items in the 2011 Action Plan.
- Add any new action items.

FEMA Review DRAFT April 2014

Emailed Bill Pachalis at NMH on 3/16/2012 with the below questions. He called me on 3/20/2012 to discuss. Phone: 413-498-3455 Email: bpachalis@nmhschool.org

The Town of Gill is working on finalizing a draft of the Gill Multi-Hazard Mitigation Plan, and I have a few follow up questions for you regarding facilities at the NMH campus.

1. At the last meeting, Trina Learned mentioned that the fire pond on campus has a dam. I am wondering if you could provide any information about this dam, such as the hazard rating (low, significant, high) and the date of the last inspection. I would like to include this information in the section of the plan discussing dams.

Low hazard rating. Never inspected. Has been registered with the DCR. DCR is very behind in issuing notices to owners alerting them to the need for an inspection – focusing on high and significant hazard dams. Understaffed. School plans on doing some work on the dam in conjunction with new water line being put in – installing a new outlet structure.

2. In the plan significant structures are identified that lie within or adjacent to the 100-year floodplain. The NMH wastewater treatment plant was identified. Can you provide an estimate for how much it would cost to replace the plant if it were completely destroyed by flooding?

\$1.2 Million – treatment plant value

3. Currently there is an action item in the action plan stating “Repair or replace the dry hydrant at Shadow Lake.” Can you let me know if this is something that the school is planning to do, and if so, a year that I can identify as a potential implementation date?

The school has a plan to develop a whole new drinking water system, with new wells closer to school, new water line, and possibly new treatment plant. This will include completing some work on the dam (see above), and replacing the Shadow Lake dry hydrant – 3 years given as a potential implementation date for this. The existing system will serve as a back-up supply. New system will have back-up power source.