

**The Town of Worthington**

# **Local Natural Hazards Mitigation Plan**

**Adopted by the Worthington Board of Selectmen on November 2, 2010**

**Prepared by:**

The Worthington Natural Hazards Mitigation Planning Committee

and

The Pioneer Valley Planning Commission  
26 Central Street, Suite 34  
West Springfield, MA 01089  
(413) 781-6045  
[www.pvpc.org](http://www.pvpc.org)

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The Pioneer Valley Planning Commission

Catherine Ratté, Principal Planner/Project Manager

Jay Levine, Senior Planner

Kathryn Slater, Intern

Todd Zukowski, Senior Planner/GIS Specialist

Jim Scace, GIS Specialist

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# 1: INTRODUCTION

## Hazard Mitigation

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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, etc. 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 Worthington and the Pioneer Valley Planning Commission, 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 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. FEMA requires that a community adopt a pre-disaster mitigation plan as a condition for mitigation funding. For example, the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance Program (FMA), and the Pre-Disaster Mitigation Program are programs with this requirement.

## Planning Process

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

- Identifying the natural hazards that may impact the community.
- Conducting a Vulnerability/Risk Assessment to identify the infrastructure at the highest risk for being damaged by the identified natural hazards, particularly flooding.
- Identifying and assessing the policies, programs, and regulations a community is currently implementing to protect against future disaster damages.
- Identifying deficiencies in the current strategies and establishing goals for updating, revising or adopting new strategies.
- Adopting and implementing the final Local Natural Hazards Mitigation Plan.

The key product of this process is the development of an Action Plan with a Prioritized Implementation Schedule.

### **Public Committee Meetings**

**July 21, 2008 7:00-9:00 pm:** Working committee meeting held at Fire Department.

**August 18 2008 7:00-9:00 pm:** Working committee meeting held at Fire Department.

**March 10 2009 7:00-9:00 pm:** Working committee meeting held at Fire Department.

A mailing was made to each committee member prior to each meeting that contained information from the previous meeting, an agenda sheet, and information to be covered.

### **Public Meetings with the Board of Selectmen**

In the Fall of 2005 the Board of Selectmen agreed to participate in the development of both a regional and a local Hazard Mitigation Plan.

**November 2, 2010:** The Board of Selectmen adopted the Local Natural Hazard Mitigation Plan. Meeting held at Worthington Town Offices.

### **Participation by Public & Entities in Surrounding Communities**

On June 30, 2008 the Pioneer Valley Planning Commission sent a press release to all area media outlets to inform private citizens that the planning process for Worthington's Hazard Mitigation Plan had commenced and that all residents of Worthington were invited to attend plan development sessions. This press release (see Appendix E) resulted in a series of news articles that enhanced awareness of Worthington's Hazard Mitigation Planning Process.

In addition to media outreach, all public meetings were posted at the Worthington Town Hall in compliance with the Commonwealth of Massachusetts' open meeting law.

In February, 2009 the Pioneer Valley Planning Commission sent a press release (see Appendix E) to all area media outlets to inform the public that a draft of Worthington's Hazard Mitigation Plan had had been placed on PVPC's and Worthington's websites and hard copies were available at PVPC's offices and Worthington Town Hall and that all residents, businesses and other concerned parties of Worthington and adjacent communities were encouraged to comment on the plan. The plans were made available in this manner for 30 days. Citizens from adjacent municipalities were also encouraged to comment on Worthington's plan.

Staff from PVPC presented on Worthington's plan at a meeting of the Hampshire county emergency preparedness committee and at a meeting of the Western Regional Homeland Security Advisory Council (WRHSAC). WRHSAC members are responsible for sharing meeting information with their peers

## 2: LOCAL PROFILE

### **Community Setting**

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Worthington is a rural community comprised of over 32 square miles (approximately 20,500 acres) located in the hilltowns of Western Massachusetts. The hilltowns are a cluster of rural towns in the Berkshires. Neighboring hilltowns include Middlefield and Chester, to the south, Chesterfield to the east, Cummington to the north, and Peru to the west. Worthington lies on the border of Hampshire and Berkshire Counties, situated in the uplands west of the Connecticut River Valley; northwest of Northampton, and east of Pittsfield. Worthington is located approximately 30 miles northwest of Springfield, Massachusetts; 40 miles from Albany, New York; and 140 miles from Boston.

Worthington was originally settled in 1764, and the Town's history is rich in agriculture, a successful industry which still thrives today. In recent years, Worthington has also earned the reputation of being a center of entrepreneurship. New ventures in biotechnology, hand tools, and baby furniture are examples of small businesses developed by town residents. Culturally, Worthington has gained national recognition for its hosting of the Sevenars Concerts, one of the best small music festivals in the country.

With a population density of less than 40 residents per square mile, the Town maintains a quiet, rural character highlighted by a forested landscape and historic villages. Despite the waning influence of agriculture on the landscape, Worthington remains largely undeveloped and fundamentally rural in nature. Dense forests, several rivers, and abundant farmland and open fields highlight the landscape in town. The overall quality of life and rural character make Worthington a desirable place to live, and the Town has seen steady growth in recent years.

### **Infrastructure**

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Worthington's infrastructure reflects its small, but growing population and rugged terrain.

#### **Roads and Highways**

Worthington is comprised of several hamlets or village centers (West Worthington, Worthington Corners, Worthington Center, Ringville and South Worthington), mostly along Route 112, the main thoroughfare. Route 112 runs north-south through town; and meets up with Route 143, which runs east-west through the northern portion of town.

#### **Public Water and Sewer Service**

Worthington's water supply comes from four spring-fed reservoirs, seven bedrock wells, and individual private wells. Worthington also has five transient non-community wells, all considered for interim wellhead protection.

Worthington does not have a public sewer system or any publicly owned wastewater treatment plants in the town. The Maples Apartments operate a minor sanitary wastewater treatment plant through the NPDES program. All other private residences and businesses are served by on-site septic systems.

## **Natural Resources**

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Worthington's most significant natural resource is the Worthington River and the large wildlife areas and parks with town limits. However, this historically rural town has been shaped by several of its other natural resources as well.

### **Water Resources**

The Nationally designated Wild and Scenic Middle Branch of the Worthington River originates near the heavily forested Worthington-Peru town line and flows south through the western portion of the town. The topography of the community is further defined by Watts and Wards Streams, which both flow south through the center of Worthington before joining the Little River. Other streams include: Bronson Brook, Fuller Brook, Jackson Brook, Kinne Brook, Trout Brook, and Whitmarsh Brook.

Additionally, Worthington contains about 324 acres of wetlands, and over 600 acres of inner riparian zone habitat. Furthermore, there are several unnamed ponds and small lakes within the Town's borders.

These water resources all provide important wildlife habitat, flood storage capacity, and recreation outlets, and in some cases they are water supply sources as well.

### **Forests and Fields**

The vast majority (84%) of the total acreage of Worthington is forested, approximately 17,194 acres. The predominant forest habitat in Worthington is the northern hardwoods hemlock. Species vary with the topography but consist primarily of hemlock, beech, sugar maple, and yellow birch. Stands of white pines, red maple, and birch appear in abandoned agricultural lands and clearings.

There are also approximately 1,700 acres of cropland, pastureland, and open land in Worthington, providing additional vegetation types and habitat opportunities.

## **Development**

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Worthington's growth was initiated first by farmers, and more recently, residential development. But the town's topography, soils, and physiography (lakes, rivers, wetlands and watershed areas) shape and constrain these land use patterns. Another key factor is that the Commonwealth of Massachusetts is the largest single land-owner in Worthington; this is due to several state-owned wildlife areas and state forests which constitute over 33% of Town land.



In addition to other factors, zoning and other land use regulations constitute Worthington's "blueprint" for its future. Land use patterns over time will continue to look more and more like the town's zoning map until the town is finally "built out"—that is, there is no more developable land left. Therefore, in looking forward over time, it is critical that the town focus not on the current use and physical build-out today, but on the potential future uses and build-out that are allowed under the town's zoning map and zoning bylaws. Zoning is the primary land use tool that the town may use to manage development and direct growth to suitable and desired areas while also protecting critical resources and ensuring that development is in keeping with the town's character.

The Worthington Zoning Bylaw establishes one base zone for the entire town: Residential-Agricultural District; and two overlay zones: Water Supply Protection District and Floodplain/Worthington River Protection District.

Although appropriate zoning is all relevant to protecting the health and safety of the Town residents, Worthington's two overlay districts are specifically relevant to natural hazard mitigation. These are outlined here:

- Floodplain and Worthington River Protection District - The floodplain overlay applies to those areas within the boundary of the one-hundred-year flood that are considered hazardous according to FEMA. This is also extended, where applicable, to lands within 100 feet of the riverbank. It limits some uses for preventing potential flood damage and/or minimizing erosion and sedimentation of the Worthington River.
- Water Supply Protection District - This purpose of this overlay district is to protect and preserve Worthington's groundwater resources from potentially damaging pollution or environmental degradation by regulating certain uses within the district. The regulations state specific prohibited and restricted uses, regulates drainage, details site plan requirements and special permit procedures.

The Zoning Bylaw also establishes a Site Plan/Special Permit Approval procedure for specific uses and structures within Worthington. This review allows the Special Permit Granting Authority the ability to review development to ensure that the basic safety and welfare of the people of Worthington are protected, and includes several specific evaluation criteria that are relevant to natural hazards.

### **Current Development Trends**

Today, the vast majority of Worthington's 32.1 square miles is undeveloped land, totaling close to 17,730 acres. Agricultural land is the second most prolific land use, at approximately 1,781 acres, followed by residential land at approximately 894 acres. There are over 60 acres of outdoor recreational land in Town, and land characterized as urban open/public land constitutes another 18 acres. Land used for commercial and industrial uses constitutes a relatively small 33 acres, and 5.5 acres, respectively.

Because of its relatively remote location, the town has been able to maintain a quiet, country character. Most current development consists of single-family homes; the

remainder of land in Worthington is hilly and forested, with scattered open and agricultural fields. The town's population has more than doubled since the 1960 census, growing by approximately 160 residents every ten years, culminating in a population increase of nearly 10 percent from 1990 to 2000. Today, the threat of development exists as single-family homes continue to replace agricultural fields and forested land.

Currently, the zoning laws are minimal and serve to space houses out along the roads. Worthington does have some land use regulations to encourage development where most appropriate, and the necessity of private septic systems also acts as a constraint on development.

### ***Development in Hazard Areas***

Hazards identified in this plan are regional risks and, as such, all new development falls into the hazard area. The exception to this is flooding. According to the Community Information System (CIS) of FEMA, there were 10 residential structures located within the Special Flood Hazard Area (SFHA) in Worthington as of January 2004, the most current records in the CIS for the Town of Worthington.

# 3: HAZARD IDENTIFICATION & ANALYSIS

## Profiling the Natural Hazards

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

Each of these hazards was assessed by the Committee for location of occurrence, extent, previous occurrences, and probability of future events. (See Appendix C for sources, methodology.) This resulted in a ranking of hazard, by risk, see Table 3.1. More detailed descriptions of each of the points of analysis are included in the Identification and Vulnerability Assessment (below).

**Table 3.1: Hazard Profiling and Risk Index Worksheet**

Type of Hazard	Location	Extent	Previous Occurrences	Probability of Future Events	Hazard Risk Index Rating
Flooding (100-year)	Small	Limited	Yes 2x in last 20 yrs	Moderate	1
Flooding (localized)	Small	Limited	Yes	Very High	1
Severe Snow/Ice Storms	Large	Critical	Yes (extensive)	Very High	1
Hurricanes/Severe Wind	Small	Minor	Yes	High	3
Tornado/Microburst	Small	Catastrophic	Yes	Moderate	3
Wildfire/Brushfire	Small	Minor	Yes	Moderate	3
Earthquake	Large	Critical	No	Very Low	5
Dam Failure	Small	Minor	No	Very Low	5
Drought	Small	Minor	Yes	Very Low	5
Man-Made Hazard: Hazardous Materials	Small	Minor	No	Very Low	5

## Natural Hazard Identification and Vulnerability Assessment

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The following is a description of natural and manmade disasters, and the areas affected by them, that have or could affect the Town of Worthington. The *Past and Potential Hazards/Critical Facilities Map* (Appendix D) reflects the contents of this analysis.

### Vulnerability Assessment Methodology

In order to determine estimated losses due to natural hazards in Worthington, each hazard area was analyzed with results shown below. The data below was calculated using FEMA's *Understanding Your Risks: Identifying Hazards and Estimating Losses*, August 2001.

**Total value of all structures in Worthington (2006): \$145,257,441**

**Median value of a home in Worthington (2006): \$195,000**

**Average household size: 2.4 persons**

Human losses are not calculated during this exercise, but could be expected to occur depending on the type and severity of the hazard. Most of these figures exclude both the land value and contents of the structure. The damage calculations are rough estimate and likely reflect worst-case scenarios. Computing more detailed damage assessment based on assessor's records is a labor-intensive task and beyond the scope of this project.

### Flooding

The average annual precipitation for Worthington and surrounding areas in northwestern Massachusetts is 46 inches. There are three major types of storms that bring precipitation to Worthington. 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. Precipitation from coastal storms, also known as nor'easters, that travel into New England from the south constitute the second major storm type. In the late summer or early fall, the most severe type of these coastal storms, hurricanes, may reach Massachusetts 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 can be classified as either flash floods, which are the product of heavy, localized precipitation in a short time period over a given location or general floods, which are caused by precipitation over a longer time period in a particular river basin. There are several local factors that determine the severity of a flooding event, including: stream and river basin topography, precipitation and weather patterns, recent soil moisture

conditions, amount of impervious surface area, and the degree of vegetative clearing. Furthermore, flooding can be influenced by larger, global climate events. Global warming and climate change have the potential to shift current rainfall and storm patterns. Increased precipitation is a realistic result of global warming, and could potentially increase the frequency and intensity of flooding in the region. Currently, floods occur and are one of the most frequent and costly natural hazards in the United States.

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

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

A floodplain is the relatively flat, lowland area adjacent to a river, lake or stream. Floodplains serve an important function, acting like large "sponges" to absorb and slowly release floodwaters back to surface waters and groundwater. Over time, sediments that are deposited in floodplains develop into fertile, productive farmland like that found in the Connecticut River valley. In the past, floodplain areas were also often seen as prime locations for development. Industries were located on the banks of rivers for access to hydropower. Residential and commercial development occurred in floodplains because of their scenic qualities and proximity to the water. Although periodic flooding of a floodplain area is a natural occurrence, past and current development and alteration of these areas will result in flooding that is a costly and frequent hazard. In addition to damage of buildings directly in the floodplain, development can result in a loss of natural flood storage capacity and can increase the water levels in water bodies. Flood levels may then increase, causing damage to structures not normally in the flood path.

The Floodplain Map for the Town of Worthington shows the 100-year and 500-year flood zones identified by FEMA flood maps. The 100-year flood zone is the area that will be covered by water as a result of a flood that has a one percent chance of occurring in any given year. Likewise, the 500-year flood has a 0.2 percent chance of occurring in any given year. In Worthington, there are several floodplain areas – primarily along Branch Brook, Bronson Brook, Watts Stream and Little River. There are some smaller 500-year floodplains mapped as well, in several low-lying areas throughout Worthington.

The major floods recorded in Western Massachusetts during the 20th century have been the result of rainfall alone or rainfall combined with snowmelt. Worthington has

experienced flooding events over the last decade. Generally, these small floods have had minor impacts, temporarily impacting roads and residents' yards.

As described above, flooding can happen on a range of scales. For the purposes of this analysis, the hazard has been broken into two separate types – **Flooding (100-year)** and **Flooding (localized)**. Risk and vulnerability assessment for these separate types of flooding are analyzed below.

### **Flooding (100-year base flood): High Risk**

There are approximately 1,004 acres of land within the FEMA mapped 100-year floodplain and 26 acres of land within the 500-year floodplain within the Town of Worthington. According to the Community Information System (CIS) of FEMA, there were 10 residential structures located within the Special Flood Hazard Area (SFHA) in Worthington as of January 2004, the most current records in the CIS for the Town of Worthington. Therefore, a vulnerability assessment for a 100-year flood equals approximately \$1.95 million of damage to residential structures, with approximately 24 people impacted.

Specific vulnerability assessments were estimated for sites within the SFHA which have been susceptible to 100-year floods in the past, they are described below. At this time the Town of Worthington has no repetitive loss properties as defined by FEMA's NFIP.

#### **Location**

##### **Dingle Road**

Bronson Brook along Dingle Road has experienced significant flooding in the past.

- 7 homes affected;
- Threat includes property damage, septic system damage, and damage to the stream banks;
- Vulnerability assessment: \$1,365,000 (assuming 100% damage to 100% of the structures);
- Cost for repairing or replacing any power lines, telephone lines, and contents of structures are not included.

##### **Williamsburg Road (Route 143 from Capen Street to the Chesterfield Line)**

Bronson Brook along Route 143 from Capen Street to the Chesterfield line has experienced significant flooding the past, to include the stream completely overflowing it's banks and flooding the roadway and residences.

- 4 homes affected

- Threat includes property damage, septic system damage, and damage to the stream banks;
- Vulnerability assessment: \$780,000 (assuming 100% damage to 100% of the structures);
- Cost for repairing or replacing any power lines, telephone lines, and contents of structures are not included.

Capen Street (from 112-143)

Bronson Brook along Capen Street has experienced significant flooding the past, to include the stream completely overflowing it's banks and flooding the roadway.

- 3 homes affected
- Threat includes property damage, septic system damage, and damage to the stream banks;
- Vulnerability assessment: \$585,000 (assuming 100% damage to 100% of the structures);
- Cost for repairing or replacing any power lines, telephone lines, and contents of structures are not included.

**Extent**

See information in Location section

**Previous Occurrences**

The Town of Worthington has only limited records of previous flooding events. Locations identified as having experienced previous occurrences of localized flooding were based on local knowledge of staff and volunteers who developed the Worthington Hazard Mitigation plan. According to local knowledge, Spring storms in 1987 caused localized flooding in Worthington. And in 2003 flooding at Bronson Brook eroded a culvert requiring replacement of the culvert.

According to the Massachusetts Emergency Management Agency, municipalities in Hampshire county, most likely including Worthington, experienced flooding during Tropical Storm Floyd in September, 1999. In October, 2005 Hampshire County experienced severe storms and flooding, which probably affected Worthington.

**34 FLOOD** event(s) were reported in **Hampshire County, Massachusetts** between **01/01/1950** and **11/30/2009** and none in Worthington. None of these severe storm events caused injury or death.

Source: National Climactic Data Center

**Probability of Future Events**

There is a moderate chance, 10-40% of localized flooding within the 100-year flood plain every year, and these floods can cause significant damage. The chance of a major flood in the 100-year flood plain is by definition 1% in any given year.

### **Flooding (localized) – High Risk**

In addition to the floodplains mapped by FEMA for the 100-year and 500-year flood, Worthington often experiences minor flooding at isolated locations due to drainage problems, or problem culverts.

There are a total of 135 problem culverts or other localized flooding areas are all over Town, and have been mapped on the Past and Potential Hazards/Critical Facilities Map (Appendix D). Most of the flood hazard areas listed here were identified due to known past occurrence in the respective area. There are many areas with no record of previous flood incidents that could be affected in the future by heavy rain and runoff. Additionally, the vast majority of culverts throughout town tend to be impacted by beavers, so localized flooding can potentially occur at any culvert crossing.

To determine the vulnerability of the Town to localized flood events, the property within identified areas was visually analyzed using aerial photography (Pictometry), which allowed structures to be identified and tallied. Specific vulnerability assessments were estimated for sites which have been susceptible to localized flooding in the past, and are described below.

#### **Location**

##### Bronson Brook

Bronson Brook along Dingle Road to Capen Street and then along Route 143 to the Chesterfield line has experienced flooding twice in the past 50 years, causing significant damage to property and stream banks. There are no critical facilities located near this trouble spot, however, there are 14 residential structures in this area that have been affected or could be affected by a flood incident. With 100% damage to 100% of the structures, the estimated cost of repairing or replacing would be \$2,730,000. Cost for repairing or replacing any power lines, telephone lines, and contents of structures are not included. There is also potential for the road to be damaged.

#### **Extent**

See information in Location section

#### **Previous Occurrences**

The Town of Worthington has only limited records of local flooding events. Locations identified as having experienced previous occurrences of localized flooding were based on local knowledge of staff and volunteers who developed the Worthington Hazard Mitigation plan. According to local knowledge, Spring storms in 1987 caused localized flooding in Worthington. And in 2003 flooding at Bronson Brook eroded a culvert requiring replacement of the culvert.



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Source: National Climactic Data Center

### **Probability of Future Events**

There is a very high (70-100% probability in the next year) chance of localized flooding within the 100-year flood plain every year, but these floods are small and generally cause little damage.

### **Severe Snow/Ice Storm – High Risk**

Severe winter storms can pose a significant risk to property and human life because the rain, freezing rain, ice, snow, cold temperatures and wind associated with these storms can disrupt utility service, phone service, and make roadways extremely hazardous. Severe winter storms can also 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.

### **Location**

Severe winter weather occurs regionally and therefore would impact the entire town, although several specific locations are more susceptible to damage. These problem areas have been identified and assessed for vulnerability.

Route 112 between the top of Witt Hill Road and the Eastern end of Kinnebrook Road

Any severe winter weather incident can cause critical snow and ice hazards due to wind blown snow across the roadway. This is due to open areas prone to high winds, causing driving difficulties and impairing visibility.

### **Extent**

New England generally experiences at least one or two severe winter storms each year with varying degrees of severity. Research on climate change indicates that there is

great potential for stronger, more frequent storms as the global temperature increases. Severe winter storms typically occur during January and February; however, they can occur from late September through late April.

The Northeast Snowfall Impact Scale (NESIS) developed by Paul Kocin of The Weather Channel and Louis Uccellini of the National Weather Service ([Kocin and Uccellini, 2004](#)) characterizes and ranks high-impact Northeast snowstorms. These storms have large areas of 10 inch snowfall accumulations and greater. 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. Thus NESIS gives an indication of a storm's societal impacts.

NESIS scores factor in the area affected by the snowstorm, the snow, and the number of people living in the path of the storm. The NESIS score varies from around one for smaller storms to over ten for extreme storms. The raw score is then converted into one of the five NESIS categories. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers.

### **Previous Occurrences**

Worthington's recent history has recorded one loss of life due to the extreme winter weather. A resident froze to death in his home and there are usually several incidents of property damage or personal injury each winter. In addition, during heavy snow years, accumulations can reach several feet deep. Worthington's rugged topography creates some steep grades, sometimes making plowing difficult and causing snow and ice hazards. Many of the farms and open meadows and fields throughout town cause snow drifts.

- Worthington has been subject to 22 winter storms categorized as major to extreme according to the NESIS scale since 1960. Additional historically significant winter storms to affect Worthington include the Great Snow of 1717 and the Blizzard of 1888
- Moderate risk town wide due to snow, ice and extreme cold.
- Elderly are affected by extreme weather.

The National Climactic Data Center (NCDC) of the NOAA reports 104 SNOW & ICE event(s) in Hampshire County, Massachusetts between 01/01/1950 and 11/30/2009. It is fair to assume that Worthington received snow during these events. Across the county these snow and ice events caused 2 injuries and cost the county \$81 million, but the Worthington Hazard Mitigation planning committee did not single out any one of these events as particularly problematic for the Town of Worthington. Severe snow and ice are expected in New England in the winter. Burying power lines would be a wonderful mitigation activity, but is deemed completely and utterly cost prohibitive.

### **Probability of Future Events**

Based on the NESIS scale, Worthington is at risk of a major to extreme winter storm in any given year is slightly less than 50 percent.

## **Hurricanes/Severe Wind – Medium Risk**

Hurricanes are violent rainstorms with strong winds that can reach speeds of up to 200 miles per hour, and large amounts of precipitation. Hurricanes generally occur between June and November and can result in flooding and wind damage to structures and above-ground utilities. Severe wind can also occur in the absence of a hurricane, especially impacting mountain tops. Global warming will increase the threat of hurricanes and severe wind as oceans and the atmosphere warms. Climate change research indicates that storms like hurricanes will become more intense and more frequent in the future.

### **Location**

All of Worthington is at risk from hurricanes with ridgetops more susceptible to wind damage and the flood-prone portions of town to flooding from the heavy rains. The higher elevations near the tops of the mountains throughout town precipitate severe wind incidents, especially during severe thunderstorms, hurricanes, or blizzards.

### **Extent**

Worthington's location in Western Massachusetts reduces the risk of extremely high winds that are associated with hurricanes, although it can experience some high wind events. During hurricanes or severe wind events, the Town has experienced small blocks of downed timber and uprooting of trees onto structures.

- Estimated wind damage: 5% of the structures with 10% damage, \$726,287;
- Estimated flood damage: 10% of the structures with 20% damage, \$2,905,149;
- Vulnerability assessment for a hurricane event (both wind and flood damages): \$3,631,436;
- Cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included.

### **Previous Occurrences**

In Massachusetts, sixteen hurricanes have had landfall since 1851, two of which impacted Western Massachusetts. These include Hurricane Carol in 1954 and Hurricane Gloria in 1985. Hurricanes are usually ranked category 1-5, using the Saffir-Simpson Scale, with category 5 hurricanes being the most severe. Both Hurricane Carol and Gloria were category 1-2 storms, meaning winds ranged from 74-110 mph with the potential for some roofing or window damage to buildings, damage to unanchored mobile homes, trees, or poor construction, and/or some minor flooding.

- 1938 hurricane was a major event - wind damage and flooding statewide.
- Power and phone lines - disruptions of services.
- Flooding/washing of evacuation routes.

**Table 3.2 Major Non-Winter Storms to Affect Worthington Area**

Hurricane/Storm Name	Year	Saffir/Simpson Category (when reached MA)
Great Hurricane of 1938	1938	Unclear, 3 or 4
Great Atlantic Hurricane	1944	1
Carol	1954	3
Edna	1954	1
Diane	1955	Tropical Storm
Donna	1960	Unclear, 1 or 2
Groundhog Day Gale	1976	Not Applicable
Gloria	1985	1
Bob	1991	2
Floyd	1999	Tropical Storm

**Probability of Future Events**

Based upon the past events, it is reasonable to say that there is a low frequency of major hurricanes in Worthington (once every fifty years is less than a one percent chance of any such storm occurring in a given year) while the possibility of a less severe hurricane or tropical storm affecting Worthington in any given year is approximately 10 percent.

**Tornadoes/Microbursts – Medium Risk**

Tornadoes 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, tornadoes have occurred most frequently in Worcester County and in communities west of Worcester, including towns in Hampshire County.

Of additional concern are microbursts, which often do tornado-like damage and can be mistaken for tornadoes. In contrast to the upward rush of air in a tornado, air blasts rapidly downward from thunderstorms to create microbursts. Microbursts and tornadoes are expected to become more frequent and more violent as the earth's atmosphere warms, due to predictions of climate change from global warming.

**Location**

The hazard area for tornadoes in Worthington varies according to the intensity and size of the tornado. There have not been enough tornadoes in Worthington to accurately predict sections of town that are more likely to experience a tornado.

**Extent**

Because tornadoes and microbursts rarely occur in this part of the country, assessing damages is difficult. Furthermore, buildings have not been built to Zone 2, Design Wind Speed Codes. The entire Town of Worthington is vulnerable.

- Tornadoes/microburst hazard estimates 20% damage to 10% of structures in Town;
- Vulnerability assessment estimates in damages; \$2,905,149
- Estimated cost does not include building contents, land values or damages to utilities.

### **Previous Occurrences**

No tornados have touched down in Worthington, but there have been several high-wind storms and hail events. In Western Massachusetts, the majority of sighted tornadoes have occurred in a swath east of Worthington, known as “tornado alley.” Thirteen incidents of tornado activity (all F2<sup>1</sup> or less) occurred in Hampshire County between 1959 and 2005.

### **Probability of Future Events**

Based upon the past events, it is reasonable to say that there is a low frequency of tornadoes in Worthington.

### **Wildfires/Brushfire – Medium Risk**

According to FEMA, there are three different classes of wildland fires: surface fires, ground fires and crown fires. The most common type of wildland fire is a surface fire that 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 lightening. Crown fires move quickly by jumping along the tops of trees. A crown fire may spread rapidly, especially under windy conditions. While wildfires or brushfires have not been a significant problem in Worthington, 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. Global climate changes may also influence precipitation patterns, making the region more susceptible to drought and therefore, wildfires.

Hampshire County has approximately 252,000 acres of forested land, which accounts for 72% of total land area. Forest fires are therefore a potentially significant issue. In Worthington, approximately 84% of the town's total land area is in forest, or about 17,194 acres, and is therefore at risk of fire.

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<sup>1</sup> F2 refers to the commonly used Fujita Tornado Damage Scale which ranks tornados F0-F5 depending on estimated wind speeds and damages, with F5 the most severe.

### **Location**

Approximately 84% of Worthington is forested so the entire town is at risk of wildfires.

### **Extent**

The Worthington Fire Department reports that it has records of only small brushfires covering less than a few acres at the most. One of the fires was a permitted burn that got out of control.

However, moderate risk exists for potential wildfire incidents, especially near some of the town's forested, agricultural, and recreational lands. Forested and agricultural areas with high fuel content have more potential to burn. In addition, it is often very difficult to access some of the locations to extinguish the brushfire.

- On Rte 112 up to 10 structures could be impacted by a wildfire;
- Assuming 100% damage to 100% of the structures, not including costs repairing or replacing any power lines, telephone lines, and contents of structures;
- Vulnerability assessment estimates approximately \$1,950,000 in damages for a wildfire.

### **Previous Occurrences**

According to the Worthington Fire Department, there are approximately 5 unauthorized burns (or brushfires) per year, on average. As a point of comparison, approximately 20 burn permits are issued annually.

There is no record, authenticated or anecdotal, of wildfires in Worthington.

According to the National Climactic Data Center, NOAA, **0 WILD & FOREST FIRE** event(s) were reported in **Hampshire County, Massachusetts** between **01/01/1950** and **11/30/2009**.

### **Probability of Future Events**

Based upon the past events, it is reasonable to say there is a low frequency of wildfires in Worthington.

### **Earthquakes – Low Risk**

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. 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 avalanches, flash floods (dam failure) and fires. Un-reinforced 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. 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.

**Location**

In the event of an earthquake, all of Worthington would be affected with some portions more impacted than others, depending on the magnitude of the earthquake.

<b>Table 3.3: New England Earthquakes (1924-2002)<sup>2</sup> magnitude 4.2 or higher</b>		
<b>Location</b>	<b>Date</b>	<b>Magnitude</b>
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

<b>Table 3.4: New England States Record of Earthquakes<sup>2</sup></b>		
<b>State</b>	<b>Years of Record</b>	<b>Number of Earthquakes</b>
Connecticut	1568 - 1989	137
Maine	1766 - 1989	391
Massachusetts	1627 - 1989	316
New Hampshire	1728 - 1989	270
Rhode Island	1766 - 1989	32
Vermont	1843 - 1989	69
New York	1737 - 1985	24
Total Earthquakes in New England (1568-1989)		1,239

**Extent**

<sup>2</sup> Northeast States Emergency Consortium Web site: [www.nesec.org/hazards/earthquakes.cfm](http://www.nesec.org/hazards/earthquakes.cfm)

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

- Because many of the buildings were built before 1975, there is potential for serious damage in Worthington;
- Structures are mostly wood frame construction, so loss estimates predict 20% of town assessed value, not including Costs of repairing or replacing roads, bridges, power lines, telephone lines, or the contents of the structures;
- Vulnerability assessment estimates approximately \$29,051,488.

### **Previous Occurrences**

Nineteen earthquakes, intensity V (Modified Mercalli scale) or greater, have centered in Massachusetts since it was colonized by Europeans. A shock in 1755 reached intensity VIII at Boston and was felt across the State. In addition, Massachusetts was affected by some of the more severe Canadian shocks plus the earthquake of 1929 that centered on Grand Banks of Newfoundland.

Strong earthquakes in the St. Lawrence Valley in 1638, 1661, 1663, and 1732 were felt in Massachusetts. The 1638 and 1663 shocks damaged chimneys at Plymouth, Salem, and Lynn. On June 11, 1643, Newbury, Massachusetts, was strongly shaken. Again in 1727 (November 9) an earthquake described as "tremendous" in one report and "violent" in another caused much damage at Newbury. The shock was felt from the Keenebec River to the Delaware River and from ships at sea to the extreme western settlements. Several strong aftershocks were reported from the area through February 1728.

Tables 3.3 & 3.4 contain information regarding most of the earthquakes, including all of affecting New England, the significant ones. None have been noted to cause any damage in Worthington or the surrounding area.

### **Probability of Future Events**

Based upon the past events, it is reasonable to say that there is a low frequency of major earthquakes in Worthington (there have been no earthquakes over 4.2 on the Richter scale in nearly 100 years) while the possibility of a less severe earthquake or tropical storm affecting Worthington in any given year is slightly less than 1 percent but these are unlikely to cause any significant damage.

### **Dam Failure – Low Risk**

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 released. Often



dam breaches lead to catastrophic consequences as the water ultimately 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. Most earthen dam failures occur when floodwaters above overtop and erode the material components of the dam.

The Massachusetts Department of Conservation and Recreation (MA DCR) was 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. This means that individual dam owners are now responsible for conducting inspections.

The state has four hazard classifications for dams:

- High Hazard: 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: 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: Dams located where failure or improper operation may cause minimal property damage to others. Loss of life is not expected.
- Non-jurisdictional: The storage capacity of the impoundment and height of dam are such that they need not be regulated.

The inspection schedule for dams is as follows:

- Low Hazard dams – 10 years
- Significant Hazard dams – 5 years
- High Hazard 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.

### **Location**

According to DCR sources, as well as local knowledge, there are currently six (6) dams<sup>3</sup> in Worthington. The follow table identifies the dams within the town as well as whether they are classified as low, significant, or high hazard.

<b>Dam name/ date built</b>	<b>ID</b>	<b>Owner</b>	<b>Purpose</b>	<b>Condition/last inspected</b>	<b>Hazard Risk</b>
Little Gallilee Pond Dam	MA02649	George Bresnick & Geraldine Hendriksen	Recreation	Unknown / Unknown	Low
Smith Farm Lower Pond Dam	MA02650	A.E. Albert & Sons, Inc.	Irrigation	Unknown / Unknown	Non- jurisdictional
Smith Farm Upper Pond Dam	MA02651		Irrigation	Unknown / Unknown	Non- jurisdictional
Ward Stream Dam	MA02652		Irrigation	Unknown / Unknown	Non- jurisdictional
House Lot Pond Dam	MA02653		Irrigation	Unknown / Unknown	Non- jurisdictional
Chesterfield Road Lot Pond Dam	MA02654		Irrigation	Unknown / Unknown	Non- jurisdictional
Earten Dam Old Port Rd, Radacher Rd	Not permitted	Chet Kellogg		Ordered to be reconstructed years ago	Non- jurisdictional

### **Extent**

None of the dams in Town are constituted significant or high risk, so no vulnerability assessment was done for any of the inundation zones.

### **Previous Occurrences**

Worthington has no history of dam failures.

### **Probability of Future Events**

Based upon the past events, it is reasonable to say that there is a low frequency of dam failure in Worthington.

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<sup>3</sup> It is difficult to track down accurate records of dams, as ownership and exact location is not clear. Furthermore, many very old dams listed in DCR records are not in existence anymore, according to local knowledge. This list is compiled from a combination of sources, and then verified by the Committee.

## **Drought – Low Risk**

Drought is a normal, recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region. In the most general sense, drought originates from a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group, or environmental sector.

Reduced crop, rangeland, and forest productivity; increased fire hazard; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitat are a few examples of the direct impacts of drought. Of course, these impacts can have far-reaching effects throughout the region and even the country.

### **Location**

A drought would affect all of Worthington.

### **Extent**

The severity of a drought would determine the scale of the event.

When evaluating the region's risk for drought on a national level, utilizing a measure called the Palmer Drought Severity Index, Massachusetts is historically in the lowest percentile for severity and risk of drought. Even so, there have been several years of drought-like conditions in Western Massachusetts: 1940-1952, 1980-1983, and 1995-2001. Furthermore, global warming and climate change may have an effect on drought risk in the region. With the projected temperature increases, some scientists think that the global hydrological cycle will also intensify. This would cause, among other effects, the potential for more severe, longer-lasting droughts. Additionally, even minor droughts will increase the risk of wildfire, especially in areas of high recreational use.

### **Previous Occurrences**

In Massachusetts, six major droughts have occurred statewide since 1930. They range in severity and length, from three to eight years. In many of these droughts, water-supply systems were found to be inadequate. Water was piped in to urban areas, and water-supply systems were modified to permit withdrawals at lower water levels.

Worthington has had limited experience with severe drought conditions. The town has not experienced a threat to its water supply, and doesn't anticipate any severe water shortages throughout town. In 1995 the Town had to work on municipally owned wells, but now the Town gets water from a private water company.

### **Probability of Future Occurrences**

Based upon the past events, it is reasonable to say that there is a low frequency of drought in Worthington.

## **Man-Made Hazards – Hazardous Materials – Medium Risk**

Hazardous materials are chemical substances, which if released or misused can pose a threat to the environment or health. These chemicals come in the form of explosives,

flammable and combustible substances, poisons, and radioactive materials. 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 and businesses routinely. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines.

The Toxics Release Inventory (TRI), a publicly available EPA database that contains information on specific toxic chemical releases and other waste management activities reported annually by certain covered industry groups as well as federal facilities. According to TRI, there are no industries currently releasing hazardous materials within Worthington's town limits.

Worthington relies on the regional HazMat team located in Holyoke for responding to incidents involving hazardous materials through a mutual aid agreement.

**Location**

Two sites in Town considered Tier II Hazardous Materials storage facilities, and are included on the Past & Potential Hazards/Critical Facilities Map (Appendix D).

In addition, varying quantities of hazardous materials are manufactured, used, or stored at an estimated 4.5 million facilities in the United States--from major industrial plants to local dry cleaning establishments or gardening supply stores. These hazardous materials are transported regularly over our highways and by rail and if released can spread quickly to any community. Incidents can occur at any time without warning. Human error is the probable cause of most transportation incidents and associated consequences involving the release of hazardous materials. Some hazardous material is transported on Rte.

<b>Table 3-7 Tier II Hazardous Materials storage facilities in Worthington</b>	
<b>Site Name</b>	<b>Site Address</b>
First Student, Inc. (diesel fuel)	786 Old North Road
Verizon Worthington Dial Office (ma823907)	Williamsburg Road
Town storage (2000 gallons diesel)	64 Huntington Road

**Extent**

The extent of hazardous chemical release is not predictable as it is dependent on the location including whether it is from a stationary or moving source, amount and type of chemical released, and weather conditions at the time of the release, but given the relative lack of hazardous chemicals present in Worthington the extent is likely to be limited.

**Previous Occurrences**

Available data dating from 1998-2003 shows zero releases of hazardous materials.

There is no history of any major accidents involving some sort of oil or chemical spill, but transportation of chemicals and bio-hazardous materials by vehicle transport on Route 112 or Route 143 is a concern. Small areas of hazardous materials storage increase the potential for future incidents.

**Probability of Future Events**

Based upon the past events, it is reasonable to say that there is a low likelihood of hazardous chemical releases in Worthington.

## 4: CRITICAL FACILITIES

A Critical Facility is defined as a building, structure, or location which:

- Is vital to the hazard response effort;
- Maintains an existing level of protection from hazards for the community;
- Would create a secondary disaster if a hazard were to impact it.

### **Critical Facilities within Hazard Areas**

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Hazards identified in this plan are regional risks and, as such, all critical facilities fall into the hazard area. The exception to this is flooding. There are several critical facilities that fall within the 100-year floodplain as shown in the table at the end of this section.

The Critical Facilities List for the Town of Worthington has been identified utilizing a Critical Facilities List provided by the State Hazard Mitigation Officer. Worthington's Hazard Mitigation Committee has broken up this list of facilities into four categories:

- The first category contains facilities needed for Emergency Response in the event of a disaster.
- The second category contains Non-Emergency Response Facilities that have been identified by the Committee as non-essential. These are not required in an emergency response event, but are considered essential for the everyday operation of Worthington.
- The third category contains Facilities/Populations that the Committee wishes to protect in the event of a disaster.
- The fourth category contains Potential Resources, which can provide services or supplies in the event of a disaster.

The critical facilities and evacuation routes potentially affected by hazard areas are identified in Table 4-1, following this list. The Past and Potential Hazards/Critical Facilities Map (Appendix D) identifies these facilities.

### **Category 1 – Emergency Response Services**

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The Town has identified the Emergency Response Facilities and Services as the highest priority in regards to protection from natural and man-made hazards.

- 1) Emergency Operations Center  
Primary: Worthington Fire Station – 51 Huntington Rd.  
Secondary: Worthington Town Hall – 160 Huntington Rd.

- 2) Fire Station  
Worthington Fire - Rescue – 51 Huntington Rd.
- 3) Police Station  
Worthington Police Department – 51 Huntington Road
- 4) Highway Department  
Department of Public Works (DPW) Headquarters – 64 Huntington Rd.
- 5) Water  
Eight small community wells
- 6) Emergency Fuel Stations  
Highway Department – 64 Huntington Road
- 7) Emergency Electrical Power Facility  
Fire Station  
3 portable generators and a stationery generator to power the EOC
- 8) Emergency Shelters\*  
Worthington Fire Station – 51 Huntington Rd.  
Worthington Town Hall – 160 Huntington Rd.  
  
\*Shelters also have generators.
- 9) Water Sources  
Numerous locations in Worthington, identified on map
- 10) Transfer Station  
Town of Worthington Transfer Station and Recycling Center – Route 112
- 11) Helicopter Landing Sites  
Rte 143 N 42 25 651 / W 72 58 992  
Rte 112 N 42 26 337 / W 72 56 365  
Rte 143 N 42 24 958 / W 72 56 316  
Rte 143 N 42 24 841 / W 72 54 342  
Rte 112 N 42 23 563 / W 72 56 004  
Prentice Rd N 42 21 687 / W 72 55 407  
Rte 112 N 42 21 734 / W 72 54 465  
(Permitted anywhere feasible.)
- 12) Communications  
none
- 13) Primary Evacuation Routes  
Route 112  
Route 143

14) Bridges/Culverts Located on Evacuation Routes

- Route 143 at Middle River
- Route 112 at Wards Stream
- Route 112 at Watts Stream
- Route 112 at Little River
- Route 112 at Bronson Brook

## **Category 2 – Non Emergency Response Facilities**

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The town has identified these facilities as non-emergency facilities; however, they are considered essential for the everyday operation of Worthington.

1) Problem Culverts

- Route 143, Dingle Road
- 63 problem culverts along Old North Road

2) Water Supply

- Privately owned water supply company and privately owned residential wells.

## **Category 3 – Facilities/Populations to Protect**

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The third category contains people and facilities that need to be protected in event of a disaster.

1) Special Needs Population

- none

2) Elderly Housing/Assisted Living

- Maples-48 Old North Road

3) Public Buildings/Areas

- Berkshire Park Camping Area - 350 Harvey Rd.
- Peru State Reservation - address
- Roads End Wildlife Sanctuary - Rt 112 and Corbett Rd.
- Sevenars Concerts - Rt. 112 and S. Ireland St.
- Wildlife Sanctuary - address
- Worthington Library - 1 Huntington Rd.
- Worthington Post Office – 2 Packard Park
- Worthington State Forest - address
- Worthington Town Hall - PO Box 247

4) Schools



Elementary School – Russel H. Conwell - 147 Huntington Rd.  
Private daycares -  
Valerie A. Sullivan - 58 E. Windsor Rd.  
Susan Warner - 703 Huntington Rd.

- 5) Churches  
First Congregational Church - Huntington Rd.
- 6) Historic Buildings/Sites  
Town Hall  
South Worthington Church-Ireland Street  
School House-Dingle and Capen  
Sevenars  
North Cemetery  
Converse Cemetery  
Old Leonard Cemetery
- 7) Apartment Complexes  
none
- 8) Employment Centers  
Hillside Electronics-17 Buffington Hill Road  
Worthington Assembly-4 South Worthington Road

## **Category 4 – Potential Resources**

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Contains facilities that provide potential resources for services or supplies.

- 1) Food/Water  
Corners Grocery – 2 Packard Park  
Kendall Food Co – 448 Huntington Rd.  
Worthington Inn - Old North Rd. and Rt. 143
- 2) Hospitals/Medical Supplies  
Worthington Health Center- 58 Old North Rd
- 3) Gas  
none
- 4) Building Materials Suppliers  
none
- 5) Heavy & Small Equipment Suppliers  
Dean Messick  
Burt Nugent

- 6) Gravel Pits  
Kerry Donovan Excavating

**Table 4.1: Critical Facilities and Evacuation Routes Potentially Affected by Hazard Areas**

Hazard Type	Hazard Area	Critical Facilities Affected	Evacuation Routes Affected
Flooding (100-year)	Bronson Brook	Bridges on 112	112
Flooding (localized)	Little River below Ringville		Rtes 112, 143
Severe Snow/Ice Storm			Rtes 112, 143
Hurricane/Severe Wind	Trees come down on Rte 112		
Wildfire/Brushfire			
Earthquake			
Dam Failure	If Knightsville dam failed		Rte 112 would be blocked
Drought			
Hazardous Materials			

(Past & Potential Hazards/Critical Facilities Map Located In Appendix D)

# 5: MITIGATION STRATEGIES

One of the steps of this Natural Hazard Mitigation Plan is to evaluate all of the town's existing policies and practices related to natural hazards and identify potential gaps in protection. Once these gaps in protection are identified, future mitigation strategies can be crafted and recommended. This is done by evaluating existing and future measures in comparison to the Town's goal statement for natural hazard mitigation.

### Goal Statement

To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to natural disasters. To provide adequate shelter, water, food and basic first aid to displaced residents in the event of a natural disaster and to provide adequate notification and information regarding evacuation procedures, etc., to residents in the event of a natural disaster.

For the extent of this analysis, the Committee reviewed the following Town documents:

- Protective Zoning By-Law
- Subdivision Rules and Regulations
- Worthington Community Development Plan
- CEM Plan
- Other relevant By-Laws as identified (Fire Department Burn Permit Procedures, Building Code, etc.)

This section of the plan serves to identify current mitigation strategies and recommend future mitigation strategies. This is done both generally, and by hazard type.

## General Mitigation Measures

Several of the recommended mitigation measures have multiple benefits because, if implemented, they will mitigate or prevent damages from more than one type of natural hazard. These do not fall under one hazard type, but could be put into place for facilitation of better natural hazard protection generally.

Some of these general hazard-related strategies and measures do not fall specifically under the category of "mitigation," but are instead tools for

### What's the CEM Plan?

An important existing general preparedness and response tool is Worthington's Comprehensive Emergency Management Plan (CEM Plan). Although the CEM Plan is focused on the procedural response to an emergency, it organizes information, includes supply and information inventories, and outlines detailed steps for increasing

preparedness. The Hazard Mitigation Planning Committee recognizes that these are also important recommendations for the Town, and has included them here:

- Form Local Emergency Planning Committee.
- Establish system to inventory supplies at existing shelters and develop a needs list and storage requirements. Establish arrangements with local or neighboring vendors for supplying shelters with food and first aid supplies in the event of a natural disaster.

## **Flooding**

The key factors in flooding are the water capacity of water bodies and waterways, the regulation of waterways by flood control structures, and the preservation of flood storage areas and wetlands. As more land is developed, more flood storage is demanded of the town's water bodies and waterways.

### **Current Mitigation Measures**

The Town currently addresses this problem with a variety of mitigation tools and strategies. Flood-related regulations and strategies are included in the Town's zoning by-law, subdivision regulations, as well as a proposed stormwater management by-law. Relevant goals are included in the adopted Open Space and Recreation Plan. Infrastructure like dams and culverts are in place to manage the flow of water. These current mitigation strategies are outlined in the following table.

**Table 5.1: Existing Flood Hazard Mitigation Measures**

<b>Existing Strategy</b>		<b>Description</b>	<b>Effectiveness</b>	<b>Potential Changes</b>
Flood Control Structures		Six dams.	Somewhat effective.	Ensure dam owners realize their responsibility to inspect the dams MA0265.
Culvert Replacement		Priority list of necessary culvert replacements and other construction projects to effectively manage flooding.	Very effective for managing flood control needs.	Seek funding from HMGP for top-priority projects.
Zoning Bylaws	Floodplain/Worthington River Protection District	Overlay district to protect areas delineated as part of the 100-year floodplain or within 100' of riverbank, by regulating uses and special permit requirements.	Very effective for preventing incompatible development within the flood prone areas.	

	Water Supply Protection District	District to protect groundwater resources by regulating certain uses, drainage, and other requirements within recharge area of aquifer.	Very effective for preventing groundwater contamination and managing infiltration.	
	Special Permit	With just one base zone in town, many uses require special permit approval.	Somewhat effective for preventing incompatible development.	Consider creating more performance-based evaluations, environmental standards.
Subdivision Regulations	Preliminary and Definitive Plan	Proposed storm drainage, sewer, water supply, and major site features (including natural features) must be included.	Somewhat effective for preventing incompatible development.	
	Design Standards	Environmental Analysis – includes impact analysis of recharge and infiltration.	Effective for protecting natural processes like flood mitigation.	
		Development Impact Statement – describes natural features, drainage systems	Effective for encouraging compatible development.	
		Storm Drainage – determines impact of development to downstream.	Effective for mitigating impacts of development to downstream.	
		Site Preservation – significant natural and cultural sites must be noted and preserved when applicable.	Effective for protecting important natural features.	
		Excavation and Grading – regulates how earth removal must be conducted.	Effective for minimizing earth removal and preventing sedimentation.	
Worthington Community Development Plan	The CD Plan identifies key goals and actions to promote natural resource preservation in the town, including areas in the floodplain; such as wetlands, groundwater recharge areas, farms and open space, rivers, streams and brooks.	Effective at identifying key policy actions necessary to preserve open space.	Work to implement relevant goals and policies in Plan.	

National Flood Insurance Program Participation	As of 2006, there were 9 homeowners with flood insurance policies. [Note: 10 properties on CIS list]	Somewhat effective, provided that the town remains enrolled in the National Flood Insurance Program.	The town should evaluate whether to become a part of FEMA's Community Rating System.
------------------------------------------------	---------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------

**Future Mitigation Measures**

Several potential changes to the Town's current strategies have been identified in the above table, and these, as well as recommendations for other future mitigation strategies, are compiled below:

- Replace top priorities on culvert replacement list.
  - Itemized list of culvert replacements here.
  - a culvert replacement
  - a culvert replacement
- Ensure dam owners realize their responsibility to inspect the dams regularly. [How?]
- Create more performance-based evaluations and environmental regulations for special permit requirements.
- Implement the goals and strategies of the Worthington Community Development Plan dealing with protection of floodplain, forests, and farmland.
- Evaluate whether to become a part of FEMA's Community Rating System.
- Educate citizens living in the floodplain about the NFIP.

**What is the NFIP's Community Rating System?**

The National Flood Insurance Program has developed suggested floodplain management activities for those communities who wish to more thoroughly manage or reduce the impact of flooding in their jurisdiction. Through use of a rating system (CRS), a community's floodplain management efforts can be evaluated for effectiveness. The rating, which indicates an above average floodplain management effort, is then factored into the premium cost for flood insurance policies sold in the community. The higher the rating achieved in that community, the greater the reduction in flood insurance premium costs for local property owners. MEMA can provide additional information regarding participation in the NFIP-CRS Program.



## Severe Snow/Ice Storm

Winter storms can be especially challenging for emergency management personnel. The Massachusetts Emergency Management Agency (MEMA) serves as the primary coordinating entity in the statewide management of all types of winter storms and monitors the National Weather Service (NWS) alerting systems during periods when winter storms are expected. Even though the storm has usually been forecast, there is no certain way for predicting its length, size or severity. Therefore, mitigation strategies must focus on preparedness prior to a severe snow/ice storm.

### Current Mitigation Measures

The Town's current mitigation tools and strategies focus on preparedness, with many regulations and standards established based on safety during storm events. These current mitigation strategies are outlined in the following table.

Note: 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 5-1 in the previous section can also be considered as mitigation measures for severe snow/ice storms.

**Table 5.2: Existing Severe Snow/Ice Storm Hazard Mitigation Measures**

Existing Strategy		Description	Effectiveness	Potential Changes
Zoning By-Law	Wireless Communications Structures and Facilities	Structures are required to be as minimally invasive as possible to the environment, have height restrictions, and must have be setback 1.25 times the structure's height.	Very effective for preventing damage in the case of a severe storm.	
Subdivision Regulations	Design Standards	Utilities must be placed underground at time of construction	Effective for preventing power loss.	
		Street grade regulations (maximum 10%)	Effective.	
State Building Code		The Town of Worthington has adopted the Massachusetts State Building Code.	Effective.	
Backup Electric Power		Shelters have backup power, three mobile generators	Very effective in case of power loss.	
Tree Management		List of dangerous trees created annually for WMECO.	Very effective, preventative collaboration.	

### Future Mitigation Measures

Several potential changes to the Town's current strategies have been identified in the above table, and these, as well as recommendations for other future mitigation strategies, are compiled below:

- Work with Western Mass Electric Company to facilitate the underground placement of new utility lines in general and existing utility lines in locations where repetitive outages occur (as applicable). [How?]
- Participate in the creation of a Regional Debris Management Plan.

#### **What is a Regional Debris Management Plan?**

Natural disasters can precipitate a variety of debris, including trees, construction and demolition materials and personal property. After a natural disaster, potential threats to the health, safety and welfare of impacted citizens can be minimized through the implementation of a debris management plan. Such a plan can be critical to recovery efforts after a disaster, including facilitating the receipt of FEMA funds for debris clearance, removal and disposal.

## **Hurricanes/Severe Wind**

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Of all the natural disasters that could potentially impact Worthington, hurricanes 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). Even with significant warning, hurricanes can do significant damage – both due to flooding and severe wind.

The flooding associated with hurricanes 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 5-1 can also be considered hurricane mitigation measures.

The high winds that oftentimes accompany hurricanes can also damage buildings and infrastructure. But regulations can be put into place to help minimize the extent of wind damages.

The Town's current mitigation strategies to deal with severe wind are equally applicable to wind events such as tornadoes and microbursts. Therefore, the analysis of severe wind strategies is coupled with this hazard.

## Tornadoes/Microbursts

The location and extent of potential damaging impacts of a tornado are completely unpredictable. Most damage from tornadoes or microbursts comes from high winds that can fell trees and electrical wires, generate hurtling debris and, possibly, hail. According to the Institute for Business and Home Safety, the wind speeds in most tornadoes are at or below design speeds that are used in current building codes. In addition, current land development regulations can also help prevent wind damages.

The following table outlines the Town's existing mitigation strategies that help prevent wind damages, whether from hurricanes, tornadoes, microbursts, or any other event.

**Table 5.3: Existing Severe Wind Hazard Mitigation Measures  
(Including Hurricane, Tornado, Microburst Hazards)**

Existing Strategy		Description	Effectiveness	Potential Changes
Zoning By-law	Mobile Homes/Trailers	Mobile homes are permitted with some additional regulations; trailers are only allowed as temporary living quarters.	Not effective for preventing damage to susceptible structures	Restrict location of mobile homes.
	Wireless Communications Structures and Facilities	Structures are required to be as minimally invasive as possible to the environment, have height restrictions, and must have be setback 1.25 times the structure's height.	Very effective for preventing damage in the case of a severe storm.	
Subdiv Regs	Design Standards	Utilities must be placed underground	Effective for preventing power loss.	
State Building Code		The Town has adopted the MA State Building Code.	Effective.	
Tree Management		List of dangerous trees created annually for WMECO.	Very effective, preventative collaboration.	

### **Future Mitigation Measures**

Several potential changes to the Town's current strategies have been identified in the above table, and these, as well as recommendations for other future mitigation strategies, are compiled below:

- Revise Zoning By-law to restrict the locations of mobile/manufactured homes.
- Work with Western Mass Electric Company to facilitate the underground placement of new utility lines in general and existing utility lines in locations where repetitive outages occur (as applicable). [How?]

- Participate in the creation of a Regional Debris Management Plan.

## **Wildfire/Brushfire**

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Although somewhat common, the vast majority of brushfires in Worthington are small and quickly contained. However, as with any illegal fire or brushfire, there is always the risk that a small brushfire could grow into a larger, more dangerous wildfire, especially if conditions are right. Therefore, it is important to take steps to prevent wildfires and brushfires from turning into natural disasters.

### **Current Mitigation Measures**

The following table identifies what the Town is currently doing to manage brushfires and makes some suggested potential changes and recommendations for decreasing the Town's likelihood of being heavily impacted by a wildfire or brushfire.

**Table 5.4: Existing Wildfire/Brushfire Hazard Mitigation Measures**

Existing Strategy		Description	Effectiveness	Potential Changes
Zoning By-Law	Wireless Communications Structures and Facilities	Fire Chief is involved in final review of site plan for structure.	Effective.	
Subdivision Regulations	General	Fire Chief may be consulted on any subdivision approval.	Effective.	
	Design Standards	Fire protection is included in the required Development Impact Statement and as a part of the rules regulating water supply to the subdivision.	Effective.	
Burn Permits		Residents must obtain burn permits, and personnel provide information on safe burn practices.	Somewhat effective.	
Public Education/ Outreach		The Fire Department has an ongoing educational program in the schools.	Effective.	None.

### **Future Mitigation Measures**

The community feels very comfortable with their Fire prevention and response activities. No additional strategies are suggested at this time.

## **Earthquake**

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Although there are five mapped seismological faults in Massachusetts, there is no discernable pattern of previous earthquakes along these faults nor is there a reliable

way to predict future earthquakes along these faults or in any other areas of the state. Consequently, earthquakes are arguably the most difficult natural hazard to plan for.

Most buildings and structures in the state were constructed without specific earthquake resistant design features. In addition, earthquakes precipitate several potential devastating secondary effects such as building collapse, utility pipeline rupture, water contamination, and extended power outages. Therefore, many of the mitigation efforts for other natural hazards identified in this plan may be applicable during the Town's recovery from an earthquake.

**Current Mitigation Measures**

The Town's most relevant existing mitigation measures are described in the following table.

<b>Table 5.5: Existing Earthquake Hazard Mitigation Measures</b>				
<b>Existing Strategy</b>		<b>Description</b>	<b>Effectiveness</b>	<b>Potential Changes</b>
Zoning By-law	Wireless Communications Structures and Facilities	Structures are required to be as minimally invasive as possible to the environment, have height restrictions, and must have be setback 1.25 times the structure's height.	Very effective for preventing damage in the case of an earthquake.	
State Building Code		The Town of Worthington has adopted the State Building Code.	Effective for new buildings only.	Evaluate older structures categorized as critical facilities to determine if they are earthquake resistant.
Debris Management Plan		A debris management plan could be developed.	Effective.	Consider participation in the creation of a Regional Debris Management Plan.

**Future Mitigation Measures**

Potential changes to the Town's current strategies have been identified in the above table, and these are compiled below:

- Participate in the creation of a Regional Debris Management Plan.

**Dam Failure**

Dam failure is a highly infrequent occurrence, but a severe incident could prove catastrophic. In addition, dam failure most often coincides with flooding, so its impacts can be multiplied, as the additional water has no where to flow.

### **Current Mitigation Measures**

The only mitigation measures currently in place are the state regulations governing the construction, inspection, and maintenance of dams. This is managed through the Office of Dam Safety at the Department of Conservation and Recreation.

**Table 5.6: Existing Dam Failure Hazard Mitigation Measures**

<b>Existing Strategy</b>	<b>Description</b>	<b>Effectiveness</b>	<b>Potential Changes</b>
New Dam Construction Permits	State law requires a permit for the construction of any dam.	Effective. Ensures dams are adequately designed.	
Dam Inspections	DCR has an inspection schedule that is based on the hazard rating of the dam (low, medium, high hazard).	Low. The responsibility for this is now on dam owners, who may not have sufficient funding to comply.	Identify sources of funding for dam safety inspections. Incorporate dam safety into development review process.

### **Future Mitigation Measures**

Recent changes in legislation have shifted some of the responsibility of dam safety onto dam owners. The Town recognizes the need to adjust to this change. Several potential changes to the Town’s current strategies have been identified in the above table, and these, as well as recommendations for other future mitigation strategies, are compiled below:

- Identify sources of funding for dam safety inspections.

## **Drought**

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Although Massachusetts does not face extreme droughts like many other places in the country, it is susceptible to dry spells and drought. And unlike other places, drought can most likely be effectively mitigated in regions like the Pioneer Valley if measures are put into place.

### **Current Mitigation Measures**

Worthington has several water protection regulations in place, as evidenced in the section on flooding. Additional regulations and mitigation options, specific to drought mitigation, are included here.

**Table 5.7: Existing Drought Hazard Mitigation Measures**

<b>Existing Strategy</b>	<b>Description</b>	<b>Effectiveness</b>	<b>Potential Changes</b>
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Zoning By-law	Water Supply Protection District John Sullivan 238-5344	District to protect groundwater resources by regulating certain uses, drainage, and other requirements within recharge area of aquifer.	Very effective for preventing groundwater contamination and increasing infiltration.	
Subdivision Regulations	Preliminary and Definitive Plan	Proposed storm drainage, sewer, water supply, and major site features (including natural features) must be included.	Effective for ensuring adequate water supply and preventing drainage problems.	
	Design Standards	Environmental Analysis – includes impact analysis of recharge and infiltration.	Effective for protecting natural processes like flood mitigation.	
		Site Preservation – significant natural and cultural sites must be noted and preserved when applicable.	Effective for protecting important natural features including waterbodies.	
		Excavation and Grading – regulates how earth removal must be conducted.	Effective for minimizing earth removal and preventing sedimentation.	
Worthington Community Development Plan	Makes several relevant recommendations regarding preventing drought, protecting water supply and quality.	Potentially effective step, if taken.	Implement recommendations.	

### **Future Mitigation Measures**

Potential changes to the Town's current strategies have been identified in the above table, and these, as well as recommendations for other future mitigation strategies, are compiled below:

- Implement recommendations from the Worthington Community Development Plan, dealing protection of water supply and quality.
- Create Water Conservation Guidelines, as education to Town residents.

### **Hazardous Materials**

Hazardous materials are in existence throughout Town, and are constantly being moved on Worthington's roads and highways. However, there is no way to anticipate where and when a hazardous materials spill or explosion could take place. Therefore, it makes is somewhat difficult to determine mitigation strategies, but Worthington has some regulations currently in place to mitigate the impacts of a hazardous materials disaster.

**Table 5.8: Existing Hazardous Materials Hazard Mitigation Measures**

Existing Strategy		Description	Effectiveness	Potential Changes
Zoning By-law	Water Supply Protection District	No hazardous materials permitted within areas delineated as recharge areas for groundwater aquifers.	Very effective for preventing groundwater contamination.	
		All hazardous materials usage or storage must be registered with the Fire Chief.	Effective.	

**Future Mitigation Measures**

None proposed but the Town is committed to keeping tier local policies up to date of state and federal policies and practices.



## 6: PRIORITIZED IMPLEMENTATION SCHEDULE

### Summary of Critical Evaluation

The Worthington Hazard Mitigation Planning Committee reviewed each of the recommendation future mitigation measures identified, and used the following factors to prioritize mitigation projects:

- Ability to reduce loss of life
- Ability to reduce disaster damage
- Social acceptability
- Ability to complete or be combined w/other actions
- Technical feasibility / potential success
- Impact on the environment
- Administrative workability
- Ability to meet regulations
- Political acceptability
- Ability to save or protect historic structures
- Legal implementation
- Ability to meet other community objectives
- Economic impact
- The duration of its implementation period
- Environmental compatibility

### Project Prioritization

The Worthington Hazard Mitigation Planning Committee created the following prioritized schedule for implementation of prioritized items. The table lists items in order of priority.

*Note: As additional information becomes available regarding project leadership, timeline, funding sources, and/or cost estimates, the Plan will be reviewed and amended accordingly.*

**Table 6.1: Prioritized Implementation Schedule – Action Plan**

Priority	Mitigation Action	Responsible Department/Board	Proposed Completion Date	Funding Source/ Estimated Cost	Incorporation into Existing Plans
1	Identify sources of funding for dam safety inspections. Incorporate dam safety into development review process.	Select Board, Emergency Manager, DPW	2010	Green Communities Act (if considering hydropower), DLTA, \$50,000	Master Plan, zoning
2	The town should evaluate whether to become a part of FEMA's Community Rating System.	Select Board, Emergency Manager, DPW	2011	Minimal up front cost	NA
3	Ensure dam owners realize their responsibility to inspect the dams MA0265.	Select Board, Emergency Manager, DPW	2011	Minimal up front cost	OSRP
4	Seek funding from HMGP for top-priority projects, especially culvert replacement and repair on Old North Rd—63 problem culverts identified.	Select Board, Emergency Manager, DPW	2010	HMGP	NA
5	Consider creating more performance-based evaluations, environmental standards in local zoning.	Planning Board, Conservation Commission, Emergency Manager	2012	DLTA (or other state funding for zoning up-dates) \$5,000	Master Plan, zoning
6	Consider restricting location of mobile homes to assure none are in flood-prone areas.	Planning Board, Conservation Commission, Emergency Manager	2012	DLTA (or other state funding for zoning up-dates) \$5,000	Master Plan, zoning
7	Consider participation in the creation of a Regional Debris Management Plan.	Select Board, Emergency Manager, DPW	2010	Minimal up front cost	NA
8	Implement hazard mitigation-related recommendations in Community Development and Open Space and Recreation plans.	Planning Board, Conservation Commission, Emergency Manager	2012	DLTA (or other state funding for zoning up-dates), self-help funds for property	Master Plan, OSRP, zoning

				acquisition / \$5,000	
9	Evaluate older structures categorized as critical facilities to determine if they are earthquake resistant.	Select Board, Emergency Manager, DPW	2013	HMGP, \$50,000	Master Plan, zoning

# 7: PLAN ADOPTION & IMPLEMENTATION

## Plan Adoption

Upon completion, copies of the Draft Local Hazards Mitigation Plan for the Town of Worthington were distributed to the town boards for their review and comment. A public meeting was held by the Worthington Board of Selectmen to present the draft copy of the Worthington Local Natural Hazards Mitigation Plan to town officials and residents and to request comments from this committee and the general public. The Natural Hazards Mitigation Plan was formally approved by the Board of Selectmen and forwarded to the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency (FEMA) for their approval.

## Plan Implementation

The implementation of the Worthington Local Natural Hazards Mitigation Plan will begin following its formal adoption by the Worthington Board of Selectmen and approval by MEMA and FEMA. Specific town departments and boards will be responsible for ensuring the development of policies, bylaw revisions, and programs as described in Sections 5 and 6 of this plan. The Worthington Natural Hazards Planning Committee will oversee the implementation of the plan.

## Plan Monitoring and Evaluation

The measure of success of the Worthington Local Natural Hazards 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.

The Worthington Natural Hazards 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. Those parties noted in Section 6 of the plan, all of whom have a representative on the Worthington Natural Hazards Planning Committee, will be responsible for seeing that the actions are implemented and will report on their progress at the annual plan review meetings. The approved Worthington Hazard Mitigation plan will be available for public review at the Town Hall and the public library and from PVPC. Comments and suggestions will be received by the EMD and integrated into plan updates as appropriate.

Outreach to the public, surrounding communities, agencies, businesses, academia, non-profits, or other interested parties outside of the town of Worthington will be done in advance of each annual meeting in order to solicit their participation in assessment of the plan. 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. At a minimum, the committee will review and update the plan every five years, beginning in the winter of 2013. The meetings of the committee will be organized and facilitated by the Emergency Management Director or the Worthington Board of Selectmen.

DRAFT CERTIFICATE OF ADOPTION

(actual certificate submitted to MEMA and FEMA)

TOWN OF WORTHINGTON, MASSACHUSETTS

BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE WORTHINGTON

NATURAL HAZARD MITIGATION PLAN

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

WHEREAS, several public planning meetings were held between January and May 2007 regarding the development and review of the Worthington Hazard Mitigation Plan; and

WHEREAS, the Worthington Hazard Mitigation Plan contains several potential future projects to mitigate hazard damage in the Town of Worthington, and

WHEREAS, a duly-noticed public hearing was held by the Worthington Board of Selectmen on November 2, 2010 to formally approve and adopt the Worthington Hazard Mitigation Plan.

NOW, THEREFORE BE IT RESOLVED that the Worthington Board of Selectmen adopts the Worthington Hazard Mitigation Plan.

ADOPTED AND SIGNED this November 2, 2010.

, Chair  
Worthington Board of Selectmen

Worthington Board of Selectmen

Worthington Board of Selectmen

ATTEST

# APPENDICES

## Appendix A – Technical Resources

### 1) Agencies

Massachusetts Emergency Management Agency (MEMA).....	508/820-2000
Hazard Mitigation Section .....	617/626-1356
Federal Emergency Management Agency (FEMA) .....	617/223-4175
MA Regional Planning Commissions:	
Berkshire Regional Planning Commission (BRPC).....	413/442-1521
Cape Cod Commission (CCC).....	508/362-3828
Central Massachusetts Regional Planning Commission (CMRPC).....	508/693-3453
Franklin Regional Council of Governments (FRCOG).....	413/774-3167
Martha's Vineyard Commission (MVC).....	508/693-3453
Merrimack Valley Planning Commission (MVPC).....	978/374-0519
Metropolitan Area Planning Council (MAPC).....	617/451-2770
Montachusett Regional Planning Commission (MRPC).....	978/345-7376
Nantucket Planning and Economic Development Commission (NP&EDC).....	508/228-7236
Northern Middlesex Council of Governments (NMCOG).....	978/454-8021
Old Colony Planning Council (OCPC).....	508/583-1833
Pioneer Valley Planning Commission (PVPC).....	413/781-6045
Southeastern Regional Planning and Economic Development District (SRPEDD).....	508/823-1803
MA Board of Building Regulations & Standards (BBRS).....	617/227-1754
MA Coastal Zone Management (CZM).....	617/626-1200
DCR Water Supply Protection.....	617/626-1379
DCR Waterways.....	617/626-1371
DCR Office of Dam Safety.....	508/792-7716
DFW Riverways.....	617/626-1540
MA Dept. of Housing & Community Development.....	617/573-1100
Woods Hole Oceanographic Institute.....	508/457-2180
UMass-Amherst Cooperative Extension.....	413/545-4800
National Fire Protection Association (NFPA).....	617/770-3000
New England Disaster Recovery Information X-Change (NEDRIX – an association of private companies & industries involved in disaster recovery planning).....	781/485-0279
MA Board of Library Commissioners.....	617/725-1860
MA Highway Dept, District 2.....	413/582-0599
MA Division of Marine Fisheries.....	617/626-1520
MA Division of Capital & Asset Management (DCAM).....	617/727-4050
University of Massachusetts/Amherst.....	413/545-0111
Natural Resources Conservation Services (NRCS).....	413/253-4350
MA Historical Commission.....	617/727-8470
U.S. Army Corps of Engineers.....	978/318-8502
Northeast States Emergency Consortium, Inc. (NESEC).....	781/224-9876
National Oceanic and Atmospheric Administration: National Weather Service; Tauton, MA.....	508/824-5116
US Department of the Interior: US Fish and Wildlife Service .....	413/253-8200
US Geological Survey .....	508/490-5000

### 2) Mitigation Funding Resources

404 Hazard Mitigation Grant Program (HMGP) .....	Massachusetts Emergency Management Agency
406 Public Assistance and Hazard Mitigation .....	Massachusetts Emergency Management Agency

Community Development Block Grant (CDBG).....DHCD, also refer to RPC  
 Dam Safety Program.....MA Division of Conservation and Recreation  
 Disaster Preparedness Improvement Grant (DPIG) .....Massachusetts Emergency Management Agency  
 Emergency Generators Program by NESEC† .....Massachusetts Emergency Management Agency  
 Emergency Watershed Protection (EWP) Program.....USDA, Natural Resources Conservation  
 Service Flood Mitigation Assistance Program (FMAP) .....Massachusetts Emergency Management Agency  
 Flood Plain Management Services (FPMS).....US Army Corps of Engineers  
 Mitigation Assistance Planning (MAP).....Massachusetts Emergency Management Agency  
 Mutual Aid for Public Works.....Western Massachusetts Regional Homeland Security Advisory Council  
 National Flood Insurance Program (NFIP) † .....Massachusetts Emergency Management Agency  
 Power of Prevention Grant by NESEC† .....Massachusetts Emergency Management Agency  
 Roadway Repair & Maintenance Program(s).....Massachusetts Highway Department  
 Section 14 Emergency Stream Bank Erosion & Shoreline Protection .....US Army Corps of Engineers  
 Section 103 Beach Erosion.....US Army Corps of Engineers  
 Section 205 Flood Damage Reduction.....US Army Corps of Engineers  
 Section 208 Snagging and Clearing .....US Army Corps of Engineers  
 Shoreline Protection Program.....MA Department of Conservation and Recreation  
 Various Forest and Lands Program(s).....MA Department of Environmental Protection  
 Wetlands Programs .....MA Department of Environmental Protection

†NESEC – Northeast States Emergency Consortium, Inc. is a 501 (c) (3), not-for-profit natural disaster, multi-hazard mitigation and emergency management organization located in Wakefield, Massachusetts. Please, contact NESEC for more information.

† Note regarding National Flood Insurance Program (NFIP) and Community Rating System (CRS): The National Flood Insurance Program has developed suggested floodplain management activities for those communities who wish to more thoroughly manage or reduce the impact of flooding in their jurisdiction. Through use of a rating system (CRS rating), a community’s floodplain management efforts can be evaluated for effectiveness. The rating, which indicates an above average floodplain management effort, is then factored into the premium cost for flood insurance policies sold in the community. The higher the rating achieved in that community, the greater the reduction in flood insurance premium costs for local property owners. MEMA can provide additional information regarding participation in the NFIP-CRS Program.

### 3) Internet Resources

Sponsor	Internet Address	Summary of Contents
Natural Hazards Research Center, U. of Colorado	<a href="http://www.colorado.edu/litbase/hazards/">http://www.colorado.edu/litbase/hazards/</a>	Searchable database of references and links to many disaster-related websites.
Atlantic Hurricane Tracking Data by Year	<a href="http://wxe.eas.purdue.edu/hurricane">http://wxe.eas.purdue.edu/hurricane</a>	Hurricane track maps for each year, 1886 – 1996
National Emergency Management Association	<a href="http://nemaweb.org">http://nemaweb.org</a>	Association of state emergency management directors; list of mitigation projects.
NASA – Goddard Space Flight Center “Disaster Finder:	<a href="http://www.gsfc.nasa.gov/ndrd/disaster/">http://www.gsfc.nasa.gov/ndrd/disaster/</a>	Searchable database of sites that encompass a wide



		range of natural disasters.
NASA Natural Disaster Reference Database	<a href="http://ftpwww.gsfc.nasa.gov/ndrd/main/html">http://ftpwww.gsfc.nasa.gov/ndrd/main/html</a>	Searchable database of worldwide natural disasters.
U.S. State & Local Gateway	<a href="http://www.statelocal.gov/">http://www.statelocal.gov/</a>	General information through the federal-state partnership.
National Weather Service	<a href="http://nws.noaa.gov/">http://nws.noaa.gov/</a>	Central page for National Weather Warnings, updated every 60 seconds.
USGS Real Time Hydrologic Data	<a href="http://h20.usgs.gov/public/realtime.html">http://h20.usgs.gov/public/realtime.html</a>	Provisional hydrological data
Dartmouth Flood Observatory	<a href="http://www.dartmouth.edu/artsci/geog/floods/">http://www.dartmouth.edu/artsci/geog/floods/</a>	Observations of flooding situations.
FEMA, National Flood Insurance Program, Community Status Book	<a href="http://www.fema.gov/fema/csb.html">http://www.fema.gov/fema/csb.html</a>	Searchable site for access of Community Status Books
Florida State University Atlantic Hurricane Site	<a href="http://www.met.fsu.edu/explores/tropical.html">http://www.met.fsu.edu/explores/tropical.html</a>	Tracking and NWS warnings for Atlantic Hurricanes and other links
The Tornado Project Online	<a href="http://www.tornadoject.com/">http://www.tornadoject.com/</a>	Information on tornadoes, including details of recent impacts.
National Severe Storms Laboratory	<a href="http://www.nssl.uoknor.edu/">http://www.nssl.uoknor.edu/</a>	Information about and tracking of severe storms.
Independent Insurance Agents of America IIAA Natural Disaster Risk Map	<a href="http://www.iaa.iix.com/ndcmap.html">http://www.iaa.iix.com/ndcmap.html</a>	A multi-disaster risk map.
Earth Satellite Corporation	<a href="http://www.earthsat.com/">http://www.earthsat.com/</a>	Flood risk maps searchable by state.
USDA Forest Service Web	<a href="http://www.fs.fed.us/land">http://www.fs.fed.us/land</a>	Information on forest fires and land management.

## Appendix B – List of Acronyms

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FEMA	Federal Emergency Management Agency
MEMA	Massachusetts Emergency Management Agency
PVPC	Pioneer Valley Planning Commission
EPA	Environmental Protection Agency
DEP	Massachusetts' Department of Environmental Protection
NWS	National Weather Service
HMGP	Hazard Mitigation Grant Program
FMA	Flood Mitigation Assistance Program
SFHA	Special Flood Hazard Area
CIS	Community Information System
DCR	Massachusetts Department of Conservation and Recreation
FERC	Federal Energy Regulatory Commission
TRI	Toxics Release Inventory
FIRM	Flood Insurance Rate Map
NFIP	National Flood Insurance Program
CRS	Community Rating System
BOS	Board of Selectmen
BOH	Board of Health
LEPC	Local Emergency Planning Committee
EMD	Emergency Management Director
Con Com	Conservation Commission
EOC	Emergency Operations Center
CEM Plan	Comprehensive Emergency Management Plan
WMECO	Western Massachusetts Electric Company
HAZMAT	Hazardous Materials

## Appendix C – Natural Hazard Profiling Methodology<sup>4</sup>

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In order to adeptly profile each of the hazards, a Hazard Identification and Analysis Matrix was prepared to organize the information that was gathered for this project.

The matrix is organized into the following sections: Type of Hazard, Location of Occurrence, Extent of Impacts, Previous Occurrences, Probability of Future Occurrence, and Hazard Index. The Hazard Index was completed to rank the hazards according to the frequency of occurrence and the amount of potential damage likely to occur. The Hazard Index forms the basis for concentrating the future mitigation efforts outlined in this plan. A description of each of the matrix categories is provided below. The completed Matrix is shown as Table 3.1 (Section 3, page 7).

### **Location of Occurrence**

The classifications are based on the area of the Town of Worthington that would potentially be affected by the hazard. The following scale was used:

<b>Table C.1: Location of Occurrence, Percentage of Town Impacted of Given Natural Hazard</b>	
<b>Location of Occurrence</b>	<b>Percentage of Town Impacted</b>
Large	More than 50% of the town affected
Medium	10 to 50% of the town affected
Small	Less than 10% of the town affected

### **Extent of Impacts**

The extent of direct impacts an affected area could potentially suffer were classified according to the following scale:

<b>Table C.2: Extent of Impacts, Magnitude of Multiple Impacts of Given Natural Hazard</b>	
<b>Extent of Impacts</b>	<b>Magnitude of Multiple Impacts</b>
Catastrophic	Multiple deaths and injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of facilities for 30 days or more.
Critical	Multiple injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 week.
Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 day.

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<sup>4</sup> Source: information adapted from Town of Holden Beach, NC Community-Based Hazard Mitigation Plan, July 15, 2003, and Hyde County, NC Multi-Hazard Mitigation Plan, Sept 2002; and the Massachusetts Emergency Management Agency (MEMA).

Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of facilities.
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**Previous Occurrences**

Whether or not previous hazard events had occurred is also included, with detailed descriptions of specific previous occurrences within the hazard identification and vulnerability assessments, if necessary.

**Probability of Future Occurrence**

The likelihood of a future event for each natural hazard was classified according to the following scale:

<b>Table C.3: Frequency of Occurrence and Annual Probability of Given Natural Hazard</b>	
<b>Frequency of Occurrence</b>	<b>Probability of Future Event</b>
Very High	70-100% probability in the next year
High	40-70% probability in the next year
Moderate	10-40% probability in the next year
Low	1-10% probability in the next year
Very Low	Less than 1% probability in the next year

**Hazard Index**

The hazard index ratings were determined after assessing the frequency, location and impact classifications for each hazard. The hazard index ratings are based on a scale of 1 (highest risk) through 5 (lowest risk). The ranking is qualitative and is based, in part, on local knowledge of past experiences with each type of hazard. The size and impacts of a natural hazard can be unpredictable however; many of the mitigation strategies currently in place and many of those proposed for implementation can be applied to the expected natural hazards, regardless of their unpredictability.

The Hazard Ratings are labeled as follows:

- 1 – High Risk
- 2 – Medium-High Risk
- 3 – Medium Risk
- 4 – Medium Low Risk
- 5 – Low Risk

## **Appendix D – Past & Potential Hazards/Critical Facilities Map**

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## **Appendix E – Documentation of the Planning Process**

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**Worthington Hazard Mitigation Planning Committee**  
**Meeting #1 July 21, 2008 7-9 pm**  
**Worthington Fire Department**  
**AGENDA**

**1. Introduction & Purpose of Committee**

**2. What is Hazard Mitigation Planning?**

**3. Hazards Analysis Methodology**

- Identify Past Hazard Occurrences, Location and Damage Assessments
- Hazard Identification and Analysis Worksheet

**4. Analyze Development Trends**

Review local zoning districts. Identify planned and proposed subdivisions and other common developments. Is planned development at risk by natural hazards? Are there mitigation measures that can be taken to prevent loss of life, property damage, and disruption of governmental services and general business activities.

**5. Review Vulnerability Assessment Methodology and Potential Loss Estimates**

**TOWN CLERK: Please Post this notice per M.G. L. Chapter 39, Section 23, A-C**

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**Worthington Hazard Mitigation Planning Committee**  
**Meeting #2, August 18, 2008 7-9 pm**  
**Worthington Fire Department**  
**AGENDA**

**1. Identify Critical Facilities** (to be shown on Base map)

- Identify Critical Facilities on Base Map. The following list contains items that should be clearly identified on the map, as they apply to your community:
  - Emergency Operations Center- Nursing Homes
  - Emergency Fuel Facilities
  - Town/City Hall
  - Police Station
  - Fire Station
  - Public Works Garages
  - Water Treatment Facilities
  - Sewage Treatment Plants
  - Water Tower/Supply Pumps
  - Power Plants
  - Electrical Power Substations
  - Schools
  - Major Highways and Roadways
  - Elderly Housing
  - Day-Care Facilities
  - Correctional Facilities
  - Other Congregate Care Facilities
  - Shelters
  - Special Needs Populations
  - Hazardous Materials Facilities
  - Access Roads to Critical Facilities
  - Evacuation Routes
  - Unique or Historic Resources
  - Commercial Economic Impact Areas
  - Socio-Economic Impact Areas

- Bridges
- Dams

- Areas with Second Language Needs
- Hospitals

**2. Identify Evacuation Routes Potentially Affected By Hazard Areas**

**3. Establish Mitigation Goals and Objectives**

**TOWN CLERK: Please Post this notice per M.G. L. Chapter 39, Section 23, A-C**

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## Appendix F – Public Outreach

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### PRESS RELEASE

CONTACT: Catherine Miller, Pioneer Valley Planning Commission, (413) 781-6045

FOR IMMEDIATE RELEASE  
December 14, 2007

#### **Pre-Disaster Mitigation Plans Under Development**

The Pioneer Valley Planning Commission is beginning the process of drafting pre-disaster mitigation plans for the Communities of Amherst, Belchertown, Brimfield, Chicopee, Cummington, Goshen, Granby, Huntington, Palmer, Southampton, Springfield, Granby, West Springfield, Westhampton, Williamsburg, and **Worthington**.

This planning effort is being undertaken to help communities assess the risks they face from natural hazards, identify action steps that can be taken to prevent damage to property and loss of life, and prioritize funding for mitigation efforts. A mitigation action is any action taken to reduce or eliminate the long-term risk to human life and property from hazards.

Individuals interested in their community's Hazard Mitigation plan can contact PVPC to request information on their community's plan development. In 2006-2007, PVPC facilitated development of plans for 16 communities in Hampshire and Hampden counties. Following completion of this second round of 16 hazard mitigation plans, PVPC will be developing a regional Hazard Mitigation plan. Communities with approved plans will be eligible for Hazard Mitigation Grant Program funding from the Massachusetts Emergency Management Agency.

These pre-disaster mitigation plans are being developed with assistance from the Pioneer Valley Planning Commission with funding provided by the Massachusetts Emergency Management Agency. For additional information, please contact Catherine Miller at (413) 781-6045 or [cmiller@pvpc.org](mailto:cmiller@pvpc.org).

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Catalyst for Regional Progress

**PVPC**

Timothy W. Brennan, Executive Director

## PRESS RELEASE

CONTACT: Catherine Miller, Pioneer Valley Planning Commission, (413) 781-6045

FOR IMMEDIATE RELEASE

February 5, 2009

### **Pre-Disaster Mitigation Plans Public Comment Period**

The Pioneer Valley Planning Commission, in conjunction with local hazard mitigation planning committees, has produced drafts of pre-disaster mitigation plans for the communities of Huntington, **Worthington**, Granby, and Goshen. Residents, business owners, and other concerned parties of these municipalities and adjacent communities are encouraged to comment on these plans, which are currently available for viewing on PVPC's website at [www.pvpc.org](http://www.pvpc.org) (under Projects and Plans) and the websites of the municipalities, where possible. Paper copies of the plans may be obtained at the Pioneer Valley Planning Commission offices at 26 Central Street, West Springfield or at the individual city and town halls. The plans will be available for the next 30 days.

Starting this month pre-disaster mitigation plans will be developed for Amherst, Belchertown, Brimfield, Chicopee, Springfield, West Springfield, and Williamsburg, and will also be available for public comment as they are developed.

This planning effort is being undertaken to help communities assess the risks they face from natural hazards, identify action steps that can be taken to prevent damage to property and loss of life, and prioritize funding for mitigation efforts. A mitigation action is any action taken to reduce or eliminate the long-term risk to human life and property from hazards.

PVPC has previously facilitated development of plans for 21 communities in the Hampshire and Hampden county areas. Following completion of all 32 local hazard mitigation plans, PVPC will be developing a regional hazard mitigation plan. Communities with approved plans are eligible for Hazard Mitigation Grant Program funding from the Massachusetts Emergency Management Agency.

These pre-disaster mitigation plans are being developed with assistance from the Pioneer Valley Planning Commission with funding provided by the Massachusetts Emergency Management Agency. For additional information, please contact PVPC's Catherine Miller at (413) 781-6045 or [cmiller@pvpc.org](mailto:cmiller@pvpc.org).