

State Hazard Mitigation Interagency Committee

Massachusetts has had an active State Hazard Mitigation Interagency Committee (SHMIC) since its creation in 1991, following two Presidential Disaster Declarations, Hurricane Bob in August and the Halloween Storm in October of that year. This committee, which consists of state, federal, and private sector organizations, is responsible for contributing to the development of the State Hazard Mitigation Plan as well as reviewing and endorsing project applications proposed by applicants for grant funding. Mitigation activities in Massachusetts are administered by an executive team called the State Hazard Mitigation Team (SHMT) comprised of staff from Department of Conservation and Recreation and Massachusetts Emergency Management Agency. The SHMT is always seeking expansion of the Interagency Committee to improve the coordination of the mitigation activities in the Commonwealth.

Current active members of the State Mitigation Interagency Committee include representatives from the State Hazard Mitigation Team and representatives from the following government agencies and private organizations:

STATE AGENCIES

Executive Office of Energy and Environmental Affairs
Department of Conservation and Recreation
Department of Environmental Protection
Office of Coastal Zone Management
Department of Fish and Game
Massachusetts Emergency Management Agency
Department of Public Safety
Division of Capital Asset Management
Massachusetts Historical Commission
Board of Building Regulation & Standards
Massachusetts Board of Library Commissioners

FEDERAL AGENCIES

US Geologic Survey
US Army Corp of Engineers, New England District
Federal Emergency Management Agency
National Weather Service
US Coast Guard

OTHER AGENCIES

Massachusetts Association of Regional Planning Agencies
Weston Observatory at Boston College
American Red Cross
Franklin Regional Council of Governments
Salvation Army
Northeast States Emergency Consortium
University of Massachusetts

COMMITTEE RESPONSIBILITIES

- Provide assistance and input in the review and update the State Hazard Mitigation Plan as required by the Disaster Mitigation Act of 2000 and 44 CFR, Subpart M. These activities include:
 - Assist in the development of a State Risk Assessment
 - Review, update, and prioritize recommendations in the State Hazard Mitigation Plan.
 - Develop a comprehensive strategy for the development and implementation of the State's mitigation program.
- Establish internal/agency policies and support the statewide mitigation goals in the State Hazard Mitigation Plan.
- Review recommended project applications for the Unified Hazard Mitigation Assistance Programs.
- Identify additional federal, state and local funding sources for mitigation projects.
- Act as "subject matter experts" for ongoing hazard mitigation projects from initiation to close-out.
- Meet a minimum of once a year during non-disaster years and more frequently if needed

Hazard Mitigation State Agency Survey

Agency Name: _____ Department/Bureau: _____

Describe Primary Responsibility: _____

Point of Contact Name: _____ Title: _____

Phone: _____ Email: _____

Please indicate whether you are completing this survey for your entire agency or your particular Department/Bureau as noted above.

- Agency
- Department/Bureau
- Other _____

-
1. Is your agency/department a current Planning Partner to the State's Hazard Mitigation Plan?
- Yes
 - No
 - Unknown

2. Is your agency/department currently a member of the *State Hazard Mitigation Interagency Committee* participating in the development of the Hazard Mitigation Plan?
- Yes
 - No
 - Unknown

3. If no, are there roadblocks preventing your agency from participating?
- Yes
 - No
- If yes, please describe _____

4. Would your agency/department like to become a member of the *State Hazard Mitigation Interagency Committee*?

- Yes
- No

Other Comments: _____

-
5. What are your agency/department's primary concerns regarding natural hazards?

- Vulnerability of specific facilities
- Response Capabilities
- Likelihood of specific hazard events
- Ability to assist clients/stakeholders
- Loss of Workforce Productivity
- Other _____

6. Does your agency/department own, operate, or manage facilities? [A facility can be defined as a building, infrastructure (road, bridge, pump station), park, engineered beach, etc.]
- Yes
 - No
7. Are the facilities your agency/department owns susceptible to impacts from natural hazards?
- Yes
 - No
8. What actions within your agency/department have been initiated to reduce the general impact from disaster events and to enhance recovery efforts for the Commonwealth?
- Agency Emergency Operations Plan
 - Participation as an Emergency Support Function at State EOC
 - Continuity of Operations Plan
 - Back-up of critical data
 - Education of staff concerning individual safety
 - Activities safety within the work place, e.g., skid mats to reduce sliding of computers during earthquakes; affixing large items to wall, etc.;
 - Other planning initiatives: (list) _____
 - Programmatic policies (list): _____
9. Has your agency/department taken actions to reduce its physical risk to natural hazards? If so, indicate which initiatives below:
- Relocation of a structure or facility
 - Structural retrofit of facilities
 - Educational outreach regarding hazards of concern
 - Incentives to customers/clients which support mitigation
 - Other _____
10. Please select all of the mitigation activities for which your agency/department interacts with MEMA or any other state agency which supports mitigation:
- Education
 - Planning
 - Mapping/GIS (i.e. LiDAR)
 - Historical Disaster Data (i.e. financial or structural losses)
 - Grants
 - Technical advice
 - Training
 - Structural Projects
11. Does your agency/department have any responsibility at the local level (i.e enforcement of any policies/regulatory authority, programs, funding opportunities, etc.).
- Yes
 - No
12. Is your agency/department currently involved in conducting any studies or developing any plans and/or programs which would further support the State's hazard mitigation program? *Studies*

can include hazard specific information, data gathering which supports risk assessments, including economic data, or statistical data of other types.

- Yes
- No

If yes, please briefly describe the type of study, plan and/or program underway, and list the anticipated year of completion:

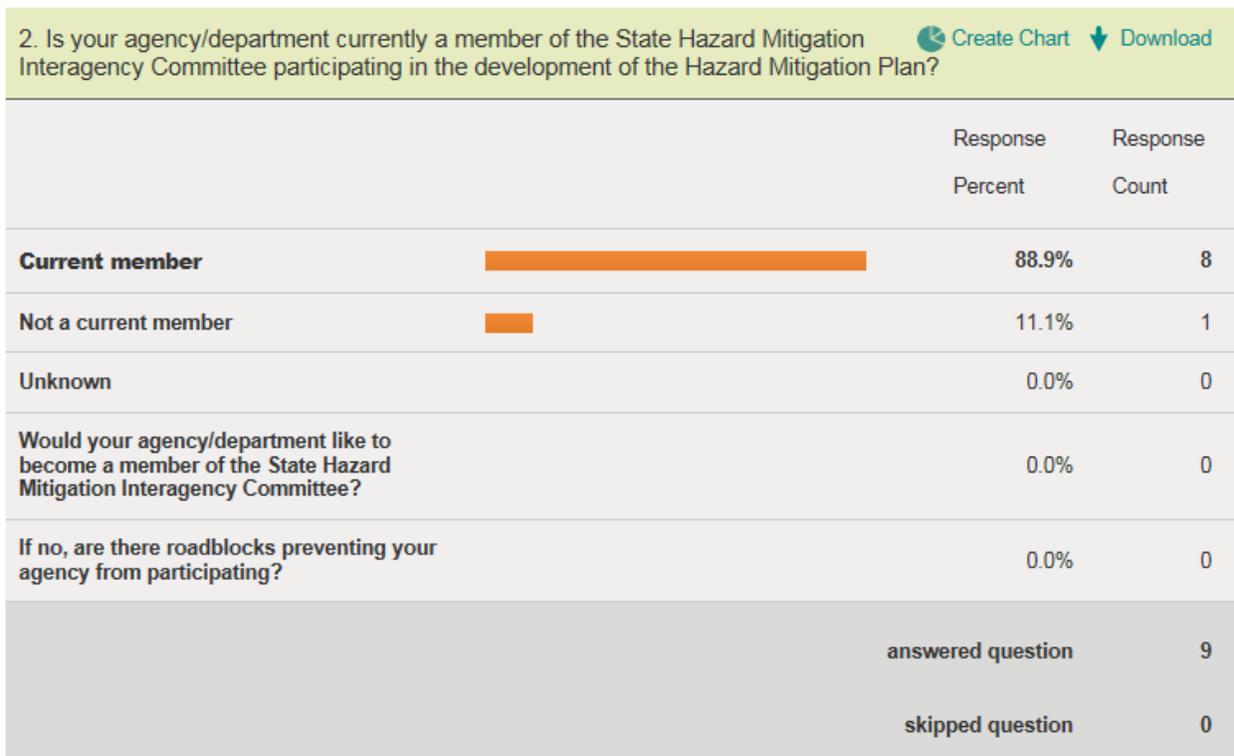
13. Does your agency/department possess any subject matter expertise with respect to the hazards of concern within the Commonwealth?

- Yes
- No

14. Please use this space to provide any additional comments.

Q1: Using the text box below enter your contact information as follows: Agency Name Department/Bureau Your Name/Title Your primary responsibility Email Phone Number Also please indicate whether you are completing this survey for your entire agency or your particular Department/Bureau as noted above.

Department of Public Safety
 MA Office of Coastal Zone Management
 Division of Fisheries and Wildlife
 DCR/ OWR - WRC Staff to MA Water Resource Commission
 Mass. Dept. of Environmental Protection Bureau of Resource Protection/Wetlands Program
 Department of Conservation and Recreation Flood Hazard Management Program
 Division of Fisheries & Wildlife Department of Fish & Game
 Massachusetts Geological Survey
 Massachusetts Board of Library Commissioners



3. What are your agency/department's primary concerns regarding natural hazards?

[Create Chart](#) [Download](#)

		Response Percent	Response Count
Vulnerability of specific facilities		33.3%	3
Response Capabilities		11.1%	1
Likelihood of specific hazard events		44.4%	4
Ability to assist clients/stakeholders		44.4%	4
Loss of Workforce Productivity		11.1%	1
Other (please specify) Show Responses		55.6%	5
		answered question	9
		skipped question	0

Other responses:

- Amount of development in high hazard areas.
- Want to create an atmosphere of cooperation where our regulatory responsibility for the natural resources of the Commonwealth interacts with the need to make repairs to infrastructure after natural disasters. We are in a position to help municipalities plan for mutually beneficial outcomes for fish and wildlife resources and built infrastructure.
- Public safety floods, droughts, geologic seismic events
- Meeting regulatory requirements to repair damage to structures caused by natural hazards (primarily flood damage)
- Hazard identification

4. Does your agency/department own, operate, or manage facilities? [A facility can be defined as a building, infrastructure (road, bridge, pump station), park, engineered beach, etc.] [Create Chart](#) [Download](#)

		Response Percent	Response Count
Yes		33.3%	3
No		66.7%	6
If yes, Are the facilities your agency/department owns susceptible to impacts from natural hazards?(please specify) Show Responses			3
answered question			9
skipped question			0

Question 4 - If yes responses:

- MassDEP owns only one facility, the Wall Experiment Station in Lawrence. A portion of the parking lot for this facility is located in the floodplain of the Merrimack River in Lawrence, within a FEMA Zone AE. Other facilities utilized by MassDEP are leased. The leased facilities are not located within areas identified as having natural hazards.
- My agency (DCR) does, and some are clearly susceptible to hazards. I am answering this and subsequent questions for the FHMP rather than for DCR as a whole. FHMP has no facilities.
- Yes, some more than others. Facilities such as our Sandwich Fish Hatchery are more susceptible to environmental impacts and natural hazards being on the coast. .

5. What actions within your agency/department have been initiated to reduce the general impact from disaster events and to enhance recovery efforts for the Commonwealth? [Create Chart](#) [Download](#)

		Response Percent	Response Count
Agency Emergency Operations Plan		50.0%	4
Participation as an Emergency Support Function at State EOC		62.5%	5
Continuity of Operations Plan		50.0%	4
Back-up of critical data		25.0%	2
Education of staff concerning individual safety		50.0%	4
Activities safety within the work place, e.g., skid mats to reduce sliding of computers during earthquakes; affixing large items to wall, etc.;		0.0%	0
Other (please specify) Show Responses		37.5%	3
		answered question	8
		skipped question	1

Question 5 – Other: the results above shows 3 “other” responses but 1 was left blank...)

- Adoption of emergency regulations to provide for speedy debris cleanup located in wetland resource areas and repair of structures damaged during flooding, provided the structural damage is less than 50% of the structure monetary value. Provision of SRF funds for public wastewater and drinking water facilities located in floodprone areas to reduce possibility of flooding impacting operations.
- We will soon be part of a University of Massachusetts Amherst Hazard Mitigation Plan

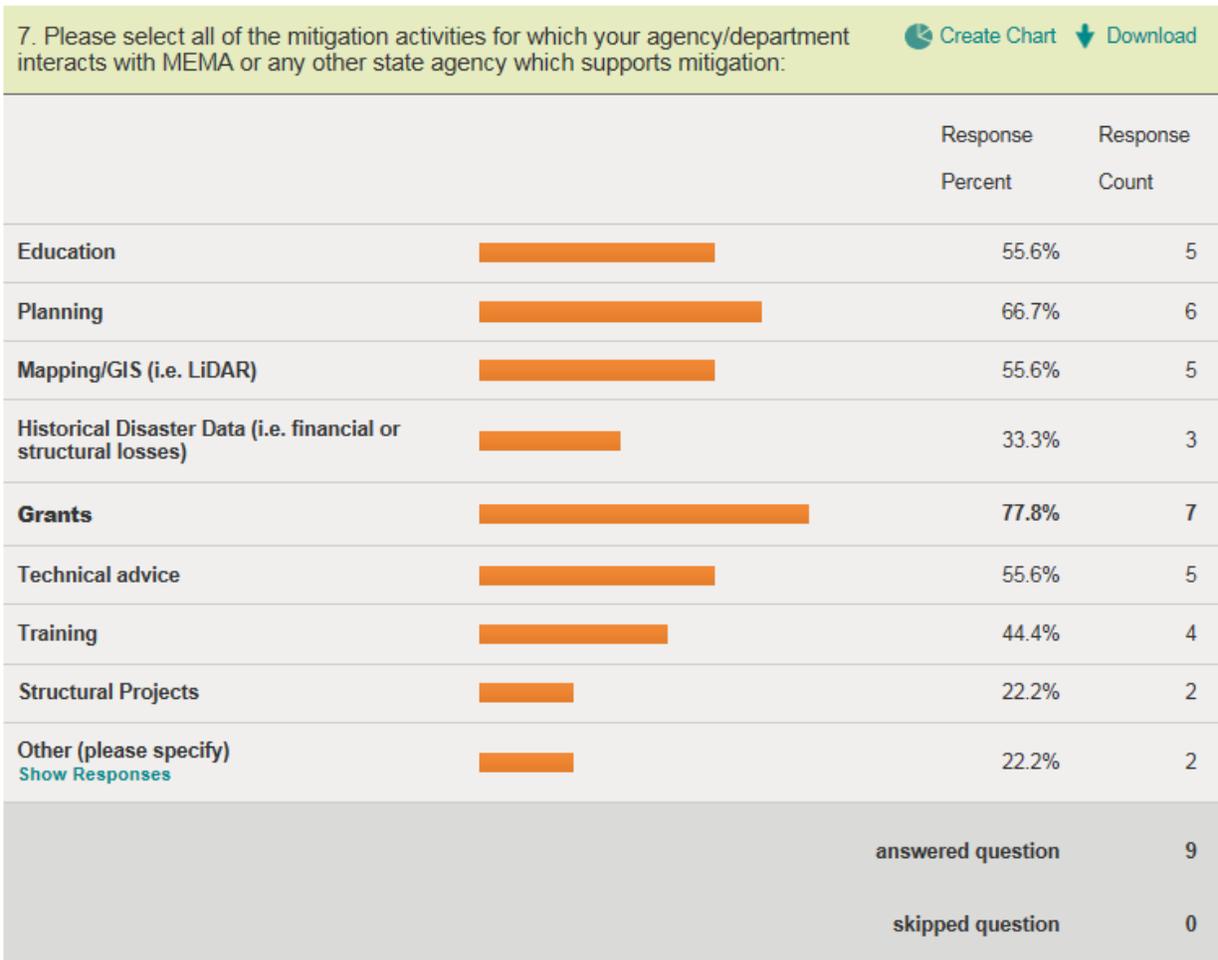
6. Has your agency/department taken actions to reduce its physical risk to natural hazards? If so, indicate which initiatives below:

[Create Chart](#) [Download](#)

		Response Percent	Response Count
Location of a structure or facility		14.3%	1
Structural retrofit of facilities		14.3%	1
Educational outreach regarding hazards of concern		42.9%	3
Incentives to customers/clients which support mitigation		14.3%	1
Other (please specify) Show Responses		42.9%	3
		answered question	7
		skipped question	2

Question 6 – Other: (the results above shows 3 “other” responses but 2 were left blank...)

- Umass Amherst Hazard Mitigation Plan

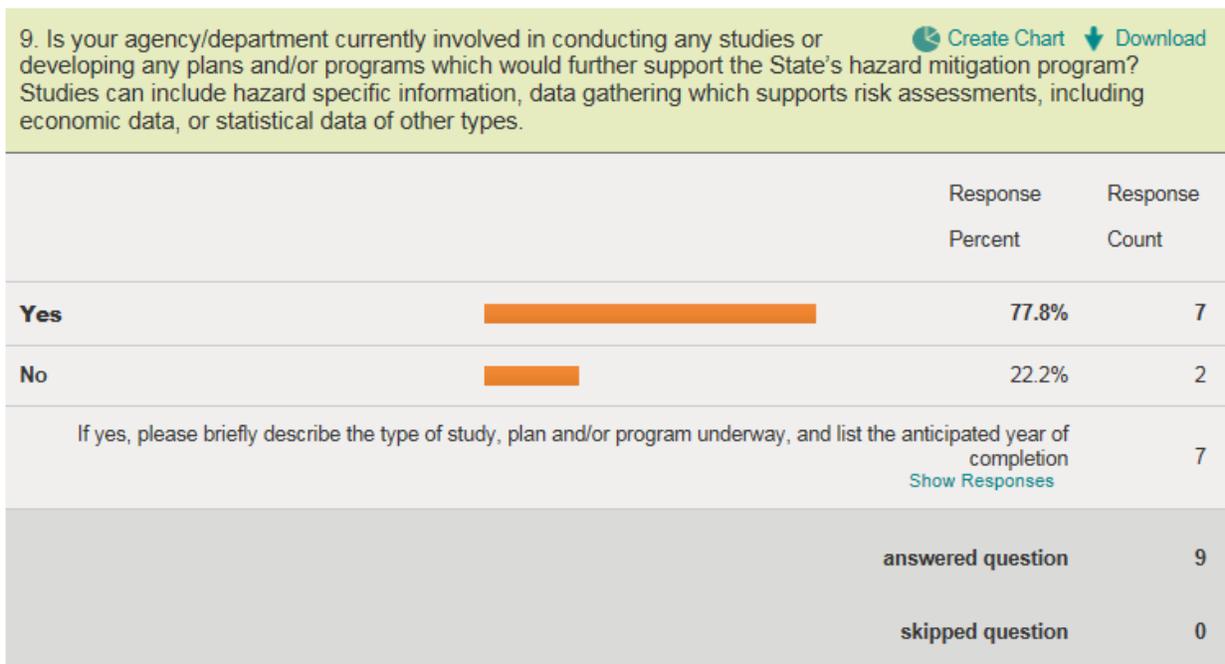


Question 7 – Other: the results above shows 2 “other” responses but both were left blank...



Question 8 – If yes responses:

- Assist municipal building inspectors with post-event damages assessments.
- CZM's Program Policies are implemented through other State Regulations, some of which are implemented first at the local level (e.g Wetlands Protection Act Regulations).
- The Massachusetts Wetlands Protection Act is jointly enforced by the MassDEP and local municipal boards known as Conservation Commissions. This Act requires submission of an application for work conducted in floodplains. The Wetland regulations require compensatory flood storage for work within inland floodplains.
- Hazard mitigation grants Also floodplain technical assistance to communities
- Our Natural Heritage & Endangered Species Program reviews and oversees the protection of critical habitat for rare and endangered species. Their responsibilities include the review of construction permitting with the local Conservation Commissions to protect and buffer critical habitat in areas of new development.
- We provide funding through state line items as well as through LSTA grant opportunities. In addition we run the Public Library Construction Program through whose regulations building modifications can be enforced.



Question 9 – If yes responses:

- Update to the Massachusetts Shoreline Change 1) Project, which adds several new shorelines and updates the shoreline change rates. See: http://www.mass.gov/czm/hazards/shoreline_change/shorelinechangeproject.htm 2) We are completing an inventory of all privately owned shore protection structures. This, combined with the inventory of state owned structures can be used to help inform hazard mitigation discussions. 3) Developing a series of fact sheets for coastal property owners on options for reducing erosion and storm damage on coastal properties. 4) CZM is developing a StormSmart Properties website. This will be part of StormSmart Coasts, with

information targeting coastal property owners. The fact sheet series mentioned above will be part of this. 5) Buzzards Bay Project is developing reports with maps for each community in their area entitled: Projected Expansion of the Floodplain with Sea Level Rise. 6) CZM is working with NOAA to create a sea level inundation viewer for Massachusetts.

- Climate Change Vulnerability Assessments of key Wildlife Habitats at the State and Regional Level as well as Climate Change Adaptation Planning.
- Updated MA Drought Management Plan scheduled to be voted for approval at April 11, 2013 Water Resources Commission Meeting
- Pilot project is being planned to look at culvert sizing.
- State hazard mitigation plan update; helping with hazard profiles.
- Landslide susceptibility Fluvial erosion hazard mapping Shear wave analysis for estimating ground motion in HAZUS
- The MBLC is currently the fiscal agent for COSTEP MA's HMGP grant to address risk assessment and mitigation planning as well as community building between the cultural resource and emergency management communities.
-



Question 10 – additional responses:

- Yes. All Department building inspectors have been educated in the use of Applied Technology Council's (ATC) programs to assess building damage due to either natural or man-made disasters.
- We have two staff with extensive backgrounds in coastal hazards.
- Yes Impacts to fish and wildlife resources from projected changes to climate
- Conducting damage assessments to structures and resources after flooding in cooperation with the Massachusetts Office of Coastal Zone Management. Characterizing annual exceedence probabilities of extreme flooding events.
- Flooding and floodplain management
- Natural hazards (erosion, mass wasting, rockfall, landslides). For seismic risk refer to Weston Observatory
- This deals specifically with library, archives, and museum collections and the buildings that house them.

Local Jurisdiction Data Capture

Jurisdiction: _____

Point of Contact Name and Title: _____

Phone: _____

Email: _____

- 1. Planning and Regulatory Capability:** Please indicate whether the following planning or regulatory tools and programs are currently in place or under development for your jurisdiction by placing an "X" in the appropriate box, followed by the date of adoption/update. Then, for each particular item in place, identify the department or agency responsible for its implementation and indicate its estimated or anticipated effect on hazard loss reduction (Supports, Neutral or Hinders) with the appropriate symbol and also indicate if there has been a change in the ability of the tool/program to result in loss reduction. Finally, please provide additional comments or explanations in the space provided.

Tool / Program	Status			Dept./Agency Responsible	Effect on Loss Reduction: + Support O Neutral - Hinder	Change Since Last Plan: + Positive - Negative	Comments
	In Place	Date Adopted or Updated	Under Development				
<i>EXAMPLE: Hazard Mitigation Plan</i>	X	1/1/2010		Hazard County EMA	+	+	Interim update in 2008 revised mitigation strategy; completed one action.
Hazard Mitigation Plan							
Emergency Operations Plan							
Disaster Recovery Plan							
Evacuation Plan							
Continuity of Operations Plan							
Shelter Plan							
Access and Functional Needs Plan							
NFIP Participant							
NFIP – Community Rating System							
Floodplain Regulations (spec. NFIP)							



Tool / Program	Status			Dept./Agency Responsible	Effect on Loss Reduction: + Support O Neutral - Hinder	Change Since Last Plan: + Positive - Negative	Comments
	In Place	Date Adopted or Updated	Under Development				
Flood Damage Prevention Ordinance)							
Floodplain Management Plan							
Zoning Regulations							
Subdivision Regulations							
Comprehensive Land Use Plan (or General, Master or Growth Mgt.)							
Open Space Management Plan (or Parks/Rec or Greenways Plan)							
Stormwater Management Plan / Ordinance							
Natural Resource Protection Plan							
Capital Improvement Plan							
Economic Development Plan							
Historic Preservation Plan							
Farmland Preservation							
Building Code							
Fire Code							
Firewise							
Storm Ready							
Other							

2. Administrative and Technical Capability: Please indicate whether your jurisdiction maintains the following staff members within its current personnel resources by placing an “X” in the appropriate box. Then, if YES, please identify the department or agency they work under and provide any other comments you may have in the space provided or with attachments.

Staff/Personnel Resources	Yes	No	Department/Agency	Comments
Planners (with land use / land development knowledge)				
Planners or engineers (with natural and/or human caused hazards knowledge)				
Engineers or professionals trained in building and/or infrastructure construction practices (includes building inspectors)				
Emergency Manager				
NFIP Floodplain Administrator				
Land Surveyors				
Scientists or staff familiar with the hazards of the community				
Personnel skilled in Geographic Information Systems (GIS) and/or FEMA’s HAZUS program				
Grant writers or fiscal staff to handle large/complex grants				
Staff with expertise or training in Benefit-Cost Analysis				
Other				

3. Fiscal Capability: Please indicate whether your jurisdiction has access to or is eligible to use the following local financial resources *for hazard mitigation purposes* (including as match funds for State or Federal mitigation grant funds). Then, identify the primary department or agency responsible for its administration or allocation and provide any other comments you may have in the space provided or with attachments.

Financial Resources	Yes	No	Department/Agency	Comments
Capital Improvement Programming				
Community Development Block Grants (CDBG)				
Special Purpose Taxes				
Gas / Electric Utility Fees				
Water / Sewer Fees				
Stormwater Utility Fees				
Development Impact Fees				
Permitting Fees				
General Obligation, Revenue, and/or Special Tax Bonds				
Partnering Arrangements or Intergovernmental Agreements				
Other				

4. Self-Assessment of Capability: Please provide an approximate measure of your jurisdiction's capability to effectively implement hazard mitigation strategies to reduce hazard vulnerabilities. Using the following table, please place an "X" in the box marking the most appropriate degree of capability (Limited, Moderate or High) based upon best available information and the responses provided in Sections 1-3 of this survey. For purposes of this self-assessment, **Limited** means there are some capabilities in place, but not at a robust level. **Moderate** means there are multiple plans/programs in place which are enforced and assist in reducing hazard impacts. A **high** rating would indicate that there are several mechanisms in place – policies, codes, regulations, permitting requirements, and enforcement capabilities.

Area	Degree of Capability		
	Limited	Moderate	High
Planning and Regulatory Capability			
Administrative and Technical Capability			
Fiscal Capability			
Community Political Capability			
Community Resiliency Capability			

5. Have you participated in the development of your local Hazard Mitigation Plan? Yes No

6. Plan Development Resources: Please indicate what resources you utilized during plan development.

Plan Development Resources Utilized		
<input type="checkbox"/> Own agency planning personnel	<input type="checkbox"/> Contracted	<input type="checkbox"/> GIS Support – Agency/Local
<input type="checkbox"/> Local Planning Councils	<input type="checkbox"/> Regional Planning Councils	<input type="checkbox"/> HAZUS-MH Software
<input type="checkbox"/> MEMA Technical Planning Staff	<input type="checkbox"/> Grant Funding	<input type="checkbox"/> Other _____

7. If you did not use MEMA Technical Planning Staff, was there a particular reason why you did not? _____

8. What type of resources could you have used during your agency’s plan development, or would be beneficial for future efforts?

Resource Needs		
<input type="checkbox"/> Technical/Planning Support	<input type="checkbox"/> Risk Assessment Support	<input type="checkbox"/> GIS Support
<input type="checkbox"/> Funding Support	<input type="checkbox"/> Completion of Grant Application	<input type="checkbox"/> HAZUS-MH Software

9. What type of or risk assessment does your jurisdiction’s plan include?

Type of Risk Assessment		
<input type="checkbox"/> Qualitative (High/Medium/Low)	<input type="checkbox"/> Quantitative (Dollar Loss Estimations)	<input type="checkbox"/> Other

10. Did you utilize MEMA resources to assist in the development of your risk assessment? If so, did you feel the assistance was beneficial?

MEMA Resources Used		
<input type="checkbox"/> Yes, our jurisdiction used MEMA Resources to complete the Risk Assessment Portion of the Plan	<input type="checkbox"/> No, we did not utilize MEMA resources to complete the Risk Assessment portion of our plan	
If yes, were the resources beneficial?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
If no, please provide us feedback as to why the assistance was not beneficial, and what could be done to improve our services.		

11. Hazards of Concern: Please indicate by placing an “X” in the appropriate column below those hazards which are addressed in your current Hazard Mitigation Plan, indicating if they are of High, Medium or Low concern to your jurisdiction based on your risk assessment.

H	M	L	Natural Hazards	H	M	L	Technological Hazards	H	M	L	Human Caused
			Coastal Erosion				Blackout				Chemical
			Dam Failure				Bridge Failures/Accidents				Biological
			Drought				Commodity Shortage				Explosive
			Earthquake				Invasive Species				Nuclear
			Fire – Major Urban				Public Health				Radiological
			Fire - Wildland				Transportation				Terrorism
			Flood/Ice Jam				Other: List				Other: List
			Hurricane and Tropical Storm								
			Landslide								
			Nor'Easter								
			Sea-Level Rise								
			Severe Weather (Extreme Temperatures –Heat/Cold, Drought, Thunderstorms, Wind)								
			Severe Winter Storm (Snow, Blizzard, Ice Storm, Freezing Rain)								
			Snow/Blizzard								

		Thunderstorm/Hail							
		Tornado/Wind							
		Tsunami							
		Other: List							

Special Needs Assessment

12. Does your jurisdiction’s current plan capture data with respect to individuals with access and functional needs? Yes No

13. If the answer to the preceding question was yes, what type of data has been captured?

Special Needs Data Captured		
<input type="checkbox"/> Number	<input type="checkbox"/> Type of Need	<input type="checkbox"/> Shelter Location to be utilized?
Local of special needs individuals mapped?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Does your jurisdiction have written plans in place to assist individuals with access or functional needs?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Strategy Implementation

14. Strategy Implementation: Has your jurisdiction completed any of the mitigation strategies outlined within their plan during the previous three years?

- Yes No

If so, how many? 1-5 _____ 6-8 _____ 9-10 _____ More than 10 _____

Were these strategies: Projects _____ Policies _____ Programs _____ Public Education/Outreach _____

APPENDIX F. LOCAL PLAN SYNOPSES

INTRODUCTION

Data Capture

Data contained within this appendix may include information from expired plans. In some instances, if a planning region submitted an updated plan to state/FEMA for review, that plan information was utilized in an effort to use best available data. It is understood that this information may be modified based on FEMA and State comments stemming from the review; however, the information concerning regional geographic makeup and census data should not be impacted by these reviews. Likewise, the hazards of concern as determined by the planning region should also not be impacted. The plan from which the information has been assimilated is noted accordingly.

Breakdown of Regional Profile

Each regional profile is divided into two sections. The first provides a brief description of the region as extracted from the most current local hazard mitigation plan in place at the time of the 2013 update, as well as more up-to-date data gathered for development of the State's plan (such as for population data).

The second section provides a synopsis of the hazards of concern throughout the planning regions, with a focus on the specific hazard of greatest concern as identified by the regional planning commission in conjunction with the planning partnership. The hazard matrix, when available, is included for review. Information also includes relevant risk data.

BERKSHIRE REGIONAL PLANNING COMMISSION

Contents for the Berkshire Regional Planning Commission is based on the February 8, 2012 plan currently approved pending adoption. Nineteen of the 32 Berkshire County communities participated in this plan.

This region consists of 30 towns and 2 cities and has a total population of 130,458, which is a decrease of 3.3% since 2000. Only 7% of the county is developed mostly due to its topography. Additional information on the land use distribution is provided in Figure 1 below. The population density is 141 persons per square mile. Growth is defined as being on a declining trend overall due to major industry and jobs relocating out of the county. Pittsfield is the largest community in the county.

Source: (MassGIS 2010)

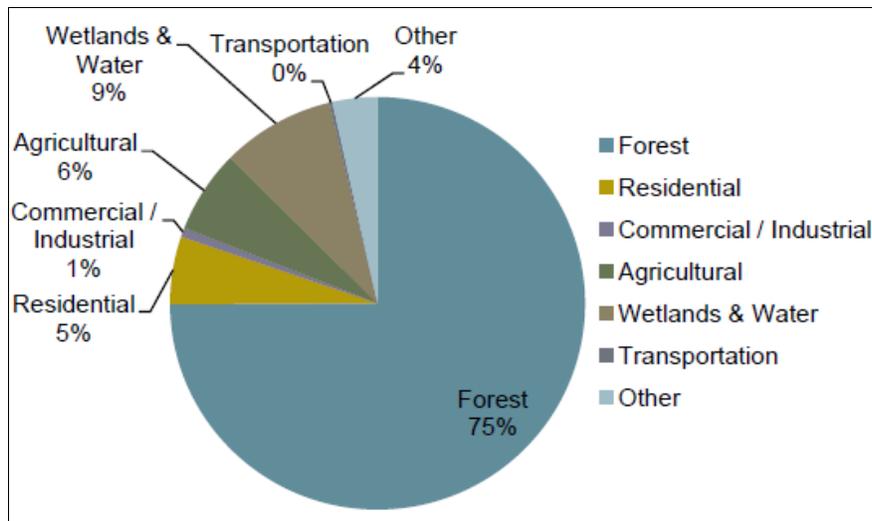


Figure 1. Land Use Distribution

Link to Hazard Mitigation Plan: Majority Plans Expired 2011; Under MEMA review 2012; Only Lanesborough is active until 10/31/13

- Adams
- Alford
- Becket
- Cheshire
- Clarksburg
- Dalton Egremont
- Florida
- Great Barrington
- Hancock
- Hinsdale
- Lanesborough
- Lenox
- Monterey
- Mount Washington
- New Ashford
- New Marlborough
- North Adams
- Otis
- Peru
- Pittsfield
- Richmond
- Sandisfield
- Savoy
- Sheffield
- Stockbridge
- Tyringham
- Washington
- West Stockbridge
- Williamstown
- Windsor

The Berkshires is a hilly region in the western part of Massachusetts, stretching north to the Vermont border and south to Connecticut. Berkshire County is 945 square miles, of which 30% is protected from development. This area is home to world-class arts and cultural venues and year-round recreational activities. There are also commercial centers in the Berkshires and home of corporate headquarters for SABIC Innovative Plastics (formerly GE Plastics), KB Toys, Crane & Company, General Dynamics Advanced Information Systems, and Berkshire Life Insurance Company of America.

Risk Assessments within the regional plan utilized Hazus, and according to the planning commission’s loss estimates, the total value of buildings and their contents at risk from flooding in the region is approximately \$2.4 billion (Berkshire, 2012, p. 178).

While flood is one of the top hazards for the Commonwealth, this planning region has sustained on the low-end of Federal disaster declarations as they relate to floods with six (6) incidents. According to the 2012 plan, approximately 7.43% of the region is in a floodplain, which demonstrates a relatively low amount.

Combined hazard rankings for the region shown in Table 1.

**TABLE 1.
COMBINED HAZARD RANKINGS FOR BERKSHIRE REGIONAL PLANNING COMMISSION**

Natural Hazard:	Area of Impact	Frequency	Severity	Hazard Ranking
Flooding	Local	High	Extensive	8
Winter Storm (Nor'easter, Snow, Blizzard, Ice Storm)	Regional	High	Serious	8
Severe Storms (thunderstorm, wind, hail, lightning)	Regional	High	Serious	8
Dam Failure	Local	Low	Catastrophic	7
Tornado	Local	Medium	Extensive	7
Hurricane & Tropical Storms	Regional	Medium	Serious	7
Extreme Temperatures	Regional	Medium	Minor	6
Drought	Regional	Medium	Minor	6
Wildfire	Local	High	Minor	6
Beaver Dams	Local	Low	Serious	5
Landslides	Isolated	Medium	Minor	4
Earthquake	Local	Low	Minor	4
Ice Jam	Isolated	Medium	Minor	4

CAPE COD COMMISSION

This region consists of 15 towns, has a total population of 215,769, which is a decrease of 2.9% population since 2000. The region has a density of approximately 548 persons per square mile. There is a large summer population on the Cape with estimates reaching over 500,000. Considering only current zoning and land use regulations, the region could reach its maximum build out by 2040. One unique feature of this region is that it is only accessible through the two four-lane bridges at the Cape Cod Canal.

The 2010 Cape Cod Hazard Mitigation Plan (HMP) includes five of the County's jurisdictions, including two new jurisdictions, Dennis and Truro. The plan identifies hurricanes having the 'potential to cause the most property damage and loss of life if adequate planning and preparation is not undertaken' (Cape, 2010, p. 16). The regional plan identifies various types of critical facilities (34 total) within various hazard zones, including airports, ferry terminals, bus and rail stations, group day care facilities, senior/youth recreation facilities, marinas, police, fire, hospitals and government facilities. No dollar loss estimations are provided. The Region identified those hazards illustrated in Table 2.

The Region has been successful in obtaining mitigation funds for various types of mitigation efforts during the time period from 1991-2009, as illustrated in Table 3.

Utilizing the STAPLEE (social, technical, administrative, political, legal, environmental and economic) method for strategy development, the Region identified and prioritized the following mitigation activities within the 2010 plan:

- High = 15 actions
- Medium = 6 actions
- Low = 2 actions

Link to Hazard Mitigation Plan:

http://www.capecodcommission.org/resources/coastalresources/Final_RegMHM_031910.pdf; Approved 6/3/11

*Barnstable
Bourne
Brewster
Chatham
Dennis
Eastham
Falmouth
Harwich
Mashpee
Orleans
Provincetown
Sandwich
Truro
Wellfleet
Yarmouth*

**TABLE 2.
COMBINED HAZARD RANKINGS FOR CAPE COD COMMISSION**

Natural Hazard:	Location [†] Rate: 1=small 2=medium 3=large	Frequency of Occurrence ^{††} Rate: 0=unlikely 1=possible 2=likely 3=highly likely	Magnitude / Severity ^{†††} Rate: 1=limited 2=significant 3=critical 4=catastrophic	Hazard Ranking
Flood	2	3	4	9
Shoreline change (long term, sea level rise, or storm-induced)	2	3	4	9
Heavy downpours	3	2	2	7
Wildfire	2	2	4	8
Snow and Ice Accumulation	3	3	2	8
Wind	3	3	2	8
Tornado	1	2	3	6
Drought	3	1	1	5
Earthquake	2	1	2	5
<p>[†] Location 1=small (isolated to a specific town during one event) 2=medium (occurring in multiple towns across county during one event) 3=large (affecting a significant portion of Barnstable County during one event)</p> <p>^{††} Frequency of Occurrence 0=unlikely (less than 1% probability in the next 100 years) 1=possible (between 1 and 10% probability in the next year; or at least one chance in next 100 years) 2=likely (between 10 and 100% probability in the next year; or at least one chance in next 10 years) 3=highly likely (near 100% probability in the next year)</p> <p>^{†††} Magnitude/Severity 1=limited (injuries and/or illnesses are treatable with first aid; minor "quality of life" loss; shutdown of critical facilities and services for 24 hours or less; property severely damaged < 10%) 2=significant (injuries and/or illnesses do not result in permanent disability; shutdown of several critical facilities for more than one week; property severely damaged <25% and >10%) 3=critical (injuries and/or illnesses result in permanent disability; complete shutdown of critical facilities for at least two weeks; property severely damaged <50%, >25%) 4=catastrophic (multiple deaths; complete shutdown of facilities for 30 days or more; property severely damaged >50%)</p>				

**TABLE 3.
MITIGATION FUNDING FOR CAPE COD COMMISSION**

Town	Grant (year granted)	Project Title	Scope of Work	Total Project Cost (\$)	Federal Funding Amount (\$)	Local Funding Amount (\$)
Brewster	HMGP 1224-08 (1998)	Breakwater Beach Drainage Improvements	Extension of corrugated metal drainage pipe towards Cape Cod Bay, restoration of sand over pipe, emplacement of pre-cast concrete.	7,200	5,400	1,800
Cape Cod Commission	PDM 02-02 (2002)	Regional Natural Hazard Plan	Community outreach and training; regional/local risk assessment and GIS mapping; development of regional/local mitigation strategy.	53,333	40,000	13,333
Chatham	HMGP 914-07 (1991)	Retrofitting – Home Protection	Retrofitting homes to protect against flood damage.	279,840	200,000	66,660
Falmouth	HMGP 914-06 (1991)	Acquisition and Demolition	Purchase of three beachfront lots and clearing of properties to restore locations to open space.	31,013	21,925	7,307
Falmouth	FEMA Section 1362 (ended)	Acquisition and Demolition	Purchase of 1.1 acres for 360 feet of beachfront property now protected as open space	400,000	300,000	100,000
Northeast States Emergency Consortium	HMGP 1364-14	Remote Wind Sensing for Hurricane Safety	Installation of remote ultrasonic wind sensor on top of the Buzzards Bay Vertical Lift Railroad Bridge over Cape Cod Canal in Bourne, MA.	9,950	7,463	2,487
Orleans	HMGP 920-05 (1992)	Retrofitting – Home Protection	Retrofitting homes to protect against flood damage.	20,780	14,691	4,896
Sandwich	FMA 00-02 (2000)	Flood Mitigation Plan	Develop a comprehensive flood mitigation plan for the town.	10,160	6,111	2,560
Yarmouth	HMGP 914-08 (1991)	Sea Gull Beach dune restoration	Design, permitting, and construction of a primary dune.	6,291	4,448	1,482

Town of Barnstable

During review of the various local plans, the 2010 Town of Barnstable HMP was selected for inclusion independent of the regional plans due to the fact that the Town's population during daytime hours increases significantly when compared to its year-round population. Additionally, there are a significant number of Native American archaeological sites within its boundaries. The Town of Barnstable is located in Barnstable County in Cape Cod, Massachusetts. The total land area of the Town is approximately 40,000 acres. Barnstable is one of the most urbanized towns on the Cape and is a regional center of administrative and commercial activity; Hyannis Village functions as a regional commercial center and Barnstable Village is the Barnstable County seat. Originally founded in 1639, the Town contains numerous historic resources; there are more than 40 known Native American archaeological sites, 14 national historic districts, two local historic districts, and an additional 74 individually designated sites. The town's coastal location, wetland habitats, and forested open spaces collectively create a high susceptibility to natural hazards.

General background from HMP:

- Year-Round Population 47,380
- Seasonal Population 78,333
- Peak Daytime Population 126,000
- Acres of Developed Land 17,764
- Acres of Conservation Land 7,198
- Miles of Coastline 170
- Acres of Open Water 1,868
- Acres of Forested Woodland 12,348
- Acres of Salt Marsh 3,817
- Acres of Fresh Marsh 264
- Acres of Cranberry Bogs 242
- Acres of Shrub Swamp 468
- Acres of Barrier Beach/Dunes 932
- Tidally Restricted Wetland Sites 17
- Acres in Hurricane Surge Zones 7,475
- Acres in Flood Zones 8,000
- Hazardous Waste Sites 30, plus 40 monitored sites
- Critical Facilities 105
- Regional Critical Facilities 11
- Repetitive Loss Properties 18

Loss estimation data is available for assessed building values within the flood zone. The Town has adequately identified an enhanced element of critical facilities, including nursing homes and churches, etc. The mitigation strategies are “designed to holistically address the threat of natural disasters through prevention, regulation, property and natural resource protection, structural improvements and increased public awareness” (Barnstable, 2010). The capabilities of the town include land use regulations enhancing mitigation efforts, including zoning ordinances, building construction ordinances, a general ordinance (Chapter 237) for wetlands protection; the 2010 Open Space and Recreation Plan, and a subset of the Town’s Comprehensive Plan, which presents land preservation strategies for flood mitigation. Capabilities also include emergency response planning. Strategies include initiatives such as reclassification of two town-owned dams; erosion control in barrier beaches and coastal banks to protect wildlife habitat from storm surge; wildfire hazard reduction efforts; and development regulations applicable to land, structures and wastewater systems in hazard-prone areas to ensure structures are designed to withstand potential events and to prevent the disturbance of natural areas. Of significant value is a strategy to incorporate hazard mitigation goals into the “Town’s land acquisition strategy, considering both direct acquisition and acquisition of development rights.” The strategy focuses “on acquiring parcels with high development pressure in hazard-prone areas and reducing the number of repetitive loss properties” (Barnstable, 2010). The plan identifies 18 repetitive loss properties. The hazards identified by the Town of Barnstable identify flood as its number one hazard (see Table 4). This ranking is consistent with the overall Cape Cod Regional Plan.

**TABLE 4.
TOWN OF BARNSTABLE HAZARD IDENTIFICATION MATRIX**

Hazard Identification Matrix				
Natural Hazard	Frequency (0-3)	Location (1-3)	Extent (1-4)	Hazard Ranking
Flood	3	3	4	10
Hurricane	2	3	4	9
Wind	3	3	3	9
Snow & Ice Accumulation (winter storm or nor'easter)	3	3	2	8
Shoreline Change/Coastal Erosion (long-term or episodic)	3	2	3	8
Drought/Wildfire	1	3	3	7
Tornado	1	2	3	6
Sea Level Rise	1	2	2	5
Earthquake	1	2	2	5
Dam Failure	1	1	2	4

Rating System

Frequency of Occurrence

- 0= Unlikely less than 1% probability in the next 100 years
- 1= Possible between 1-10% probability in the next year; or at least 1 chance in next 100 years
- 2= Likely between 1-100% probability in the next year; or at least 1 chance in next 10 years
- 3= Highly Likely near 100% probability in the next year

Location

- 1= Small isolated to a specific parcel, building, intersection, or neighborhood
- 2= Medium occurring in multiple locations across town during one event
- 3= Large affecting a significant portion of town during one event

Extent

- 1= Limited injuries and/or illnesses are treatable with first aid; minor "quality of life" loss; shutdown of critical facilities for 24 hours or less; property severely damaged is <10%
- 2= Significant injuries and/or illnesses do not result in permanent disability; shutdown of several critical facilities for more than one week; property severely damaged <25% and >10%
- 3= Critical injuries and/or illnesses result in permanent disability; complete shutdown of critical facilities for at least two weeks; property severely damaged <50% and >25%
- 4= Catastrophic multiple deaths; complete shutdown of facilities for 30 days or more; property severely damaged >50%

Note that one hazard can be the result of numerous events. For example, flooding is a natural hazard that can be caused by a hurricane, winter storm, or nor'easter.

CENTRAL MASSACHUSETTS REGIONAL PLANNING COMMISSION

During this process, 27 communities actively participated in the planning process, including the development of action plans specific to their municipality. The Central Massachusetts Regional Planning Commission region occupies 1000 square miles of area in the southern two-thirds of Worcester County, Massachusetts. The area surrounds the City of Worcester, which is the second-largest city in Massachusetts and second largest in all of New England, with a population of 182,000. More than 550,000 people live in the Central Massachusetts Region.

Generally, the Region varies greatly. Worcester represents a highly urbanized center, surrounded by communities that are generally considered rural, including New Braintree, with a 2010 population of only 999 and a density of only one-one-hundredth (1/100th) that of Worcester, with only 48 people/square mile.

Each of the 40 communities in the Central Massachusetts region participates in the National Flood Insurance Program (NFIP).

Worcester receives about 50% more snowfall than Boston, averaging approximately 69 inches per year. Worcester's 49 inches of annual precipitation is about 15% higher than in Boston, and Worcester will experience precipitation on about 30% of the days each year. Worcester's average relative humidity ranges from 67%-81% in the mornings, and between 49%-62% in the afternoons. The average relative humidity in the morning is 75% and the average in the afternoon is 57%.

At the time of the writing of the plan, the 2010 Census data in its entirety had not yet been released. Therefore, the plan utilizes the 2000 census data unless otherwise noted. The median value of owner occupied housing units in 2000 was substantially less in the Region as compared to the State (\$146,000 vs. \$186,000). However, the housing "boom" in the early decade may have altered this comparison, or at least the values. Household income values in the Region (\$61,791 in 2007) are similar to those of the state (\$62,383), and 9.5% of the area falls below the poverty level. Additional population data is available in Table 5 and Figure 2.

Elevations within the planning area range from 201 feet above mean sea level to elevations greater than 1,201 feet above mean sea level are rare, found only in three towns in the North Sub-region: in Barre on several hilltops, in Princeton on portions of Mt. Wachusett, and in Paxton on Asnebumkit Hill.

In Central Massachusetts, storm surges are unlikely to affect any part of the region except in the most epic catastrophe producing a storm surge that travels 18 miles from the Hurricane Barrier in Providence Rhode Island to the Uxbridge/Millville/Blackstone portion of the region in Massachusetts.

Link to Hazard Mitigation Plan
(Original Submission January 2010; to FEMA 10/10/12 for Review):
<http://cmrpc.org/sites/default/files/Documents/CDAP/CMRPC%20Regional%20PDM%20Plan%20Jan%202010.pdf> (2012 plan on line)

Auburn
Barre
Berlin
Blackstone
Boylston
Brookfield
Charlton
Douglas
Dudley
East Brookfield
Grafton
Hardwick
Holden
Hopedale
Leicester
Mendon
Millbury
Millville
New Braintree
North Brookfield
Northborough
Northbridge
Oakham
Oxford
Paxton
Princeton
Rutland
Shrewsbury
Southbridge
Spencer
Sturbridge
Sutton
Upton
Uxbridge
Warren
Webster
West Boylston
West Brookfield
Westborough
Worcester

**TABLE 5.
AREA AND POPULATION DATA FOR CENTRAL MASSACHUSETTS REGION TOWNS**

Geographic Area Municipality	Land Area (sq. mi.)	Total Population 2010 US Census	Pop. Density pop/ sq mi
Auburn	15.36	16,188	1,054
Barre	44.33	5,398	122
Berlin	12.93	2,866	222
Blackstone	10.90	9,026	828
Boylston	16.03	4,355	272
Brookfield	15.52	3,390	218
Charlton	42.53	12,981	305
Douglas		8471	
Dudley	21.05	11,390	541
East Brookfield	9.84	2,183	222
Grafton	22.74	17,765	781
Hardwick	38.59	2,990	77
Holden	34.99	17,346	496
Hopedale	5.16	5,911	1,146
Leicester	23.36	10,970	470
Mendon	18.10	5,839	323
Millbury	15.73	13,261	843
Millville	4.93	3,190	647
New Braintree	20.70	999	48
North Brookfield	21.06	4,680	222
Northborough	18.53	14,155	764
Northbridge	17.18	15,707	914
Oakham	21.12	1,902	90
Oxford	26.63	13,709	515
Paxton	14.73	4,806	326
Princeton	35.44	3,413	96
Rutland	35.26	7,973	226
Shrewsbury	20.73	35,608	1,718
Southbridge	20.36	16,719	821
Spencer	32.85	11,688	356
Sturbridge	37.41	9,268	248
Sutton	32.38	8,963	277
Upton	21.52	7,542	350
Uxbridge		13,457	
Warren	27.53	5,135	187
Webster	12.49	16,767	1,342
West Boylston	12.90	7,669	594
West Brookfield	20.47	3,701	181
Westborough	20.52	18,272	890
Worcester	37.56	181,045	4,820
CMRPC Region	925.37	556,698	602

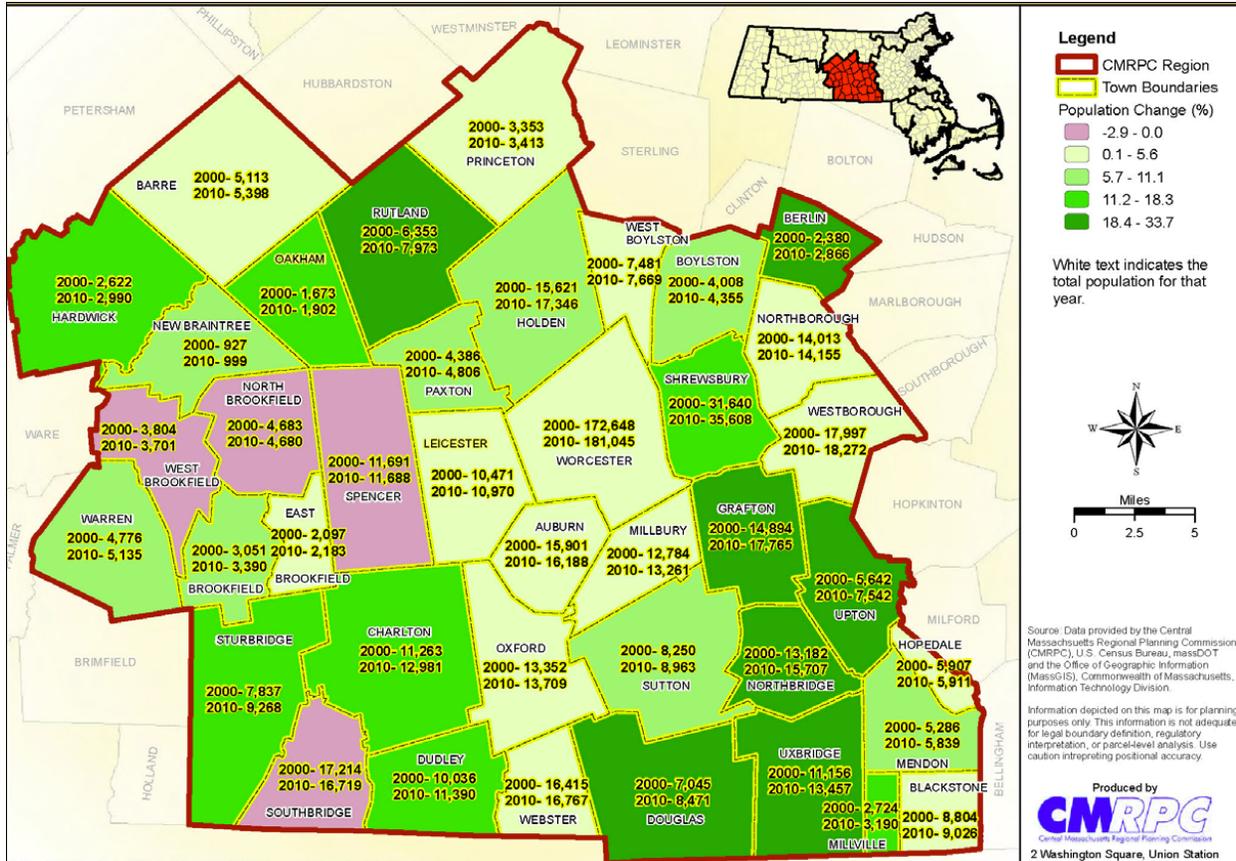


Figure 2: Percent Population Change for Central Massachusetts Region Communities, 2000 - 2010

This Region is at moderate risk for flood threats, which may result in serious or extensive damage. The most extensive damage would result from the highly infrequent dam failure. However, the most frequent flood threat is due to riverine and stormwater flooding. Stormwater floods occur frequently in isolated locations throughout the region, although the impacts are typically minor.

According to the 2010 plan, this Region is at medium risk for Hurricane threats, and may experience serious impacts wind, vegetative debris, flooding, stormwater flooding, and rain. Impacts are typically isolated, but may be serious and potentially extensive.

In Worcester County, there have been a number of F1 tornadoes occurring sporadically over the years. However, a data search for tornadoes rating 3 or above, or resulting in death/injury, or significant property damage, identifies the following events:

- In 1953, an F4 tornado struck Worcester. The event resulted in at least 90 fatalities, and more than 1200 injured. There was extensive property damage
- In 1981 an F3 tornado struck, resulting in just 3 injuries and very little reported property damage.
- In June 2011, an F3 tornado struck Massachusetts. Few deaths were reported, all in Hamden County. No deaths were reported in Worcester County. Property damage assessments in this Region were focused on Sturbridge (more than \$100,000 damage) and Southbridge (more than \$3/4 million).



Figure 3. October 2005 Flooding

Notwithstanding the events of 1953 and 2011, tornados are not common in this Region and, when they do occur, are typically small and specific. They are considered to be an extremely minor threat in this Region.

Winter storms and related hazards are high-frequency events in this Region, although their impacts are typically minor. Earthquakes are extremely rare in this Region and, when they do occur, are small and specific. They are considered to be a low threat in this Region.

This plan also analyzes other natural hazards such as drought, wildfire, earthquake, landslide, tsunami, extreme temperatures, and conflagrations; however, based on the fact that no Disaster Declarations have been issued for any of these conditions in the entire state dating back more than 50 years, none of these is considered to be a risk for the Region. Riverine flooding is also a risk, relative to the Blackstone, Quaboag, Quinebaug, and Ware rivers in particular. While riverine flooding may cause more severe impacts, those impacts are more likely to be isolated and relatively infrequent. The region also addresses volcano at a very low threat. The regional vulnerability matrix is below in Table 6.

Using data provided through MassGIS and MEMA, the Region was able to determine the number of critical facilities, other than dams, in the vulnerable portions of our Region. For the purpose of this exercise, it was determined by the planning partners that the Region was vulnerable to flooding. In order to use a methodical approach to the assessment, the planning commission determined that vulnerable areas were deemed those falling within the 100-year flood plain on the Flood Insurance Rate Maps.

The 45 critical infrastructure and facilities in the region are listed in Table 7 and Table 8.

**TABLE 6.
HAZARD VULNERABILITY MATRIX FOR CENTRAL MASSACHUSETTS REGION**

Hazards	Frequency			Severity				Affected Geography		
	Low	Med	High	Minor	Serious	Extensive	Catastrophic	Localized	Sub Regions	Region wide
1. Flood-related Hazards § Riverine	All			BER BOY BRK EBRK HOL MEN NBRA NBRK OAK PAX PRI RUT SHR SPE UPT WAR WEB WBOY WBOR	AUB BAR BLK CHA DOU DUD GRA HAR HPD LEI MBY MVL MBOR NBRI OXF SOU STU SUT UXB WBRK WORC			X		X
2. Flood-related Hazards § Dam Failures	All			BER BOY BRK EBRK MEN NBRA NBRK OAK PAX PRI RUT SHR WAR WBOY WBOR	DUD HOL NBOR OXF SPE WEB WBRK	AUB BAR BLK CHA DOU GRA HAR HPD LEI MBY MVL NBRI SOU STU SUT UPT UXB WORC		X		X
3. Flood-related Hazards § Stormwater	All			All				X		X
4. Flood-related Hazards § T'storms			All	All						X

**TABLE 6 (continued).
HAZARD VULNERABILITY MATRIX FOR CENTRAL MASSACHUSETTS REGION**

	Frequency			Severity				Affected Geography		
	Low	Med	High	Minor	Serious	Extensive	Catastrophic	Localized	Sub Regions	Region wide
5. Flood-related Hazards § Winter Storms			All	All				X		X
6. Flood-related Hazards § Nor'easters			All		All			X		X
7. Flood-related Hazards § Hurricanes		All			All			X		
8. Hurricanes/ Tropical storms (wind/rain)	All					All			SE & SW Sub-regions	X
9. Severe Storms (Wind, Hail, Lighting)	All				All			X		X
10. Wind-Related Hazards § Hurricanes § Nor'easters § Winter Storms		All	All All		All All All					X X X
11. Tornados	All				All					X
12. Severe Winter Storms			All		All				NW & N Sub-Regions	X
13. Drought	All			All						X
14. Fire Hazards	All			All						X
15. Geologic Hazards* Tsunami Earthquake Landslide	All				All			X		
16. Extreme Cold**			All	X						X
17. Extreme Heat***			All	X						X
18. Conflagrations	All						All			X

**TABLE 7.
CRITICAL INFRASTRUCTURE AND FACILITIES IN CENTRAL MASSACHUSETTS REGION**

SUMMARY Type of Facility	# in Vulnerable Areas	SUMMARY Type of Facility	# in Vulnerable Areas
Day Care Centers (>20 children)	16	Power Generating Plants	1
Electrical Power Substations	1	Schools; Elementary, Middle, High	1
Emergency Facilities/Shelters	4	Sewage Treatment Plants	2
Fire Stations	7	Water Treatment Plants	3
Government offices/ Town Halls	10		

**TABLE 8.
CRITICAL INFRASTRUCTURE AND FACILITIES IN CENTRAL MASSACHUSETTS REGION, BY
COMMUNITY**

Town	Day Care Centers (>20 Children)	Electrical Power Substations	Emergency Facilities/ Shelters	Fire Stations	Gov. Offices/ Town Halls	Power Genera. Plants	Schools; Elem, Middle, High	Sewage Treat. Plants	Water Treat. Plants
Auburn				1	3				1
Barre				1					
Chariton	2				1				
Dudley	1					1			
East Brookfield			1						
Hopedale					1				
Leicester	1			1					
Milbury	1	1							1
North Brookfield								1	
Northborough	1		1	1			1		
Northbridge					1				
Oxford			1	1	1				
Rutland			1						
Sturbridge								1	
Sutton									1
Uxbridge	1								
West Boylston					2				
Webster	1								
Worcester	8			2	1				
Total	16	1	4	7	10	1	1	2	3

 indicates a community in the CMRPC region which has a vulnerable critical facility, but which is not participating in this PDM Planning process at this time.

FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS

This region consists of 26 communities, has a total population of 71,599, and has a population density of 102 people per square mile, making it the most rural county in Massachusetts. In addition, 16 of 26 communities have a per capita income lower than the national average, and 20 of 26 have a per capita income less than the state average. The largest community is Greenfield, in the center of the county with a population of about 17,511. 18 of the 26 towns have a population fewer than 2,000. The county’s population growth has slowed significantly since 1980. For some communities the population decline is considerable; region wide, the increase from 2000 to 2011 is only 0.1%. Only 5.2% of the county is developed residential and 0.4% is commercial.

Franklin County is located along the northern tier of western Massachusetts, bordering Vermont and New Hampshire to the north and Hampshire County and the Springfield metropolitan area to the south. Franklin County is the most rural area in the Commonwealth. The County continues to expand its natural-resource-based business opportunities and has retained an active manufacturing sector that includes major employers manufacturing plastics, fabricated metals and other products. Franklin County has several educational institutions and museums, year-round outdoor recreation activities, and other amenities.

As of the 2013 Update to the State’s HMP, the Franking County COG plan had expired, but information contained within the document constitutes best available data, and the decision was made by the State Hazard Mitigation Team to utilize the information. Several of the local jurisdictions are in the process of developing their own plans, which should be completed relatively soon.

Link to Hazard Mitigation Plan:
http://www.frco.org/pubs/natural/res/HazMit/2005_FC_NatHazMitPlan.pdf

- Ashfield*
- Bernardston*
- Buckland*
- Charlemont*
- Colrain*
- Conway*
- Deerfield*
- Erving*
- Gill*
- Greenfield*
- Hawley*
- Heath*
- Leverett*
- Leyden*
- Monroe*
- Montague*
- New Salem*
- Northfield*
- Orange*
- Rowe*
- Shelburne*
- Shutesbury*
- Sunderland*
- Warwick*
- Wendell*
- Whately*

**TABLE 9.
 FRANKLIN REGIONAL COUNCIL OF GOVERNMENTS HAZARD IDENTIFICATION AND ANALYSIS WORKSHEET**

TYPE OF HAZARD	FREQUENCY OF OCCURRENCE	LOCATION OF OCCURRENCE	IMPACT	HAZARD RISK INDEX RATING
Flooding	Low-Moderate	Small	Limited	2
Severe Snowstorms/Ice Storms	High	Large	Limited	1
Hurricanes	Moderate	Large	Limited/Critical	2
Tornadoes	Low-Moderate	Small	Critical	2
Wildfire/Brushfire	Low-Moderate	Small	Minor	4
Earthquakes	Low	Large	Critical	3
Dam Failure	Very Low	Small	Critical/Catastrophic	3

No dollar loss information was provided within the existing plan; however, the Commonwealth, during completion of the risk assessment associated with update to the 2013 State HMP, did include data which can be utilized to determine local risk and loss estimations for some of the hazards within its risk assessment document contained in Section 5.

Goals, objectives, strategies and capability information from the expired plan have been incorporated into the general data contained previously within this section.

MARTHA'S VINEYARD COMMISSION

This island region is comprised of seven (7) towns on several islands with a population of 15,000 off-season, and a summer population of 75,000. It is estimated that within the next 50 years, development could increase more than 53% in currently developable areas. However this estimate is unlikely because it does not account for areas with current conservation restrictions or agricultural restrictions. Currently, the County's population is approximately 16,766, which is an 11.9% increase from 2000 population counts. 2020 estimated population puts the count at 21,822, or a 30% increase from the 2011 levels.

Martha's Vineyard is an ~87-square-mile island located seven miles off the coast of Cape Cod (MV Commission, 2008, p. 10). Its topography results from its location at the southern extremity, or terminal moraine, of the part of North America covered by ice during the last Ice Age. Home to the Wampanoag Tribe, it was settled by Europeans in the mid-17th century.

The cornerstone of the Island's economy is providing services to seasonal residents and visitors. The service, retail trade, construction, and finance, insurance and real estate sectors—mainly seasonal industries—account for 54% of Island jobs. A large majority of the businesses on the Island employ four or fewer workers each. The tourism and service industry is highly image-conscious, seasonal and labor intensive.

Review of the plan indicates that 123 critical facilities were identified from MassGIS data, in conjunction with emergency management personnel. These facilities include day care facilities, schools, senior centers, etc., as well as the customary critical infrastructure of police, fire, hospitals, etc. The plan goes on to indicate that the major bridges on Martha's Vineyard are in the process of being replaced, and there was no need to plan for hazard mitigation associated with structurally deficient bridges.

Loss statistics varied in nature, and included assessed building values; applied average exempt building values, and various other data source. The SLOSH model was utilized to determine loss estimations for storm surge events for residential (and some limited commercial) structures. For flooding, the plan identifies NFIP data as demonstrated in Table 10.

Included within the plan, the planning commission has included a detailed assessment of the impact of coastal erosion on Martha's Vineyard.

The risk assessment identifies the overall rating matrix identified in Table 11. A vulnerability matrix was prepared for each community, using numeric points (one point for each step of higher frequency or impact) and the resulting scores were averaged for the following table of vulnerability for the overall area of Dukes County:

Unique capabilities include the Coastal District of Critical Planning Councils, which are specific to individual ponds, harbors and shores. These regulations for "districts of critical planning concern" are, in most cases, more restrictive than the FEMA floodplain by-laws. Also unique is the state Department of Conservation and Recreation-established fire-wise program on the Vineyard, which is "staffed 24/5 by an outreach worker who speaks to groups and distributes literature, as well as responding to fires" (MV Commission, 2008 p. 69).

Link to Hazard Mitigation Plan (Expires: 5/13/13):
<http://www.mvcommission.org/doc.php/Pre-Disaster%20Mitigation%20Plan%20for%20Dukes%20County.pdf?id=1443>

*Aquinnah
 Chilmark
 Edgartown
 Gosnold
 Oak Bluffs
 Tisbury
 West Tisbury*

**TABLE 10.
MARTHA'S VINEYARD LOSS STATISTICS AS OF APRIL 30, 2008**

Community Name	Total Losses	Total Payments	Repeat Claims Properties	Repeat Claims Claims	Repeat Claims Total Paid
Aquinnah	2	13,462.39	1	2	13,462.39
Edgartown	33	606,587.69	4	10	301,823.68
Gosnold	1	2,214.00	0	0	0
Oak Bluffs	54	723,872.98	9	23	559,418.42
Tisbury	24	257,608.95	3	6	148,302.98
Totals	114	\$1,603,746.03	17	41	\$1,023,007.47

**TABLE 11.
OVERALL VULNERABILITY FOR DUKES COUNTY**

Natural Hazard	Frequency of Occurrence	Location	Impacts	Hazard Index
	(very low, low, medium, high)	(local or small, medium, multiple towns or large)	(minor, serious, extensive, catastrophic)	(rank by combining how much impact & how frequently this affects the community - average for all planning areas)
Flood-Related Hazards				
Riverine	very low	n/a	n/a	0
Coastal	medium	large	serious	8
Erosion	high	large	serious	7.4
Dam Failures	very low	local	serious	1
Thunderstorms	medium	local	minor	4.1
Winter Storms (snow)	low	local	minor	4
Coastal Storms/Nor'easters	high	medium	serious	9.4
Hurricanes	medium	large	extensive	9
Wind-Related Hazards				
Hurricanes	medium	large	extensive	9.1
Coastal Storms	high	large	serious	9.1
Winter Storms (snow)	low	local	serious	5
Downspouts	very low	local	serious	3
Tornadoes	very low	local	serious	4.1
Fire-Related Hazards				
Drought	medium	medium	serious	6
Wildfires	low	local	serious	6
Geologic Hazards				
Earthquakes	very low	n/a	n/a	0
Landslides	very low	local	minor	3.6
Sink Holes	very low	n/a	n/a	0
Other Hazards				
Ice	very low	local	serious	3.4
Sea Level Rise	high	large	serious	6.6

MERRIMACK VALLEY PLANNING COMMISSION

Information for this local plan review was gathered from the 2008 plan, which is currently being updated for renewal during 2013. This plan covers the majority of Essex County. The existing plan covers 13 of the 15 communities, with two electing not to be part of the regional planning effort.

This region consists of 15 towns and cities, referred to as the Merrimack Valley. The region encompasses ~267 square miles of divergent towns and cities, and is where over 330,000 residents call home. The Upper, or western portion of the Valley is where you will find large, former industrial cities such as Lawrence and Haverhill. Seaside communities dominate the Lower, or eastern portion of the Valley. Small, picturesque communities and villages, such as West Newbury and Groveland dot the center of the Region. The plan indicates a density of 1,192 persons per square mile.

Based on a regional build out analysis (discussed below) there is the potential to increase population by an additional 27% within this region. Single family residential units are the principle form of growth in this region with an average of about 1000 new homes per year since 1980. Approximately 40% of the region's population is in two communities, Lawrence and Haverhill.

The Valley's makeup is as follows:

- 40% of the Region is forested
- 26% is devoted to residential uses
- 20.2% consist of farmland, wetlands & water
- 5 communities are considered cities

In 2002, "the Merrimack Valley Planning Commission conducted a 'buildout' analysis for each of the 15 communities. (Buildout is a calculation of a community's maximum land development potential under current zoning.) Based on these analyses, the planning commission projects a maximum regional population of 406,149 if all remaining residential building sites are developed. This represents a 27.5% increase over the current (2000) population (MVPC, 2008).

Review of the plan demonstrates that employment diversification into various sectors have resulted in what appears to be a fairly stable economic region. Construction accounted for less than 10% of the region's economic sector, so the most recent recession period (2009-2012) may have had a less than average economic impact on the region.

The region encompasses parts of five of the Commonwealth's 28 watersheds, with the Merrimack Watershed area encompassing 147 square miles, or 55% of the region. The Merrimack River has an average daily flow of 7,500 cubic feet per second at the Lowell gage, and is greater than the average flow of any other eastern Massachusetts rivers combined. The highest flow of record, 170 cubic feet per second, occurred during the 1936 flood event.

Link to Hazard Mitigation Plan
(Expires 2/25/13—currently in update process): http://mvpc.org/wp-content/uploads/MEMA_PDM_Complete4.11.2011.pdf

*Amesbury
Andover
Boxford
Georgetown
Groveland
Haverhill
Lawrence
Merrimac
Methuen
Newbury
Newburyport
North Andover
Rowley
Salisbury
West Newbury*



Figure 4. Shawsheen River Flooding, Lawrence - May 2006 (MVPC, 2008).

According to the Regional 2008 HMP, the region is vulnerable to a wide array of natural hazards, including floods, hurricanes, northeasters, snow and ice storms, drought, wildfires, and tornadoes and earthquakes.

Review of the Commonwealth's 2013 risk assessment data confirms the Merrimack Region's hazard ranking of 'high' for flooding events, including coastal hazards, Nor'easters, snow and blizzards, and ice storms, all of which have the potential to enhance flooding. Historic gage data reveals a number of the flood disasters occurring in the region raising to the level of a 100 year event in certain areas (DR-790, 1987 event), while a number of other events, such as DR-1642 (May 2006) range from a 40 to 3 year event within the Region.

Review of the MV HMP identifies 18 various types of critical facilities, including those identified within the Hazus model, as well as public works garages, treatment plants, communications facilities, hospitals and medical clinics, libraries, senior centers, nursing homes and "hotspots" based on local knowledge (MVPC, 2008). The risk assessment portion of the plan indicates that risk assessment for the region (based on composite analysis of all 13 communities) was based primarily on information contained in the County's Comprehensive Emergency Management Plan, and utilizes high, moderate-high, moderate, low-moderate and low risk scaling system identified by the table extracted below.

Limited dollar loss estimations were included, and are based on 2007 building valuation estimations within the flood and SLOSH models. In some instances, land value is designated as the loss. It is unclear whether the assessor's data has been manipulated to include only structure values, or land and structure values for other loss estimations.

**TABLE 12.
MERRIMACK VALLEY REGION-WIDE NATURAL HAZARDS RISK ASSESSMENT**

(13 Communities)		
Natural Hazard	Composite Score	Regional Risk
Floods/Storm Surges	65	HIGH
Winter Storms (blizzard/snow/ice)	65	HIGH
Hurricanes	39	Moderate
Dam Failure	37	Moderate
Wildfire/Brush Fires	36	Moderate
Drought	33	Moderate
Earthquakes	19	Low
Tornadoes	16	Low
Landslides	13	Low

**TABLE 13.
MERRIMACK VALLEY REGION POTENTIAL VULNERABILITY TO FUTURE NATURAL HAZARDS**

Hazard	Frequency	Severity
Flood	High	Extensive
Dam Failure	Medium	Extensive
Hurricane and Tropical Storms	Medium	Serious
Severe storms (wind, hail, lightning)	Medium	Serious
Tornadoes	Medium	Extensive/Catastrophic
Severe Winter Weather (snow, ice, wind)	High	Extensive
Drought	Medium	Serious
Earthquake	Low	Catastrophic
Wildfire	Medium	Serious
Landslide	Low	Minor
Heat Wave	Medium	Serious

METROPOLITAN AREA PLANNING COUNCILS

Stretching west from Boston to include most of the communities inside the I-495 corridor, the planning area for the Metropolitan Area Planning Councils (MAPCs) consists of 22 cities and 79 towns that include coastal communities, older industrial centers, rural towns and modern cities. MAPC works with its cities and towns through eight subregional committees (identified above). Inclusion of information from these MAPC areas was completed through review of a number of local hazard mitigation plans (LHMPs), as well as regional plans, as appropriate.

Link to Hazard Mitigation Plan (Multiple): MAPC Expired; MAPC 1 Expired 4/29/10 - 9/12 to FEMA; MAPC 2 Exp. 4/29/10/ MEMA Review; MAPC 3 Expires 7/22/13; MAPC 4 Expires 2013, 2015, 2016, 2017; MAPC 5 Expires 11/20/13-2017; MAPC 6 Expires 8/3/17; MAPC 7 Expired except: Framingham 10/12/17; Wakefield 3/26/13

Inner Core Committee
Minuteman Advisory Group on Interlocal Coordination
MetroWest Regional Collaborative
North Shore Task Force
North Suburban Planning Council
South Shore Coalition
SouthWest Advisory Planning Committee
Three Rivers Interlocal Council

City of Boston 2008 LHMP

The largest city within the MAPC planning region is also the largest city within the Commonwealth of Massachusetts—the City of Boston, which is also the capital of the Commonwealth and home to the State House. Located in Suffolk County, the City of Boston attracts in excess of 12 million tourists annually, and is ranked the 21st largest City in the United States according to the 2011 U.S. Census Bureau. Major attractions in the city range from the Museum of Science, Museum of Fine Arts, numerous theaters, Fenway Park, and the Harbor Islands. Boston is also home to many historic buildings and structures that are of symbolic significance to not only the Commonwealth but also the nation as a whole. These include large and well-known sites and structures such as the U.S. Constitution, numerous burying grounds, the Paul Revere House, and Old North Church, as well as many smaller, lesser known, but historically important sites scattered around the City. In addition to state and local level critical infrastructure, Boston is also home to many Federal agencies, financial institutions, medical facilities and institutions of higher education.

When discussing its critical facilities, the 2008 LHMP indicates that due to the fact that “such a large portion of Boston was constructed on fill and because of the city’s extensive coast line, a large number of critical facilities and vulnerable populations are located in hazard zones and a number are located in more than one hazard zone” (p. 16). In addition, the plan indicates that many of its “critical facilities not listed as being in a flood zone could actually be located in one” given the age of the flood maps used during development of the 2008 plan. Preliminary digital Flood Insurance Rate Maps were issued in 2012, which include new coastal modeling and mapping for the impacted communities within Suffolk County. This will enhanced the City’s ability to enhance their ability to determine associated risk during the next plan update. While not all-inclusive, the plan identifies in excess of 800 critical facilities.

According to the 2008 LHMP, “Boston has a unique history of land reclamation. According the city’s *Open Space Plan*, the city grew from 1,000 acres to 30,000 acres due to land reclamation and annexation. As a result, large areas of Boston are built on fill” (p. 3). The plan indicates, and history has demonstrated, that filled land affects a jurisdiction’s vulnerability to certain natural hazards.

The numerous cultural facilities within Boston are also of great concern, given that many of the facilities are older, and built to lower building code standards. The plan indicates that while newer buildings housing cultural artifacts, “the vast majority of collections, both in storage and on display, have not been retrofitted to protect fragile objects during tremors. Fire remains one of the great risks to cultural heritage because the resultant loss is so often irrecoverable and irreplaceable” (Boston LHMP, 2008, p. 16).

The 2008 plan lists nine hazards to which the City of Boston is susceptible, identified in Table 14.

TABLE 14. FREQUENCY AND SEVERITY OF NATURAL HAZARDS IN THE STATE AND BOSTON			
Hazard	Frequency	Severity	Comments
Flood	High	Serious to extensive	
Dam Failure	Low	Extensive	
Hurricanes	Medium	Extensive to catastrophic	Boston has an extensive coast line
Severe Storms (wind, hail, lightning)	Medium	Serious	High density and on-street parking in urban areas can make street tree damage a concern
Tornados	Medium	Extensive to catastrophic	No tornados recorded in Boston
Winter Storms	High	Serious	High density can pose challenges
Earthquakes	Low	Catastrophic	Higher potential for damage in areas prone to liquefaction. Boston area at higher risk than rest of state
Landslides	Low	Minor	Coastal erosion issues in Boston
Brush Fires	Medium	Serious	

Definitions Used in the Commonwealth of Massachusetts State Hazard Mitigation Plan

Frequency

- Very Low Frequency: Events that occur less frequently than once in 1,000 years (less than 0.1% per year).
- Low Frequency: Events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year).
- Medium Frequency: Events that occur from once in 10 years to once in 100 years (1% to 10% per year).
- High Frequency: Events that occur more frequently than once in 10 years (greater than 10% per year).

Severity

- Minor: Limited and scattered property damage; no damage to public infrastructure (roads, bridges, trains, airports, public parks, etc.); contained geographic area (i.e., 1 or 2 communities); essential services (utilities, hospitals, schools, etc.) not interrupted; no injuries or fatalities.
- Serious: Scattered major property damage (more than 50% destroyed); some minor infrastructure damage; wider geographic area (several communities); essential services are briefly interrupted; some injuries and/or fatalities.
- Extensive: Consistent major property damage; major damage to public infrastructure (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and fatalities.
- Catastrophic: Property and public infrastructure destroyed; essential services stopped, thousands of injuries and fatalities.

The 2008 LHMP identifies 17 repetitive loss structures in Boston, located throughout the city. Review of state data for the 2013 update demonstrates an increase of five (5) properties since the 2008 Boston LHMP was written, for a total of 23 repetitive loss (RL) properties.

While Hazus was utilized to some extent, it was not utilized to determine flood losses due to the fact that it was felt to be “subject to a great deal of uncertainty” (Boston LHMP, 2008, p. 44). In lieu of using Hazus, the plan indicates that actual damages were “calculated for the city’s largest and most damaging area of flooding—the Muddy River. Flooding in 1996 caused \$63 million in damages, though this damage extends beyond the Boston boundary” (Boston LHMP, 2008, p. 46).

For the remaining hazards for which loss estimations were provided, 2002 replacement value was utilized. Loss estimations for Category 2 and 4 hurricane events are estimated in Table 15.

TABLE 15. HURRICANE LOSS ESTIMATES FOR BOSTON		
	Cat. 2	Cat 4*
Building Characteristics		
Estimated total buildings	76,183	
Estimated total building value (Year 2002 \$)=	\$38,104,000,000	
General Building Damage		
# of buildings sustaining minor damage	2,173	17,890
# of buildings sustaining moderate damage	432	21,178
# of buildings sustaining severe damage	19	13,329
# of buildings destroyed	2	7,396
Population Needs		
% of hospital beds available on day of event	90%	0%
# of households displaced	389	85,535
# of displaced people seeking public shelter	102	23,576
Debris		
Building debris generated (tons)	27,722	1,553,786
Tree debris generated (tons)	87,786	153,671
# of truckloads to clear building debris	1,129	62,046
Value of Damages		
Total property damage	\$125,748,980	\$14,114,728,370
Total business interruption loss	\$14,441,700	\$2,330,165,600

Existing mitigation measures identified by the City of Boston include the following:

- The City of Boston's Emergency Management Division is staffed by five, full time, interdisciplinary members that work to mitigate, plan, and prepare for emergencies; educate the public about preparedness, coordinate resources for emergency response and recovery efforts; collect and disseminate critical information; and, seek further opportunities to support the overall preparedness of the City of Boston. In addition, the Emergency Management Division plays a critical role within routine and non-routine emergencies by maintaining on-scene and remote situational awareness of the incident as well as coordinating inter-agency response. Moreover, the Emergency Management Division also has the responsibility of managing and utilizing the Emergency Operations Center during a time of need. Such Division will work with other entities throughout the Region to ensure proper hazard mitigation measures are put into place.
- The city recently prepared and distributed *Ready Boston: An Emergency Preparedness and Evacuation Guide for City Residents*. The guide is available in English, Spanish, French, Chinese, Portuguese, and Vietnamese. Highlights of the plan include:

- How to assemble an emergency supply kit and create a household preparedness plan
- Small and large scale evacuations, including provisions for those without cars
- The city set up a phone system that can contact 60,000 residents in an hour
- The importance of ensuring that communications systems work during a natural event was reiterated by local officials. The city is currently addressing this issue through its homeland security work.
- The Public Health Commission provides information on disaster preparedness for residents, employers, and health care providers. See <http://www.bphc.org/programs/program.asp?b=7&d=0&p=200>
- The city, along with the Town of Brookline and the state are undertaking the Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Landscape Preservation Project. The project proposes to fix the current problem (increase the river's hydraulic capacity) and address the cause of the problem (establish management practices to reduce sediment and debris in the watershed). Camp Dresser & McKee Inc., has been designing the mitigation project and preparing environmental permit applications.

Existing goals of the plan closely align with those of the Commonwealth's 2013 Update.

North Shore MAPC 1

Beverly, Massachusetts

The City of Beverly, Massachusetts, located within the boundary of Essex County, is one of the oldest communities in the state. Residents describe their City as the birthplace of the United States Navy, noting that the first ship commissioned by the Navy first sailed from Beverly Harbor. Review for the 2013 Commonwealth's update included the City of Beverly's February 2012 plan.

Review of the plan identifies similar hazards and hazard ranking as surrounding communities as identified in Table 16.

TABLE 16.
BEVERLY, MA HAZARD RANKING

Hazard	Frequency	Severity
Flooding	High	Serious
Winter storms	High	Serious
Hurricanes	Medium	Serious
Earthquakes	Low	Extensive
Tornadoes	Low	Serious
Landslides	Low	Minor
Brush fires	Medium	Minor
Dam failures	Low	Serious

Review of the 2012 plan identifies 15 repetitive loss (RL) structures in Beverly, which is identified as an increase of nine structure from the 2005 plan. Comparison to information contained within the 2013 update to the Commonwealth's plan identifies 17 RL properties, which coincides with the fact that Essex County is rated in the top five counties for claims filed throughout the Commonwealth. Flooding is also

rated as one of the highest ranked hazards of concern within both the community and the county, followed by winter storms.

Capabilities include ones which cross jurisdictional boundaries, referred to as “Inter-Community Considerations” in the Town’s attempt to preserve its coastal areas. Strategies developed demonstrate the significance of this perception and include activities involving municipalities along the North Shore working together to determine “mutually beneficial means of protecting their shore side communities from the impacts of storm damage and sea-level rise” (MAPC, 2010).

The City of Beverly utilizes Hazus at a Level 1 for analysis of their loss estimations. Various hazard information representing dollar losses are demonstrated in Table 17 and Table 18.

**TABLE 17.
BEVERLY DAMAGE ESTIMATES FOR CATEGORY 2 AND 4 HURRICANES**

	Category 2	Category 4¹
Building Characteristics		
Estimated total number of buildings	11,054	11,054
Estimated total building replacement value (Year 2002 \$) (Millions of Dollars)	\$3,478	\$3,478
Building Damages		
# of buildings sustaining minor damage	355	1,121
# of buildings sustaining moderate damage	39	170
# of buildings sustaining severe damage	1	6
# of buildings destroyed	0	1
Population Needs		
# of households displaced	13	63
# of people seeking public shelter	3	14
Debris		
Building debris generated (tons)	5,192	11,283
Tree debris generated (tons)	3,219	5,980
# of truckloads to clear building debris	79	213
Value of Damages (Thousands of dollars)		
Total property damage	\$12,555	\$33,331.79
Total losses due to business interruption	\$1,052.06	\$4,024.29
¹ No Category 4 or 5 hurricanes have been recorded in New England. However, a Category 4 hurricane was included to help the communities understand the impacts of a hurricane beyond what has historically occurred in New England.		

**TABLE 18.
BEVERLY DAMAGE ESTIMATES FOR EARTHQUAKES**

	Magnitude 5.0	Magnitude 7.0
Building Characteristics		
Estimated total number of buildings	11,054	11,054
Estimated total building replacement value (Year 2002 \$) (Millions of dollars)	\$3,478	\$3,478
Building Damages		
# of buildings sustaining slight damage	415	3,691
# of buildings sustaining moderate damage	82	3,319
# of buildings sustaining extensive damage	10	1,153
# of buildings completely damaged	1	391
Population Needs		
# of households displaced	16	1,811
# of people seeking public shelter	3	406
Debris		
Building debris generated (tons)	Not available	Not available
Value of Damages (Millions of dollars)		
Total property damage	\$55.95	\$961.05
Total losses due to business interruption	\$2.80	\$170.80

Hazus-MH was not utilized to estimate flood damages in Beverly due to technical difficulties with the software, and the fact that the jurisdiction felt the riverine module was not a reliable indicator. Rather, the jurisdiction utilized an exposure analysis based on the number of structures identified by the hurricane and earthquake modules. Based on their method of analysis, the City estimated a range for flood damages to be “\$16,927,470- \$84,637,350”; however, the calculations were “not based solely on location within the floodplain or a particular type of storm (i.e. 100 year flood)” (City of Beverly, 2012, p. 36).

Review of the relationship between critical infrastructure and the various hazards of concern shows a low rate of impact, with the exception potentially of snow-fall accumulations, for which loss estimations cannot be adequately determined beyond a potential exposure analysis due to the inability to determine with any certainty the geographic boundary which is potentially vulnerable.

The City’s goals closely align with those identified within the remaining MAPC region, as well as the Commonwealth’s 2013 updated goals.

Lexington (Middlesex County) 2011 LHMP Review

Review was focused on the 2011 MAPC plan for the Town of Lexington. Lexington is located in Middlesex County in Eastern Massachusetts and is bordered by Lincoln on the southwest; Bedford on the northwest; Burlington on the northeast; Woburn, Winchester, and Arlington on the east; and Belmont and Waltham on the south. Lexington is 11 miles northwest of Boston and 18 miles south of Lowell. As of the writing of the plan, the 2000 Census indicated that “just over 30,000 people live in Lexington. The town has a fairly high percentage of residents that are over age 65 (19%). Of the town’s 11,333 housing units, one quarter were built before 1940” (Lexington, 2011, p. 3). Table 19 demonstrates the hazard rankings for the Town of Lexington.

**TABLE 19.
LEXINGTON HAZARD RANKING**

Hazard	Frequency in State	Severity in State	Issues in Lexington
Flood	High	Serious to extensive	Same as state
Dam Failure	Low	Extensive	Same as state
Hurricanes	Medium	Extensive to catastrophic	Same as state
Severe Storms (wind, hail)	Medium	Serious	Same as state
Tornadoes	Medium	Extensive to catastrophic	Not a major issue in Lexington
Winter Storms	High	Serious	Same as state
Earthquakes	Low	Catastrophic	Not a major issue in Lexington
Landslides	Low	Minor	Not a major issue in Lexington
Brush Fires	Medium	Serious	Not a major issue in Lexington
Definitions Used in the Commonwealth of Massachusetts State Hazard Mitigation Plan			
Frequency			
- Very Low Frequency: Events that occur less frequently than once in 1,000 years (less than 0.1% per year).			
- Low Frequency: Events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year).			
- Medium Frequency: Events that occur from once in 10 years to once in 100 years (1% to 10% per year).			
- High Frequency: Events that occur more frequently than once in 10 years (greater than 10% per year).			
Severity			
- Minor: Limited and scattered property damage; no damage to public infrastructure (roads, bridges, trains, airports, public parks, etc.); contained geographic area (i.e., 1 or 2 communities); essential services (utilities, hospitals, schools, etc.) not interrupted; no injuries or fatalities.			
- Serious: Scattered major property damage (more than 50% destroyed); some minor infrastructure damage; wider geographic area (several communities); essential services are briefly interrupted; some injuries and/or fatalities.			
- Extensive: Consistent major property damage; major damage to public infrastructure (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and fatalities.			
- Catastrophic: Property and public infrastructure destroyed; essential services stopped, thousands of injuries and fatalities.			

There were no repetitive loss properties within the Town of Lexington as of the writing of the 2011, however, analysis conducted during the 2013 State plan update indicate the Town now has five repetitive flood losses.

North Reading (Updated January 2012)

North Reading is located in Northeastern Massachusetts, bordered by Wilmington on the west, Andover and North Andover on the north, Middleton and Lynnfield on the east, and Reading on the south. North

Reading is 10 miles south of Lawrence and 15 miles north of Boston. The total land area is 13.26 square miles, with a total area of 13.52 square miles. The elevation of the town is 100 feet above sea level.

The Town of North Reading is an outlying suburban town in Middlesex County, lying entirely within the watershed of the Ipswich River. North Reading is situated in the Greater Boston Area, which has excellent rail, air, and highway facilities.

During development of its risk assessment, the planning team established the hazard categories listed in Table 20. Based on the Hazard Ranking Index shown in Table 21, the planning committee determined the hazards of concern as illustrated in Table 22.

Risk estimations for dollar losses are based on Hazus analysis for some of the hazards of concern (see section 6, beginning page 6-6 of the Pre-Disaster Mitigation Plan, North Reading, 2012). Based on additional Hazus analysis, the planning committee identified the potential losses for the planning region shown in Table 23 and Table 24 (Section 7 of the 2012 North Reading HMP).

The capabilities of the jurisdiction are comparable to those in the surrounding area. The plan does speak of a Wastewater and Stormwater Advisory Committee, which has been active with respect to planning purposes. The Committee has “identified and prioritized the areas of Town that represent the greatest need for alternative wastewater disposal options, evaluated two parcels capable of serving as subsurface disposal areas (the former Berry Rehabilitation Center and a property off Chestnut Street), quantified the volume of treated wastewater that could be discharged on those parcels, developed a preliminary wastewater collection and treatment scheme utilizing this information and started a public outreach program designed to provide information to the various stakeholders relative to the plan” North Reading HMP, 2012, p 8-3). The four goals as identified by the plan committee coincide with those goals identified by the Commonwealth.

**TABLE 20.
NORTH READING HAZARD CATEGORIES**

<p>Flood – Related Hazards</p> <ul style="list-style-type: none"> ▪ Beaver Dams ▪ Dam breaches ▪ Flood ▪ Heavy rainstorms and thunderstorms <p>Wind – Related Hazards</p> <ul style="list-style-type: none"> ▪ Hurricanes ▪ Microburst ▪ Tornadoes <p>Winter – Related Hazards</p> <ul style="list-style-type: none"> ▪ Ice jams ▪ Nor’easter and Blizzards ▪ Snow events <p>Fire – Related Hazards</p> <ul style="list-style-type: none"> ▪ Drought ▪ Wildfire <p>Geologic – Related Hazards</p> <ul style="list-style-type: none"> ▪ Earthquake ▪ Landslide <p>Other Potential Hazards</p> <ul style="list-style-type: none"> ▪ Extreme cold ▪ Extreme heat and heat wave ▪ Technological/man-made disasters/accidents * <ul style="list-style-type: none"> ○ Critical infrastructure threats, terrorism, criminal acts ○ Oil, chemical, bio-hazards spills and accidents ○ Building fires
--

* Not covered under this PDM Plan

**TABLE 21.
NORTH READING HAZARD RANKING INDEX**

Impact →				
Frequency of occurrence ↓	Catastrophic	Critical	Limited	Negligible
Highly likely	5 (Highest)	4 (High)	4 (High)	3 (Moderate)
Likely	5 (Highest)	4 (High)	3 (Moderate)	2 (Low)
Possible	4 (High)	3 (Moderate)	2 (Low)	2 (Low)
Unlikely	3 (Moderate)	2 (Low)	1 (Lowest)	1 (Lowest)
Highly unlikely	2 (Low)	1 (Lowest)	1 (Lowest)	1 (Lowest)

Hazard Index Scale: 1-5, with 5 indicating the highest priority for considering mitigation measures and 1 indicating the lowest priority. (Highest, High, Moderate, Low, Lowest)

**TABLE 22.
NORTH READING HAZARD RISK LEVEL**

Hazard	Level of Risk
Flood Related	High
Beaver Dams	Very Low
Dam breaches	Low
Heavy rainstorms & thunderstorms	Moderate
Wind Related	Moderate
Hurricanes	Moderate
Microburst	Very Low
Tornado	Very Low
Winter Related	High
Ice Jams	Low
Nor'easter and Blizzard	High
Snow Events	High
Fire Related	Very Low
Drought	Very Low
Wildfire	Very Low
Geologic Related	Low
Earthquake	Low
Landslide	Very Low
Other Potential Hazards	Low
Extreme Cold	Moderate
Extreme Heat	Very Low
Technological & Man made disasters/accidents	Very Low

TABLE 23.
NORTH READING ESTIMATED BUILDING LOSSES FROM A 100-YEAR FLOOD EVENT

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.10	0.01	0.00	0.00	0.11
	Content	0.05	0.03	0.01	0.02	0.11
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	0.15	0.04	0.01	0.03	0.22
Business Interruption						
	Income	0.00	0.07	0.00	0.04	0.11
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.06	0.00	0.10	0.16
	Subtotal	0.00	0.13	0.00	0.14	0.26
ALL	Total	0.15	0.17	0.01	0.17	0.49

TABLE 24.
NORTH READING ESTIMATED ANNUAL BUILDING LOSSES FROM A 100-YEAR HURRICANE

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	12,869.28	994.30	206.45	67.14	14,137.17
	Content	2,508.89	337.17	123.73	22.17	2,991.95
	Inventory	0.00	14.20	20.60	1.02	35.83
	Subtotal	15,378.17	1,345.66	350.78	90.33	17,164.95
Business Interruption Loss						
	Income	0.00	86.27	2.73	4.61	93.62
	Relocation	964.39	156.37	21.76	12.13	1,154.65
	Rental	362.98	63.57	2.86	0.59	430.00
	Wage	0.00	88.26	4.55	31.99	124.80
	Subtotal	1,327.37	394.48	31.90	49.32	1,803.07
Total	Total	16,705.54	1,740.14	382.68	139.66	18,968.02

South West MAPC 5

Franklin (Norfolk County)

Franklin belongs to the Southwest Subregion of the Metropolitan Area Planning Council. The Town of Franklin is a suburban industrial community on the watershed between the Charles and the Blackstone Rivers. It is one of the highest elevated towns in Norfolk County. Franklin is located in southeastern Massachusetts and bordered by Norfolk and Wrentham on the east and south, Bellingham on the west, and Medway on the north. Franklin is about 26 miles southeast of Worcester; 28 miles southwest of Boston; 26 miles north of Providence, Rhode Island. Franklin is situated in the Greater Boston Area.

Review of this local plan indicates a summary of hazards identified in Table 25. The evaluation considered the frequency of the hazard, historical records and variations in land use. This analysis used the same vulnerability assessment methodology used in the Commonwealth of Massachusetts' 2004 State Hazard Mitigation Plan. These risks were reviewed with the Local Committee, and the local officials concurred that flooding and brush fires were the primary hazards facing the town.

**TABLE 25.
FRANKLIN HAZARD RANKING**

Hazard	Frequency in State	Severity in State	Issue in Franklin
Flood	High	Serious to extensive	Same as state
Dam Failure	Low	Extensive	Same as state
Hurricanes	Medium	Extensive to catastrophic	Same as state
Severe Storms (wind, hail, lightning)	Medium	Serious	Same as state
Tornadoes	Medium	Extensive to catastrophic	Same as state
Winter Storms	High	Serious	Same as state
Earthquakes	Low	Catastrophic	Same as state
Landslides	Low	Minor	Not a major issue in Franklin
Brush Fires	Medium	Serious	Same as state
Definitions Used in the Commonwealth of Massachusetts State Hazard Mitigation Plan			
<u>Frequency</u>			
- Very Low Frequency: Events that occur less frequently than once in 1,000 years (less than 0.1% per year).			
- Low Frequency: Events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year).			
- Medium Frequency: Events that occur from once in 10 years to once in 100 years (1% to 10% per year).			
- High Frequency: Events that occur more frequently than once in 10 years (greater than 10% per year).			

At the time of this plan, the Town had three repetitive loss properties, all three (3) single family residences totally seven losses between 1979 and 2005. During the 2013 update of the Commonwealth's HMP, State review of the 2012 statistics now indicate five (5) repetitive loss properties.

The plan does utilize the Hazus hurricane module at a Level 1, for a Category 3 and 4 storm events. The risk assessment did not use Hazus to estimate flood damages due to technical difficulties with the software and un-reliability of certain modules. However, the planning commission did attempt to demonstrate some losses by melding a combination of Hazus identified buildings and the location within the floodplain for a particular storm. Based on the analysis, the range of estimates for flood damages was \$~132,000 to ~\$4,296,000.

Table 26 demonstrates losses. It should be noted that at the time of writing of the plan, the area had never been impacted by a Category 4 or 5 hurricane.

The risk assessment did not use Hazus to estimate flood damages due to technical difficulties with the software and un-reliability of certain modules. However, the planning commission did attempt to demonstrate some losses by melding a combination of Hazus identified buildings and the location within the floodplain for a particular storm. Based on the analysis, the range of estimates for flood damages was \$~132,000 to ~\$4,296,000.

**TABLE 26.
FRANKLIN ESTIMATED LOSSES FROM HURRICANES**

	Category 3	Category 4
Building Characteristics		
Estimated total number of buildings	8,739	8,739
Estimated total building replacement value (Year 2002 \$) (Millions of Dollars)	\$2,888	\$2,888
Building Damages		
# of buildings sustaining minor damage	1,196	2,466
# of buildings sustaining moderate damage	174	683
# of buildings sustaining severe damage	7	72
# of buildings destroyed	4	45
Population Needs		
# of households displaced	33	147
# of people seeking public shelter	7	30
Debris		
Building debris generated (tons)	3,991	11,775
Tree debris generated (tons)	10,791	28,827
# of truckloads to clear building debris	160	470
Value of Damages		
Total property damage	\$29,135,350	\$103,145,520
Total losses due to business interruption	\$3,323,080	\$13,311,860

Milford (Worcester County)

Review included the March 2009 Town of Milford LHMP. The Town of Milford is located in east central Massachusetts, bordered by Upton on the west; Hopkinton on the north; Holliston, Medway, and Bellingham on the east; and Hopedale on the south. Milford is 18 miles southeast of Worcester; 30 miles southwest of Boston; and 32 miles north of Providence, Rhode Island. Land use statistics from the plan are based on 1999 data.

Hazards of concern within the town are indicated in Similar to the Town of Franklin, the risk assessment did not use Hazus to estimate flood damages due to technical difficulties with the software and unreliability of certain modules. However, the planning commission did attempt to demonstrate some losses by melding a combination of Hazus identified buildings and the location within the floodplain for a particular storm. In addition, the planning committee met with the town engineer and was able to obtain a more accurate count of the number of structures in the floodplain within the hazard area. Based on the analysis, the range of estimates for flood damages was \$~1,066,464 to ~\$27,493,495.

Table 27 Similar to the Town of Franklin process, the risks were based on the Commonwealth's 2004 HMP. Flooding was the most prevalent serious natural hazard identified by local officials in Milford, with hurricanes, nor'easters, severe rainstorms and thunderstorms being attributing factors. The existing plan for the Town of Milford identifies no repetitive loss properties, yet review of 2012 data utilized for the 2013 update to the State's HMP indicates the Town of Milford now has one repetitive loss.

The town identified 50 critical facilities within its boundaries being susceptible to the various hazards.

The plan does utilize the Hazus hurricane module at a Level 1, for a Category 3 and 4 storm events. Table 28 demonstrates losses. It should be noted that at the time of writing of the plan, the area had never been impacted by a Category 4 or 5 hurricane.

Similar to the Town of Franklin, the risk assessment did not use Hazus to estimate flood damages due to technical difficulties with the software and un-reliability of certain modules. However, the planning commission did attempt to demonstrate some losses by melding a combination of Hazus identified buildings and the location within the floodplain for a particular storm. In addition, the planning committee met with the town engineer and was able to obtain a more accurate count of the number of structures in the floodplain within the hazard area. Based on the analysis, the range of estimates for flood damages was \$~1,066,464 to ~\$27,493,495.

**TABLE 27.
MILFORD HAZARD RANKING**

Hazard	Frequency in State	Severity in State	Issues in Milford
Flood	High	Serious to extensive	Same as state
Dam Failure	Low	Extensive	Same as state
Hurricanes	Medium	Extensive to catastrophic	Same as state
Severe Storms (wind, hail, lightning)	Medium	Serious	Same as state
Tornadoes	Medium	Extensive to catastrophic	Same as state
Winter Storms	High	Serious	Same as state
Earthquakes	Low	Catastrophic	Same as state
Landslides	Low	Minor	Not a major issue in Milford
Brush Fires	Medium	Serious	A number of areas in Milford are prone to frequent brush fires; concerns about residential damages

**TABLE 28.
MILFORD ESTIMATED LOSSES FROM HURRICANES**

	Category 3	Category 4
Building Characteristics		
Estimated total number of buildings	7,940	7,940
Estimated total building replacement value (Year 2002 \$) (Millions of Dollars)	\$2,563	\$2,563
Building Damages		
# of buildings sustaining minor damage	1,365	1,631
# of buildings sustaining moderate damage	261	358
# of buildings sustaining severe damage	15	25
# of buildings destroyed	7	11
Population Needs		
# of households displaced	73	102
# of people seeking public shelter	18	25
Debris		
Building debris generated (tons)	6,083	7809
Tree debris generated (tons)	6,590	8,128
# of truckloads to clear building debris	245	316
Value of Damages		
Total property damage	\$37,947,340	\$51,162,020
Total losses due to business interruption	\$5,579,180	\$8,036,340

Walpole (Norfolk County) 2008 LHMP Plan Review

The Town of Walpole is located 19 miles south of Boston and 26 miles north of Providence. As of the writing of the plan, the 2000 population was 22,824 people and there were 8,229 housing units. The plan indicates that much of “the critical infrastructure in the town is located in clusters, often near areas of floodplain. These facilities are therefore at higher risk during natural hazards, (Walpole, 2008, p. 10).

As indicated within the plan, the Town of Walpole is at a higher elevation than its neighboring communities; “nor is it impacted by as many bodies of water as its neighboring communities. However, the town still has a problem with water inundation during high rain and storm events and during the spring snowmelt season” (ibid).

Hazards of concern as determined by the planning committee are listed in Table 29. Based on analysis, Flooding and potential for brush fires were the most prevalent serious natural hazards identified by local officials in Walpole. Flooding is caused by hurricanes, nor’easters, severe rainstorms and thunderstorms. At the time of the writing of the LHMP, there were no repetitive flood losses within the Town, and review of the 2012 data for the 2013 State Hazard Mitigation Plan indicates that that information remains valid.

In order to determine damages from hurricanes, the Hazus-MH hurricane module was used. For the purposes of the plan, Category 3 (Hurricane Gloria 1985) and a Category 4 (Hurricane Donna 1960) storms were chosen to illustrate damages. The results of that analysis are shown in Table 30. Of note,

while the methodology indicates Category 3, the table illustrates a Category 2 event, so it is uncertain what storm event was actually utilized in determining damages.

The Town’s risk assessment also used Hazus for determining loss estimations for the earthquake hazard. For the purposes of this plan two earthquakes were selected: an 1847 earthquake with a magnitude of 5.0 and an 1817 earthquake with a magnitude of 5.7. The results are demonstrated in Table 31.

Estimating flood damages did not include the use of Hazus: “MAPC did not use Hazus-MH to estimate flood damages in Walpole. In addition to technical difficulties with the software, the riverine module is not a reliable indicator of flooding in areas where inadequate drainage systems, beaver activity, and increased impervious surfaces contribute to flooding even in areas outside of mapped flood zones. In lieu of using Hazus, MAPC developed a methodology to give a rough approximation of flood damages” (2008, p. 32). Based on the analysis conducted (similar to those described within the Town of Franklin and Milford), loss estimates for flood damages ranged from \$9,857,445 to \$49,287,227. These calculations were not based solely on location within the floodplain or a particular type of storm (i.e. 100 year flood). Review of the LHMP reveals that while “the flood zones have not been properly studied as a system, town officials believe that many of the town’s more frequent flooding problems are related to insufficient or inoperable flood management structures, such as culverts, dams and drain pipes that are not large enough to quickly transport flood waters away from town streets and neighborhoods and toward the nearby wetlands” Walpole, 2008, p. 38). The LHMP does identify a number of mitigation strategies to assist in management and mitigation of these issues. Those strategies are incorporated in the State’s overall strategy review discussed previously in this section.

**TABLE 29.
WALPOLE HAZARDS OF CONCERN**

Hazard	Frequency in State	Severity in State	Issues in Walpole
Flood	High	Serious to extensive	Same as state
Dam Failure	Low	Extensive	Same as state
Hurricanes	Medium	Extensive to catastrophic	Same as state
Severe Storms (wind, hail, lightning)	Medium	Serious	Same as state
Tornadoes	Medium	Extensive to catastrophic	Not a major issue in Walpole
Winter Storms	High	Serious	Same as state
Earthquakes	Low	Catastrophic	Not a major issue in Walpole
Landslides	Low	Minor	Not a major issue in Walpole
Brush Fires	Medium	Serious	Not a major issue in Walpole

TABLE 29. WALPOLE HAZARDS OF CONCERN			
Hazard	Frequency in State	Severity in State	Issues in Walpole
Definitions Used in the Commonwealth of Massachusetts State Hazard Mitigation Plan			
<u>Frequency</u>			
<ul style="list-style-type: none"> • Very Low Frequency: Events that occur less frequently than once in 1,000 years (less than 0.1% per year). • Low Frequency: Events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year). • Medium Frequency: Events that occur from once in 10 years to once in 100 years (1% to 10% per year). • High Frequency: Events that occur more frequently than once in 10 years (greater than 10% per year). 			
<u>Severity</u>			
<ul style="list-style-type: none"> • Minor: Limited and scattered property damage; no damage to public infrastructure (roads, bridges, trains, airports, public parks, etc.); contained geographic area (i.e., 1 or 2 communities); essential services (utilities, hospitals, schools, etc.) not interrupted; no injuries or fatalities. • Serious: Scattered major property damage (more than 50% destroyed); some minor infrastructure damage; wider geographic area (several communities); essential services are briefly interrupted; some injuries and/or fatalities. • Extensive: Consistent major property damage; major damage to public infrastructure (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and fatalities. • Catastrophic: Property and public infrastructure destroyed; essential services stopped, thousands of injuries and fatalities. 			

TABLE 30. WALPOLE ESTIMATED DAMAGE FROM HURRICANE		
	Cat. 2	Cat 4*
Building Characteristics		
Estimated total buildings	7,168	
Estimated total building replacement value (Year 2002 \$)	\$2,479,234,000	
General Building Damage		
# of buildings sustaining minor damage	842	2,549
# of buildings sustaining moderate damage	117	1,070
# of buildings sustaining severe damage	5	216
# of buildings destroyed	2	141
Population Needs		
% of hospital beds available on day of event	0	0
# of households displaced	24	358
# of people seeking public shelter	4	71
Debris	15,159	58,172
Building debris generated (tons)	2,728	19,778
Tree debris generated (tons)	12,430	38,394
# of truckloads to clear building debris	109	795
Value of Damages (Thousands of dollars)		
Total property damage	\$20,950.28	\$209,395.40
Total business interruption loss	\$2,055.91	\$28,116.53
<p>*No category 4 or 5 hurricanes have been recorded in New England. However, a Category 4 hurricane was included to help the communities understand the impacts of a hurricane beyond what has historically occurred in New England.</p>		

TABLE 31. WALPOLE ESTIMATED DAMAGE FROM EARTHQUAKE		
	Magnitude 5.0	Magnitude 5.7
Building Characteristics		
Estimated total number of buildings		7,168
Estimated total building replacement value (Year 2002 \$)		\$2,479,234,000
Building Damages		
# of buildings sustaining slight damage	89	445
# of buildings sustaining moderate damage	15	89
# of buildings sustaining extensive damage	1	10
# of buildings completely damaged	0	1
Population Needs		
# of households displaced	1	8
# of people seeking public shelter	0	1
Debris		
Building debris generated (tons)	0	0
# of truckloads to clear building debris	0	0
Value of Damages (Millions of dollars)		
Total property damage	\$0.48	\$2.14
Total losses due to business interruption	\$11.19	\$23.03

MONTACHUSETT REGIONAL PLANNING COMMISSION

This region consists of 22 towns and cities, has a total population of 228,005, and has a density of 337 persons per square mile. The largest communities are Fitchburg, Leominster and Gardner. Growth is defined as slowly increasing at about 6% between 1990 and 2000, less than the national average of 13.2%. New residential development is important and “Approval Not Required” is a major trend in residential development. Only 50 square miles of 100-year flood zone are in the region.

Review of the local planning efforts demonstrates varied methods of conducting risk assessment: the Town of Ashby provides limited dollar losses for the 100 year flood event only, and does not include content losses. The Town of Harvard utilizes Q3 Flood Zones within their risk assessment. The plan also includes the following statement when discussing dollar loss estimations: “These figures do not take into account monetary damages to property and personal property as well as Critical Infrastructure that are not buildings such as bridges and dams.” Also, “At the recommendation of the Federal Insurance Administration, a 250-foot buffer was applied to the FEMA Q3 Flood Zones in determining whether structures are located within the Special Flood Hazard Area boundaries. If any part of the parcel, building or structure intersected this buffer, then it was considered to have the potential to be inside the flood zone.”

Link to Hazard Mitigation Plan (Expires 5/29/14): Not available on-line.

- [Ashburnham](#)
- [Ashby](#)
- [Athol](#)
- [Ayer](#)
- [Clinton](#)
- [Devens](#)
- [Fitchburg](#)
- [Gardner](#)
- [Groton](#)
- [Harvard](#)
- [Hubbardston](#)
- [Lancaster](#)
- [Leominster](#)
- [Lunenburg](#)
- [Petersham](#)
- [Phillipston](#)
- [Royalston](#)
- [Shirley](#)
- [Sterling](#)
- [Templeton](#)
- [Townsend](#)
- [Westminster](#)
- [Winchendon](#)

The Town of Clinton (Worcester County)—November 2008 LHMP

The Town of Clinton is located in North Central Massachusetts, bordered by Bolton and Berlin on the east, and Boylston on the south, Sterling on the west, and Lancaster on the northwest and north. Clinton is 13 miles north of Worcester, 16 miles south of Fitchburg, 35 miles west of Boston, and 200 miles from New York City.

Strategies for the town were developed throughout the planning process and ultimately prioritized based on those having a low to moderate cost to implement, due to the limited resources of the Town. The local action items “represent a multi-faceted approach to addressing natural hazards in the Town and will be undertaken as resources become available, and will be integrated into ongoing planning activities” (Clinton LHMP, 2008, p. 12). The planning team clearly understands the benefits of the intent behind mitigation planning, as it discusses how “mitigation planning will also lead to benefits that go beyond solely reducing the costs associated with hazard vulnerability. Measures such as the acquisition or regulation of land in known hazard areas can help achieve multiple community goals, such as preserving open space, maintaining environmental health and natural features, and enhancing recreational opportunities” (Clinton LHMP, 2008, p. 14). The planning partnership further discusses the “Good Common Sense” when it discusses the fact that as “responsible people, hazard mitigation should become common language and practice among regional and local officials. For example, regularly scheduled clean-ups of waterways, catch basins, and streets prevent water pollution and debris, and runoff into brooks and rivers—these actions can also prevent flooding during heavy rainfall” (ibid). Robust concepts such as this demonstrate a holistic approach to mitigation, fitting into FEMA’s *whole community* concept of operation.

Review of the Town’s risk assessment demonstrates additional hazards which were not included in other plans, specifically sewer back-up and sink holes. Table 32 demonstrates the hazard ranking matrix utilized, which also differs from those of other planning councils, but is well documented and organized. Critical facilities are identified for some of the hazards; however, limited dollar estimations are provided. The plan identifies one repetitive loss property; review of the 2013 State updated data indicates three RL properties.

**TABLE 32.
CLINTON RISK MATRIX TABLE**

Table 3 Hazard & Vulnerability Session Matrix Review Town of Clinton				
<u>Natural Hazard</u>	<u>Likelihood of Occurrence</u>	<u>Location</u>	<u>Impacts</u>	<u>Hazard Index</u>
Natural Hazard Separated by Flood, Wind, Fire, Geologic and Ice & Snow Related Hazards	3 = Highly Likely 2 = Possible 1 = Unlikely	3 = Large/Multi-Community 2 = Medium/Regional 1 = Small/Local	4 = Catastrophic 3 = Critical 2 = Limited 1 = Negligible	Ranking Determined by Combining the Likelihood, Location and Impacts of a Natural Hazard
Flood-Related Hazards: Dam Failures	2.00	3.00	4.00	9.00
Geologic Hazards: Earthquakes	2.00	3.00	4.00	9.00
Fire-Related Hazards: Drought	0.50	3.00	4.00	7.50
Ice & Snow Hazards: Snow Storms	3.00	2.00	2.50	7.50
Flood-Related Hazards: Thunderstorms	2.00	2.00	3.00	7.00
Flood-Related Hazards: Beavers	3.00	2.00	1.00	6.00
Flood-Related Hazards: Drainage	3.00	1.00	2.00	6.00
Flood-Related Hazards: Storm Water Run-off	3.00	1.00	2.00	6.00
Wind-Related Hazards: Hurricane	1.50	2.00	2.50	6.00
Fire-Related Hazards: Urban Fires	1.50	1.00	3.00	5.50
Flood-Related Hazards: Sewer Back-up	1.50	1.00	1.50	4.00
Wind-Related Hazards: Tornadoes	1.00	2.00	2.50	5.50
Flood-Related Hazards: Flooding	2.50	1.00	1.00	4.50
Fire-Related Hazards: Wildfires	1.00	1.00	1.50	3.50
Flood-Related Hazards: Erosion	1.00	1.00	1.00	3.00
Flood-Related Hazards: Land Slides	1.00	1.00	1.00	3.00
Ice & Snow Hazards: Ice Jams	1.00	1.00	1.00	3.00

Town of Townsend (Middlesex County) December 2008 LHMP Review:

Townsend is located in the extreme northwestern part of Middlesex County, in north central Massachusetts. It is the north of Worcester on the New Hampshire border. The Town is bordered by Ashby on the west, Mason and Brookline on the north, Pepperell, Gorton and Shirley on the east, and Lunenburg on the South. The town is located 42 miles northwest of Boston, 33 miles north of Worcester, and 210 miles from New York City.

Townsend lies almost entirely within the Nashua River Watershed, with over 85% of the town's land draining into the Squannacook River. There are approximately 206 acres of open water, with three water bodies ranging from 17 to 42 acres.

Concepts similar to those discussed for the Town of Clinton exist within this plan, demonstrating a holistic approach to mitigation, fitting into FEMA's *whole community* concept of operation.

The Town of Townsend identified similar hazards as other plans within this planning region, including storm sewer and sink holes, as identified in Table 33

Review of the plan identifies approximately 54 pieces of critical infrastructure have the potential to be affected by these flood hazards, with loss estimations "due to loss of all buildings in these flood zones is approximately \$210,900,200 for the 100 Year Flood Zone and \$259,989,800 for the 500 Year Flood Zone, which includes the 100 Year Flood Zone (source: Townsend Assessor's Office)" (Townsend LHMP, 2008, p. 25). While some other hazard profiles identify critical infrastructure at risk by number, no dollar loss estimations are provided.

Review of the goals and strategies of the jurisdiction demonstrate a close alignment with the Commonwealth's 2013 goals as identified. Strategies include structural and non-structural activities. STAPLEE is used as the method to prioritize strategies.

**TABLE 33.
TOWNSEND HAZARD RANKING**

Natural Hazard	Likelihood of Occurrence	Location	Impacts	Hazard Index Ranking
Natural Hazard Separated by Flood, Wind, Fire, Geologic and Ice & Snow Related Hazards	3 = Highly Likely 2 = Possible 1 = Unlikely	3 = Large/ Multi-Community 2 = Medium/ Regional 1 = Small/Local	4 = Catastrophic 3 = Critical 2 = Limited 1 = Negligible	Determined by Combining the Likelihood, Location and Impacts of a Natural Hazard
Flood-Related Hazards: Thunderstorms	3.00	3.00	3.00	9.00
Wind-Related Hazards: Hurricanes	2.00	3.00	3.50	8.50
Wind-Related Hazards: Tornadoes	2.00	3.00	3.50	8.50
Fire-Related Hazards: Wildfires	3.00	2.00	3.00	8.00
Ice & Snow Hazards: Snow Storms	3.00	2.00	3.00	8.00
Flood-Related Hazards: Beavers	3.00	1.00	3.00	7.00
Geologic Hazards: Earthquakes	2.00	2.00	3.00	7.00
Flood-Related Hazards: Flooding	2.00	1.00	3.00	6.00
Fire-Related Hazards: Urban Fires	2.00	1.00	3.00	6.00
Flood-Related Hazards: Dam Failures	2.00	1.00	2.00	5.00
Flood-Related Hazards: Drainage	2.00	1.00	2.00	5.00
Flood-Related Hazards: Stormwater Run-off	2.00	1.00	2.00	5.00
Fire-Related Hazards: Drought	2.00	1.00	2.00	5.00
Flood-Related Hazards: Erosion	1.00	1.00	1.00	3.00
Flood-Related Hazards: Land Slides	1.00	1.00	1.00	3.00
Flood-Related Hazards: Sewer Back-up	1.00	1.00	1.00	3.00
Geologic Hazards: Sink Holes	1.00	1.00	1.00	3.00
Ice & Snow Hazards: Ice Jams	1.00	1.00	1.00	3.00

NANTUCKET PLANNING & ECONOMIC DEVELOPMENT COMMISSION

This island community has a population of 10,142. While historically there has been a stable increase in population over the past 5 years, 2011 saw a decline in population of over 1,000, yet this is still a 6.5% increase from the 2000 population count. There are 226 people per square mile. Unlike most coastal communities in the US, residential development is not concentrated on the coastline, mainly due to conservation and current zoning. Large developments are low; most of the increases are seen in individual residential developments. Historically, there are approximately 100 new residential developments per year, including single and multi-unit development. Estimated 2020 population for Nantucket shows a 42% increase from 2011 levels.

No plan in place.

*Town and County of
Nantucket*

Nantucket's hazard mitigation plan is currently expired, therefore, updated data concerning risk for this area may be obtained within the various risk profile data contained within Section 5—Risk Assessment. However, information concerning the goals, objectives, strategies and capabilities are captured from the expired plan.

NORTHERN MIDDLESEX COUNCIL OF GOVERNMENTS

The Greater Lowell region consists of the City of Lowell and its eight suburbs—Billerica, Chelmsford, Dracut, Dunstable, Pepperell, Tewksbury, Tyngsborough and Westford—and has a land area of approximately 196 square miles and an inland water area of 5.76 square miles. The City of Lowell serves as the central city and economic center of the region. According to the U.S. Census Bureau, the Greater Lowell region had a population of 286,901 in 2010, which represented an increase of 2.2% since 2000. This growth rate was one-third of what the region experienced between 1990 and 2000.

The City of Lowell accounts for the largest percent of the region's population and is the largest community and continues to have the highest population density, at over 7,325 persons per square mile. Billerica, Chelmsford, Dracut and Tewksbury, the early suburbanizing communities with population densities over 1,000 persons per square mile, collectively account for ~46% of the region's population. The remaining communities, where much of the development activity occurred during the 1990s, account for 17% of the region's population. In 2010, there were 296,000 households in the region. The total number of housing units in the region increased from 101,973 units in 2000 to 109,446 units in 2010, an increase of 7,473 units or 7.3%. The City of Lowell accounted for the largest share of housing units in the region, however, its percentage share of the total housing units in the region decreased slightly from 38.7% in 2000 to 37.9% in 2010. The number of vacant units in the region nearly doubled from 2.6% in 2000 to 5% in 2010. In terms of housing unit density, the City of Lowell was the only community in 2010 that had more than 600 housing units per square mile at ~2,849 housing units, with the next highest community being Chelmsford at 593 housing units per square mile.

Link to Hazard Mitigation Plan:
<http://www.nmcoq.org/2012%20PDM%20June%202012.pdf> Expired 9/8/11; Under MEMA Review 10/12.

*Town of Billerica
Town of Chelmsford
Town of Dracut
Town of Dunstable
City of Lowell
Town of Pepperell
Town of Tewksbury
Town of Tyngsborough
Town of Westford*



Figure 5. 2007 Flooding at the Lawrence Mill in Lowell

Notwithstanding the current housing slump, the number of households in the region is projected to increase from 104,022 in 2010 to 118,900 households in 2035, an increase of 14.3%. The principal areas of household growth will be in Dunstable (55.2%), Pepperell (38.2%), Tyngsborough (33.8%), Westford (25.8%), and Dracut (25.7%), as outlined in Table 10 below. The more developed communities, such as the City of Lowell (5.7%), Billerica (10.6%), Chelmsford (11.6%) and Tewksbury (15.8%), will experience more restrained household growth between 2010 and 2035.

The trend toward urbanization/suburbanization of the region has implications for natural hazard planning. As more land is developed, additional impervious surface is created, potentially increasing the flood risk and decreasing the area available for flood storage. As population and housing density increases, the potential for property damage and economic loss as a result of a natural disaster also increases.

According to the National Climatic Data Center, 53 flood events were reported in Middlesex County from January 1, 1950 and July 2010.

Billerica has more repetitive loss structures than any other community in the region. It ranks eleventh in the state in terms of National Flood Insurance Program repetitive flood loss properties. Fifty structures have experienced repetitive losses due to flooding.

In 2010, new FEMA floodplain maps were released for the communities located in the Northern Middlesex region. The updated Flood Insurance Rate Maps indicate a net increase of approximately 532 acres now determined to be located in the flood plain. The greatest increases are in the towns of Chelmsford, Lowell and Dunstable, as shown in Table 34.

No dollar losses were established for critical infrastructure within the planning document.

TABLE 34.
NORTHERN MIDDLESEX PERCENT CHANGE OF FLOODPLAIN AREA, 1979 – 2010

Community	Acres of floodplain as shown on 1979 FIRM maps	Acres of floodplain as shown on 2010 FIRM maps	Difference in acres (1979-2010 FIRM maps)	% Change 1979-2010	Total Land Area in Acres	% Land Area in Flood Plain (according to the 2010 FIRM maps)
Billerica	2,267.94	2,284.43	16.49	0.73	16,815.68	13.58
Chelmsford	1,947.67	2,076.28	128.61	6.60	14,749.89	14.08
Dracut	1,128.86	1,144.05	15.19	1.35	13,647.04	8.38
Dunstable	1,847.58	1,960.73	113.15	6.12	10,717.41	18.29
Lowell	1,226.20	1,285.33	59.13	4.82	9,299.48	13.82
Pepperell	1,470.85	1,518.10	47.25	3.21	14,846.93	10.23
Tewksbury	1,602.31	1,617.72	15.41	0.96	13,511.40	11.97
Tyngsborough	1,731.76	1,814.20	82.44	4.76	11,545.96	15.71
Westford	2,991.97	3,045.77	53.80	1.80	20,036.33	15.20
Regional Total	16,215.14	16,746.61	531.47	3.28	125,170.10	13.38

TABLE 35.
ASSESSED VALUE OF BUILDINGS IN THE 100 YEAR FLOOD PLAIN BY COMMUNITY WITHIN THE NORTHERN MIDDLESEX COUNCIL OF GOVERNMENTS PLANNING REGION:

	Number of Structures	Residential	Commercial	Industrial	Governmental /Institutional	Total Value
Billerica	321	\$46,852,100	\$5,771,300	\$1,779,200	\$3,682,400	\$58,085,000
Chelmsford ¹	400	50,197,574	8,959,400	8,307,900	1,191,600	89,301,774
Dracut	68	9,811,200	3,342,900	8,092,700	100,000	21,346,800
Dunstable	28	5,230,900	0	0	0	5,230,900
Lowell	451	113,199,600	16,304,900	9,084,500	8,744,800	147,333,800
Pepperell	30	4,082,885	187,600	81,100	87,900	4,439,485
Tewksbury	246	26,027,600	5,211,200	1,837,200	810,400	33,886,400
Tyngsborough	111	16,852,800	7,466,800	383,400	221,200	24,924,200
Westford	113	20,645,300	5,883,100	9,366,600	0	50,733,300
Total	1788	\$292,899,959	\$53,127,200	\$38,932,600	\$14,838,300	\$435,281,659 ²

¹Includes 118 Condo units, representing \$28,506,204 in the Williamsburg Condominium Complex

²Based on assessed value of structures and adjusted for condo units when majority of building is out of the flood zone.

**TABLE 36.
ESTIMATED CONTENTS REPLACEMENT COSTS FOR BUILDINGS IN THE NORTHERN
MIDDLESEX 100-YEAR FLOODPLAIN**

Community	Residential Contents Value	Commercial Contents Value	Industrial Contents Value	Governmental/ Institutional Contents Value	Total Contents Value
Billerica	\$23,426,050	\$5,771,300	\$2,224,400	\$3,682,400	\$35,104,150.00
Chelmsford ¹	25,098,787	8,959,400	10,384,875	1,191,600	45,634,662
Dracut	4,905,600	3,342,900	10,115,875	100,000	18,464,375
Dunstable	2,615,450	0	0	0	2,615,450
Lowell	56,599,800	16,304,900	11,355,635	8,744,800	93,005,135
Pepperell	2,041,279	187,600	101,375	87,900	2,418,154
Tewksbury	13,013,800	5,211,200	2,296,500	810,400	21,331,900
Tyngsborough	8,426,400	7,466,800	479,250	221,200	16,593,650
Westford	10,322,650	5,883,100	11,708,250	0	27,914,000
Total	\$146,449,816	\$53,127,200	\$48,666,160	\$14,838,300	\$263,081,476.00

Source: Local Assessor records, FIRM maps, contents value calculations utilize HAZUS methodology.

**TABLE 37.
NORTHERN MIDDLESEX HAZARDS OF CONCERN**

HAZARD	FREQUENCY				SEVERITY				AREA OF IMPACT			AREA OF OCCURRENCE		
	VERY LOW	LOW	MODERATE	HIGH	MINOR	SERIOUS	EXTENSIVE	CATASTROPHIC	ISOLATED	LOCAL/MUNICIPAL	REGIONAL	ISOLATED	LOCAL/MUNICIPAL	REGIONAL
FLOOD				X		X				X	X		X	X
DAM FAILURE	X					X				X			X	
HURRICANE			X			X					X			X
TORNADO			X				X			X	X		X	X
THUNDERSTORM				X	X						X			X
NOR'EASTER				X			X				X			X
SNOWSTORM/ BLIZZARD				X		X					X			X
ICE STORM			X			X					X			X
ICE JAM	X				X				X	X			X	
DROUGHT		X			X						X			X
WILDFIRE			X			X				X			X	
EARTHQUAKE		X				X					X			X
LANDSLIDES	X				X				X	X		X	X	
CLIMATE CHANGE			X				X				X			X

KEY:

FREQUENCY:

- Very Low: Occurs less frequently than once in 100 years
- Low: Occurs from once in 50 years to once in 100 years
- Moderate: Occurs from once in 5 years to once in 50 years
- High: Occurs more frequently than once in 5 years

SEVERITY:

- Minor: Limited and scattered property and infrastructure damage; essential services not interrupted
- Serious: Scattered major public and private property and infrastructure damage, brief service interruptions, injuries and deaths possible
- Extensive: Widespread major public and private property and infrastructure damage with long term public service interruptions, many injuries and fatalities probable
- Catastrophic: Destruction of private and public property and infrastructure with numerous deaths and injuries

AREA OF IMPACT:

- Isolated: Impact will only be realized in a small area within a local jurisdiction or parts of one of more local jurisdictions
- Local municipal: Impact will only be realized within a local jurisdiction or parts of one of more local jurisdictions
- Regional: Impact will be realized within two or more local jurisdictions on a more widespread basis

AREA OF OCCURRENCE:

- Isolated: Impact will only be realized in a small area within a local jurisdiction or parts of one of more local jurisdictions
- Local municipal: Impact will only be realized within a local jurisdiction or parts of one of more local jurisdictions
- Regional: Impact will be realized within two or more local jurisdictions on a more widespread basis

OLD COLONY PLANNING COUNCIL

This plan covers the 344 square mile Old Colony Planning Council region in Southeastern Massachusetts. The Old Colony region is comprised of the City of Brockton and 14 towns: Abington, Avon, Bridgewater, East Bridgewater, Easton, Halifax, Hanson, Kingston, Pembroke, Plymouth, Plympton, Stoughton, West Bridgewater and Whitman. The City of Brockton and the Town of Plymouth serve as the anchor of the northern and southern part of the region respectively. All fifteen communities are participants in the current 2012 hazard mitigation plan. The fifteen communities run northwest to southeast from Brockton and Stoughton along Route 24 in the northwestern part of the region down to Plymouth and Kingston along Route 3 and the Atlantic Ocean in the southeastern part of the region. The region is situated south of the metropolitan concentration of activity and population around Boston and Cambridge, but is oriented towards that center and largely cuts across the north-south transportation lines between Greater Boston and the rest of Southeastern Massachusetts. The Old Colony region's terrain consists of generally low and gently rolling glaciated land with many drumlins, eskers and other glacial features, as well as a generally north-south drainage system and extensive wetlands including the Hockmock Swamp in parts of Bridgewater, Easton and West Bridgewater and the Great Cedar Swamp in Halifax and Hanson.

**Link to Hazard Mitigation Plan
(Expired 8/23/11):**

http://www.ocpcrpa.org/docs/comprehensive/Draft_Old_Colony_Hazard_Mitigation_Plan.pdf Draft Plan Dated 9/12/2012.

Abington
Avon
Bridgewater
Brockton
Duxbury
East Bridgewater
Easton
Halifax
Hanson
Kingston
Pembroke
Plymouth
Plympton
Stoughton
West Bridgewater
Whitman

According to the 2010 U.S. Census Bureau, the Old Colony region had a population of 333,468 in 2010, which represented an increase of 3.7% since 2000. The rate of growth was one-third of what the region experienced between 1990 and 2000.

The region is located in the southeastern section of Massachusetts, with its eastern-most communities located along the Atlantic Ocean. The City of Brockton is located 20 miles south of the City of Boston, 24 miles northeast of the Town of Plymouth and 30 miles east of Providence, Rhode Island and the Town of Plymouth is located 24 miles southeast of Brockton, 37 miles southeast of Boston and 44 miles east of Providence, Rhode Island.

The region's 15 communities can be categorized into three groups:

- Greater Brockton (Abington, Avon, Bridgewater, Brockton, East Bridgewater, Easton, Stoughton, West Bridgewater, and Whitman). This relatively developed area has many streams, scattered, often man-made ponds, and commonly tight glacial soils. While the extensive drainage system has many streams, none are very large because the communities are close to the headwaters of the several basins. Though the streams are small, some segments are confined to narrow walled channels to allow or protect nearby buildings. This leaves no room for safe flooding and informal flood storage. Thus streams can overflow during storms into nearby developed areas. The area also has many sections with relatively tight soils limiting on-site disposal opportunities and groundwater yields.
- The Lake Communities (Hanson, Halifax, Pembroke, and Plympton). The Lake region has a range of tight wetlands soils and porous areas of sand and gravel, with many lakes and ponds and fewer major streams.

- The South Coastal Area (Kingston and Plymouth). The South Coastal area of the region has typically porous sandy soils and many ponds. It supports very few streams of any size since the coarse soils and irregular terrain absorb much rainfall before it can run off. Instead, the major surface waters consist of the frequent ponds and lakes, many of them consisting of exposed groundwater.

Residential growth is estimated to occur at a fast rate in the less populated communities in the region. There has been recent growth in commercial and retail development in the region. Though most is not in or near the floodplain, there are some developments in or near the scrub oak and pitch pine forest, which could increase wildfire risk.

Currently the City of Brockton accounts for approximately 28% of the region's population and continues to have the region's highest population density as well, with approximately 4,356 persons per square mile. Brockton, along with Abington, Stoughton and Whitman, the three other early urbanizing communities with population densities over 1,000 persons per square mile, collectively account for 45% of the region's population. While the population density is highest in the northern part of the region, the past decade has seen much of the region's growth occur in the southeastern half of the region, where many communities grew by over 6 percent. Communities in the northwestern half experienced substantially less growth during this same time period. Areas in the southeastern half of the region generally have had more available developable land, where a substantial amount of subdivisions and low-density, large-lot development has occurred.

The total number of housing units in the region increased from 118,300 in 2000 to 128,081 units in 2010, an increase of 9,781 units or 8.7%. The City of Brockton accounted for the largest share of housing units in the region, however, its percentage share of the total housing units in the region decreased slightly from 29.5% in 2000 to 27.8% in 2010. In 2010, 6.7% of the total housing units were vacant in the region, with Plymouth having the highest rate of vacant units at 14.2%. In terms of housing unit density, the communities of Abington, Brockton, Stoughton and Whitman were the only communities in 2010 that had more than 600 housing units per square mile.

Between 2010 and 2035, each community in the region is expected to increase in population, but none more so than the towns of Plympton and Plymouth, whose population is expected to increase 37.45% and 25.84% respectively. For those communities that are much more developed, such as Avon, Brockton, Stoughton and Whitman, less dramatic population growth is expected to occur in the next twenty-five years. Overall, the rate of growth rates for the remaining communities range between 5.61% (Brockton) to 23.19% (Hanson).

The number of housing units in the region is expected to increase from 119,437 in 2010 to 138,700 in 2035, an increase of 16.1%. The principal areas of household growth will be in Plympton (50.3%), Hanson (32.5%) and Plymouth (26.3%). The more developed communities of Avon (4.9%), Brockton (6.5%) and Whitman (9.2%) will experience more restrained household growth between 2010 and 2035.

Based on review of the hazards of concern addressed within the profiles and risk assessment portions of the Regional Hazard Mitigation Plan, flood is the number one hazard of concern, with five (5) of the seven hazards occurring within the planning region during the time period 2001-2011 resulting in FEMA disaster declarations.

Review of analysis conducted by the Commonwealth demonstrates that Plymouth County filed 9,677 NFIP claims, with sums of dollars expended reaching in excess of \$115 million (losses and premiums paid).

PIONEER VALLEY PLANNING COMMISSION

This region consists of 43 towns and cities, has a total population of 608,000, and has a density of 506 persons per square mile. Growth is defined as being fairly stable with minor urban sprawl around Springfield, Northampton, and Westfield in the form of residential development. The Pioneer Valley is experiencing a unique form of growth called “sprawl without population growth,” due to a variety of factors. Undeveloped farmland conversion rose at a rate of 48%, but this rate of development is not sustainable due to the nearly stable population in the region.

Hampden County is the most populous county in western Massachusetts. It has a strong industrial and commercial employment base. Hampden County’s largest city, Springfield, is the third largest community in the Commonwealth. The County is called “the Crossroads of New England” and features rail service in all directions, as well as several exchanges of the Massachusetts Turnpike and I-91. The leading employers in the County include the following: Baystate Health, Big Y Supermarkets, Friendly Ice Cream Corp., Hasbro Games, Holyoke Community College, Holyoke Medical Center, Mass Mutual Financial Group, Mercy Medical Center, Monson Development Center, and Springfield Technical Community College.

Hampshire County is bisected by the Connecticut River and is located in the middle of western Massachusetts. The County has a mix of rural and urban areas and is becoming a popular residential and recreational area. Hampshire County contains several state parks and the Quabbin Reservoir, a man-made reservoir that serves Boston. I-91 is the County’s primary highway and has an extensive network of public bus service links. Passenger rail service via Amtrak is available in Northampton. There are two general hospitals and one veteran’s hospital. The County also contains several state parks and forests. The leading employers in the County include the following: Amherst College, Berry Tubed Products, C&S Wholesale Grocers, Inc., Cooley Dickinson Hospital, Delivery Express, Hampshire College, IntelliCoat Technologies, Mount Holyoke College, Smith College, and the University of Massachusetts.

West Springfield LHMP Review

The West Springfield LHMP was adopted on December 20, 2010. West Springfield in Western Massachusetts’ is a diverse community with both suburban and rural qualities, and a historic downtown. The town is comprised of over 17 square miles, located on the western bank of the Connecticut River. West Springfield is bordered by Holyoke to the north, and Chicopee and Springfield to the east. Westfield lies to West Springfield’s west, and Agawam to the south. Zoning is the primary land use tool that the town uses 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. While relying primarily on zoning as the tool to mitigate potential impacts to disaster incidents, the town also has four districts which are specifically relevant to natural hazard mitigation: the River

Hazard Mitigation Plan: (Multiple Single Jurisdiction Plans Expiration ranging from 2/14/13 to 3/5/17).

Agawam
Amherst
Belchertown
Blandford
Brimfield
Chester
Chesterfield
Chicopee
Cummington
East Longmeadow
Easthampton
Goshen
Granby
Granville
Hadley
Hampden
Hatfield
Holland
Holyoke
Huntington
Longmeadow
Ludlow
Middlefield
Monson
Montgomery
Northampton
Palmer
Pelham
Plainfield
Russell
South Hadley
Southampton
Southwick
Springfield
Tolland
Wales
Ware
West Springfield
Westfield
Westhampton
Wilbraham
Williamsburg
Worthington

Protection District, Water Supply Protection District, Flood Hazard District, and Age Restricted Housing District. Each of these promotes sustainability and incorporates mitigation into the intent behind the intended purpose to the district. More information on these specific districts can be obtained within the 2010 West Springfield LHMP, beginning at page 7.

Table 38 identifies the hazard ranking index as established by the planning committee during the 2010 plan update process.

**TABLE 38.
WEST SPRINGFIELD HAZARDS OF CONCERN**

Type of Hazard	Location	Extent	Previous Occurrences	Probability of Future Events	Hazard Risk Index Rating
Flooding (100-year)	Large	Catastrophic	Yes	Very Low	5
Flooding (localized)	Medium	Limited	Yes	Very High	1
Severe Snow/Ice Storms	Large	Minor	Yes	Very High	5
Hurricanes/Severe Wind	Medium	Limited	Yes	Low	3
Tornado/Microburst	Small	Catastrophic	Yes	Low	3
Wildfire/Brushfire	Medium	Limited	Yes	Low	3
Earthquake	Large	Catastrophic	No	Very Low	5
Dam Failure	Small	Minor	Yes	Low	4
Drought	Small	Minor	No	Very Low	5
Man-Made Hazard: Hazardous Materials	Large	Critical	Yes	Low	3

Data utilized to determine dollar losses were based on Community Information System (CIS) of FEMA, and is based on 2005 data. Vulnerability for a 100-year flood event was estimated at approximately \$1.7 million of damages, with 22 individuals impacted. The plan indicates that at the time of the update, there were no repetitive loss properties identified. Review of the 2013 data utilized to update the Commonwealth's HMP confirms this information to be accurate for data collected within Hampden County through December 31, 2012. The plan identifies Hurricanes and Severe Wind to be a low risk, but indicates that all of West Springfield is at risk. Loss estimations were also provided for hurricane wind damage, but the methodology used to determine those figures is unclear. The plan identifies critical facilities, but states that "all critical facilities fall into the hazard area" as the hazards identified in the plan are regional risks (Springfield, 2010, p. 25).

Mitigation strategies remain consistent with the remaining planning area, as do the goals and capabilities assessment. That information is captured in the overall general data for the State's review previously contained in this section.

Town of Palmer LHMP Review:

Palmer reviewed involved the LHMP adopted December 2010. The Town of Palmer is located in eastern Hampden County in Western Massachusetts, where the confluence of the Ware, Quaboag, and Swift Rivers form the headwaters of the Chicopee River. Palmer is made up of four villages: Bondsville, Depot Village (or Palmer Center), Thorndike, and Three Rivers. It has a total land area of just over 32 square miles, and is bordered by Monson to the south, Wilbraham and Ludlow to the west, Belchertown and Ware to the north, and Warren and Brimfield to the east. Palmer lies seventeen miles from downtown Springfield, and seventy-three miles from the metropolitan center of Boston.

Palmer spans the Ware, Quaboag, and Swift River Valleys from the Wilbraham Hills in the west, to the Warren and Brimfield mountains in the east. With these major river courses and multiple hills, the Town's landscape is very irregular. The valley plains along the riverbanks are the most populated areas for industry and commercial activity as well as residential living. At the time of the writing of the 2010 plan, the "vast majority (68%) of the total acreage of Palmer is undeveloped forestland, at approximately 14,260 acres" (Palmer, 2010, p. 6). The 2010 plan identifies that "the vast majority of Palmer's 32.7 square miles is undeveloped land, totaling close to 14,260 acres. Residential land is the second most prolific land use, at approximately 3,110 acres, followed by agricultural land at approximately 1,295 acres. Land used for industry constitutes a relatively large 470 acres, with commercial use occupying just 142 acres. Land characterized as urban open/public land constitutes 243 acres, and there are 111 acres of outdoor recreational land throughout Town. Water in the town of Palmer comprises over 470 acres" (ibid).

Table 39 shows the hazard profiling and risk index worksheet.

TABLE 39.
PALMER HAZARD PROFILING AND RISK INDEX WORKSHEET

Type of Hazard	Previous Occurrences	Location of Occurrence	Extent of Impacts (Damage)	Probability of Future Events	Hazard Risk Index Rating
Flooding (100-year)	Yes	Large	Critical	Low	3
Flooding (localized)	Yes	Medium	Critical	Very High	1
Severe Snow/Ice Storms	Yes (minimal)	Large	Limited	Very High	2
Hurricanes/Severe Wind	Yes	Large	Critical	Very Low	4
Tornado/Microburst	Micrburst only	Small	Catastrophic	Low	4
Wildfire/Brushfire	Yes	Medium	Limited	Moderate	3
Earthquake	No	Large	Catastrophic	Low	4
Dam Failure	Yes	Large	Catastrophical	Very Low	5
Drought	No	Small	Minor	Very Low	5
Man-Made Hazard: Hazardous Materials	No	Medium	Minor	Low	3

Loss estimates are based on 2006 total value of all structures and median home value, with an average household size of 2.4 persons/household. Loss estimates are based on exposure analysis, "assuming 100% damage to 100% of the structures" within the hazard area (ibid, p. 13). No Hazus analysis was conducted. Flood is rated at high risk for the planning area, while severe snow/ice storms are rated as medium-high risk. Along with the natural hazards, the town also identifies hazardous materials at medium risk as there

are 21 facilities within Palmer, 17 of which are Tier II facilities. The plan references no repetitive loss properties; review of the 2013 State plan update data does not reveal any RL properties within the township.

The plan identifies a well-established list of critical facilities, including what are referred to as “Category 3—Facilities/Populations to Protect,” which focuses on special needs populations, elderly and assisted living areas, among others (ibid, p. 35).

Goals remain consistent with those of the state; capabilities are also consistent with other local and state initiatives. One of the action items identified by the town is the establishment of an Emergency Operations Center, and to equip the Community Emergency Response Team response trailer. The town also has zoning ordinances in place to help reduce impervious surfaces, allowing more groundwater infiltration (p. 42).

Town of Brimfield LHMP Review

Review for this analysis stems from the January 31, 2011 Brimfield LHMP. Brimfield is a small, rural town located in the southeastern corner of Hampden County in western Massachusetts. Comprised of five villages—Brimfield Center, East and West Brimfield, Fentonville, and Dingley Dell—it has managed to remain a rural, residential community of approximately 3,400 residents. Native woodlands are the principle vegetation type in Brimfield. Woodlands cover 17,803 acres of Brimfield, approximately 80 percent of the Town’s land area. As of the writing of the plan, the community was “home to approximately 3,400 residents. The majority of Brimfield’s 22,588 acres is undeveloped land, totaling nearly 18,569 acres. Residential land totaling 1,601 acres and agricultural land totaling 1,586 acres account for the majority of the remaining Town area” Brimfield, 2011, p. 7).

Table 40 lists the hazard profiles and risk index portion of the plan. Localized flooding and severe snow/ice storms, as well as wildfire/brushfire are the highest hazards of concern. Loss estimations are based on 2006 valuation for all structures within the planning area (\$406,673,450), with a 2007 valuation for median home values (\$192,450), and 2.4 persons per household.

Analysis states that there “are approximately 1,678 acres of land within the FEMA mapped 100-year floodplain and 715 acres of land within the 500-year floodplain within the Town of Brimfield. According to the Community Information System (CIS) of FEMA, there were 23 structures (all residential) located within the Special Flood Hazard Area in Brimfield as of July 1999, the most current records in the CIS for the Town of Brimfield” (ibid, p. 11). The vulnerability assessment for a 100-year flood equals approximately \$4,426,350 million of damage, with approximately 57 people impacted. The plan indicates no repetitive loss properties, but review of the State’s 2013 data indicates the town has one.

The plan identifies a well-established list of critical facilities, again including what are referred to as “Category 3—Facilities/Populations to Protect,” which focuses on special needs populations, elderly and assisted living areas, among others.

**TABLE 40.
BRIMFIELD HAZARD PROFILING AND RISK INDEX WORKSHEET**

Type of Hazard	Location	Extent	Previous Occurrences	Probability of Future Events	Hazard Risk Index Rating
Flooding (100-year)	Large	Limited	Yes	Low	2
Flooding (localized)	Medium	Minor	Yes(extensive)	Very High	1
Severe Snow/Ice Storms	Large	Limited	Yes	Very High	1
Hurricanes/Severe Wind	Large	Minor	Yes (minimal)	Very Low	4
Tornado/Microburst	Small	Catastrophic	No	Very Low	4
Wildfire/Brushfire	Small	Minor	Yes (minimal)	Very High	3
Earthquake	Large	Catastrophic	No	Very Low	4
Dam Failure	Small	Minor	No	Very Low	5
Drought	Small	Minor	No	Very Low	5
Man-Made Hazard: Hazardous Materials	Large	Limited	No	Very Low	3

SOUTHEASTERN REGIONAL PLANNING AND ECONOMIC DEVELOPMENT DISTRICT

While the Southeastern Regional Planning and Economic Development District plan expired in January 2010, in an effort to maintain a statewide assessment of information, the State Hazard Mitigation Team determined it would be valuable to capture the planning commission's risk assessment for statewide continuity. The information from the expired plan is incorporated below.

The regional population is 600,000 with the population being dispersed from the smallest community—Rochester with 4,581 persons—to New Bedford with 93,768. There are 765.5 people per square mile in this region. The 6 coastal communities have an increased summer population due to tourism. From 1990-2000 the population's growth percentage was 6.1%, less than the national average of 13.2%. In a 1999, 42.7% of the region is considered urbanized or built out, 20.6% is considered developable, and 37% is not developable or protected. The four urban areas have 47.5 % of the regional population and have population densities in the range of 2,254—4,655 persons per square mile. This contrasts with the more rural areas of the region where the densities are generally less than 300 persons per square mile. New Bedford stands out in the region because it has the greatest population and is a significant outlier in terms of density. The topography includes many basin areas that are generally wetlands and marshes that provide recharge to the local aquifers. Approximately 22.1% of the region is classified as wetland areas according to Mass GIS. Within the region, there is a total of approximately 348 miles of tidal shoreline.

Link to local plan:

<http://www.srpedd.org/zoning/Final%20PDM%20Regional%20Plan%2004.pdf> Expired 1/28/10: Mansfield Expires 2/12/14; Middleborough to FEMA 11/12.

*Acushnet
Attleboro
Berkley
Carver
Dartmouth
Dighton
Fairhaven
Fall River
Freetown
Lakeville
Mansfield
Marion
Mattapoisett
Middleborough
New Bedford
North Attleborough
Norton
Plainville
Raynham
Rehoboth
Rochester
Seekonk
Somerset
Swansea
Taunton
Wareham
Westport*

The 800 square mile southeastern region covers most of the expanse of southeastern Massachusetts below greater Boston and before Cape Cod. It is bounded along the west and southwest by the Rhode Island border, to the north and northeast by the greater Boston region, and to the south and southeast by open water. It stretches for over 35 miles from the shoreline of Wareham, to its northern interior in Plainville. This region includes 27 communities, 23 of which are towns and four (4) are cities, which can be divided into subregions of communities grouped by geographically dominant characteristics:

- South Coastal—seven communities with coastline along Buzzards Bay: Acushnet, Dartmouth, Fairhaven, Marion, Mattapoisett, New Bedford, Wareham, and Westport;
- Cranberry Country—four low density communities with large areas of cranberry bogs: Carver, Rochester, Lakeville and Middleborough;
- Greater Fall River—five communities in the Fall River urban area: Fall River, Freetown, Somerset and Swansea;
- Greater Taunton—four communities in the Taunton urban area: Berkley, Dighton, Raynham and Taunton;
- Greater Attleboro—seven communities in the Attleboro urban area: Attleboro, Mansfield, Norton, North Attleborough, Plainville, Seekonk, and Rehoboth.

Geologists classify the southeastern Massachusetts area as part of the Northeast Coastal Lowlands/Coastal Plain region. The area is characterized by the conditions created over 12,000 years ago when massive glaciers receded. These characteristics include: low hills; highly porous soils; deposits of sand and gravel; multiple swamps, lakes, rivers and ponds; and a high water table. The glaciers left behind glacial till that contains thick deposits of both sand and gravel, lying over bedrock. There are occasionally boulders, known as glacial erratics, of different rock types that were carried from northern regions and left behind as the glaciers receded.

It is not uncommon for flooding to occur in the spring as some of the rivers in the region overflow their banks. In particular, rivers that are in more developed areas are problematic. These rivers have typically been channeled or covered, and receive heavy influxes of point and non-point run-off from impervious surfaces such as roadways and parking lots. It is worth noting that of the entire region, 17% or approximately 141 square miles are within the 100-year floodplain and an additional 4% in the five-hundred year flood plain.

The hazards within the Southeastern region 2004 plan are divided into four groups: flood related hazards, wind related hazards; fire-related hazards, and geologic hazards. Review of the hazards profiles reveals that the Southeastern region plan also places the highest emphasis of hazard risk to those associated to flooding. However, within their analysis, several hazards fall into the flood category, specifically: Riverine, Coastal, Erosion, Dam Failures, Thunderstorms, Winter Storms, Coastal Storms/Nor'easters, and Hurricanes.

Within the same concept of risk ranking, the jurisdictions again utilizes Hurricanes, Coastal Storms/Nor'easter and Winter Storms to determine risk ranking for Wind Related Hazards, as well as Flooding to determine the risk ranking for the Fire-Related Hazards.

The breakdown of hazards is shown in Table 41 and Table 42.

**TABLE 41.
SOUTHEAST REGION HAZARD MATRIX**

Natural Hazard	Likelihood/ Frequency	Impact Area Assessment	Severity/ Magnitude	Hazard Index
FLOOD RELATED HAZARDS <ul style="list-style-type: none"> ➤ Riverine ➤ Coastal ➤ Erosion ➤ Dam Failures ➤ Thunderstorms ➤ Winter Storms ➤ Coastal Storms/ Nor'easters ➤ Hurricanes 	Highly Likely (3)	Medium (2)	Limited (1)	6 Pts.* Rank #1
WIND RELATED HAZARDS <ul style="list-style-type: none"> ➤ Hurricanes ➤ Coastal Storms/ Nor'easters ➤ Winter Storms ➤ Downspouts ➤ Tornadoes 	Highly Likely (3)	Medium (2)	Limited (1)	6 Pts.* Rank #1
FIRE-RELATED HAZARDS <ul style="list-style-type: none"> ➤ Drought ➤ Wildfires ➤ Urban Fires ➤ Flooding 	Highly Likely (3)	Medium (2)	Limited (1)	6 Pts.* Rank #1
GEOLOGIC HAZARDS <ul style="list-style-type: none"> ➤ Earthquakes ➤ Landslides ➤ Sink Holes ➤ Subsidence 	Possible (1)	Small (1)	Limited (1)	3 Pts. Rank #4
				* equally ranked

**TABLE 42.
POINT VALUES USED IN SOUTHEAST REGION HAZARD MATRIX**

FREQUENCY/ LIKELIHOOD		
POINT VALUE	CATEGORY	CHARACTERISTICS
3	Highly Likely	Near 100% Probability in the next year
2	Likely	Between 10 – 100% probability in the next year; or at least one chance in 10 years
1	Possible	Between 1- 10% probability in the next year; or at least one chance in the next 100 years
0	Unlikely	Less than 1% probability in the next 100 years

IMPACT ASSESSMENT		
POINT VALUE	CATEGORY	CHARACTERISTICS
3	Large	Relative to total land area and concentrations of population/structures and critical facilities
2	Medium	Relative to total land area and concentrations of population/structures and critical facilities
1	Small	Relative to total land area and concentrations of population/structures and critical facilities

MAGNITUDE/SEVERITY		
POINT VALUE	CATEGORY	CHARACTERISTICS
3	Catastrophic	Multiple Deaths. Complete shutdown of facilities for 30 days or more. Property severely damaged >50%.
2	Critical	Injuries and/or illness result in permanent disability. Complete shutdown of critical facilities for at least two weeks. Property severely damaged <50%, >25%.
1	Limited	Injuries and/or illness do not result in permanent disability. Complete shutdown of critical facilities for more than one week. Property severely damaged <25%, >10%.
0	Negligible	Injuries and/or illnesses are treatable with first aid Minor quality of life loss. Shutdown of critical facilities and services for 24 hours or less. Property severely damaged <10%.

(Source: State of North Carolina Emergency Management Agency)