

STATE HAZARD MITIGATION PLAN

2013



Commonwealth of Massachusetts

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THE COMMONWEALTH OF MASSACHUSETTS

MASSACHUSETTS EMERGENCY MANAGEMENT AGENCY
400 WORCESTER RD., FRAMINGHAM, MA 01702-5399 508-820-2000 FAX 508-820-1404

DEPARTMENT OF CONSERVATION & RECREATION
251 CAUSEWAY STREET, SUITE 600-700, BOSTON, MA 02114-2104 617-626-1250 FAX 617-626-1449



Kurt N. Schwartz
DIRECTOR

Deval L. Patrick
GOVERNOR

John P. Murray
COMMISSIONER

July 1, 2013

Paul Ford, Acting Regional Administrator
FEMA Region I
99 High Street, 6th Floor
Boston, Massachusetts 02110-2132

Dear Administrator Ford:

Please find enclosed for your review and approval the Commonwealth of Massachusetts State Hazard Mitigation Plan. Through this letter, we, the Director of the Massachusetts Emergency Management Agency (MEMA) and the Commissioner of the Massachusetts Department of Conservation and Recreation (DCR), hereby adopt this plan on behalf of the Commonwealth of Massachusetts. The plan is the result of a collaborative process involving our two agencies, a State Hazard Mitigation Interagency Committee, regional planning agencies, local government officials, and others.

The plan provides the framework for meeting the state hazard mitigation strategy to: **Through partnerships, reduce the statewide loss of life, property, economy, infrastructure, and cultural resources from disasters through development of a comprehensive hazard mitigation program which involves planning, awareness, coordination, project development and implementation.** It identifies natural and manmade hazards to which the Commonwealth is vulnerable, profiles the range of natural hazards affecting the Commonwealth, assesses the Commonwealth's risk and vulnerability to natural and manmade hazards, examines existing hazard mitigation capabilities, develops statewide mitigation goals and strategies, and establishes a framework for implementing those goals and strategies as well as for monitoring, evaluating, and updating this plan.

We believe that the plan is in full compliance with the planning requirements of the Disaster Mitigation Act of 2000 and the Final Rule (44 CFR Parts 201 and 206), thus keeping the Commonwealth of Massachusetts qualified to receive funding under all FEMA disaster assistance and hazard mitigation programs. Please accept our assurances that Massachusetts will comply with all applicable federal statutes and regulations in effect with respect to the periods in which it receives grant funding, and will amend its plan whenever necessary to reflect changes in state and federal laws and statutes, as required in 44 CFR 13.11 (c) and (d).

MEMA and DCR will work diligently with our State Hazard Mitigation Interagency Committee and all our hazard mitigation partners to implement the State Hazard Mitigation Strategy contained in the plan, thereby reducing the Commonwealth's vulnerability to natural and man-made hazards.

We would like to thank your staff for their valuable guidance and assistance in the preparation of this plan.

Sincerely yours,

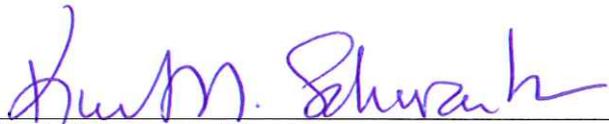
Kurt N. Schwartz, Director
Massachusetts Emergency Management Agency

John P. Murray, Commissioner
Department of Conservation and Recreation

PLAN PROMULGATION

July 1, 2013

In accordance with the planning requirements of the Disaster Mitigation Act of 2000 and the Final Rule (44 CFR Parts 201 and 206), we promulgate and adopt the Commonwealth of Massachusetts State Hazard Mitigation Plan.



Kurt N. Schwartz, Director
Massachusetts Emergency Management Agency



John P. Murray, Commissioner
Department of Conservation and Recreation

ACKNOWLEDGMENTS

The *Commonwealth of Massachusetts 2013 State Hazard Mitigation Plan* was compiled by the State Hazard Mitigation Team, which consists of staff from the Massachusetts Emergency Management Agency and the Massachusetts Department of Conservation and Recreation:

- Richard Zingarelli
- Marybeth Groff
- Sherry Leung
- Colleen Bailey
- Scott MacLeod
- Christine Packard
- Dan Nietzsche
- Kathryn Fatherly
- Sarah White
- Eric Carlson
- Alex Gill

Many federal, state, and local agencies participated in the plan development during the 2013 update cycle. Information, guidance, and assistance provided by these various agencies greatly enhanced this document. Those agencies participating in this update cycle are listed within Appendix H.

Special appreciation is also extended to all of those individuals who participated in this update by contributing valuable time and efforts (the extensive list is provided in Appendix H). Your dedication and feedback made this update more comprehensive and set the high-quality standards for the drafts and revisions.

EXECUTIVE SUMMARY

BACKGROUND

At the turn of the millennium, the United States saw significant changes in the way it prepares for and responds to disaster events. The Disaster Mitigation Act of 2000 (DMA 2000) refocused Federal Emergency Management Agency (FEMA) programs toward enhancing the resiliency of the nation's communities through programs to reduce the exposure of people and properties to the impacts of natural hazards. The DMA 2000 was the first legislation to require states to develop and regularly maintain hazard mitigation plans that specifically address not only the local hazards of concern, but also strategies and actions to help reduce the impact of those hazards on citizens. With further refinement in 2002, Congress established a set of rules providing guidance and criteria for the content to be contained in hazard mitigation plans. To remain eligible for federal mitigation and public assistance funds associated with presidentially declared disasters, a state must have a FEMA-approved hazard mitigation plan.

The Commonwealth of Massachusetts was a forerunner in efforts to protect citizens through hazard mitigation almost 30 years ago, when it joined the National Flood Insurance Program, and later when the Commonwealth developed its first state mitigation hazard mitigation plan in 1986. Following subsequent disaster declarations, the Commonwealth updated its state hazard mitigation plan in 1989, 1993, 1998, 2000, 2004, 2007, 2010, and 2013. Each plan identified natural hazards, assessed vulnerability to the most frequent hazards, examined existing capabilities, developed statewide mitigation goals and strategies, and established a framework for implementing those goals and strategies.

NATURAL AND NON-NATURAL HAZARD RISKS

History has demonstrated that the Commonwealth of Massachusetts is vulnerable to damage from several types of hazards – both natural and non-natural. As required by DMA 2000, this plan focuses on the natural hazards of concern, which were identified in the following categories: flooding, coastal hazards, atmospheric hazards, severe winter weather, and fire hazards. According to the comprehensive risk analysis completed for the 2013 update, the Commonwealth of Massachusetts is most vulnerable to flooding, severe storms, and winter events. This plan also analyzes other natural hazards: dam failure, drought, hurricane, ice jam, ice storm, coastal erosion, sea level rise, nor'easter, wildfire, earthquake, landslide, tornado, tsunami, and extreme temperature.

The 2013 update of the state hazard mitigation plan is integrated with the Commonwealth's first Threat Hazard Identification and Risk Assessment (THIRA), which was completed simultaneously. The THIRA serves as the primary body of information related to all hazards of concern in the Commonwealth, including natural and non-natural hazards. It is a primary source of information supporting the hazard mitigation plan. The THIRA document is referenced throughout this document, and is considered a companion document. Selected elements of the THIRA are included as an annex.

DISASTER DECLARATIONS

Massachusetts ranks 35th out of 50 states and nine territories for the number of FEMA disaster declarations. Massachusetts has had more than 48 major disaster declarations, including federal disaster declarations and state disaster declarations. Since 1991, more than \$600 million in federal aid and state aid has been disbursed to help Massachusetts residents recover from natural disasters. From February 1, 2010 through December 31, 2012, the Commonwealth was declared for six federal disasters.

COORDINATION AND PLANNING

One of the strongest partnerships that grew out of this mitigation program was the daily, cooperative relationship between the Massachusetts Emergency Management Agency and the Department of

Conservation and Recreation. Staff members from these agencies make up the State Hazard Mitigation Team and lead the State Hazard Mitigation Interagency Committee, which are the foundation of the mitigation program in Massachusetts. Their dedication and expertise in analyzing risks to citizens and infrastructure in Massachusetts allow for a successful mitigation program. For the 2013 update, the State Hazard Mitigation Interagency Committee was expanded to include new partners who supported this effort.

PROJECT IMPLEMENTATION

With the National Flood Insurance Program and the state planning strategies serving as a mitigation program cornerstone, and with the establishment of federal mitigation grant programs in the mid-1990s, Massachusetts has been successful in leveraging federal funding for hundreds of hazard mitigation projects. In addition, following presidential disaster declarations, the state has the option to contribute half, or 12.5 percent of the 25-percent non-federal share, for federal infrastructure support funds. Since 1991, the state has contributed more than \$27 million to match FEMA's funding following presidentially declared disasters.

GOALS

The Statewide Hazard Mitigation Strategy for Massachusetts was updated for the 2013 Hazard Mitigation Plan to more closely align with the expansion of the program and growth of planning partnerships. The mission statement for the updated plan is as follows:

- Through partnerships, reduce the statewide loss of life, property, economy, infrastructure, and cultural resources from disasters through development of a comprehensive hazard mitigation program that involves planning, awareness, coordination, project development, and implementation.

The hazard mitigation goals of the Commonwealth were also enhanced for the 2013 plan update:

- Evaluate and analyze vulnerability in order to guide and promote sound mitigation activities through integrated planning to support a comprehensive state mitigation program.
- Increase awareness of the benefits of hazard mitigation through outreach and education.
- Increase coordination and cooperation between state agencies in implementing sound hazard mitigation planning and sustainable development.
- Promote cost-effective hazard mitigation actions that protect and promote public health and safety from all hazards with a particular emphasis on reducing damage to repetitive and severe repetitive loss properties.
- Monitor, evaluate, and disseminate information on the effectiveness of hazard mitigation actions implemented by state, local, and private partnerships.

STRATEGIES AND ACTIONS

From February 1, 2010 through December 31, 2012, the Commonwealth made progress on many of the strategies and mitigation actions identified in the previous hazard mitigation plan update. At the same time, new strategies were identified for the 2013 update (see Table 17-1). Four actions saw the most significant progress since 2010:

- **Development of the THIRA**— The development of the THIRA was completed in January 2013. The THIRA serves as the cornerstone for identifying all hazards of concern throughout the Commonwealth. Its risk assessment provides information and insight into the hazards; and that information was incorporated into the risk assessments in the hazard profiles provided with this hazard mitigation plan.

- **Increased planning partner and stakeholder involvement**—Development of the THIRA significantly increased the number of partners and stakeholders involved in hazard planning efforts in Massachusetts. Data gathering to complete the THIRA included review of reports, studies, after-action reports, and plans, as well as workshops and one-on-one interviews. The collected information supported other areas of the mitigation planning process, while significantly increasing local jurisdiction planning partner involvement. It is estimated that at least 50 individuals from various levels of governments—federal, state, and local—and private industry were involved in development of the THIRA. Many of these participants continued their involvement as the hazard mitigation plan was completed.
- **Development of elements for the Commonwealth’s hazard mitigation plan to qualify as an enhanced plan**—The 2013 update incorporates planning elements necessary for the Commonwealth to gain enhanced plan status for the hazard mitigation plan, rather than standard plan status. Enhanced status can increase the amount of funds received by the Commonwealth after a disaster from 15 percent to 20 percent, greatly expanding the ability to fund projects across the state. One element of enhanced plan status is a streamlined process to conduct loss avoidance studies. Such studies determine the return on investment for projects, particularly projects designed to mitigate damage from natural hazards. An example of the benefits that such studies can demonstrate is the Commonwealth’s work with FEMA to evaluate avoided losses on the FEMA-funded Ell Pond Flood Mitigation Project in the City of Melrose. A loss avoidance study of that project was conducted for the Massachusetts Emergency Management Agency in September 2010. Using FEMA’s hazard modeling tool and benefit-cost analysis, the study demonstrated that 246 percent of the project cost was recovered, based on losses avoided since the project was completed in 2008 (FEMA, 2010). It is anticipated that similar studies can demonstrate similar results, further enhancing the significance of the Commonwealth’s endeavor to maintain such efforts.
- **Increased program outreach and technical assistance regarding available hazard mitigation project grant program funding** – Since 2010 the Mitigation Unit at MEMA has added multiple positions to their staff. This expansion in staffing resources has provided the ability to increase direct technical assistance to communities and organizations throughout the Commonwealth. For example, in 2012 two Hazard Mitigation Grant Coordinators were hired to assist with FEMA Hazard Mitigation Assistance grant programs. With this expansion, the SHMT has increased their outreach efforts by approximately 50% over the level of effort since 2010.

**Commonwealth of Massachusetts
STATE HAZARD MITIGATION PLAN**

SEPTEMBER 2013

Kurt Schwartz, Director
Massachusetts Emergency Management Agency

John P. Murray, Commissioner
Department of Conservation and Recreation

Prepared by:



TETRA TECH

complex world | **CLEAR SOLUTIONS™**

1000 The American Road
Morris Plains, NJ 07950

Project 103S2350

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SECTION 1. INTRODUCTION AND ASSURANCES

1.1 PURPOSE

The purpose of this State Hazard Mitigation Plan (SHMP) is to help the Commonwealth of Massachusetts and its residents understand when, where, why, and how natural hazards occur; minimize their impacts; and reduce the cost of recovery and rebuilding. This plan also outlines specific actions that should be taken by the federal, state, and local governments as well as the general public in order to manage the risks of natural hazards and reduce future costs of rebuilding. The SHMP is designed to be a reference for a variety of users having specific interests in some aspect of its detailed contents.

This document is an update of the 2010 Massachusetts State Hazard Mitigation Plan, in compliance with the Disaster Mitigation Act of 2000, or DMA 2000, (Public Law 106-390), and implementing regulations found in the Code of Federal Regulations (CFR) at 44 CFR Parts 201 and 206. Massachusetts had received Federal Emergency Management Agency (FEMA) Region I approval of its State Hazard Mitigation Plan in 1998, 2000, 2004, 2007, and 2010 in compliance with the requirements at that time of 44 CFR 206.405, specifically Subpart M, Hazard Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

The 2013 edition of the Massachusetts State Hazard Mitigation Plan is written to meet the requirements for a state plan under 44 CFR 201, published by FEMA. It also meets the requirements of plan review guidance developed by FEMA in 2008 for updating state plans. With the standard hazard mitigation plan, Massachusetts qualifies for receipt of hazard mitigation funds according to the following formula:

- 15 percent for amounts not more than \$2 billion
- 10 percent for amounts more than \$2 billion and not more than \$10 billion
- 7.5 percent for amounts more than \$10 billion and not more than \$35 billion.

The principal value of having a FEMA-approved state hazard mitigation plan lies in Massachusetts' potential for catastrophic events. In light of recent disaster events in the New England region, approval of a state hazard mitigation plan is in the best interest of everyone living in the Commonwealth, as the funds received after a disaster event can increase from 15 percent of grant funds available to 20 percent.

In addition, meeting the requirements of the regulations noted above keeps the Commonwealth of Massachusetts qualified to obtain all disaster assistance, including hazard mitigation grants available through the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288, as amended).

This update incorporates the hazard mitigation lessons learned following recent disasters to be better prepared for future events. It meets DMA 2000 state mitigation planning requirements. This plan also accomplishes the following:

WHY THIS SECTION?

This section of the State Hazard Mitigation Plan meets the requirements of 44 CFR §201.4(c)(7), which states the following:

Assurances. The Plan must include assurances that the State will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c) of this chapter. The State will amend its plan whenever necessary to reflect changes in State or Federal statutes and regulations as required in 44 CFR 13.11(d) of this chapter.

- Expands the Commonwealth's statewide risk assessment through integration of the Threat Hazard Identification and Risk Assessment (THIRA), which includes information on all hazards having the potential to impact the Commonwealth
- Documents the statewide strategy for regional and local hazard mitigation planning mandated under the DMA 2000
- Gives an overview of the state's current capabilities, areas of improvement, and strategies to improve hazard mitigation throughout the state
- Provides an overview of more than a decade of successful hazard mitigation projects funded through the Hazard Mitigation Grant Program, the Flood Mitigation Assistance Program, and the Pre-Disaster Mitigation Program.

1.2 AUTHORITY AND SCOPE

Prior to 2000, Section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) (Public Law 93-288, as amended) was the impetus for the involvement of state and local governments in evaluating and mitigating natural hazards as a condition of receiving federal disaster assistance. A requirement of the Stafford Act's Section 409 was the development of a state hazard mitigation plan.

Under Section 409 of the Stafford Act, a state was required to update its state hazard mitigation plan following every presidential disaster declaration. Massachusetts updated and received FEMA approval of its state plan following presidential disaster declarations in 1986, 1987, 1989, 1993, and 1998. In addition, Massachusetts' State Hazard Mitigation Plan was reviewed and approved by FEMA Region I in 2000, 2004, 2007, and 2010.

The DMA 2000, with its Interim Final Rules, 44 CFR Part 201 and 206 (Hazard Mitigation Planning and Hazard Mitigation Grant Program), eliminated the state mitigation update requirement following each presidential disaster declaration. Currently, states must complete and receive FEMA approval of updated state mitigation plans every three years. These regulations also provide specific requirements for the content of a state hazard mitigation plan.

In response to Hurricane Sandy, which caused extensive human suffering and damage to public and private property, Congress passed the Sandy Recovery Improvement Act of 2013 (Public Law 113-2). The law authorizes several significant changes to the way FEMA may deliver disaster assistance under a variety of programs.

The 2013 SHMP update addresses all Stafford Act and the DMA 2000 elements required to achieve enhanced status. Achieving enhanced status means that states are able to successfully implement federal grant programs and that they have built successful mitigation programs. Receiving enhanced status provides states additional Hazard Mitigation Grant Program (HMGP) funds when a major disaster is declared.

The 2013 SHMP provides a framework that links pre- and post-disaster mitigation planning and measures with both public and private interests. The intent is to ensure an integrated and comprehensive approach to disaster loss reduction. This approach supports state administration of HMGP and non-disaster programs such as the Pre-Disaster Mitigation grant program (PDM) and the Flood Mitigation Assistance program (FMA). The SHMP represents a clear state commitment to mitigation activities, comprehensive state mitigation planning, and improved state program management.

1.3 ADOPTION BY THE STATE

This SHMP has been reviewed and endorsed by the State Hazard Mitigation Interagency Committee (SHMIC). This is a standing committee of state and federal agencies and private organizations involved in hazard mitigation (discussed in greater detail in Section 2). After review and approval of this plan by the SHMIC, the two primary state agencies responsible for preparing and implementing the hazard mitigation plan in Massachusetts—the Massachusetts Emergency Management Agency (MEMA) and the Department of Conservation and Recreation (DCR)—reviewed and adopted this plan.

The letter of adoption and assurance demonstrates the State’s commitment to fulfilling the mitigation mission, legitimizes the plan, and authorizes the responsible agencies identified in the plan to execute their responsibilities. This letter is signed by the Director of MEMA and the Commissioner of DCR, is presented in the front of this plan.

WHY THIS SECTION?

This section of the State Hazard Mitigation Plan meets the requirements of 44 CFR §201.4(c)(7)(d), and 44 CFR §201.5(c)(1), which states the following:

Review and Updates. The Plan “must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities and resubmitted for approval to the appropriate Regional Administrator every three years.”

1.4 ASSURANCES

The Commonwealth of Massachusetts will comply with all applicable federal statutes and regulations in effect with respect to the periods in which it receives grant funding, in compliance with 44 CFR 13.11(c). The Massachusetts SHMP will be amended according to the process described in Section 18, whenever necessary to reflect changes in state or federal statutes as required in 44 CFR 13.11(d).

1.5 PLAN ORGANIZATION AND UPDATE INFORMATION

The 2013 SHMP is a comprehensive update of the 2010 plan. It has been reformatted for ease of use and to incorporate new information and data necessary to meet the enhanced plan status. All information previously contained in the 2010 plan has been incorporated in this plan and updated with the most current data available. Enhanced and standard plan elements have been integrated throughout the document to meet federal requirements. The newly updated plan illustrates the following:

- The Commonwealth has developed a comprehensive mitigation program.
- The Commonwealth effectively uses available mitigation funding.
- The Commonwealth is capable of managing all funding, including that which results from achieving enhanced status.

The plan is coordinated through appropriate state, local and regional agencies, as well as non-governmental interest groups. This 2013 Plan, and its future updates, will provide guidance in merging the planning efforts of all state agencies, local governments, the private sector, and non-profit organizations into one viable, comprehensive, and statewide mitigation program.

1.6 REVISIONS TO THE 2013 SHMP

The 2013 plan incorporates information for events, disasters, studies, and planning efforts occurring since the end capture date of the 2010 plan (February 1, 2010) through December 31, 2012. While Hurricane Sandy is referenced in various portions of the plan, damage assessment, and recovery efforts are still ongoing, so any information contained within the 2013 plan is preliminary in nature and will need to be updated with more accurate data for the 2016 update. The following are the main updates incorporated in this plan:

- New additions—There are several new additions to the 2013 SHMP. New elements, indicated as such throughout the document, support the Commonwealth seeking enhanced hazard mitigation plan status. They also include sections that can be used by local jurisdictions to support development of their own hazard mitigation plans and grant applications. The 2013 plan strives to be more robust in this nature, providing additional information and data. This document also incorporates information contained in the Threat Hazard Identification and Risk Assessment, which is the foundation for identification of all the hazards of concern throughout the Commonwealth.
- Maps, charts, and visual effects—Throughout the plan, maps, charts, and graphs were updated with current information. Each altered item was dated for ease in reference to make certain the most current information has been used. Sources used to create illustrations are referenced either within the body of the content, or beneath the illustration. In a few instances, data for specific illustrations contained in previous plan editions could not be re-created. In such cases, the date of the illustration is referenced.

1.6.1 Section Outline

The plan has been reorganized into a section format to enhance its usability and ease of reference. This format also allows for the addition of new sections, including supporting data for the enhanced plan requirements. The new plan organization is presented below; Section 2 presents a more detailed assessment of the planning process:

- **Section 1, Introduction and Assurances**—Updated with current information and reaffirmation of assurances on the part of the Commonwealth as required by 44 CFR 201.4 and 44 CFR 201.5.
- **Section 2, Planning Process**—Describes how the plan was reviewed and revised for the 2013 update; includes the agencies and individuals involved and the manner of their involvement. This section provides a link between state and local mitigation programs as well as the efforts to coordinate mitigation information between all levels of government. The SHMIC believes that an all-inclusive mitigation planning approach results in a better understanding of the risks and vulnerabilities the Commonwealth faces. This section was updated in general with current information.
- **Section 3, Coordination with Local Plans**—Description of the coordination of this plan with local planning initiatives. This section also provides a link between state and local mitigation programs, as well as efforts to coordinate mitigation information between all levels of government. This portion of the plan has been greatly enhanced to include analysis at the state, county, and city/town levels (depending upon the information captured), including information from plans developed by regional planning commissions as appropriate. This section of the plan describes support provided to local jurisdictions during the 2010-2012 update cycle. It describes how local plans were reviewed and approved with relevant information incorporated into the 2013 SHMP. It also discusses how local mitigation projects are reviewed, prioritized, and recommended for funding. Socio-economic profiles of the state's 14 counties are included. Population figures and median household incomes for each county were updated, using 2010 U.S. Census Data (unless otherwise indicated). Where more current data were available, it is indicated as such. Hazard tables and loss estimates were updated to reflect revisions made in the hazard profiles and determination of at-risk state facilities and economic impact, when available.
- **Section 4, State Profile**—Description of the state, including its geographic makeup, structure of government, and demographic data, updated with current 2010 data unless otherwise indicated.

- **Sections 5, Risk Assessment Introduction and Overview**—Description of the process followed for conducting both the Threat Hazard Identification and Risk Assessment (THIRA) and the natural hazards risk assessment; comparison of risk determined by the state’s analysis to that determined by local jurisdictions; and identification of hazards of concern and ranking by the state and by local jurisdictions. The categorizing of similar hazards was modified slightly from the 2010 plan in order to more appropriately align the natural hazards of concern.
- **Sections 6 through 16, Hazard Profiles**—Hazard-specific information. All hazard profiles were reorganized during this update and are presented in a new layout. The profiles include the geographic areas of impact, loss estimations, and vulnerability assessments of people, property, and the economy. Risk assessments include both quantitative and qualitative assessments as appropriate to the hazards of concern and the ability to determine specific areas of impact and loss estimates. Additional information concerning specific hazard profiles is further discussed below.
- **Section 17, Mitigation Strategy**—Description of the goals, strategies, and mission statement for the SHMP (new to 2013). During this update, goals were reviewed and updated as discussed in detail in this section. Tables identifying the status of mitigation actions identified in the mitigation strategy were updated. New strategies were developed to enhance the state’s resilience to disasters (new strategies are referenced as “New”). This section includes a loss avoidance study, as required by 44 CFR 201.5(b)(2)(iv), which is new to this edition. The loss avoidance study details the process to be used in future plan editions to determine the level of success of completed mitigation projects. This study goes beyond FEMA-funded projects and includes initiatives underway that have the potential to have a high impact on mitigation initiatives statewide.
- **Section 18, Plan Maintenance**—Description of the 2013 implementation process, how the 2010 process worked during the 2010-2012 period, and revisions made to the process for the current plan life cycle. The 2010 maintenance section was reviewed as a starting point for the current plan update. This section outlines how the current SHMP plan will be maintained once approved by FEMA.
- **Annexes:**
 - **Annex 1**, Threat Hazard Identification and Risk Assessment Components.
 - **Annex 2**, Massachusetts Administrative Plan for federally funded hazard mitigation grant programs.
- **Appendices:**
 - **Appendix A, Methodology**—This is a new section to the SHMP that provides a description of the analysis methodology used in the various sections of the plan. It provides greater detail than previous plan editions and provides an accounting for local jurisdictions to re-create a similar analysis.
 - **Appendix B , Best Available Science**—This is another new section, which provides a list of resources available for hazard information.
 - **Appendix C, Best Practices** —This is a new section that includes mitigation projects completed in Massachusetts. The intent to this section is to bring awareness of the types of mitigation projects completed and the types of difficulties that local jurisdictions and the State had in gathering all required data to complete grant applications. It is hoped that this section will provide a source for jurisdictions to gather information, as well as examples of projects that surrounding communities have completed.

- **Appendix D, State Agency Survey**—The State Agency Survey is a new effort on the part of the State Hazard Mitigation Team (SHMT) and SHMIC to further enhance state agency involvement and information gathering. This appendix contains survey and its results.
- **Appendix E, Local Plan Survey**—The Local Jurisdiction Survey is a new effort on the part of the SHMT and SHMIC to further enhance technical support to local jurisdictions and assist the state in capturing relevant information during local plan development. This appendix contains the newly developed survey.
- **Appendix F, Synopses of Local Plan Data**—This is a new section summarizing some of the reviewed local plans. Data presented are taken from the local plans and may include hazard data, risk assessment and loss information, the type of analysis performed, critical facility information, and unique strategies or capabilities. In some instances, Repetitive Flood Claim and Severe Repetitive Loss property information is provided.
- **Appendix G, STAPLEE Results**—This appendix presents the mitigation strategy update process using the STAPLEE criteria (social, technical, administrative, political, legal, environmental, and economic), as detailed in Section 17.
- **Appendix H, Participating Team Members**—This appendix lists team members associated with development of the plan.
- **Appendix I, National Flood Insurance Program Claims**—This appendix lists National Flood Insurance Program (NFIP) cities and claims filed throughout Massachusetts.
- **Appendix J, Ice Jam Table**—This appendix lists ice jams that have occurred in Massachusetts.
- **Appendix K, Glossary**—This appendix lists unique terminology associated with the plan, as well as acronyms used.
- **Appendix L, Bibliography**—This appendix lists sources referenced throughout the SHMP. It can be used as a source of information for local jurisdictions developing plans of their own.

1.6.2 Risk Assessment Hazard Profiles (Sections 6 –16)

The groupings of similar hazards were modified from the 2010 plan in order to more appropriately align hazards of concern. The current grouping is as summarized in Table 1-1. Data from previous plans are incorporated into the 2013 plan update, with new data added and previous data updated with the most current information. The profiles describe the hazards of concern, the risk assessment, and vulnerability based on those hazards. This plan includes all of the natural hazards profiled in the 2010 edition of the SHMP. The risk profiles include information on at-risk facilities owned or leased by state agencies. The profiles also contain programmatic information and resources as appropriate, such as the NFIP, Community Rating System (CRS), and Severe Repetitive Loss data (for the flood hazard profile). Information concerning non-natural or human-caused hazards is contained in Annex 1 (THIRA Profiles).

**TABLE 1-1.
NATURAL HAZARD GROUPINGS IN 2010 AND 2013 HAZARD MITIGATION PLANS**

2013 Hazard Groupings	2010 Natural Hazard Grouping Titles						
	Flood Related Hazards (Rain, Snow Melt, Dam Failure, Ice Jams)	Coastal Related Hazards (Storms, Erosion, Sea Level Rise, Sediments)	Other Natural Hazards (Fire, Drought, Extreme Temp)	Atmospheric Related and Winter Hazards (Snow, Ice Storms, Blizzard)	Atmospheric Related and Winter Hazards (Hurricane/Tropical Storm, Nor'easter)	Atmospheric Related and Winter Related Hazards (Thunderstorm, Drought, Extreme Temperature, Winds, Tornadoes)	Geologic Hazards (Earthquake, Landslide, Tsunami)
Category: Flood-Related Hazards							
Inland or Riverine Flooding	X						
Dam Failure	X						
Ice Jams	X						
Category: Coastal-Related Hazards							
Decreased Sediment		X					
Coastal Erosion & Shoreline Change		X					
Sea Level Rise		X					
Category: Atmospheric-Related Hazards							
Hurricanes					X		
Nor'easter					X		
Tropical Storm					X		
Category: Severe Weather Hazards							
Thunderstorms						X	
Drought						X	
Extreme Temperatures						X	
Tornadoes						X	
High Winds						X	
Category: Severe Winter Weather Hazards							
Snow and Blizzards				X			
Ice Storms				X			
Category: Geologic Hazards							
Tsunami							X
Earthquake							X
Landslide							X
Category: Fire Hazards							
Major Urban Fires			X				
Wildfire			X				

Risk Assessment and Hazard Areas

Geospatial data sets for hazard areas in combination with geo-coded facility information was used to refine the projected loss information for state facilities. Some data sets used during this plan update have been enhanced dramatically as further described below. Data sets used for each hazard and the analysis methods used to estimate loss are detailed in Appendix A.

State Facilities Data—Leased and Owned

Working with the Massachusetts Division of Capital Asset Management, data sets were gathered listing all state-owned or leased facilities (total of 6,854 facilities). Previous plan editions estimated over 6,000

facilities. Of the data received, all locations were geocoded using the ArcGIS Online North America Streets 10.0 online geocoding service. Upon initial inspection of the MEMA Capital Asset Management Information System spreadsheet of owned facilities, 6,422 facilities were included. Of these, 5,398 were matched via geocoding to the street, rooftop, or street name geocoding level.

Out of the initial set of facilities, 916 facilities contained no address and 108 facilities would not match via coding with the address provided. After the initial geocoding of the owned facilities data, these 1,024 facilities were sent back to the Division of Capital Asset Management and Maintenance (DCAMM) for review and to obtain additional information that would allow them to be located. Of the 1,024 facilities sent back for updating, 935 were able to be successfully located with the inclusion of additional data. This allowed for 6,333 facilities to be included in the overall analysis of state-owned facilities, which is 98.6 percent of the 6,422 state-owned facilities that were provided. All 432 state-leased facilities were successfully geocoded, for a 100-percent return. The data set used to run the 2013 state-owned and -leased facility risk analysis included information on a total of 6,765 facilities.

These data were used along with FEMA's Hazus risk-modeling program to determine potential dollar losses. It was also used in an exposure analysis of hazards for which Hazus cannot be used. This information provides a more accurate risk assessment for the 2013 SHMP. Appendix A provides additional information concerning the process used to manipulate data into a usable format and to incorporate it into a comprehensive data management system/Hazus format.

Hazard Profiles

The 2013 SHMP focuses on the same natural hazards of concern as the 2010 plan. All profiles were updated to match a new format that includes information on at-risk state facilities, either through GIS exposure analysis or through Hazus analysis. All profiles were updated with current information, including all significant hazard events that occurred between early 2010 and December 2012. The following is a summary of hazard profile updates:

- **Section 6, Coastal Erosion Hazard Profile**—It includes sediment loss and sea level rise (sea level rise is also addressed in the flood profile). New maps are presented, and all data have been updated with the best available science accessible at the time of this update.
- **Section 7, Dam Failure Hazard Profile**—Limited data are available concerning inundation areas caused by dam failure, as this is considered confidential information and protected data by dam owners. The profile was updated with new dam maps and includes the best available science.
- **Section 8, Earthquake Hazard Profile**—This section was rewritten and enhanced using best available science. The profile includes information on the hazard as it relates to both the Commonwealth and its jurisdictions. Hazus modeling was used to determine risk and exposure at both the state and county levels. Once completed, the profile was reviewed by subject matter experts to validate and confirm the updates. The analysis used FEMA's new Shake Map catalog as appropriate. Analysis was also conducted using available National Earthquake Hazards Reduction Program (NEHRP) soils data to assess exposure.
- **Section 9, Fire Hazard Profile**—This profile includes both wildfires and major urban fires. State-owned and leased facilities with exposure to the urban interface/intermix zones were used to determine potential loss estimations. Major urban fire consists of a qualitative analysis, as prediction of future fire events in an urban area is not possible.
- **Section 10, Flood Hazard Profile**—This section was rewritten and enhanced to include more data such as NFIP, Repetitive and Severe Repetitive Loss properties, and CRS information, both generally and as they relate to the Commonwealth and its jurisdictions. In

previous plan editions, this information was contained in various portions of the plan. The SHMT felt that the data are better contained in one section, and referenced in other areas as needed. The best available Digital Flood Insurance Rate Map (DFIRM) databases (and, where not available, Quality-3 (Q3) data) were used to determine risk and exposure at the state and county levels. Information has been added on events occurring from February 1, 2010 through December 31, 2012. Any enhanced information on previous events was also incorporated. This section also includes information on ice jams, for which data have been updated with the most current information and maps, as well as to address sea level rise.

- **Section 11, Hurricane/Tropical Storm Hazard Profile**—Hazard analysis was conducted using historical events: Category 1—Gloria (1985); Category 2—Bob (1991); Category 3—1938 unnamed hurricane; and Tropical Storm—Irene. Data from the Sea, Lake and Overland Surges from Hurricanes (SLOSH) model were used, based on the most significant damage outputs per hurricane category. A wind-only loss analysis was conducted for state-owned and leased facilities; a combination wind and surge loss analysis was conducted for buildings across the state, summarized at the county level. The SLOSH model is a computerized numerical model developed by the National Weather Service (NWS) to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes by taking into account the atmospheric pressure, size, forward speed, and track data. These parameters are used to create a model of the wind field, which drives the storm surge.
- **Section 12, Landslide Hazard Profile**—This section was reviewed and updated as appropriate. Little new data are available; however, the Commonwealth applied for and received two separate grants for landslide studies, which will greatly enhance this data set for future plan updates. These are discussed in greater detail in Section 5—Risk Assessment Overview, the landslide profile, and Section 17—Mitigation Strategy.
- **Section 13, Nor’easter Hazard Profile**—Hazard analysis was conducted for the 1978 Nor’easter. The SLOSH data set was used based on the “maximum of maximums” outputs per hurricane category. A wind-only loss analysis was conducted for state-owned and leased facilities; a combination wind and surge loss analysis was conducted for buildings across the state, summarized at the county level.
- **Section 14, Severe Weather Hazard Profile**—This profile was regrouped to incorporate drought, high winds, thunderstorms, tornado, and extreme temperatures. Maps were developed demonstrating areas of impact and statistical information as appropriate:
 - Drought hazard profile—This profile was updated with the most current information available. The risk assessment is based on a qualitative analysis, as modeling is not possible for this type of hazard.
 - High winds, thunderstorms, and tornados were combined in one profile. The profiles were updated to include most current events impacting the Commonwealth, as well as historical impacts, where available. The risk assessment is based on a qualitative analysis demonstrating areas of impact. The high winds profile addresses events that are below the wind speeds associated with other hazards, such as hurricanes.
 - Extreme Temperatures—This profile was updated with the most current information available. The risk assessment is based on a qualitative analysis, as modeling is not possible for this type of hazard.
- **Section 15, Severe Winter Storm Hazard Profile**—This profile was grouped to incorporate snow, blizzards, and ice storms. The profiles were updated with the most current information available, with maps demonstrating areas of impact. The analysis is based on a qualitative method, as GIS analysis is not possible to estimate losses, due to the inability to determine

geographic areas of impact. Also updated during this plan edition is the methodology transition from the Northeast Snowfall Impact Scale (NESIS) to the Regional Snowfall Index by the National Climatic Data Center (NCDC).

- **Section 16, Tsunami Hazard Profile**—This portion of the plan was updated to include the most current data available, and displayed in the new profile format.

The Hazus model provides some form of geospatial hazard zone information for four of the hazards: earthquake, flood, hurricane/tropical storm, and nor'easter. These are the hazards for which the state has an emphasis on preparedness and mitigation.

During the period that the SHMP was being updated, the Commonwealth was also in the process of developing a mandatory THIRA document, which included an extensive list of human-caused and technological hazards. Additional information concerning the THIRA document is contained in Section 5. Annex 1 presents non-confidential portions of the THIRA on the following hazards:

- Technological hazards—Blackouts, barge accidents, bridge failures, invasive species, public health hazards (e.g., epidemic, pandemic), train derailments, and truck accidents.
- Terrorist-related hazards—Biological/biological building, chemical/chemical building, improvised explosive devices (multiple types), radiological/radiological building, ramming, standoff (shoulder-fire) weapon, and toxic industrial chemicals.

1.6.3 Hazard Mitigation Grant Administrative Plan

Annex 2 to this plan is the most current and approved version of the Commonwealth's Administrative Plan and FEMA's notification of approval of it.