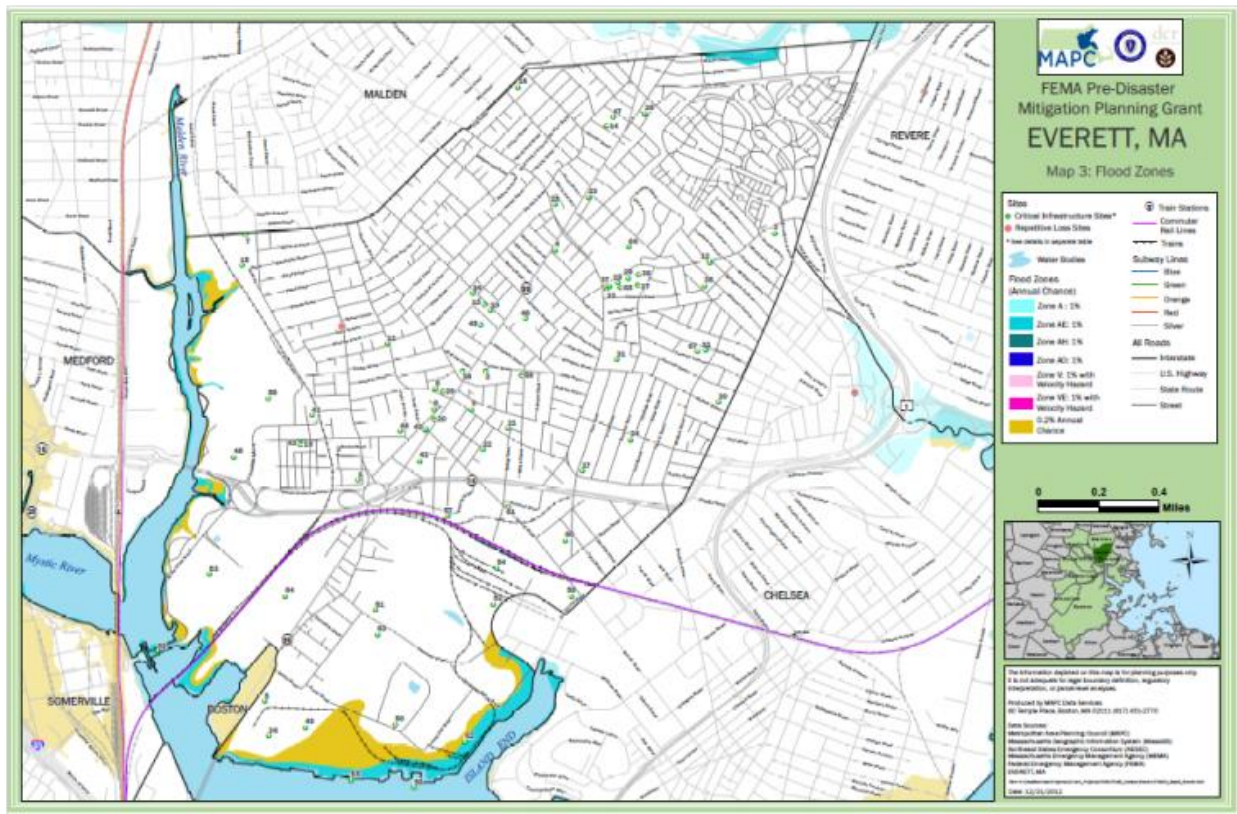


CITY OF EVERETT HAZARD MITIGATION PLAN 2016 UPDATE



Final Plan
Approved by FEMA
October 21, 2016

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ACKNOWLEDGEMENTS AND CREDITS

This plan was prepared for the City of Everett by the Metropolitan Area Planning Council (MAPC) under the direction of the Massachusetts Emergency Management Agency (MEMA) and the Massachusetts Department of Conservation and Recreation (DCR). The plan was funded by the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation (PDM) Grant Program.

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I. EXECUTIVE SUMMARY

Hazard Mitigation planning is a proactive effort to identify actions that can be taken to reduce the dangers to life and property from natural hazard events. In the communities of the Boston region of Massachusetts, hazard mitigation planning tends to focus most on flooding, the most likely natural hazard to impact these communities. The Federal Disaster Mitigation Act of 2000 requires all municipalities that wish to be eligible to receive FEMA funding for hazard mitigation grants, to adopt a local multi-hazard mitigation plan and update this plan in five year intervals.

Planning Process

Planning for the Everett Hazard Mitigation Plan update was led by the Everett Local Hazard Mitigation Planning Committee, composed of staff from a number of different City Departments. This committee discussed where the impacts of natural hazards most affect the City, goals for addressing these impacts, and hazard mitigation measures that would benefit the City.

Public participation in this planning process is important for improving awareness of the potential impacts of natural hazards and to build support for the actions the City takes to mitigate them. Two advertised public meetings were held, the first on April 18, 2013 with the Everett Conservation Commission and the second on April 22, 2013 with the Planning Board. The draft Plan also was posted on the City's website for public review and comment for a ten day period following the two public meetings and completion of the first draft of the Plan. Both meetings included a description of the hazard mitigation planning process, an overview of the plan and proposed mitigation actions, as well as directions on how the public could access the draft plan on the City website and make comments. The public was given time to ask questions and comment at all public meetings.

Preceding these meetings, a public, regional meeting of the Metro Boston Multiple Hazard Community Planning Team was held April 13, 2012 to re-introduce participating communities to the hazard mitigation planning process and to identify inter-community hazard mitigation issues.

Risk Assessment

The plan update provides risk assessment for the following natural hazards in Everett: flooding, wind, including hurricanes and Northeasters, brush fires, tornados, landslides and earthquakes.

The Everett Local Committee identified those areas where flooding most frequently occurs, comprising 12.21 % of the City's land area, and approximately 1,142 buildings worth an estimated \$337,239,452.

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Hazard Mitigation Goals

1. Prevent and reduce the loss of life, injury and property damages resulting from all major natural hazards.
2. Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.
3. Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.
 - Ensure that the Planning Department considers hazard mitigation in its review and permitting of new development.
 - Review zoning regulations to ensure that the ordinance incorporates all reasonable hazard mitigation provisions.
 - Ensure that all relevant municipal departments have the resources to continue to enforce codes and regulations related to hazard mitigation.
4. Prevent and reduce the damage to public infrastructure resulting from all hazards.
 - Begin to assess the vulnerability of municipal buildings and infrastructure to damage from an earthquake.
 - Maintain existing mitigation infrastructure in good condition.
5. Encourage the business community, major institutions and non-profits to work with the City to develop, review and implement the hazard mitigation plan.
6. Work with surrounding communities, state, regional and federal agencies to ensure regional cooperation and solutions for hazards affecting multiple communities.
 - Continue to participate in the Mystic Region LEPC.
7. Ensure that future development meets federal, state and local standards for preventing and reducing the impacts of natural hazards.
8. Educate the public about natural hazards and mitigation measures that can be undertaken by property-owners.
 - Provide information on hazard mitigation activities in the languages most frequently spoken in Everett.
9. Take maximum advantage of resources from FEMA and MEMA to educate City staff and the public about hazard mitigation.

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Highlighted Potential Hazard Mitigation Actions

- Resolve ownership and legal issues of the Island End Culvert that will allow culvert cleaning and drainage ditch upgrade.
- Install appropriate stormwater management measures (BMPs) at Springvale, Madison and Elm Streets.
- Relieve the flooding at Elm Street due to infrastructure failure.
- Flooding of Tremont and Elton Street area- Dredging the creek streambed that drains this area remains a top priority, but is problematic due to contamination of the creek, land ownership, activity and use limitations.
- Complete the reconstruction of Lower Broadway: Flooding associated with the Island End culvert and failed infrastructure; replacing catch basins and installing new drain lines will help alleviate some of the flooding associated with the Island End culvert in this area.
- Complete updating Chapter 9 of the Everett General Ordinances- Flood Damage Prevention.

Plan Review and Update Process

Table 1 Plan Review and Update

Chapter	Reviews and Updates
III – Public Participation	The Everett Local Committee placed an emphasis on public participation for the update of the Hazard Mitigation Plan, discussing strategies to enhance participation opportunities at the first local committee meeting. During plan development, the plan was presented to the Planning Board and the Conservation Commission in public meetings. The plan was also available on the City’s website for public comment. No written comments were received by the City
IV – Risk Assessment	MAPC gathered the most recently available hazard and land use data and met with City staff to identify changes in local hazard areas and development trends. City staff reviewed critical infrastructure with MAPC staff in order to create an up-to-date list. MAPC also used the most recently available version of HAZUS and assessed the potential impacts of flooding using the latest data.
V - Goals	The Hazard Mitigation Goals were reviewed and endorsed by the Local Hazard Mitigation Committee.
VI – Existing Mitigation Measures	The list of existing mitigation measures was updated to reflect current mitigation activities in the City.
VII & VIII – Hazard Mitigation Strategy	Mitigation measures from the 2008 plan were reviewed and assessed as to whether they were completed, on-going, or deferred. The Local Committee determined whether to carry forward measures into the 2016 plan or delete them. The 2016 Hazard Mitigation Strategy reflects both new measures and measures carried forward from the 2008 plan. The Committee re-prioritized all of these measures based

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	on current conditions
IX – Plan Adoption & Maintenance	This section of the plan was updated with a new on-going plan implementation review and five year update process that will assist the City in incorporating hazard mitigation issues into other City planning and regulatory review processes and better prepare the City to update the plan in 2021.

As indicated in more detail on Table 22, Everett made progress on implementing mitigation measures identified in the 2008 Hazard Mitigation Plan. Many of the measures identified in that plan are now considered on-going aspects of the regular work of City staff from the department head level to the regular work of Public Works staff. While some of the measures identified in that plan were completed, many more still require the identification of a source of funds to support equipment and/or additional manpower. Moving forward into the next five year plan implementation period there will be many more opportunities to incorporate hazard mitigation into the City's decision making processes.

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II. INTRODUCTION

Planning Requirements under the Federal Disaster Mitigation Act

The Federal Disaster Mitigation Act, passed in 2000, requires that after November 1 2004, all municipalities that wish to continue to be eligible to receive FEMA funding for hazard mitigation grants, must adopt a local multi-hazard mitigation plan and update this plan in five year intervals. This planning requirement does not affect disaster assistance funding.

Massachusetts has taken a regional approach and has encouraged the regional planning agencies to apply for grants to prepare plans for groups of their member communities. The Metropolitan Area Planning Council (MAPC) received a grant from the Federal Emergency Management Agency (FEMA) under the Pre-Disaster Mitigation (PDM) Program, to assist the City of Everett and seven other Metro Boston communities to update their local Hazard Mitigation Plans, which were first adopted in as part of a Metro Boston Multi-Jurisdictional Hazard Mitigation Plan. The local Hazard Mitigation Plan updates produced under this grant are designed to individually meet the requirements of the Disaster Mitigation Act for each community.

In order to address multijurisdictional and regional issues, the participating municipalities were afforded the opportunity to meet with their neighboring communities during plan development. A public, regional meeting of the Metro Boston Multiple Hazard Community Planning Team was held April 13, 2012 to re-introduce participating communities to the hazard mitigation planning process and to identify inter-community hazard mitigation issues.

What is a Hazard Mitigation Plan?

Natural hazard mitigation planning is the process of determining how to systematically reduce or eliminate the loss of life and property damage resulting from natural hazards such as floods, earthquakes, and hurricanes. Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries, and property resulting from natural hazards through long-term strategies. These long-term strategies include planning, policy changes, programs, projects, and other activities.

Previous Federal/State Disasters

The City of Everett has experienced 21 natural hazards that triggered federal or state disaster declarations since 1991. These are listed in Table 2 below. The vast majority of these events involved flooding.

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Table 2 Previous Federal/State Disaster Declarations

DISASTER NAME (DATE OF EVENT)	TYPE OF FEDERAL ASSISTANCE PROVIDED	DECLARED AREAS IN MA
Hurricane Bob (August 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (16 projects)
No-Name Storm (October 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	FEMA Individual Household Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	Statewide
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	Statewide
October Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
(1997)	Community Development Block Grant-HUD	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
June Flood (June 1998)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester

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DISASTER NAME (DATE OF EVENT)	TYPE OF FEDERAL ASSISTANCE PROVIDED	DECLARED AREAS IN MA
	Community Development Block Grant-HUD	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
March Flood (March 2001)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (16 projects)
February Snowstorm (Feb 17-18, 2003)	FEMA Public Assistance Project Grants	Statewide
January Blizzard (January 22-23, 2005)	FEMA Public Assistance Project Grants	Statewide
Hurricane Katrina (August 29, 2005)	FEMA Public Assistance Project Grants	Statewide
May Rainstorm/Flood (May 12-23, 2006)	Hazard Mitigation Grant Program	Statewide
April Nor'easter (April 15-27, 2007)	Hazard Mitigation Grant Program	Statewide
Flooding (March, 2010)	FEMA Public Assistance FEMA Individuals and Households Program SBA Loan	Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Statewide
Tropical Storm Irene (August 27-28, 2011)	FEMA Public Assistance	Statewide
Hurricane Sandy (October 27-30, 2013)	FEMA Public Assistance	Statewide

(Source: database provided by MEMA)

FEMA Funded Mitigation Projects

Over the last 20 years the City of Everett has not any received funding from FEMA for mitigation projects under the Hazard Mitigation Grant Program.

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Community Profile

The City of Everett is a municipality in Middlesex County, Massachusetts. The population of Everett was 41,745 at the 2010 U.S. Census. Everett was settled in 1630, established as a town in 1870 and incorporated as a city in 1892. A blue-collar working class community, Everett has served as a gateway city to immigrants for most of its history. The community has a diversified industrial and commercial base with manufacturing accounting for approximately 31% of all jobs and more than 35% of the total annual payroll, followed by services and retail trade. The city's public facilities include seven elementary schools, one junior and one senior high school, which offers a vocational education program. Water and sewer services are provided by the MWRA. Everett has a convenient and accessible location abutting Boston on the Mystic River. The city is close to Interstate Highways 93 and 95, has 60 miles of public roads and is served by the MBTA. Logan International Airport is approximately 15 minutes away.

A small city of 3.5 square miles, Everett's residential area has a population density of approximately 18,000 per square mile, yet is able to provide a high level of educational, public safety, public works and recreational services to its citizens at a modest tax rate. Everett's assessed value in FY94 is \$2.0 billion and the city has maintained an "A" bond rating during the difficult economic times of recent years. Everett industry contributes significantly to the economic well being of the Commonwealth of Massachusetts, with many of its companies producing and servicing products in use world-wide. (Narrative supplied by community from: MA Department of Housing and Community Development)

Table 3. Everett Characteristics

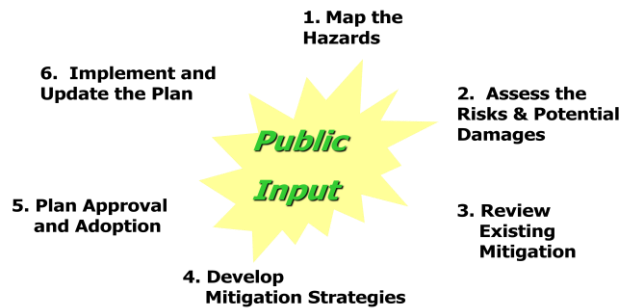
Population = 42,101 (2011 estimate)
23% are under the age 18
12% are over age 65
27 % speak English less than “very well” (over age 5)
18% of households have no vehicle
Number of Housing Units = 16,962
~ 60% are renter-occupied housing units
63% of housing units were built prior to 1940

Source: U.S. Census, 2010, American Community Survey 2006-2011

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III. PUBLIC PARTICIPATION

MAPC employs a six step planning process based on FEMA's hazard mitigation planning program focusing on local needs and priorities but maintaining a regional perspective matched to the scale and nature of natural hazard events. Public participation is a central component of this process, providing critical information about the local occurrence of hazards while also serving as a means to build a base of support for hazard mitigation activities. This process is illustrated and described below.



1. Map the Hazards – MAPC relies on data from a number of different federal, state, and local sources in order to map the areas with the potential to experience natural hazards. This mapping represents a multi-hazard assessment of the municipality and is used as a set of base maps for the remainder of the planning process. A particularly important source of information is the knowledge drawn from local municipal staff on where natural hazard impacts have occurred, which is collected. These maps can be found in Appendix B.
2. Assess the Risks & Potential Damages – Working with local staff, critical facilities, infrastructure, vulnerable populations, and other features are mapped and contrasted with the hazard data from the first step to identify those that might represent particular vulnerabilities to these hazards. Land use data and development trends are also incorporated into this analysis. In addition, MAPC develops estimates of the potential impacts of certain hazard events on the community.
3. Review Existing Mitigation – Municipalities in the Boston Metropolitan Region have an active history in hazard mitigation as many have adopted flood plain zoning districts, wetlands protection programs, and other measures as well as enforcing the State building code, which has strong provisions related to hazard resistant building requirements. All current municipal mitigation measures must be documented.
4. Develop Mitigation Strategies – MAPC works with the local municipal staff to identify new mitigation measures, utilizing information gathered from the hazard identification, vulnerability assessments, and the community's existing mitigation efforts to determine where additional work is necessary to reduce the potential damages from hazard events. Additional information on the development of hazard mitigation strategies can be found in Chapter VII.

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5. Plan Approval & Adoption – Once a final draft of the plan is complete it is sent to MEMA for the state level review and, following that, to FEMA for approval. Typically, once FEMA has approved the plan the agency issues a conditional approval with the condition being adoption of the plan by the municipality. More information on plan adoption can be found in Chapter IX and documentation of plan adoption can be found in Appendix D.
6. Implement & Update the Plan – Implementation is the final and most important part of any planning process. Hazard Mitigation Plans must also be updated on a five year basis making preparation for the next plan update an important on-going activity. Chapter IX includes more detailed information on plan implementation.

Public participation occurred at four levels; the Metro Boston Multiple Hazard Community Planning Team (regional committee) and the Everett Multiple Hazard Community Planning Team (local committee). In addition, the City held two advertised meetings open to the general public to present the plan and hear citizen input. Following the presentation of the draft plan at the two public meetings, the draft was placed on the City website for ten days for public comment and questions. No written comments were received by the City.

Everett's Participation in the Regional Committee

On February 28, 2012 a letter was sent notifying the communities of the first meeting of the Metro Boston Regional Committee and requesting that the Chief Elected Official designate a minimum of two municipal employees and/or officials to represent the community. The following individuals were appointed to represent Everett on the regional committee:

David Butler	Fire Chief
James Errickson	Community and Economic Development, Executive Director

The regional committee serves as an opportunity for neighboring communities to discuss hazard mitigation issues of shared concern. The Metro Boston Regional Committee met on April 13, 2012. At that meeting, representatives from each of the nine Metro Boston communities beginning the process of reviewing and revising their 2008 Natural Hazard Mitigation Plans were re-introduced to the following items:

- The Massachusetts State Hazard Mitigation Plan and the FEMA hazard mitigation planning and grant process;
- The concept of each community engaging staff and the public to update its current Natural Hazard Mitigation Plan;
- FEMA plan overview and requirements and plan eligibility;
- Review of the overall scope of work and plan revision schedule
- Question and of Discussion of local issues, inter-community and Metro Boston Region hazard mitigation issues and how to address.

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- Re-introduction to identifying and mapping municipal Critical Facilities, municipal Areas of Concern, Inter-Community Areas of Concern, and Regional Shared areas of Concern.
- Municipal representatives were also briefed on the importance of trying to create a diversified presence on the local Multiple Hazard Community Planning Team in advance of local team meetings, being asked to contact major employers, business owners, schools and non-profit organizations to participate in the process.

In addition, as the same group of MAPC staff is working on each community's plan, these issues of shared concern, and other issues that may arise between neighboring communities, are discussed in greater detail in local committee meetings and resulting actions reflected in the identified mitigation measures, as noted in Chapter VIII.

The Local Multiple Hazard Community Planning Team

In addition to the regional committee meetings, MAPC worked with the local community representatives to organize a local Multiple Hazard Community Planning Team for Everett (local committee). MAPC briefed the local representatives as to the desired composition of that team as well as the need for representation from the business community and citizens at large.

The Local Multiple Hazard Community Planning Team Meetings

On April 24, 2012 MAPC conducted the meeting of the Everett Local Committee. The purpose of the meeting was to review the existing plan and mitigation goals, including gathering information on local hazard mitigation issues, updating existing mitigation practices, and determining the status of mitigation measures from the 2008 plan. The meeting also included discussion of new or modified mitigation measures and a process for public involvement and outreach. Table 4 lists the attendees at each meeting of the team. The agenda for these meeting is included in Appendix A.

Table 4 Attendance at the Everett Local Committee Meeting	
Name	Representing
April 24, 2012	
Roberto Santamaria	Health Department
Peter Pietrantonio	Department of Public Works (DPW)
Marzie Galazka	Community and Economic Development
James Erickson	Community and Economic Development
Patrick Johnston	Police/Fire Departments
David Butler	Fire Chief

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Public Meetings

The plan was introduced to the public at two public, advertised meetings, both while the draft plan was being completed. The public had an opportunity to provide input to the planning process during a meeting of the Everett Planning Board on April 22, 2013 held at Everett City Hall. The draft planning process was also introduced at a meeting of the Everett Conservation Commission on April 18, 2013 at Everett City Hall.

Both the Planning Board and Conservation Commission meetings were advertised as public meetings. The attendance list for each meeting can be found in Table 5. In addition to staff and elected officials, approximately ten people attended the Planning Board meeting and six at the Conservation Commission meeting. In addition, the plan was made available on the City's website for public review following edits by the Everett Natural Hazard Mitigation Team. MAPC staff announced at both the Planning Board and Conservation Commission public meetings that the draft plan would be available for comments and questions for a ten day posting period and encouraged Board members and public attendees to read the plan and submit comments. No public comments were received by the City.

**Table 5
Attendance at Public Meetings**

Name	Representing
<u>First Public Meeting</u>	
Jon E. Norton	Everett Conservation Commission, Chairman
Eamon Kernan, P.E.	Everett Conservation Commission
Christine L. Pelosi	Everett Conservation Commission
Rita E. Hashem	Everett Conservation Commission
Sam Cleaves	MAPC
Members of the public	
<u>Second Public Meeting</u>	
Anthony Medeiros	Everett Planning Board,
Leo Pizzano, Jr.	Everett Planning Board
Michael J. Bono	Everett Planning Board
Jamie Errickson	Planning and Development, Executive Director
James Soper, CBO	Building Commissioner
Sam Cleaves	MAPC
Members of the public	

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Other Opportunities for Public Involvement

Review by Community Organizations

Notice was sent to the following organizations and neighboring municipalities inviting them to review the Everett Hazard Mitigation Plan and submit their comments to the City.

City of Everett Boards and Commissions
City of Malden
City of Medford
City of Somerville
City of Cambridge

The draft plan was posted on the City's website for 10 days for public comment. The posting was announced at both the Conservation Commission and Planning Board meetings. MAPC contacted organizations and individuals suggested by the Everett NHM Team and let them know that the draft plan was available on the City website for comments and questions. No written comments were received by the City.

Continuing Public Participation

Following the adoption of the plan update, the planning team will continue to provide residents, businesses, and other stakeholders the opportunity to learn about the hazard mitigation planning process and to contribute information that will update the city's understanding of local hazards. This will occur through a combination of in-person meetings, presentations at regular committee meetings, and provision of information on the city's website. It will also occur through day-to-day sharing of information received from the public with applicable departments, such as residents' calls to inform about flooding and feedback about changes following infrastructure improvements.

Planning Timeline Summary

February 28, 2011	Letter to the municipalities initiating the project.
April 13, 2012	Meeting of the Metro Boston Regional Mitigation Committee
April 24, 2012	Meeting of the Everett Local Hazard Mitigation Committee
April 18, 2013	First Public Meeting in with the Conservation Commission
April 22, 2013	Second Public Meeting with the Everett Planning Board
May 30, 2013	Draft Plan submitted to MEMA
August 27, 2014	Revised Plan submitted to MEMA
June 2, 2015	Revised Plan submitted to MEMA
August 31, 2015	Revised Plan submitted to MEMA
May 3, 2016	Approval Pending Adoption issued by FEMA
September 19, 2016	Final Plan adopted by the City
October 21, 2016	FEMA Plan Approval

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IV. RISK ASSESSMENT

The risk assessment analyzes the potential natural hazards that could occur within the City of Everett as well as the relationship between those hazards and current land uses, potential future development, and critical infrastructure. This section also includes a vulnerability assessment that estimates the potential damages that could result from certain large scale natural hazard events.

Update Process

In order to update Everett's risk assessment, MAPC gathered the most recently available hazard and land use data and met with City staff to identify changes in local hazard areas and development trends. MAPC also used the most recently available version of HAZUS (described below).

Overview of Hazards and Impacts

The Massachusetts Hazard Mitigation Plan 2013 (state plan) provides an in-depth overview of natural hazards in Massachusetts. The state plan indicates that Massachusetts is subject to the following natural hazards (listed in order of frequency); floods, heavy rainstorms, nor'easters or winter storms, coastal erosion, hurricanes, tornadoes, urban and wildfires, drought and earthquakes. Previous state and federal disaster declarations since 1991 are summarized in Table 2.

Table 6 summarizes the hazard risks for Everett. This evaluation takes into account the frequency of the hazard, historical records, and variations in land use. This analysis is based on the vulnerability assessment in the Commonwealth of Massachusetts State Hazard Mitigation Plan, 2013. The statewide assessment was discussed and modified by plan participants to reflect local conditions in Everett using the definitions for hazard frequency and severity listed below in Table 6.

Table 6 - Hazard Risks Summary

Hazard	Frequency		Likely Severity	
	Massachusetts	Everett	Massachusetts	Everett
Flooding	High	High	Serious	Serious
Dam failures	Very Low	Very Low	Extensive	Serious
Coastal Hazards	High	High	Serious	Serious
Nor'easters	High	High	Minor	Minor
Winter storms	High	High	Minor	Minor
Hurricanes	Medium	Medium	Serious	Serious
Severe Thunderstorms	High	High	Minor	Minor
Tornadoes	Medium	Very Low	Serious	Serious
Brush fires	Medium	Very Low	Minor	Minor
Earthquakes	Very Low	Very Low	Serious	Serious

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Landslides	Low	Very Low	Minor	Minor
Drought	Low	Low	Minor	Minor
Extreme temperatures	Medium	Medium	Minor	Minor

Definitions used in the Commonwealth of Massachusetts State Hazard Mitigation Plan

Frequency

Very low frequency: events that occur less frequently than once in 100 years (less than 1% per year)

Low frequency: events that occur from once in 50 years to once in 100 years (1% to 2% per year);

Medium frequency: events that occur from once in 5 years to once in 50 years (2% to 20% per year);

High frequency: events that occur more frequently than once in 5 years (greater than 20% per year).

Severity

Minor: Limited and scattered property damage; limited damage to public infrastructure and essential services not interrupted; limited injuries or fatalities.

Serious: Scattered major property damage; some minor infrastructure damage; essential services are briefly interrupted; some injuries and/or fatalities.

Extensive: Widespread major property damage; major public infrastructure damage (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and/or fatalities.

Catastrophic: Property and public infrastructure destroyed; essential services stopped, numerous injuries and fatalities.

Flood Related Hazards

Flooding was the most prevalent serious natural hazard identified by local officials in Everett. Flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and, thunderstorms. Sea level rise has the potential to exacerbate these issues over time.

Regionally Significant Storms

There have been a number of major floods that have affected the region over the last fifty years. Significant historic flood events in Everett have included:

- March 1968
- The blizzard of 1978
- January 1979
- April 1987
- October 1991 ("The Perfect Storm")

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- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007
- March 2010
-

Previous Occurrences and Impacts

City-specific data for previous flooding occurrences is not available and county flooding data was used as the best available. Middlesex County, which includes Everett, experienced ten non-Coastal or non- Urban Small Stream flood events from January 1, 1950 – March 1, 2014. There were no deaths or injuries reported and the six flooding events associated with property damage totaled \$25.733 million dollars.

The most severe recent flooding occurred during the major storm of March 2010, a total of 14.83 inches of rainfall accumulation was officially recorded by the National Weather Service (NWS). The weather pattern that caused these floods consisted of early springtime prevailing westerly winds that moved three successive storms, combined with tropical moisture from the Gulf of Mexico, across New England. Torrential rain falls lasting ten days caused March 2010 to be the wettest month on record.

Based on data from the National Climatic Data Center, historic flood events from 2005 through March 30, 2014 were compiled and are summarized in Table 7. Damages from the March 2010 floods totaled \$35.2 million, while total damages for all floods since 2005 totaled \$40.5 million.

Table 7: Middlesex County Flood Events 2005 – 4/30/2014

Date	Type	Deaths	Injuries	Property Damage
10/15/2005	Flood	0	0	125.00K
5/13/2006	Flood	0	0	5.000M
5/13/2006	Flood	0	0	0.00K
7/11/2006	Flood	0	0	2.00K
10/28/2006	Flood	0	0	5.00K
4/16/2007	Flood	0	0	25.00K
2/13/2008	Flood	0	0	0.00K
5/27/2008	Flood	0	0	3.00K
6/24/2008	Flood	0	0	10.00K
6/29/2008	Flood	0	0	5.00K
8/10/2008	Flood	0	0	15.00K
8/10/2008	Flood	0	0	40.00K
9/6/2008	Flood	0	0	15.00K
12/12/2008	Flood	0	0	20.00K

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3/14/2010	Flood	0	0	26.430M
3/29/2010	Flood	0	0	8.810M
4/1/2010	Flood	0	0	0.00K
8/28/2011	Flood	0	0	5.00K
10/14/2011	Flood	0	0	0.00K
6/8/2012	Flood	0	0	0.00K
6/23/2012	Flood	0	0	0.00K
6/23/2012	Flood	0	0	0.00K
6/23/2012	Flood	0	0	0.00K
6/23/2012	Flood	0	0	0.00K
6/23/2012	Flood	0	0	15.00K
7/18/2012	Flood	0	0	5.00K
10/29/2012	Flood	0	0	0.00K
6/7/2013	Flood	0	0	0.00K
7/1/2013	Flood	0	0	0.00K
7/1/2013	Flood	0	0	0.00K
7/23/2013	Flood	0	0	0.00K
9/1/2013	Flood	0	0	10.00K
3/30/2014	Flood	0	0	35.00K
3/30/2014	Flood	0	0	0.00K
3/30/2014	Flood	0	0	0.00K
TOTAL		0	0	40,510,000

(Source: NOAA NCDC)

Overview of City-Wide Flooding

The City of Everett is subject to three types of flooding: inland flooding in the forms of riverine flooding, urban flooding and coastal flooding. Riverine flooding occurs when the rate of precipitation and/or amount of stormwater runoff overwhelms the capacity of natural or structured drainage systems causing overflows; urban flooding occurs when precipitation causes the water table to rise and leads to flooding of low-lying areas such as streets and underpasses. Coastal flooding is where wind and tide leads to flooding along tidal waterways such as the Island End River. From January 1, 2005 to April 30, 2014, Middlesex County, including Everett, did not experience any coastal flooding events. These types of flooding are often combined as storm events lead to large amounts of draining stormwater, which can be blocked by elements of the built environment and can be backed up when drainage locations (ponds, streams, etc.) are at or above capacity. The City not to address ice jams in this plan. Though no local data exists, best available Middlesex County data indicates that Everett has never experienced an ice jam and the entire county has only experienced one ice jam event from 2000 to 2014, when the Nashoba Brook, near Acton, MA, experienced an ice jam on February, 17, 2008. (2013 Mass State Hazard Mitigation Plan, Appendix J-1) The city is divided into two major watersheds, approximately 75% being in the Mystic River Watershed and the remainder in the North Coastal Watershed. Flooding was the most prevalent serious natural hazard

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identified by local officials in Everett. Flooding is caused by hurricanes, nor'easters, severe rainstorms and thunderstorms and is often worsened by coastal storm surges and high tides. The majority of flooding in the City is caused by deficiencies in the drainage system rather than location within the flood plain.

Overview of Drainage System

Almost all of Everett's flooding problems are associated with problems in the drainage system and old infrastructure. Many of the City's currently identified areas of flooding concern are directly linked to the filling of the Island End River in the early 1900s by the Eastern Gas and Coal Company. The river was replaced by a ditch and culvert, which are partially located in adjoining Chelsea, and eventually drain into the Island End River in Chelsea near Williams Street. The top three flooding areas of concern identified by the City are associated with the clogged Island End culvert. Under the 1901 agreement, the backfilling of the Island End River was allowed by the state, with the permit stating that Eastern Gas and its descendants, now Keyspan Energy, install and maintain connections between the then existing sewer lines (storm and sanitary) and maintain these lines in perpetuity. The current owner of the culvert has refused to maintain the culvert and it has clogged regularly during precipitation events. The culvert is located on land and streets not accepted by the City of Everett and all repairs would need to include remediation of contaminated soil sites, which Keyspan has agreed to cover, but not infrastructure repair costs such as the culvert and ditch.. Infrastructure issues and clogged/restricted drain lines in the vicinity of Lower Broadway, Route 16 and restricted drainage to Chelsea Creek, along with flood waters trapped by the closed Town Line Brook Tide Gate in Revere during storm events that impacts the Springvale Avenue and Jefferson Avenue neighborhoods.

Information on flood hazard areas was taken from two sources. The first was the current National Flood Insurance Rate Map, dated June 4, 2010. The FIRM flood zones are shown on Map 3 in Appendix B and defined below.

Flood Insurance Rate Map Zone Definitions

Zone A (Also known as Unnumbered A Zones): Special Flood Hazard Areas where, because detailed hydraulic analyses have not been performed, no Base Flood Elevations or depths are shown.

Zones AE: Special Flood Hazard Areas that are subject to inundation by the base flood, determined using detailed hydraulic analysis. Base Flood Elevations are shown within these zones.

Zone AO: Special Flood Hazard Areas that are subject to inundation by types of shallow flooding where average depths are between 1 and 3 feet. These are normally areas prone to shallow sheet flow flooding on sloping terrain.

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Zone VE, V1-30: Special Flood Hazard Areas along coasts that are subject to inundation by the base flood with additional hazards due to waves with heights of 3 feet or greater. Base Flood Elevations derived from detailed hydraulic analysis are shown within these zones.

Zone X (shaded): Zones where the land elevation has been determined to be above the Base Flood Elevation, but below the 500 year flood elevation. These zones are not Special Flood Hazard Areas.

The second source of flooding information was discussions with local officials. The Locally Identified Areas of Flooding described below were identified by City staff as areas where flooding is known to occur. These areas do not necessarily coincide with the flood zones from the FIRM maps. They may be areas that flood due to inadequate drainage systems or other local conditions rather than location within a flood zone. The numbers correspond to the numbers on Map 8, "Hazard Areas". The numbers do not reflect priority order. Areas vulnerable to local flooding include:

Locally Identified Areas of Flooding

1. Market Forge: drains to clogged Island End culvert and causes backup flooding- High priority.
2. Spring Street: drains to clogged Island End culvert and causes backup flooding-High priority.
3. Vale Street: drains to clogged Island End culvert and causes backup flooding- High priority.
4. Springvale, Jefferson, and Madison Streets: flooding due to constricted/undersized drainage line; drainage goes to Chelsea Creek. - High priority
5. Elm Street: same issue as Site 4 - High priority.
6. Malden River bank erosion: DCR Malden and Mystic river draw down (see Regional Problems) : Medium priority.
8. Elton and Tremont Streets area: clogged drain lines - High priority
9. Lower Broadway: Constructed in the 1800s, drain lines are clogged and/or under-sized leading to backups and flooding during heavier precipitation events. Everett plans to address, at least partially, during planned reconstruction of Broadway, with the MWRA contributing video analysis of drain lines. - High Priority
10. Exxon Dock: Outfalls and river bulkhead deterioration have led to back-ups and flooding on former Eastern Coal land - Lower priority

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11. Bryant, Edyth and Fuller Streets Area: flooding due to backup from closed Town Line Brook Tide Gate in Revere during storm events- Medium priority.

12. Route 16: flooding due to lack of maintenance to catch basins and drain lines: regional issue involving MA DOT

In addition to these areas, several of the Critical Facilities listed in Table 16 are vulnerable to flooding because they are located in the AE zone. These include the Distrigas Marine Terminal, the Exxon/Mobil Martine Terminal, and Preferred Freezer.

Repetitive Loss Structures

There are three repetitive loss structures in Everett, an increase of two from the 2008 plan. All are residential properties, one of which is located in a Zone A flood hazard zone. There have been a total of six losses, an increase of four since the previous plan, with total losses of \$60,703, an increase of \$23,876 since the previous plan. As defined by the Community Rating System (CRS) of the National Flood Insurance Program (NFIP), a repetitive loss property is any property which the NFIP has paid two or more flood claims of \$1,000 or more in any given 10-year period since 1978. For more information on repetitive losses see <http://www.fema.gov/business/nfip/replps.shtm>.

Coastal Erosion and Coastal Bank Undercutting

Coastal erosion and coastal bank undercutting are related issues increasingly impacting some communities along the Massachusetts coast. Rising sea levels have led to increased rates of erosion along beaches and coastlines and the undermining of coastal bulkheads and estuarine river banks in Everett. Bulkheads and coastal banks in Everett protect the buildings from storm damage and their failure can lead to increased property damage. As a community that fronts on an urbanized estuarine/river environment, Everett is impacted by sea level rise although it is largely protected from more the damage experienced by ocean front communities to seawalls and beaches. The City experiences erosion and undercutting along its Mystic River banks when the Amelia Earhart dam is opened by MA Department of Conservation and Recreation (DCR) to increase storm water storage capacity by lowering the level of the Mystic River. The city does not keep records of specific coastal erosion events, but the process is an incremental one over the long term. The areas potentially impacted along the Mystic River do not include populated residential areas (see Map 1), and are industrial properties, some of which are abandoned or underutilized sites, but also include some currently active operations. However no significant impacts were identified by the Hazard Mitigation Planning Team.

FEMA has indicated in their latest rules that post hazard event reconstruction or repair funding for coastal protection structures will only be made available where the damage can be directly attributed to the storm event. Therefore, in order to receive this funding, the City must maintain records of maintenance and repair activities that demonstrate the status of each structure.

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Dams and Dam Failure

The Amelia Earhart Dam is located on the Mystic River between the Cities of Everett and Somerville, and it separates the tidal and the non-tidal parts of the Mystic River. The dam is owned and operated by the Department of Conservation and Recreation (DCR), which also owns the Mystic Lakes Dam in Medford/Arlington which is part of the Mystic Lakes system, located further upstream the Mystic River watershed.

The Amelia Earhart Dam is listed as a low hazard dam but is in poor condition and is estimated to need \$5 million dollars in repairs, including repairs to the third pump and the possible installation of a fourth pump. The dam is currently able to pump 4,000 cubic feet per second of flow from the Mystic and Malden Rivers against high tide into Boston Harbor. The pump improvements would increase the rate that flood water can travel out of the cities and towns along the Mystic River. The Mystic Lakes Dam was rebuilt by DCR in 2011.

Dam failure can arise from two types of situations. Dams can fail because of structural problems independent of any storm event. Dam failure can follow an earthquake by causing structural damage. Dams can fail structurally because of flooding arising from a storm or they can overspill due to flooding. However there has never been a dam failure in Everett.

In the event of a dam failure, the energy of the water stored behind even a small dam can cause loss of life and property damage if there are people or buildings downstream. The number of fatalities from a dam failure depends on the amount of warning provided to the population and the number of people in the area in the path of the dam's floodwaters. Dam failure in general is infrequent but has the potential for severe impacts. An issue for dams in Massachusetts is that many were built in the 19th century without the benefits of modern engineering or construction oversight.

The Massachusetts DCR has three hazard classifications for dams:

- | | |
|---------------------|---|
| High Hazard: | Dams located where failure or mis-operation will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s). |
| Significant Hazard: | Dams located where failure or mis-operation may cause loss of life and damage home(s), industrial or commercial facilities, secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important facilities. |
| Low Hazard: | Dams located where failure or mis-operation may cause minimal property damage to others. Loss of life is not expected. |

Although there has never been a dam failure, if one did occur the lower elevation areas of Everett along the Mystic River could be impacted by flooding. These areas do not

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include populated residential areas (see Map 1), and are mostly industrial properties, some of which are abandoned or underutilized sites, but also include some currently active operations.

The probability of future dam failure events is classified in the Massachusetts State Hazard Mitigation Plan 2013 as very low frequency, or an event that occurs less frequently than once in 1,000 years (less than 0.1% per year).

Wind Related Hazards

Wind-related hazards include hurricanes and tornadoes as well as high winds during severe rainstorms and thunderstorms. As with many communities, falling trees that result in downed power lines and power outages are an issue in Everett.

Between 1858 and 2013, Massachusetts has experienced approximately 35 tropical storms, eleven Category 1 hurricanes, five Category 2 hurricanes and one Category 3 hurricane. This equates to a frequency of once every six years. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm.

Hurricanes

A hurricane is a violent wind and rainstorm with wind speeds of 74-200 miles per hour. A hurricane is strongest as it travels over the ocean and is particularly destructive to coastal property as the storm hits the land. Hurricanes generally occur between June and November. Falling trees are a significant problem because they can cause power outages when they fall on power lines or block traffic and emergency access.

In 1944 a Category 1 hurricane tracked through northwestern Everett. This storm track is shown on Map 5 in Appendix B. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. The City does experience the impacts of the wind and rain of hurricanes and tropical storms, regardless of the storm track. The hazard mapping indicates that the 100 year wind speed is 110 miles per hour.

Hurricanes typically have regional impacts beyond their immediate tracks, and numerous hurricanes have affected the communities of eastern Massachusetts (see Table 8). A hurricane or tropical storm track is the line that delineates the path of the eye of the hurricane or storm. Falling trees are a big problem because they can cause power outages when they fall on power lines or block traffic. There have been no significant changes to address hurricane emergency response since 2005. The two major mitigation measures in place are adherence to the Massachusetts State Building Code and the City's Comprehensive Emergency Management Plan which addresses hurricane hazards although primarily from a response perspective.

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Table 8: Hurricane Records for Massachusetts

Hurricane Event	Date
Great New England Hurricane*	September 21, 1938
Great Atlantic Hurricane*	September 14-15, 1944
Hurricane Doug	September 11-12, 1950
Hurricane Carol*	August 31, 1954
Hurricane Edna*	September 11, 1954
Hurricane Diane	August 17-19, 1955
Hurricane Donna	September 12, 1960
Hurricane Gloria	September 27, 1985
Hurricane Bob	August 19, 1991
Hurricane Earl	September 4, 2010
Tropical Storm Irene	August 28, 2011
Hurricane Sandy	October 29-30, 2013

*Category 3 Source: National Oceanic and Atmospheric Administration (NOAA)

Hurricane intensity is measured according to the Saffir/Simpson scale, which categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential. These are combined to estimate potential damage. The following gives an overview of the wind speeds, surges, and range of damage caused by different hurricane categories:

Scale No. (Category)	Winds(mph) Storm	Surge (ft)	Potential Damage
1	74 – 95	4 - 5	Minimal
2	96 – 110	6 - 8	Moderate
3	111 – 130	9 - 12	Extensive
4	131 – 155	13 - 18	Extreme
5	> 155	>18	Catastrophic

Source: NOAA

Hurricanes are a city-wide hazard in Everett. Based on the record of previous occurrences, Hurricanes in Everett are a Medium frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur from once in 5 years to once in 50 years, or a 2% to 20% chance per year.

Severe Thunderstorms

While less severe than the other types of storms discussed, thunderstorms can lead to localized damage and represent a hazard risk for communities. Generally defined as a storm that includes thunder, which always accompanies lightning, a thunderstorm is a storm event featuring lightning, strong winds, and rain and/or hail. Thunderstorms sometime give rise to tornados. On average, these storms are only around 15 miles in

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diameter and last for about 30 minutes. A severe thunderstorm can include winds of close to 60 mph and rain sufficient to produce flooding.

Eastern Massachusetts is at risk of one to two severe thunderstorms per year. Past occurrences that are listed in the Massachusetts Hazard Mitigation Plan 2013 include:

March 1972
March-April 1982
October 1996
June 1998
March-April 2001
October 2005
May 2006
April 2007
March 2010
August 2011

Everett has experienced three severe thunderstorm events from 2005 to April 30, 2014 with no deaths or injuries. The most severe storm was July 7, 2014 when high winds downed power lines and trees along Corey Street and Riverside Avenue, causing an estimated \$25,000 in property damage. Middlesex County as whole had 64 severe thunderstorms for the same period with 6 reported injuries and \$1.94 million in property damages. There were also 29 hail events with one reported instance of property damage and 25 Middlesex County lightening events with no fatalities but \$1.07 million in property damage for the same period. (NCDC)

Severe thunderstorms are a city-wide hazard for Everett. The City is vulnerable to both the wind and precipitation associated with thunderstorms. High winds can cause damage to structures, fallen trees, and downed power lines leading to power outages. Intense rainfall can overwhelm drainage systems causing localized flooding of rivers and streams as well as urban stormwater ponding and localized flooding.

Based on the record of previous occurrences, severe thunderstorms in Everett are high frequency events as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20% per year).

Tornadoes

A tornado is a violent windstorm characterized by a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. They develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. Most vortices remain suspended in the atmosphere. Should they touch down, they become a force of destruction.

Some ingredients for tornado formation include:

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- Very strong winds in the mid and upper levels of the atmosphere
- Clockwise turning of the wind with height (from southeast at the surface to west aloft)
- Increasing wind speed with altitude in the lowest 10,000 feet of the atmosphere (i.e., 20 mph at the surface and 50 mph at 7,000 feet.)
- Very warm, moist air near the ground with unusually cooler air aloft
- A forcing mechanism such as a cold front or leftover weather boundary from previous shower or thunderstorm activity

Tornados can form from individual cells within severe thunderstorm squall lines. They can form from an isolated ‘supercell’ thunderstorm. They can be spawned by tropical cyclones or even their remnants that are passing through. And, weak tornados can even sometimes occur from air that is converging and spinning upward, with little more than a rain shower occurring in the vicinity.

Tornadoes are rare in this part of Massachusetts. Although no tornadoes have been recorded within the City of Everett, a tornado rated as F2 struck the neighboring cities of Chelsea and Revere on July 28, 2014. The tornado touched down at 9:32 AM just south of Route 16 (Revere Beach Parkway) and moved north into Revere’s business district along Broadway, ending at 9:36 AM near the intersection of Routes 1 and 60.

Since 1955 there have been 17 tornadoes in surrounding Middlesex County recorded by the Tornado History Project. Two of these were and F3 tornadoes, four were F2, and the rest were F1. These 17 tornadoes resulted in a total of one fatality and six injuries. as summarized in Table 9.

**Table 9
Tornado Records for Middlesex County**

Date	Fujita	Fatalities	Injuries	Width	Length	Damage
10/24/1955	1	0	0	10	0.1	\$500-\$5000
6/19/1957	1	0	0	17	1	\$5K-\$50K
6/19/1957	1	0	0	100	0.5	\$50-\$500
7/11/1958	2	0	0	17	1.5	\$50K-\$500K
8/25/1958	2	0	0	50	1	\$500-\$5000
7/3/1961	0	0	0	10	0.5	\$5K-\$50K
7/18/1963	1	0	0	50	1	\$5K-\$50K
8/28/1965	2	0	0	10	2	\$50K-\$500K
7/11/1970	1	0	0	50	0.1	\$5K-\$50K
10/3/1970	3	1	0	60	35.4	\$50K-\$500K
7/1/1971	1	0	1	10	25.2	\$5K-\$50K
11/7/1971	1	0	0	10	0.1	\$50-\$500
7/21/1972	2	0	4	37	7.6	\$500K-\$5M
9/29/1974	3	0	1	33	0.1	\$50K-\$500K
7/18/1983	0	0	0	20	0.4	\$50-\$500

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9/27/1985	1	0	0	40	0.1	\$50-\$500
8/7/1986	1	0	0	73	4	\$50K-\$500K

There have been no changes since the 2008 NHM Plan to address tornadoes in Everett beyond maintaining emergency shelters in the event that they were needed. The City has adopted the Massachusetts State Building Code. The code's provisions are the most cost-effective mitigation measure against tornadoes given the extremely low probability of occurrence. The City does maintain American Red Cross certified emergency shelters if they were needed in case of evacuations due to tornadoes.

Tornado damage severity is measured by the Fujita Tornado Scale, in which wind speed is not measured directly but rather estimated from the amount of damage. As of February 01, 2007, the National Weather Service began rating tornadoes using the Enhanced Fujita-scale (EF-scale), which allows surveyors to create more precise assessments of tornado severity. The EF-scale is summarized below:

Fujita Scale			Derived		Operational EF Scale	
F Number	Fastest ¼ mile (mph)	3-second gust (mph)	EF Number	3-second gust (mph)	EF Number	3-second gusts (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over -200

Information on wind related hazards can be found on Map 5 in Appendix B.

Given their unpredictable track, tornadoes are a potential city-wide hazard in Everett. Most structures pre-date current building codes and could be subject to significant damages. Evacuation may be required on short notice. Sheltering and mass feeding efforts may be required along with debris clearance, search and rescue, and emergency fire and medical services.

Based on the record of previous occurrences since 1950, Tornado events in Everett are a Medium frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur from once in 10 years to once in 100 years, or a 1% to 10% chance per year

Nor'easters

A classic nor'easter is a strong low pressure system that forms over land or is positioned just off the coastal waters of New England. Nor'easters are relatively common in the winter months in New England, occurring one to two times a year, and are notorious for

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producing heavy snow, rain and tremendous waves that crash onto Atlantic beaches causing beach erosion and structural damage. The characteristics of a nor'easter produce strong northeasterly winds blowing in from the ocean ahead of the storm and over the coastal areas. These strong northeast winds typically cause coastal flooding, coastal erosion and gale to hurricane force winds. The storm radius of a nor'easter can be as much as 1,000 miles and these storms feature sustained winds of 10 to 40 mph with gusts of up to 70 mph.

In Massachusetts, northeast coastal storms known as nor'easters occur 1-2 times per year, typically in January or February. Winter storms are a combination hazard because they often involve wind, ice and heavy snow fall. The impact of heavy snowfall is to impair the flow of vehicles needed for day-to-day commuting, local businesses and public safety response. All parts of Everett are at equal risk from nor'easters.

Previous occurrences of Nor'easters include the following which are listed in the Massachusetts State Hazard Mitigation Plan 2013:

February 1978	Blizzard of 1978
October 1991	Severe Coastal Storm ("Perfect Storm")
December 1992	Great Nor'easter of 1992
January 2005	Blizzard/ Noreaster
October 2005	Coastal Storm/Nor'easter
April 2007	Severe Storms, Inland & Coastal Flooding/Nor'easter
January 2011	Winter Storm/Nor'easter
October 2011	Severe Storm/Nor'easter

Everett is vulnerable to both the wind and precipitation that accompanies nor'easters. High winds can cause damage to structures, fallen trees, and downed power lines leading to power outages. Intense rainfall can overwhelm drainage systems causing localized flooding of rivers and streams as well as urban stormwater ponding and localized flooding. The entire city of Everett could be at risk from the wind, rain or snow impacts from a nor'easter, depending on the track and radius of the storm. Based on the record of previous occurrences, nor'easters in Everett are high frequency events as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20% per year).

Winter Storms

Winter storms are the most common and most familiar of the region's hazards that affect large geographic areas. The majority of blizzards and ice storms in the region cause more inconvenience than they do serious property damage, injuries, or deaths. However, periodically, a storm will occur which is a true disaster, and necessitates intense large-scale emergency response. Occasionally winter storms can also hinder the tidal exchange in tidally restricted watersheds and result in localized flooding within these areas. Ice build-up at gate structures can also damage tide gates and increase the hazard potential as

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a result of malfunctioning tide gates. Coastal storms also cause flooding because of tidal surges. The average annual snowfall for the majority of the city is 36.1-48.0 inches. There is a small band in the northwestern part of the City where the average snowfall is 48.1-72.0 inches. The most severe winter storm was the blizzard of 1978.

The Northeast Snowfall Impact Scale (NESIS) developed by Paul Kocin of The Weather Channel and Louis Uccellini of the National Weather Service (Kocin and Uccellini, 2004) characterizes and ranks high impact northeast snowstorms. These storms have large areas of 10 inch snowfall accumulations and greater. NESIS has five categories: Extreme, Crippling, Major, Significant, and Notable. NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers. The NESIS categories are summarized below:

Category	NESIS	Value Description
1	1–2.499	Notable
2	2.5–3.99	Significant
3	4–5.99	Major
4	6–9.99	Crippling
5	10.0+	Extreme

Source: Massachusetts State Hazard Mitigation Plan, 2013

Since 1958 Massachusetts has experienced two Category 5 Extreme snow storms, nine Category 4 (Crippling) storms, and 13 Category 3 (Major) snow storms. The most significant winter storm in recent history was the “Blizzard of 1978,” which resulted in over 3 feet of snowfall and multiple day closures of roadways, businesses, and schools. Historically, severe winter storms have occurred in the following years:

Blizzard of 1978	February 1978
Blizzard	March 1993
Blizzard	January 1996
Severe Snow Storm	March 2001
Severe Snow Storm	December 2003
Severe Snow Storm	January 2004
Severe Snow Storm	January 2005
Severe Snow Storm	April, 2007
Severe Snow Storm	December 2010
Blizzard of 2013	February 2013

The City of Everett does not keep local records of winter storms. Data for Middlesex County, which includes Everett, is the best available data to help understand previous occurrences and impacts of winter storm events. According to National Climate Data Center (NCDC) records, from 1996 to 2014, Middlesex County experienced 50 heavy snowfall events, resulting in no deaths or injuries and \$1.45 million dollars in property damage. See Table 10 for and heavy snow events and impacts in Middlesex County.

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Table 10 - Heavy Snow Events and Impacts in Middlesex County 1996 –2011

Date	Type	Deaths	Injuries	Property Damage
1/2/1996	Heavy Snow	0	0	0.00K
1/7/1996	Heavy Snow	0	0	1.400M
2/16/1996	Heavy Snow	0	0	0.00K
3/2/1996	Heavy Snow	0	0	0.00K
3/7/1996	Heavy Snow	0	0	0.00K
4/7/1996	Heavy Snow	0	0	0.00K
4/9/1996	Heavy Snow	0	0	0.00K
12/6/1996	Heavy Snow	0	0	0.00K
3/31/1997	Heavy Snow	0	0	0.00K
4/1/1997	Heavy Snow	0	0	0.00K
12/23/1997	Heavy Snow	0	0	0.00K
1/15/1998	Heavy Snow	0	0	0.00K
1/14/1999	Heavy Snow	0	0	0.00K
2/25/1999	Heavy Snow	0	0	0.00K
3/6/1999	Heavy Snow	0	0	0.00K
3/15/1999	Heavy Snow	0	0	0.00K
1/13/2000	Heavy Snow	0	0	0.00K
1/25/2000	Heavy Snow	0	0	0.00K
2/18/2000	Heavy Snow	0	0	0.00K
1/20/2001	Heavy Snow	0	0	0.00K
2/5/2001	Heavy Snow	0	0	0.00K
3/5/2001	Heavy Snow	0	0	0.00K
3/9/2001	Heavy Snow	0	0	0.00K
12/8/2001	Heavy Snow	0	0	0.00K
3/16/2004	Heavy Snow	0	0	0.00K
2/24/2005	Heavy Snow	0	0	0.00K
12/13/2007	Heavy Snow	0	0	0.00K
12/16/2007	Heavy Snow	0	0	0.00K
1/14/2008	Heavy Snow	0	0	28.00K
2/22/2008	Heavy Snow	0	0	0.00K
12/19/2008	Heavy Snow	0	0	0.00K
12/20/2008	Heavy Snow	0	0	8.00K
12/31/2008	Heavy Snow	0	0	0.00K
1/11/2009	Heavy Snow	0	0	0.00K
1/18/2009	Heavy Snow	0	0	0.00K
3/2/2009	Heavy Snow	0	0	0.00K
12/20/2009	Heavy Snow	0	0	0.00K

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Date	Type	Deaths	Injuries	Property Damage
1/18/2010	Heavy Snow	0	0	0.00K
2/16/2010	Heavy Snow	0	0	15.00K
1/26/2011	Heavy Snow	0	0	0.00K
12/29/2012	Heavy Snow	0	0	0.00K
2/8/2013	Heavy Snow	0	0	0.00K
3/7/2013	Heavy Snow	0	0	0.00K
3/18/2013	Heavy Snow	0	0	0.00K
12/14/2013	Heavy Snow	0	0	0.00K
12/17/2013	Heavy Snow	0	0	0.00K
1/2/2014	Heavy Snow	0	0	0.00K
2/5/2014	Heavy Snow	0	0	0.00K
2/13/2014	Heavy Snow	0	0	0.00K
Total	50	0	0	1.45 M

(Source: NOAA NCDIC)

Because a major feature of winter storms is the tendency for higher tides with associated flooding, the same mitigation measures in place for flooding are all important for mitigating the impacts of winter storms. However, the rapid melting of snow after major storms, combined with rainfall, is more of a common flooding threat.

The DPW works to clear roads as requested by emergency service providers and carries on general snow removal operations, in conjunction with local snow removal contractors. The City continues to ban on-street parking at nights during snow storm events and during snow removal to ensure that streets can be plowed and public safety vehicle access is maximized.

Winter Storms are a City-wide hazard in Everett. Map 6 in Appendix B displays areas of average annual snowfall, which is in the range of 36 to 48 inches in most of the City, with a small area on the northwest side in the 48 to 72 inches per year category. The City's overall vulnerability to winter storms is primarily related to restrictions to travel on roadways, temporary road closures, school closures, and potential restrictions on emergency vehicle access. A secondary vulnerability is power outages due to fallen trees and utility lines.

Based on the record of previous occurrences, winter storm events in Everett are high frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20 % per year).

Fire-Related Hazards

A wildfire is any uncontrolled fire that occurs in a suburban or a wilderness area. A wildfire differs greatly from other fires by its extensive size, the speed at which it can spread out from its original source, its potential to unexpectedly change direction, and its

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ability to jump gaps such as roads, rivers and fire breaks. Wildfire season can begin in March and usually ends in late November. The majority of wildfires typically occur in April and May, when the majority of vegetation is void of any appreciable moisture, making them highly flammable. Once "green-up" takes place in late May to early June, the fire danger usually is reduced somewhat

Everett is completely built out and all development consists of the redevelopment of existing properties, so there is little open vegetated land in the City. Brush fires were not noted as being a concern in Everett and no areas of concern were mapped by local plan participants. Historically, the few brush fires experienced by the City have not resulted in extensive property damage, injury or loss of life. Only one area was identified as potentially vulnerable to brushfires in Everett. In the past, brush fires were noted around the Gateway Mall area where there are large areas of phragmites in the wetlands. These fires have not resulted in significant property damage. Given the limited frequency and extent of brushfires in Everett, the city's vulnerability is minimal and these fires pose more of a nuisance than a serious hazard to the City.

The probability of future wildfires frequency is listed in the Massachusetts State Hazard Mitigation Plan as high, an event that can be expected to occur more frequently than once every 10 years, greater than 10% per year.

Geologic Hazards

Geologic hazards include earthquakes, landslides, sinkhole, subsidence, and unstable soils such as fill, peat, and clay. Although new construction under the most recent building codes generally will be built to seismic standards, there are still many structures which pre-date the most recent building code. Information on geologic hazards can be found on Map 4 in Appendix B.

Earthquakes

Damage from an earthquake stems from ground motion, surface faulting, and ground failure in which weak or unstable soils, such as those composed primarily of saturated sand or silts, liquefy. The effects of an earthquake are mitigated by distance and ground materials between the epicenter and a given location. An earthquake in New England affects a much wider area than a similar earthquake in California due to New England's solid bedrock geology (NESEC).

Earthquakes are a hazard with multiple impacts beyond the obvious building collapse. Buildings may suffer structural damage which may or may not be readily apparent. Earthquakes can cause major damage to roadways, making emergency response difficult. Water lines and gas lines can break, causing flooding and fires. Another potential vulnerability is equipment within structures. For example, a hospital may be structurally engineered to withstand an earthquake, but if the equipment inside the building is not properly secured, the operations at the hospital could be severely impacted during an earthquake. Earthquakes can also trigger landslides.

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Most plan participants acknowledged that earthquakes were the hazard for which their community was least prepared. There have been no recorded earthquake epicenters within the City of Everett although residents may feel the tremors from one or more of the infrequent earthquakes recorded within the region. Historical earthquakes in Massachusetts and surrounding area are summarized in Table 11.

The City enforces the MA State Building Code which is adequate in ensuring that new construction meets seismic standards. The Everett Fire Department also has mobile generators and light towers to assist with emergency power loss response in case of an earthquake.

There have been no significant mitigation measures to address earthquake hazards since the 2008 NHM Plan, primarily because of the lower historical risk of a serious earthquake within the eastern MA region and because most mitigation resources are directed to flooding and coastal storm related issues. There have been no comments from the community regarding earthquakes.

Table 11 Historical Earthquakes in Massachusetts or Surrounding Area

Location	Date	Magnitude
MA - Cape Ann	11/10/1727	5
MA - Cape Ann	12/29/1727	NA
MA – Cape Ann	2/10/1728	NA
MA – Cape Ann	3/30/1729	NA
MA – Cape Ann	12/9/1729	NA
MA – Cape Ann	2/20/1730	NA
MA – Cape Ann	3/9/1730	NA
MA - Boston	6/24/1741	NA
MA - Cape Ann	6/14/1744	4.7
MA - Salem	7/1/1744	NA
MA - Off Cape Ann	11/18/1755	6
MA – Off Cape Cod	11/23/1755	NA
MA - Boston	3/12/1761	4.6
MA - Off Cape Cod	2/2/1766	NA
MA - Offshore	1/2/1785	5.4
MA – Wareham/Taunton	12/25/1800	NA
MA - Woburn	10/5/1817	4.3
MA - Marblehead	8/25/1846	4.3
MA - Brewster	8/8/1847	4.2
MA - Boxford	5/12/1880	NA
MA – Newbury	11/7/1907	NA
MA - Wareham	4/25/1924	NA
MA – Cape Ann	1/7/1925	4

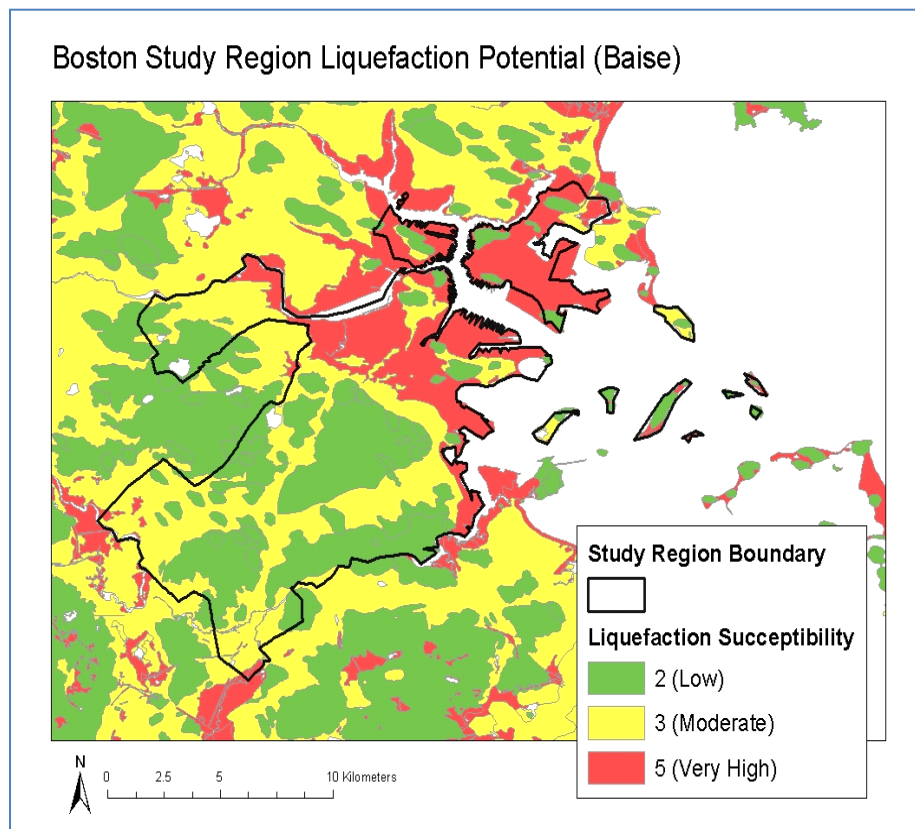
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Table 11 Historical Earthquakes in Massachusetts or Surrounding Area

Location	Date	Magnitude
MA – Nantucket	10/25/1965	NA
MA – Boston	12/27/74	2.3
VA –Mineral	8/23/11	5.8
MA - Nantucket	4/12/12	4.5
ME - Hollis	10/17/12	4.0

Liquefaction poses a risk in areas of soft clays or filled land (see Figure 1). During an earthquake event these soils may become unstable, effectively liquefying, destabilizing the buildings above and potentially leading to ruptured utilities, and other related impacts.

Figure 1 - Boston Study Region Liquefaction Potential



Source: Baise, Laurie G., Rebecca B. Higgins ; and Charles M. Brankman, Tufts University

Seismologists use a Magnitude scale (Richter Scale) to express the seismic energy released by each earthquake. The typical effects of earthquakes in various ranges are:

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Richter Magnitudes	Earthquake Effects
Less than 3.5	Generally not felt, but recorded
3.5- 5.4	Often felt, but rarely causes damage
Under 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas up to about 100 km. across where people live.
7.0- 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or greater	Great earthquake. Can cause serious damage in areas several hundred meters across.

Source: Nevada Seismological Library (NSL), 2005

Earthquakes are a potential city-wide hazard in Everett. The City has many un-reinforced, older masonry buildings which would be vulnerable in a severe earthquake.

According to the Boston College Weston Observatory, in most parts of New England, there is a one in ten chance that a potentially damaging earthquake will occur in a 50 year time period. The Massachusetts State Hazard Mitigation Plan classifies earthquakes as "very low" frequency events that occur less frequently than once in 100 years, or a less than 1% per year.

Landslides

According to the USGS, "The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on an over steepened slope is the primary reason for a landslide, there are other contributing factors." Among the contributing factors are: erosion by rivers, glaciers, or ocean waves create over steepened slopes; rock and soil slopes weakened through saturation by snowmelt or heavy rains; earthquakes create stresses that make weak slopes fail; and excess weight from accumulation of rain or snow, and stockpiling of rock or ore, from waste piles, or from man-made structures.

Landslides can result from human activities that destabilize an area or can occur as a secondary impact from another natural hazard such as flooding. In addition to structural damage to buildings and the blockage of transportation corridors, landslides can lead to sedimentation of water bodies.

Landslides are a potential city-wide hazard in Everett. The entire city is classified as having a moderate risk for landslides (see Map 4 in Appendix B). However, there have been no documented landslides in Everett. The City has limited vulnerability to landslides, and no critical facilities were identified with high vulnerability to landslides.

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The City's Local Hazard Mitigation Planning Team did not believe that landslides pose a significant risk to Everett and did not take actions regarding this hazard in the 2008 Plan. There have been no comments from the community regarding landslides.

Based on past occurrences, landslides in Everett are of Very Low frequency, events that can occur less frequently than once in 1,000 years (less than 0.1% per year).

Drought

Drought is a temporary irregularity in precipitation and differs from aridity since the latter is restricted to low rainfall regions and is a permanent feature of climate. Drought is a period characterized by long durations of below normal precipitation. Drought conditions occur in virtually all climatic zones yet its characteristics vary significantly from one region to another, since it is relative to the normal precipitation in that region. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life.

In Massachusetts, droughts are caused by the prevalence of dry northern continental air and a decrease in coastal- and tropical-cyclone activity. During the 1960's, a cool drought occurred because dry air from the north caused lower temperatures in the spring and summer of 1962-65. The northerly winds drove frontal systems to sea along the Southeast Coast and prevented the Northeastern States from receiving moisture (U.S. Geological Survey Water-Supply Paper 2375, National Water Summary 1988-89--Floods and Droughts: Massachusetts Floods and Droughts). This is considered the drought of record in Massachusetts. See Figure 2.

Figure 2. Principal Source and Pattern of Delivery of Moisture into Massachusetts

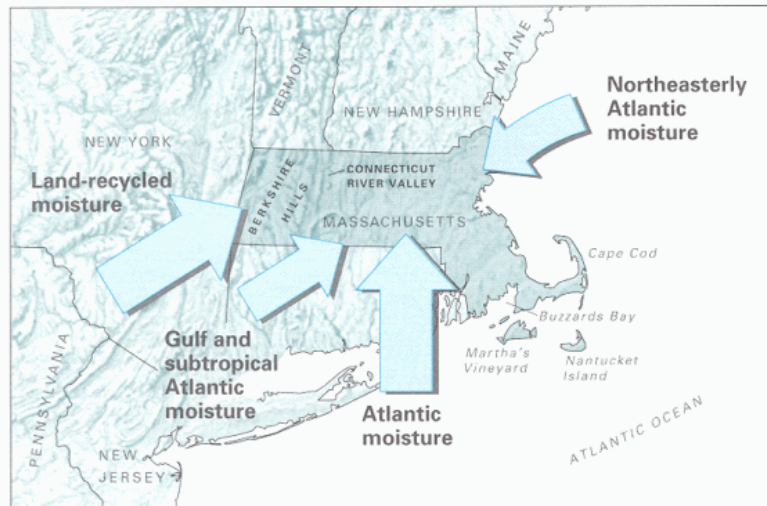


Figure 1. Principal sources and patterns of delivery of moisture into Massachusetts. Size of arrow implies relative contribution of moisture from source shown. (Source: Data from Douglas R. Clark and Andrea Lage, Wisconsin Geological and Natural History Survey.)

U.S. Geological Survey Water-Supply Paper 2375, National Water Summary 1988-89,
Floods and Droughts: Massachusetts

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Although Massachusetts is relatively small, it has a number of distinct regions that experience significantly different weather patterns and react differently to the amounts of precipitation they receive. The DCR precipitation index divides the state into six regions: Western, Central, Connecticut River Valley, Northeast, Southeast, and Cape and Islands. Everett is located in the Northeast Region.

Average annual precipitation in Massachusetts is 44 inches per year, with approximately 3 to 4 inch average amounts for each month of the year. Everett averages 48.5 inches of rain per year. Regional monthly precipitation ranges from zero to 17 inches. Statewide annual precipitation ranges from 30 to 61 inches. Thus, in the driest calendar year (generally 1965), the statewide precipitation total of 30 inches was 68 percent of average.

Five levels of drought have been developed to characterize drought severity:

- Normal
- Advisory
- Watch
- Warning
- Emergency

These drought levels are based on the conditions of natural resources and are intended to provide information on the current status of water resources. The levels provide a basic framework from which to take actions to assess, communicate, and respond to drought conditions. They begin with a normal situation where data are routinely collected and distributed, move to heightened vigilance with increased data collection during an advisory, to increased assessment and proactive education during a watch. Water restrictions might be appropriate at the watch or warning stage, depending on the capacity of each individual water supply system. A warning level indicates a severe situation and the possibility that a drought emergency may be necessary. A drought emergency is one in which mandatory water restrictions or use of emergency supplies is necessary. Drought levels are used to coordinate both state agency and local response to drought situations.

As dry conditions can have a range of different impacts, a number of drought indices are available to assess these various impacts. Massachusetts uses a multi-index system that takes advantage of several of these indices to determine the severity of a given drought or extended period of dry conditions.

Drought level is determined monthly based on the number of indices which have reached a given drought level. In practice, the drought level designation has been based upon the condition in which the majority of the drought indices occur. That is, a majority of the indices would need to be triggered in a region in order for a drought designation for that region to move to a more severe level. Drought levels are declared on a regional basis for each of six regions in Massachusetts: Northeast, Southeast, Central, Connecticut River, Western, Cape Cod and Islands. County by county or watershed-specific determinations may also be made.

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Once a drought level of warning and emergency have been reached for the precipitation index, conditions must improve to those of the previous level before a determination is made to reduce the warning or emergency.

A determination of drought level is based on seven indices:

- Standardized Precipitation Index: The Standardized Precipitation Index (SPI) reflects soil moisture and precipitation conditions.
- Crop Moisture Index: The Crop Moisture Index (CMI) reflects short-term soil moisture conditions as used for agriculture.
- Keetch-Byram Drought Index: The Keetch-Byram Drought Index (KBDI) is designed specifically for fire potential assessment. It is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers.
Source: Res. Paper SE-38. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 32pp. Revised 1988.
- Precipitation: The Precipitation Index is a comparison of measured precipitation amounts (in inches) to historic normal precipitation. Cumulative amounts for 3-, 6-, and 12-month periods are factored into the drought determination.
- Groundwater levels: The Groundwater Level Index is based on the number of consecutive months groundwater levels are below normal (lowest 25% of period of record for the respective months).
- Stream flow levels: The Stream flow Index is based on the number of consecutive months that stream flow levels are below normal (lowest 25% of period of record for the respective months).
- Index Reservoir levels: – The Reservoir Index is based on the water levels of small, medium and large index reservoirs across the state. The reservoir level relative to normal conditions for each month of the year will be considered.

Determinations regarding the end of a drought or reduction of the drought level focus on two key drought indicators: precipitation and groundwater levels. These two factors have the greatest long-term impact on stream flow, water supply, reservoir levels, soil moisture and potential for forest fires. Precipitation is a key factor because it is the overall cause of improving conditions. Groundwater levels respond slowly to improving conditions, so they are good indicators of long- term recovery to normal conditions.

A drought emergency will end when the conditions that led to the specific emergency have abated. For example, a critically low reservoir will need to have made a significant recovery, or groundwater wells will need to have returned to normal operating capacities. If an emergency has been declared based on environmental impacts, the emergency will end when these conditions have abated. (Massachusetts Drought Management Plan, 2013)

See Table 12. Mass. Drought Indices: Source: Massachusetts Drought Management Plan, 2013

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Table 12. Mass. Drought Indices, Mass. Drought Management Plan- 2013

Drought Level	Standardized Precipitation Index	Crop Moisture Index*	Keetch-Byram Drought Index*	Precipitation	Groundwater	Streamflow	Reservoir***
Normal	3-month > -1.5 or 6-month > -1.0 or 12-month > -1.0	0.0 to -1.0 slightly dry	< 200	1 month below normal	2 consecutive months below normal**	1 month below normal**	Reservoir levels at or near normal for the time of year
Advisory	3-month = -1.5 to -2.0 or 6-month = -1.0 to -1.5 or 12-month = -1.0 to -1.5	-1.0 to -1.9 abnormally dry	200-400	2 month cumulative below 65% of normal	3 consecutive months below normal**	At least 2 out of 3 consecutive months below normal**	Small index Reservoirs below normal
Watch	3-month < -2.0 or 6-month = -1.5 to -3.0 or 12-month = -1.5 to -2.0	-2.0 to -2.9 excessively dry	400-600	1 of the following criteria met: 3 month cum. < 65% or 6 month cum. < 70% or 12 month cum. < 70%	4-5 consecutive months below normal**	At least 4 out of 5 consecutive months below normal**	Medium index Reservoirs below normal
Warning	6-month < -3.0 or 12-month = -2.0 to -2.5	< -2.9 severely dry	600-800	1 of the following criteria met: 3 month cum. < 65% and 6 month cum. < 65%, or 6 month cum. < 65% and 12 month cum. < 65%, or 3 month cum. < 65% and 12 month cum. < 65%	6-7 consecutive months below normal**	At least 6 out of 7 consecutive months below normal**	Large index reservoirs below normal
Emergency	12-month < -2.5	< -2.9 severely dry	600-800	Same criteria as Warning and previous month was Warning or	>8 months below normal**	>7 months below normal**	Continuation of previous month's conditions

** Below normal for groundwater and stream flow are defined as being within the lowest 25th percentile of the period of record.

*** Water suppliers should be consulted to determine if below normal reservoir conditions are due to operational issues.

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Location and Impact

In Everett drought is a potential city-wide hazard. However the impact of drought on Everett's water supply is limited because the City receives its water supply from the Massachusetts Water Resources Authority (MWRA), which operates two large reservoirs in central Massachusetts, Wachusett and Quabbin Reservoirs. Because of the very large ratio of storage to annual demand, the MWRA water system is very well buffered from the impacts of drought in terms of its ability to supply water to its service population. Even the multi-year drought of record from 1962 to 1965 did not seriously impair the MWRA water system. The City of Everett has not had to impose emergency water restrictions. Were there to be a severe drought worse than the drought of record, water use restrictions could be implemented, which would mainly have an impact on nonessential outdoor water use for irrigation of public parks and playing fields and residential lawns.

Previous Occurrences

Everett does not collect data relative to drought events. Because drought is more of a regional natural hazard, this plan references state data as the best available data for drought.

For summary purposes, this analysis of drought history in Massachusetts is limited to a statewide analysis. The statewide scale is a composite of six regions of the state: West, Connecticut River, Central, Northeast, Southeast, and Cape Cod and the Islands. Regional composite precipitation values are based on monthly values from six stations, and three stations in the smaller regions (Cape Cod/Islands and West). Because the statewide analysis will result in a muting of more extensive local drought impacts, this Drought History summary will likely underestimate the spatial frequency of droughts (i.e., droughts may occur more frequently in individual regions than depicted in the statewide analysis).

The attached graph (Figure 3) indicates incidents of drought levels' occurrence in Massachusetts using the SPI parameter alone. On a monthly basis, the state would have been in a Drought Watch to Emergency condition 11 percent of the time between 1850 and 2012. A chronology of major droughts since 1929 is summarized in Table 13.

Drought Emergency

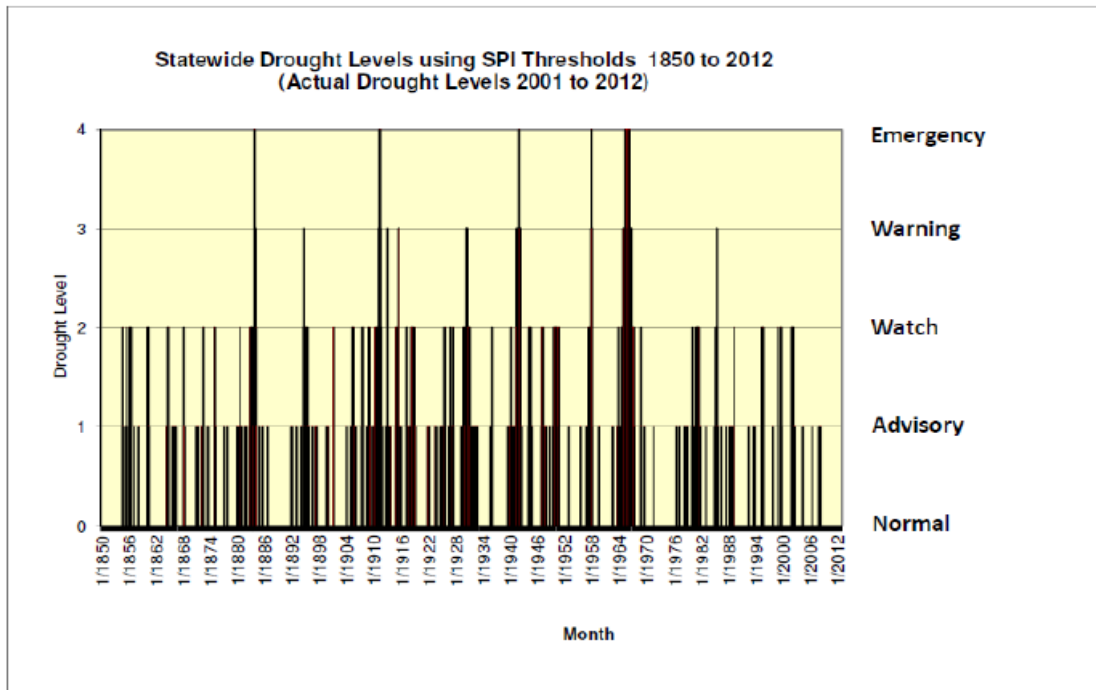
Drought emergencies have been reached infrequently, with 5 events occurring in the period between 1850 and 2012: in 1883, 1911, 1941, 1957, and 1965-1966. The 1965-1966 drought period is viewed as the most severe drought to have occurred in modern times in Massachusetts given the period of record for precipitation data because of its long duration. On a monthly basis over the 162-year period of record, there is a one percent chance of being in a drought Emergency.

Drought Warning

Drought Warning levels not associated with drought Emergencies would have occurred in 1894, 1915, 1930, and 1985. On a monthly basis over the 162-year period of record, there is a two percent chance of being in a drought Warning level.

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Figure 3. Statewide Drought Levels using SPI Thresholds 1850 – 2012



(Source: Mass. State Drought Management Plan 2013)

Table 13 - Chronology of Major Droughts in Massachusetts

Date	Area affected	Recurrence interval (years)	Remarks
1929-32	Statewide	10 to >50	Water-supply sources altered in 13 communities. Multistate.
	Statewide	15 to >50	More severe in eastern and extreme western Massachusetts. Multistate.
1957-59	Statewide	5 to 25	Record low water levels in observation wells, northeastern Massachusetts.
1961-69	Statewide	35 to >50	Water-supply shortages common. Record drought. Multistate.
1980-83	Statewide	10 to 30	Most severe in Ipswich and Taunton River basins; minimal effect in Nashua River basin. Multistate.
1985-88	Housatonic River basin	25	Duration and severity unknown. Streamflow showed mixed trends elsewhere.

Drought Watch

Drought Watches not associated with higher levels of drought generally would have occurred in three to four years per decade between 1850 and 1950. The drought

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Emergency dominated the 1960s. There were no drought Watches or above in the 1970s. In the 1980s, there was a lengthy drought Watch level of precipitation between 1980 and 1981, followed by a drought Warning in 1985. A frequency of drought Watches at a rate of three years per decade resumed in the 1990s (1995, 1998, 1999). In the 2000s, Drought Watches occurred in 2001 and 2002. The overall frequency of being in a drought Watch is 8 percent on a monthly basis over the 162-year period of record.

Probability of Future Occurrences

The state has experienced Emergency Droughts five times between 1850 and 2012. Even given that regional and local drought conditions may occur at a different interval than state data indicates, droughts remain primarily regional and state phenomena in Massachusetts. Everett can expect to experience Emergency Droughts at very close to the same frequency as its region and the state. Emergency Drought conditions over the 162 history of recorded droughts in Massachusetts have generated a Low Frequency natural hazard event, with events that can occur from once in 100 years to once in 1,000 years (0.1% to 1% per year).

Extreme Temperatures

There is no universal definition for extreme temperatures. The term is relative to the usual weather in the region based on climatic averages. Extreme heat, for this climatic region, is usually defined as a period of 3 or more consecutive days above 90 °F, but more generally a prolonged period of excessively hot weather, which may be accompanied by high humidity. Extreme cold, again, is relative to the normal climatic lows in a region. Extremes temperatures are a City-wide hazard.

Temperatures that drop decidedly below normal and wind speeds that increase can cause harmful wind-chill factors. The wind chill is the apparent temperature felt on exposed skin due to the combination of air temperature and wind speed.

Everett has four well-defined seasons. The seasons have several defining factors, with temperature one of the most significant. Extreme temperatures can be defined as those which are far outside of the normal ranges for Massachusetts. The average temperatures for Massachusetts are: Winter (Dec-Feb) Average = 31.8°F
Summer (Jun-Aug) Average = 71°F

Extreme Cold

For extreme cold, temperature is typically measured using Wind Chill Temperature Index, which is provided by the National Weather Service (NWS). The latest version of the index was implemented in 2001 and it meant to show how cold conditions feel on unexposed skin. The index is provided in Figure 4 below.

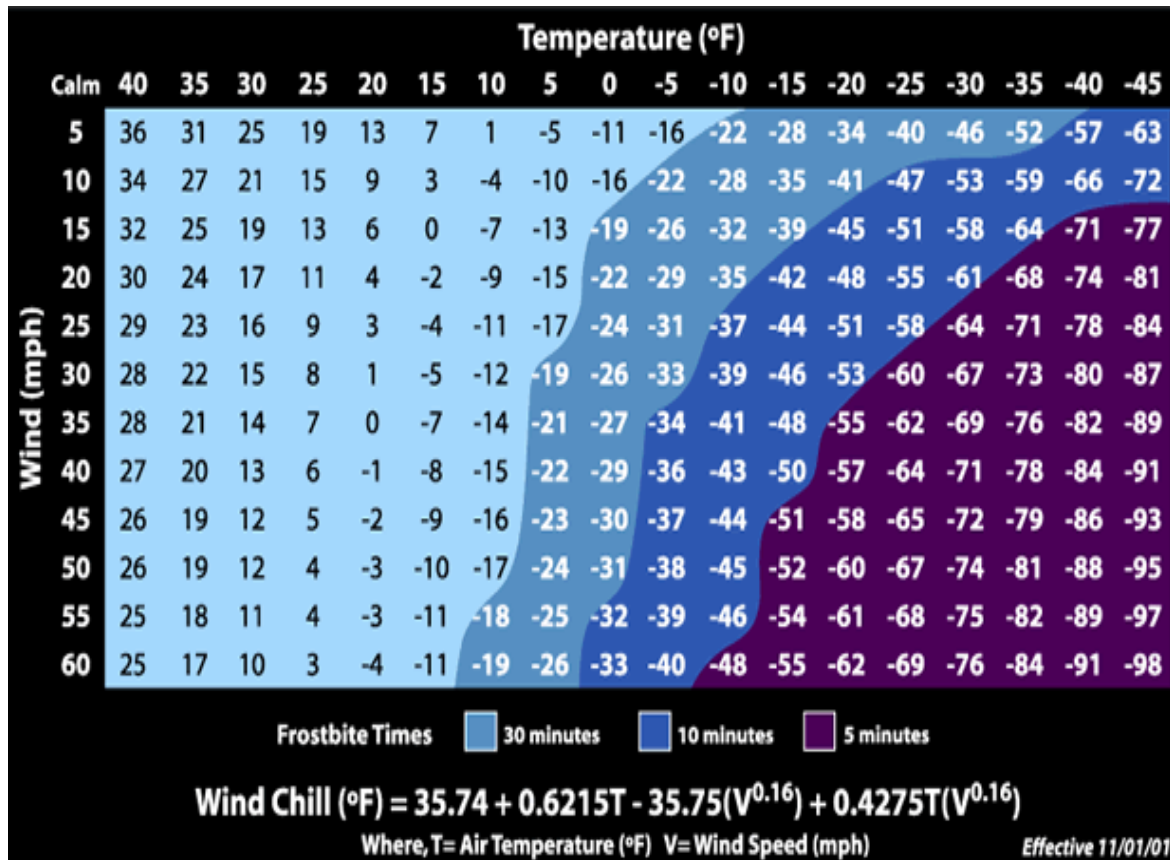
Extreme cold is also relative to the normal climatic lows in a region. Temperatures that drop decidedly below normal and wind speeds that increase can cause harmful wind-chill

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factors. The wind chill is the apparent temperature felt on exposed skin due to the combination of air temperature and wind speed.

Extreme cold is a dangerous situation that can result in health emergencies for susceptible people, such as those without shelter or who are stranded or who live in homes that are poorly insulated or without heat.

Figure 4 - Wind Chill Temperature Index and Frostbit Risk



The City of Everett does not collect data for previous occurrences of extreme cold. The best available local data are for Middlesex County, through the National Climatic Data Center (NCDC). There are two extreme cold events on record in February 2015, which caused no deaths, injuries, or property damage (see Table 14). Everett's lowest recorded temperature: was -30°F in 1946.

Table 14 – Middlesex County Extreme Cold and Wind Chill Occurrences

Date	Type	Deaths	Injuries	Property Damage
02/15/2015	Extreme Cold/wind Chill	0	0	0.00K
02/16/2015	Extreme Cold/wind Chill	0	0	0.00K

Source: NOAA, National Climatic Data Center

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Extreme Heat

While a heat wave for Massachusetts is defined as three or more consecutive days above 90°F, another measure used for identifying extreme heat events is through a Heat Advisory from the NWS. These advisories are issued when the heat index (Figure 5) is forecast to exceed 100 degree Fahrenheit (F) for 2 or more hours; an excessive heat advisory is issued if forecast predicts the temperature to rise above 105 degree F.

Figure 5 Heat Index Chart

Temperature (°F)																	
Relative Humidity (%)		80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
	40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
	45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
	50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
	55	81	84	86	89	93	97	101	106	112	117	124	130	137			
	60	82	84	88	91	95	100	105	110	116	123	129	137				
	65	82	85	89	93	98	103	108	114	121	128	136					
	70	83	86	90	95	100	105	112	119	126	134						
	75	84	88	92	97	103	109	116	124	132							
	80	84	89	94	100	106	113	121	129								
	85	85	90	96	102	110	117	126	135								
	90	86	91	98	105	113	122	131									
	95	86	93	100	108	117	127										
	100	87	95	103	112	121	132										
Category		Heat Index					Health Hazards										
Extreme Danger		130 °F – Higher					Heat Stroke or Sunstroke is likely with continued exposure.										
Danger		105 °F – 129 °F					Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.										
Extreme Caution		90 °F – 105 °F					Sunstroke, muscle cramps, and/or heat exhaustions possible with prolonged exposure and/or physical activity.										
Caution		80 °F – 90 °F					Fatigue possible with prolonged exposure and/or physical activity.										

From 1979-2003, excessive heat exposure caused 8,015 deaths in the United States. During this period, more people in this country died from extreme heat than from hurricanes, lightning, tornados, floods, and earthquakes combined. Because most heat-related deaths occur during the summer, people should be aware of who is at greatest risk and what actions can be taken to prevent a heat-related illness or death.

At greater risk are the elderly, children, and people with certain medical conditions, such as heart disease. However, even young and healthy individuals can succumb to heat if they participate in strenuous physical activities during hot weather. Some behaviors also put people at greater risk: drinking alcohol; taking part in strenuous outdoor physical activities in hot weather; and taking medications that impair the body's ability to regulate its temperature or that inhibit perspiration.

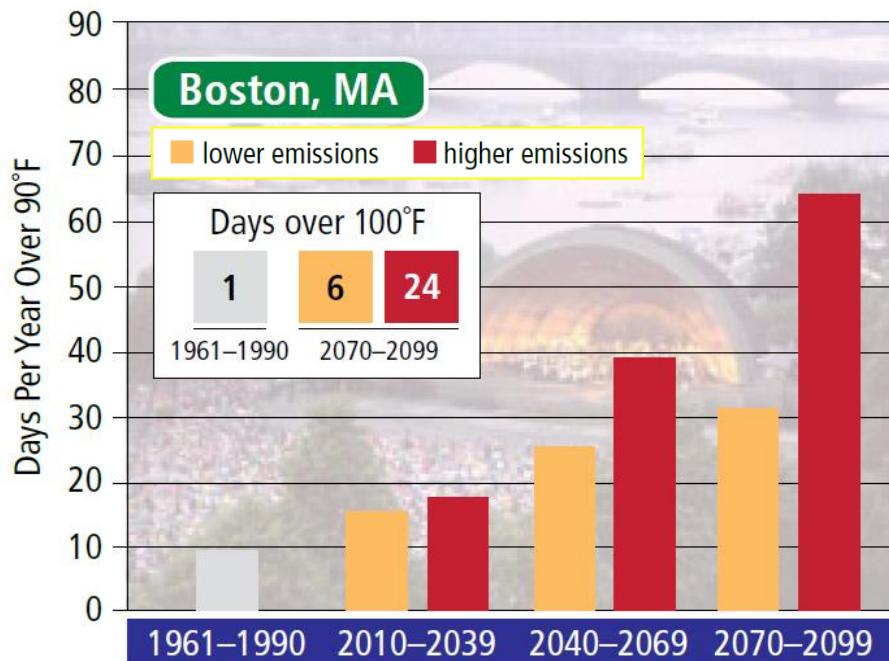
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Hot summer days can worsen air pollution, especially in urban areas. In areas of the Northeast that currently face problems with smog, inhabitants are likely to experience more days that fail to meet air quality standards. More frequent heat waves and lower air quality can threaten the health of vulnerable people, including the very young, the elderly, outdoor workers, and those without access to air conditioning or adequate health care. People who live in Northeastern cities are particularly at-risk, since the region is generally not as well adapted to heat as warmer regions of the country. Northeastern cities are likely to experience some of the highest numbers of heat-related illnesses and deaths, compared with the rest of the nation. (Source: EPA)

The highest recorded temperature for Everett was 104 °F in 1911.

The City of Everett does not collect data on excessive heat occurrences. The best available data is from the National Climatic Data Center (NCDC) for Middlesex County, which includes Marlborough. The NCDC records indicate that July 6, 2010 the temperature in eastern Massachusetts ranged from 100 to 106 degrees Fahrenheit. There were no reported deaths, injuries or property damage resulting from excessive heat. (NOAA: NCDC). Boston and nearby Middlesex County, including Everett, will experience an increase in the number of days over 100°F due to climate change, depending on whether a higher or lower greenhouse gas emission scenario is met, as shown in Figure 6. ([USGCRP, 2009](#)).

Figure 6. Boston Days above 100°F



Extreme temperature events are projected to be medium frequency events based on past occurrences, as defined by the Massachusetts State Hazard Mitigation Plan, 2013. Both extreme cold and hot weather events occur between once in five years to once in 50 years, or a 2 percent to 20 percent chance of occurring each year.

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Land Use and Development Trends

Existing Land Use

The most recent land use statistics available from the state are from aerial photography done in 2005. Table 15 shows the acreage and percentage of land in 33 categories. If the five residential categories are aggregated, residential uses make up 44.03 % of the area of the City (712.20 acres). The highest percentage use is multi-family residential which comprises 25.53 % with 371.95 acres.

Table 15: 2005 Land Use*

Land Type	Acres	Percent
Cropland	0	0
Pasture	0	0
Forest	6.52	0.30
Wetland	6.49	0.29
Mining	0	0
Open Land	53.37	2.42
Participation Recreation	48.53	2.20
Spectator Recreation	0	0
Water-based Recreation	0	0
Multifamily Residential	890.30	40.46
High Density Residential	78.54	3.57
Medium Density Residential	0	0
Low Density Residential	0	0
Very Low Density Residential	0	0
Saltwater Wetland	0	0
Commercial	202	9.18
Industrial	431.76	19.62
Urban Open	1.35	0.06
Transportation	210.44	9.56
Waste Disposal	0	0
Water	2.92	0.13
Cranberry Bog	0	0
Power line	0	0
Saltwater Beach	5.21	0.20
Golf Course	0	0
Marina	0	0
Urban Public	77.38	3.51
Cemetery	165.36	7.51
Orchard	0	0
Nursery	0	0
Forested Wetland	0.03	.0014
Junkyards	1.60	0.072
Brush land/Succession	18.60	0.84
TOTAL	2,200.43	

* Latest available land use mapping

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For more information on how the land use statistics were developed and the definitions of the categories, please go to <http://www.mass.gov/mgis/lus.htm>.

Economic Elements

Everett's employment is concentrated in industries associated with its Designated Port Area along the Mystic River; in finance, reflecting the Mellon Bank location, and in a range of service and retail establishments, especially those serving health care and social services. Many of these jobs are associated with the City's Mystic River waterfront based on the amount of industrial and commercial space in that area. (Everett Open Space and Recreation Plan, 2010)

Community Development

The City is characterized by both densely developed residential neighborhoods bordered by walkable neighborhoods serving commercial retail streets as well as an intensely used industrial area that includes a power plant and a materials processing facility. The residential neighborhood and commercial areas are in the upland hills while the industrial area is adjacent to the Mystic River. Everett is a densely populated city with over 20,000 people per square mile and is also an Environmental Justice community. With the exception of the waterfront areas, there is little natural open space, with acres of cemeteries located in the northeast section of the City and smaller parks located throughout the City. (Everett Open Space Plan, 2010)

Development Patterns

Industrial development made a significant impact on the landscape during the mid to late 1800s, with the New England Chemical Company establishing itself along the tidal waterfront marshes. Other industries would come to include iron, coke, petroleum products, oil and shoes. By 1920, Everett was almost completely built out and since that time land use has focused almost entirely on redevelopment of existing uses. Today, the City is roughly two-thirds residential and one-third industrial with about 50 acres of parks scattered through its 2300 hundred acres. Everett's close proximity to Boston and a tidal waterfront capable of providing water power, along with rail lines that provided easy access to transportation and employment, all shaped the City's development. (Everett Open Space Plan, 2010)

Recent and Potential Future Development

MAPC consulted with City staff to determine areas that have been or are likely to be developed in the future, defined for the purposes of this plan as a ten year time horizon. These areas are shown on Map 2, "Potential Development" and are described below. The letter for each site corresponds to the letters on Map 2.

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- A. Redevelopment of former Brownfield: 2 acres, 198 units, permitting stage
- B. Berkeley Investments: former Brownfield; 40 acres, 5 separate parcels, light industrial uses only; has gone through MEPA review
- C. Former Modern Continental staging site: 20 acres, part of current Sasaki reuse study area
- D. Charleston Lofts: Phase 3, about 1 acre, 200 + condos, permitting stage
- E. Old Everett High School: about 3 acres, possible housing/mixed use/ municipal offices, at conceptual stage
- F. 69 Norman Street: 30+ acres, existing industrial condos, some 21 E contamination sites; water-dependent use in Designated Port Area, conceptual stage
- G. Brittany Place Condos: 3+ acres, 93 condos, built

Future Development in Hazard Areas

Table 16 shows the relationship of these parcels to two of the mapped hazards. This information is provided so that planners can ensure that development proposals comply with flood plain zoning and that careful attention is paid to drainage issues.

Table 16: Relationship of Potential Development to Hazard Areas		
Parcel	Landslide risk	Flood Zone
Redevelopment of former Brownfield	Moderate Susceptibility	No
Berkeley Investments	Moderate Susceptibility	3.3772% in AE
Former Modern Continental staging site	Moderate Susceptibility	34.096% in AE
Charlestown Lofts	Moderate Susceptibility	No
Old Everett High School	Moderate Susceptibility	No
69 Norman Street	Moderate Susceptibility	.896% in AE
Brittany Place Condos	Moderate Susceptibility	No

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Critical Infrastructure in Hazard Areas

Critical infrastructure includes facilities that are important for disaster response and evacuation (such as emergency operations centers, fire stations, water pump stations, etc.) and facilities where additional assistance might be needed during an emergency (such as nursing homes, elderly housing, day care centers, etc.). These facilities are listed in Table 17 and are shown on all of the maps in Appendix B.

The purpose of mapping the natural hazards and critical infrastructure is to present an overview of hazards in the community and how they relate to critical infrastructure, to better understand which facilities may be vulnerable to particular natural hazards.

Explanation of Columns in Table 16

Column 1: ID #: The first column in Table 10 is an ID number which appears on the maps that are part of this plan. See Appendix B.

Column 2: Name: The second column is the name of the site. If no name appears in this column, this information was not provided to MAPC by the community.

Column 3: Type: The third column indicates what type of site it is.

Column 4: Landslide Risk: The fourth column indicates the degree of landslide risk for that site. This information came from NESEC. The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to <http://pubs.usgs.gov/pp/p1183/pp1183.html>.

Column 5: FEMA Flood Zone: The fifth column addresses the risk of flooding. A “No” entry in this column means that the site is not within any of the mapped risk zones on the Flood Insurance Rate Maps (FIRM maps). If there is an entry in this column, it indicates the type of flood zone as follows:

Zones AE: Special Flood Hazard Areas that are subject to inundation by the base flood, determined using detailed hydraulic analysis. Base Flood Elevations are shown within these zones.

Zone A (Also known as Unnumbered A Zones): Special Flood Hazard Areas where, because detailed hydraulic analyses have not been performed, no Base Flood Elevations or depths are shown.

Zone AO: Special Flood Hazard Areas that are subject to inundation by types of shallow flooding where average depths are between 1 and 3 feet. These are normally areas prone to shallow sheet flow flooding on sloping terrain.

Zone VE, V1-30: Special Flood Hazard Areas along coasts that are subject to inundation by the base flood with additional hazards due to waves with heights of 3 feet or greater. Base Flood Elevations derived from detailed hydraulic analysis are shown within these zones.

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Zone B and X (shaded): Zones where the land elevation has been determined to be above the Base Flood Elevation, but below the 500 year flood elevation. These zones are not Special Flood Hazard Areas.

Column 6: Locally-Identified Flood Area: The locally identified areas of flooding were identified by city staff as areas where flooding occurs. These areas do not necessarily coincide with the flood zones from the FIRM maps. They may be areas that flood due to inadequate drainage systems or other local conditions rather than location within a flood zone. The numbers correspond to the numbers on Map 8, "Hazard Areas".

Column 7: Average Annual Snowfall: This column indicates the category of snowfall, with Low signifying 48 to 72 inches per year, and High signifying over 72 inches per year.

Column 8: Hurricane Surge Category: The eighth column indicates whether or not the site is located within a hurricane surge area and the category of hurricane estimated to be necessary to cause inundation of the area. The following explanation of hurricane surge areas was taken from the US Army Corps of Engineers web site:

"Hurricane storm surge is an abnormal rise in sea level accompanying a hurricane or other intense storm. Along a coastline a hurricane will cause waves on top of the surge. Hurricane Surge is estimated with the use of a computer model called SLOSH. SLOSH stands for Sea, Lake, and Overland Surge from Hurricanes. The SLOSH models are created and run by the National Hurricane Center. The SLOSH model results are merged with ground elevation data to determine areas that will be subject to flooding from various categories of hurricanes. Hurricane categories are defined by the Saffir-Simpson Scale." See www.sam.usace.army.mil/hesdata/General/hestasks.htm

According to the Saffir-Simpson Scale, the least damaging storm is a Category 1 (winds of 74-95 miles per hour) and the most damaging storm is a Category 5 (winds greater than 155 miles per hour).

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Table 17: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide	FEMA Flood Zone	Locally Id'ed Area of Flooding	Avg. Annual Snow Fall	Hurricane Surge Areas (Category#)
1	66 Main Street	Elderly Housing	Moderate Risk	No	No	Low	2
2	Whittier House	Elderly Housing	Moderate Risk	No	No	Low	0
3	Everett Nursing & Rehab.	Nursing Home	Moderate Risk	No	No	Low	0
4	Mass Electric Substation	Power Substation	Moderate Risk	No	No	Low	0
5	Constellation Group	Power Generation Plant	Moderate Risk	No	No	Low	4
6	MGH Hospital Everett Family Care	Medical Facility	Moderate Risk	No	No	Low	0
7	The Community Family	Special Needs	Moderate Risk	No	No	High	0
8	Sacro Plaza	Elderly Housing	Moderate Risk	No	No	Low	0
9	Park Plaza	Elderly Housing	Moderate Risk	No	No	Low	0
10	Children's Playhouse Day Care	Child Care	Moderate Risk	No	No	Low	0
11	Children's Playhouse Day Care	Child Care	Moderate Risk	No	No	Low	0
12	Patti Cake Day Care	Child Care	Moderate Risk	No	No	Low	0
13	Chapman Nursery Kindergarten	Child Care	Moderate Risk	No	No	Low	0
14	M&M Day Care Center	Child Care	Moderate Risk	No	Bryant, Edyth and Fuller Streets Area	Low	0
15	Madeline English School	School	Moderate Risk	No	No	High	2
16	Lafayette School	School	Moderate Risk	No	No	High	0
17	School Administration	Municipal Office	Moderate Risk	No	No	Low	0
18	Adams School	Hazardous Materials	Moderate Risk	No	No	Low	2
19	Everett Police Headquarters	Police Station	Moderate Risk	No	No	Low	0

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Table 17: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide	FEMA Flood Zone	Locally Id'ed Area of Flooding	Avg. Annual Snow Fall	Hurricane Surge Areas (Category#)
20	Parlin Library	Municipal Office	Moderate Risk	No	No	Low	0
21	Everett Armory	Municipal Office	Moderate Risk	No	No	Low	0
22	Everett Stadium	Municipal Office	Moderate Risk	No	No	Low	0
23	Shute Library	Municipal Office	Moderate Risk	No	No	Low	0
24	Golden Age Circle	Elderly Housing	Moderate Risk	No	No	Low	0
25	Glendale Towers	Elderly Housing	Moderate Risk	No	No	Low	0
26	Whittier Elderly Housing	Elderly Housing	Moderate Risk	No	Bryant, Edyth and Fuller Streets Area	Low	0
27	Allied Veterans Memorial Rink	Hazardous Material Site	Moderate Risk	No	No	Low	0
28	Recreation Center	Municipal Office	Moderate Risk	No	Elm Street	Low	0
29	U.S. Post Office	Post Office	Moderate Risk	No	No	Low	0
30	Phoenix Charter Academy	School	Moderate Risk	No	No	Low	0
31	George Keverian School	School	Moderate Risk	No	No	Low	0
32	Whidden Memorial Hospital	Hospital	Moderate Risk	No	No	Low	0
33	Ferry Street Fire Station	Fire Station	Moderate Risk	No	No	Low	0
34	Hancock Street Fire Station	Fire Station	Moderate Risk	No	No	Low	0
35	Webster School	School	Moderate Risk	No	No	Low	0
36	Constellation Energy 7	Power Generation Plant	Moderate Risk	No	No	Low	2
37	Emergency Operations Ctr	Emergency Operations	Moderate Risk	No	No	Low	0
38	Everett City Hall	Municipal Office	Moderate Risk	No	No	Low	0

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Table 17: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide	FEMA Flood Zone	Locally Id'ed Area of Flooding	Avg. Annual Snow Fall	Hurricane Surge Areas (Category#)
39	Allied Veterans Memorial Pool	Recreation	Moderate Risk	No	Elm Street	Low	0
40	Central Fire Station	Fire Station	Moderate Risk	No	No	Low	0
41	Department of Public Works Facility	Municipal Office	Moderate Risk	No	No	Low	1
42	Whittier School	School	Moderate Risk	No	No	Low	0
43	Adams School	School	Moderate Risk	No	No	Low	2
44	St. Anthony's School	School	Moderate Risk	No	No	Low	0
45	Boys & Girls Club (former High School)	Municipal Building	Moderate Risk	No	No	Low	0
46	Parlin School	School	Moderate Risk	No	No	Low	0
47	Pope John High School	School	Moderate Risk	No	Bryant, Edyth , & Fuller St. Area	Low	0
48	Mellon Financial	Private Facility	Moderate Risk	No	No	Low	2
49	Constellation Energy 8 & 9	Power Generation Plant	Moderate Risk	No	No	Low	4
50	Distrigas Corporation	LNG Storage & Dist.	Moderate Risk	No	No	Low	2
51	Exxon / Mobil	Gas/Oil Storage & Dist.	Moderate Risk	No	No	Low	0
52	New England Produce Center	Grocery Store	Moderate Risk	No	No	Low	1
53	Gateway Mall	Place of Assembly	Moderate Risk	No	No	Low	2
54	Boston Market Terminal	Transportation Facility	Moderate Risk	No	No	Low	1
55	Distrigas Marine Terminal	LNG Marine Terminal	No	AE	No	High	0
56	Exxon / Mobil Marine Terminal	Marine Terminal (Gas/Oil)	No	AE	No	High	0
57	Dampney Paint	Hazardous Materials	Moderate Risk	No	No	Low	2

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Table 17: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide	FEMA Flood Zone	Locally Id'ed Area of Flooding	Avg. Annual Snow Fall	Hurricane Surge Areas (Category#)
58	Duncan Galvanizing	Hazardous Materials	Moderate Risk	No	No	Low	1
59	Middlesex Gasses Technologies	Gas Distribution	Moderate Risk	No	No	Low	1
60	Associated Gas	Gas Distribution	Moderate Risk	No	No	Low	1
61	Bay State Galvanizing	Hazardous Materials	Moderate Risk	No	No	Low	1
62	Preferred Freezer	Grocery Store	Moderate Risk	AE	No	Low	1
63	Sprague Energy	Hazardous Materials	Moderate Risk	No	No	Low	0
64	MBTA Repair Facility	Hazardous Materials	Moderate Risk	No	No	Low	0
65	911 Communications Center		Moderate Risk	No	No	Low	0
66	Everett High School	School	Moderate Risk	No	No	Low	0
67	Whidden Memorial Hospital	Communication Tower	Moderate Risk	No	No	Low	0
68	Pioneer Charter School	School	Moderate Risk	No	No	Low	0
69	Amelia Earhart Dam	Dam	Moderate Risk	AE	Amelia Earhart Dam	Low	4

Vulnerability Assessment

The purpose of the vulnerability assessment is to estimate the extent of potential damages from natural hazards of varying types and intensities. A vulnerability assessment and estimation of damages was performed for hurricanes, earthquakes, and flooding. The methodology used for hurricanes and earthquakes was the HAZUS-MH software. The methodology for flooding was developed specifically to address the issue in many of the communities where flooding was not solely related to location within a floodplain.

Introduction to HAZUS-MH

HAZUS- MH (multiple-hazards) is a computer program developed by FEMA to estimate losses due to a variety of natural hazards. The following overview of HAZUS-MH is taken from the FEMA website. For more information on the HAZUS-MH software, go to <http://www.fema.gov/plan/prevent/hazus/index.shtm>

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“HAZUS-MH is a nationally applicable standardized methodology and software program that contains models for estimating potential losses from earthquakes, floods, and hurricane winds. HAZUS-MH was developed by the Federal Emergency Management Agency (FEMA) under contract with the National Institute of Building Sciences (NIBS). Loss estimates produced by HAZUS-MH are based on current scientific and engineering knowledge of the effects of hurricane winds, floods and earthquakes. Estimating losses is essential to decision-making at all levels of government, providing a basis for developing and evaluating mitigation plans and policies as well as emergency preparedness, response and recovery planning.

HAZUS-MH uses state-of-the-art geographic information system (GIS) software to map and display hazard data and the results of damage and economic loss estimates for buildings and infrastructure. It also allows users to estimate the impacts of hurricane winds, floods and earthquakes on populations.”

There are three modules included with the HAZUS-MH software: hurricane wind, flooding, and earthquakes. There are also three levels at which HAZUS-MH can be run. Level 1 uses national baseline data and is the quickest way to begin the risk assessment process. The analysis that follows was completed using Level 1 data.

Level 1 relies upon default data on building types, utilities, transportation, etc. from national databases as well as census data. While the databases include a wealth of information on the City of Everett, it does not capture all relevant information. In fact, the HAZUS training manual notes that the default data is “subject to a great deal of uncertainty.”

However, for the purposes of this plan, the analysis is useful. This plan is attempting to only generally indicate the possible extent of damages due to certain types of natural disasters and to allow for a comparison between different types of disasters. Therefore, this analysis should be considered to be a starting point for understanding potential damages from the hazards. If interested, communities can build a more accurate database and further test disaster scenarios.

Estimated Damages from Hurricanes

The HAZUS software was used to model potential damages to the community from a 100 year and 500 year hurricane event; storms that are .01% and .005% likely to happen in a given year and roughly equivalent to a Category 2 and Category 4 hurricane. The damages caused by these hypothetical storms were modeled as if the storm track passed directly through the City, bringing the strongest winds and greatest damage potential.

Though there are no recorded instances of a hurricane equivalent to a 500 year storm passing through Massachusetts, this model was included in order to present a reasonable “worst case scenario” that would help planners and emergency personnel evaluate the impacts of storms that might be more likely in the future, as we enter into a period of

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more intense and frequent storms. The results of the analysis for Everett are summarized in Table 18.

**Table 18
Estimated Damages from Hurricanes**

	100 Year	500 Year
Building Characteristics		
Estimated total number of buildings	9,309	9,309
Estimated total building replacement value (Year 2002 \$) (Millions of Dollars)	\$2,749	\$2,749
Building Damages		
# of buildings sustaining minor damage	838	3,018
# of buildings sustaining moderate damage	146	1,299
# of buildings sustaining severe damage	12	207
# of buildings destroyed	1	42
Population Needs		
# of households displaced	105	798
# of people seeking public shelter	27	206
Debris		
Building debris generated (tons)	8,282	34,305
Tree debris generated (tons)	6,791.24	29,845.35
# of truckloads to clear building debris		
Value of Damages (Thousands of dollars)		
Total property damage	\$30,310.51	\$192,640.65
Total losses due to business interruption	\$4408.24	\$30,089.39

Estimated Damages from Earthquakes

The HAZUS earthquake module allows users to define an earthquake magnitude and model the potential damages caused by that earthquake as if its epicenter had been at the geographic center of the study area. For the purposes of this plan, two earthquakes were selected: magnitude 5.0 and a magnitude 7.0. Historically, major earthquakes are rare in New England, though a magnitude 5 event occurred in 1963. The results of the analysis for Everett are summarized in Table 19.

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**Table 19
Estimated Damages from Earthquakes**

	Magnitude 5.0	Magnitude 7.0
Building Characteristics		
Estimated total number of buildings	9,309	9,309
Estimated total building replacement value (Year 2002 \$)(Millions of dollars)	\$2,749	\$2,749
Building Damages		
# of buildings sustaining slight damage	1,595	663
# of buildings sustaining moderate damage	617	2,518
# of buildings sustaining extensive damage	117	2,571
# of buildings completely damaged	17	3,472
Population Needs		
# of households displaced	213	8,751
# of people seeking public shelter	136	5,591
Debris		
Building debris generated (million tons)	0.03	0.95
Value of Damages (Millions of dollars)		
Total property damage	\$156.46	\$425.98
Total losses due to business interruption	\$17.19	\$2,118.09

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Estimated Damages from Flooding

MAPC did not use HAZUS-MH to estimate flood damages in Everett. In addition to technical difficulties with the software, the riverine module is not a reliable indicator of flooding in areas where inadequate drainage systems contribute to flooding even when those structures are not within a mapped flood zone. In lieu of using HAZUS, MAPC developed a methodology to give a rough approximation of flood damages.

Everett is 3.38 square miles or 2,163 acres. Approximately 269 acres have been identified by local officials as areas of flooding. This amounts to 12.21 % of the land area in Everett. The number of structures in each flood area was estimated by applying the percentage of the total land area to the number of structures (9,309) in Everett; the same number of structures used by HAZUS for the hurricane and earthquake calculations. HAZUS uses a value of \$295,306 per structure for the building replacement value. This was used to calculate the total building replacement value in each of the flood areas. The calculations were done for a low estimate of 10% building damages and a high estimate of 50% as suggested in the FEMA publication, "State and Local Mitigation Planning how-to guides" (Page 4-13). The range of estimates for flood damages is \$33,723,945 - \$168,619,726. These calculations are not based solely on location within the floodplain or a particular type of storm (i.e. 100 year flood). The results are summarized in Table 20.

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**Table 20:
Estimated Damages from Flooding**

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area	# of Structures	Replacement Value-\$	Low Estimate of Damages\$	High Estimate of Damages \$
1	Market Forge	6.90	0.31	29	\$8,563,874	\$856,387.40	\$4,281,937
2	Spring Street	1.74	0.08	7	\$2,067,142	\$206,714.20	\$103,3571
3	Vale Street	1.55	0.07	7	\$2,067,142	\$206,714.20	\$103,3571
4	Springvale, Jefferson, and Madison Streets	10.94	0.50	46	\$13,584,076	\$135,8407.60	\$679,2038
5	Elm Street	1.43	0.06	6	\$1,771,836	\$177,183.60	\$885,918
6	Malden River	7.84	0.36	34	\$10,040,404	\$1,004,040.40	\$5,020,202
7	Amelia Earhart Dam	6.0	0.27	25	\$7,382,650	\$738,265	\$3,691,325
8	Elton and Tremont Streets area	3.43	0.16	15	\$4,429,590	\$442,959	\$2,214,795
9	Lower Broadway	15.12	0.69	64	\$18,899,584	\$1,889,958.40	\$9,449,792
10	Exxon Dock	13.96	0.63	64	\$18,899,584	\$1,889,958.40	\$9,449,792
11	Bryant, Edyth, and Fuller Streets Area	118.27	5.37	500	\$14,765,3000	\$1,476,5300	\$7,382,6500
12	Route 16	81.70	3.71	345	\$101,880,570	\$1,018,8057	\$5,094,0285
	Totals	268.88	12.21	1,142	\$337,239,452	\$33,723,945.2	\$168,619,726

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V. HAZARD MITIGATION GOALS

The Everett Local Multiple Hazard Community Planning Team met on April 24, 2012. At that meeting, the team reviewed and discussed the goals from the 2008 Hazard Mitigation Plan for the City of Everett. After some discussion, the existing goals were found to still be reflective of the City's objectives with regard to addressing hazard mitigation in the community.

The following nine goals were endorsed by the Committee for the 2016 update of the Everett Hazard Mitigation Plan:

1. Prevent and reduce the loss of life, injury and property damages resulting from all major natural hazards.
2. Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.
3. Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.
 - Ensure that the Planning Department considers hazard mitigation in its review and permitting of new development.
 - Review zoning regulations to ensure that the ordinance incorporates all reasonable hazard mitigation provisions.
 - Ensure that all relevant municipal departments have the resources to continue to enforce codes and regulations related to hazard mitigation.
4. Prevent and reduce the damage to public infrastructure resulting from all hazards.
 - Begin to assess the vulnerability of municipal buildings and infrastructure to damage from an earthquake.
 - Maintain existing mitigation infrastructure in good condition.
5. Encourage the business community, major institutions and non-profits to work with the City to develop, review and implement the hazard mitigation plan.
6. Work with surrounding communities, state, regional and federal agencies to ensure regional cooperation and solutions for hazards affecting multiple communities.
 - Continue to participate in the Mystic Region LEPC.
7. Ensure that future development meets federal, state and local standards for preventing and reducing the impacts of natural hazards.

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8. Educate the public about natural hazards and mitigation measures that can be undertaken by property-owners.
 - Provide information on hazard mitigation activities in the languages most frequently spoken in Everett.
9. Take maximum advantage of resources from FEMA and MEMA to educate City staff and the public about hazard mitigation.

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VI. HAZARD MITIGATION STRATEGY

Existing Multi-Hazard Mitigation Measures

There are several mitigation measures that impact more than one hazard. These include the Comprehensive Emergency Management Plan (CEMP), the Massachusetts State Building Code and participation in a local Emergency Planning Committee.

Comprehensive Emergency Management Plan (CEMP) – Every community in Massachusetts is required to have a Comprehensive Emergency Management Plan. These plans address mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies. These plans contain important information regarding flooding, dam failures and winter storms. Therefore, the CEMP is a mitigation measure that is relevant to many of the hazards discussed in this plan.

Enforcement of the State Building Code – The Massachusetts State Building Code contains many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing and snow loads.

Participation in the Mystic Region Emergency Management Planning Committee (LEPC) – The Mystic Region LEPC serves as the LEPC for the following communities: Chelsea, Everett, Lynnfield, Malden, Medford, Melrose, North Reading, Reading, Revere, Saugus, Stoneham, Wakefield, Winchester, Winthrop and Woburn.

Existing Flood Hazard Mitigation Measures

Participation in the National Flood Insurance Program (NFIP) – FEMA maintains a database on flood insurance policies and claims. This database can be found on the FEMA website at <http://www.fema.gov/nfip/pcstat.shtm>. The reporting period covers January 1, 1978 through June 30, 2014. The following information is provided for the City of Everett.

Flood insurance policies in force (as of June 30, 2014)	15
Coverage amount of flood insurance policies	\$4,048,000
Premiums paid	6,941
Total losses (all losses submitted regardless of the status)	10
Closed losses (Losses that have been paid)	8
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	2
Total payments (Total amount paid on losses)	\$63,612.42

Flood Damage Prevention Ordinance (Chapter 9) - Chapter 9 of the City's General Ordinances pertains to flood damage prevention. Article 1 includes a statement of purpose, lists methods of reducing flood losses and includes definitions. Article 2

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discusses the administration of the ordinance, reviews the required information for a development permit and lists the factors that the appeals board will use to make a decision on appeals and variances. Article 3 includes provisions for flood hazard reduction including anchoring, construction, utilities, subdivision proposals and residential and non-residential construction.

Zoning Ordinance- The version of the City's zoning that was reviewed was the ordinance available on the City's website. The zoning ordinance contains a number of provisions relevant to flood hazard mitigation.

Section 3 (10) – Requires an impact report be approved by the Building Inspector, Department of Public Works and the City Engineer for any uses that have an impermeable surface of more than 30% of the lot area. This provision does not apply to residential dwelling of less than 3 units.

Section 19: Site Plan Review – The requirements for site plan review include a provision under which the Planning Board may request additional studies that pertain to the adequacy of proposed methods of surface drainage from the site.

Street sweeping – The City has a regular program of street sweeping on a 6 month cycle. The City owns two sweepers. The City uses both a sand/salt mix and straight salt during the winter depending on the nature of the storm. Sand is also used in the case of auto accidents when fluids spill. The street is sanded and then swept by the street sweepers.

Catch basin cleaning - The City does catch basin cleaning every spring using a JetVac purchased in 2011. Catch basin cleaning is also done by the MWRA as part of their community assistance program. To get catch basins cleaned, the City needs to make a request in writing, five weeks in advance which makes scheduling more difficult.. Disposal of the spoils is also an issue. The DEP classified catch basin spoils as hazardous materials ten years ago.

Water main replacement- The City has been making use of the MWRA's interest free loan program for water main replacement.

Plans and Studies – The Army Corps of Engineers has done a study of habitat restoration on the Malden River.

The City contracted with CDM to prepare an evaluation of the water system. The subcontractor, SEA Inc. has done a hydrology study. The City also has an NPDES implementation plan.

The MWRA Community Assistance Program – A community must request assistance in writing. The MWRA uses sonar to visually inspect water and sewer pipes and to look for debris. If requested, the MWRA will use vacuum jet equipment to clean out catch basins or culverts.

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Participation in the Mystic Region Local Emergency Planning Committee – In lieu of a local LEPC, the City of Everett participates in the Mystic Region LEPC. Participation in this committee is not just limited to issues related to flooding.

Existing Dam Failure Mitigation

DCR dam safety regulations – The city does not own any dams. The Earhart Dam is located in Everett and owned by MA DCR.

The state has enacted dam safety regulations mandating inspections and emergency action plans. All new dams are subject to state permitting. Local Emergency Management staff are required to inspect dams as part of the CEMP updating process. The Lynn Water and Sewer Commission are also required to inspect their dams.

Existing Wind Hazard Mitigation Measures

Massachusetts State Building Code – The City enforces the Massachusetts State Building Code whose provisions are generally adequate to mitigate against most wind damage. The code's provisions are the most cost-effective mitigation measure against tornados given the extremely low probability of occurrence. If a tornado were to occur in Everett, damages would be extremely high due to the prevalence of older construction and the density of development.

City of Everett Comprehensive Emergency Management Plan (CEMP) – The CEMP does address hurricanes although the emphasis is on emergency response rather than mitigation.

Tree-trimming program – Both the City and Mass. Electric have tree-trimming programs. Mass Electric focuses on trimming trees that are close to power lines. The City does have a stump grinder.

Existing Winter Hazard Mitigation Measures

Plowing, snow and ice removal – The City engages in snow plowing and removal as needed to keep City streets and sidewalks clear and safe.

Existing Fire Hazard Mitigation Measures

Prohibition on outdoor burning - The City does not allow outdoor burning.

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Subdivision review - The Fire Department is involved in reviewing site plans for subdivisions to ensure that there is adequate access for fire trucks and an adequate water supply.

Existing Geologic Hazard Mitigation Measures

Massachusetts State Building Code – The State Building Code contains a section on designing for earthquake loads (780 CMR 1612.0). Section 1612.1 states that the purpose of these provisions is “to minimize the hazard to life to occupants of all buildings and non-building structures, to increase the expected performance of higher occupancy structures as compared to ordinary structures, and to improve the capability of essential facilities to function during and after an earthquake”. This section goes on to state that due to the complexity of seismic design, the criteria presented are the minimum considered to be “prudent and economically justified” for the protection of life safety. The code also states that absolute safety and prevention of damage, even in an earthquake event with a reasonable probability of occurrence, cannot be achieved economically for most buildings.

Section 1612.2.5 sets up seismic hazard exposure groups and assigns all buildings to one of these groups according to a Table 1612.2.5. Group II includes buildings which have a substantial public hazard due to occupancy or use and Group III are those buildings having essential facilities which are required for post-earthquake recovery, including fire, rescue and police stations, emergency rooms, power-generating facilities, and communications facilities.

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Table 21 Existing Mitigation Measures				
Type of Existing Protection	Description	Area Covered	Effectiveness /Enforcement	Improvements/ Changes Needed
MITIGATION MEASURES RELATING TO MULTIPLE HAZARDS				
Comprehensive Emergency Management Plan (CEMP)	Every community in Massachusetts is required to have a Comprehensive Emergency Management Plan. These plans address mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies.	City-wide	Emphasis is on emergency response.	None.
Massachusetts State Building Code	The Massachusetts State Building Code contains many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing and snow loads.	City-wide	Most effective for new construction. Many buildings in the City pre-date the most recent, more stringent requirements.	None.
Participation in the Mystic Region Local Emergency Planning Committee.	The Mystic Region LEPC serves as the LEPC for the following communities: Chelsea, Everett, Lynnfield, Malden, Medford, Melrose, North Reading, Reading, Revere, Saugus, Stoneham, Wakefield, Winchester, Winthrop and Woburn.	Regional.	Effective.	None.

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<p style="text-align: center;">Table 21 Existing Mitigation Measures</p>				
Type of Existing Protection	Description	Area Covered	Effectiveness /Enforcement	Improvements/ Changes Needed
FLOOD RELATED HAZARDS				
Flood Damage Prevention Ordinance – Chapter 9 of the General Ordinances	Ordinance outlines methods of reducing flood losses, sets forth requirements for obtaining a development permit, sets standards for anchoring, construction materials and methods, utilities, residential and non-residential construction.	Special flood hazard areas from the 1985 Flood Insurance Study.	Effective.	None.
Zoning Section 3(10): being updated	Requires an impact report for uses with impermeable surfaces greater than 30% of the lot area.	City-wide.	Effective.	Finish updating.
Section 19 (20) Site Plan Review: City has added additional land disturbance parameters since 2008.	.Planning Board may request environmental studies that assess the adequacy of the method of surface drainage from a site.	City-wide.	Effective.	None
Street sweeping	The City has a regular program of street sweeping on a 6 month cycle.	City-wide.	Effective.	None.

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Table 21 Existing Mitigation Measures				
Type of Existing Protection	Description	Area Covered	Effectiveness /Enforcement	Improvements/ Changes Needed
Catch basin cleaning	Done every spring by the City of Everett	City-wide.	Effective.	None.
Participation in the National Flood Insurance Program	Homes and businesses in designated flood zones can purchase flood insurance.	Flood hazard areas on FIRM maps.	Effective for owners who participate in the program.	None
Mystic Region LEPC	Everett participates in the Mystic Region LEPC rather than a local LEPC.	Mystic River Watershed	Effective	None
Water main replacement program	The City has been taking advantage of the MWRAs Water Main Replacement Program.	Selective areas.	Effective.	None.
MWRA Community Assistance Program	The City has utilized the Community Assistance Program to inspect water and sewer mains for debris.	Selective areas.	Effective.	None
Dam Failures				
The Amelia Earhart Dam is in Everett but not under the city's jurisdiction.				

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<p style="text-align: center;">Table 21 Existing Mitigation Measures</p>				
Type of Existing Protection	Description	Area Covered	Effectiveness /Enforcement	Improvements/ Changes Needed
WIND-RELATED HAZARDS				
Comprehensive Emergency Management Plan (CEMP)	The City has developed a CEMP that addresses hurricane/tornado concerns.	City-wide.	Effective primarily for emergency response; less geared towards mitigation.	No changes needed; plan fulfills the requirements for a CEMP.
The Massachusetts State Building Code	The City enforces the Massachusetts State Building Code.	City-wide.	Effective for most situations except severe storms	None.
Tree trimming program	Both the City and Mass. Electric have tree-trimming programs. Mass. Electric only trims trees that interfere with power lines.	City-wide.	Effective.	Consider tree ID and removal program.
WINTER-RELATED HAZARDS				
Snow and ice removal	The City conducts plowing and snow removal operations.	City-wide.	Effective.	Consider partner with FEMA/MEMA to reduce risk to public infrastructure.

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Table 21 Existing Mitigation Measures				
Type of Existing Protection	Description	Area Covered	Effectiveness /Enforcement	Improvements/ Changes Needed
FIRE RELATED HAZARDS				
Prohibition on outdoor burning	The City does not allow outdoor burning.	City-wide.	Effective.	None.
Subdivision review	The Fire Department reviews subdivision plans to ensure adequate access for fire trucks and an adequate water supply.	City-wide.	Effective.	Consider wind hazard information program.
GEOLOGIC HAZARDS				
The Massachusetts State Building Code	The City enforces the Massachusetts State Building Code.	City-wide.	Effective for most situations.	Consider seismic inventory.

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Mitigation Measures from the 2008 Plan

Review and Update Process

At a meeting of the Everett Hazard Mitigation Committee, City staff reviewed the mitigation measures identified in the 2008 North Shore Regional Pre-Disaster Mitigation Plan Everett Annex and determined whether each measure had been implemented or deferred. Of those measures that had been deferred, the committee evaluated whether the measure should be deleted or carried forward into the 2016 Everett Hazard Mitigation Plan. The decision on whether to delete or retain a particular measure was based on the committee's assessment of the continued relevance or effectiveness of the measure and whether the deferral of action on the measure was due to the inability of the City to take action on the measure.

<p style="text-align: center;">Table 22 Mitigation Measures from the 2008 Plan</p>			
Mitigation Measures	Priority	Implementation Responsibility	2016 Status
<u>Island End River Culvert and Drainage Ditch Upgrade</u>			
a) Inspect the Island End River Culvert	High	Unresolved at this time.	Inspected but still unresolved due to ownership and legal issues. The measure has been included in the updated action plan.
b) Clean out the Island End River Culvert	High	Unresolved at this time.	Not cleaned; unresolved legal and ownership issues. The measure has been included in the updated action plan.
c) Repair the Island End River Culvert	High	Unresolved at this time	Not repaired; unresolved legal and ownership issues. The measure has been included in the updated action plan.
Study and install appropriate stormwater management measures at Springvale, Madison and Elm streets	High	City of Everett Dept. of Public Works	Unresolved: City applied for but did not receive grant from Charles River Watershed Association to install stormwater

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<p style="text-align: center;">Table 22 Mitigation Measures from the 2008 Plan</p>			
Mitigation Measures	Priority	Implementation Responsibility	2016 Status
Install appropriate stormwater management measures at the Lafayette School	Medium	City of Everett Dept. of Public Works	mitigation: rain garden. The measure has been included in the updated action plan. Resolved: new JetVac catch basin and drain line practice resolved problem.
Install appropriate stormwater management measures at Fuller Street	Low	City of Everett Dept. of Public Works	Resolved: catch basin rebuilt and new JetVac cleaning practice.
Install appropriate stormwater management measures upstream from Malden and Union Streets	Low	City of Everett Dept. of Public Works	Resolved: new drain lines and two new catch basins and cleaning program.
Norman and Henderson Streets	Low	City of Everett Dept. of Public Works	Culvert creating backup and flooding has been cleaned and the problem resolved for now but is ongoing regional MA DOT maintenance issue.
Begin a valve/gate exercising program	Medium	City of Everett Dept. of Public Works.	Resolved: valve and gate exercising program started in 2009.

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2016 Updated Hazard Mitigation Strategy

What is Hazard Mitigation?

Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries and property resulting from natural hazards through long-term strategies. These long-term strategies include planning, policy changes, education programs, infrastructure projects and other activities. FEMA currently has three mitigation grant programs: the Hazards Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation program (PDM), and the Flood Mitigation Assistance (FMA) program. The three links below provide additional information on these programs.

<http://www.fema.gov/government/grant/hmgp/index.shtm>

<http://www.fema.gov/government/grant/pdm/index.shtm>

<http://www.fema.gov/government/grant/fma/index.shtm>

Hazard Mitigation Measures can generally be sorted into the following groups:

- **Prevention:** Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection:** Actions that involve the modification of existing buildings or infrastructure to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter resistant glass.
- **Public Education & Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the potential risks from hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.
- **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls (e.g., culverts), floodwalls, seawalls, retaining walls, and safe rooms.
- **Emergency Services Protection:** Actions that will protect emergency services before, during, and immediately after an occurrence. Examples of these actions include protection of warning system capability, protection of critical facilities, and protection of emergency response infrastructure.

(Source: *FEMA Local Multi-Hazard Mitigation Planning Guidance*)

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Regional and Inter-Community Considerations

Regional Issues

Some hazard mitigation issues are strictly local. The problem originates primarily within the municipality and can be solved at the municipal level. Other issues are inter-community issues that involve cooperation between two or more municipalities. There is a third level of mitigation which is regional; involving a state, regional or federal agency or an issue that involves three or more municipalities.

Regional Partners

In the densely developed communities of the study area, mitigating natural hazards, particularly flooding, is more than a local issue. The drainage systems that serve these communities are a complex system of storm drains, tide gates, roadway drainage structures, pump stations and other facilities owned and operated by a wide array of agencies including but not limited to the City of Everett, the Department of Conservation and Recreation (DCR), the Massachusetts Water Resources Authority (MWRA), Massachusetts Highway Department (MHD) and the Massachusetts Bay Transportation Authority (MBTA). The planning, construction, operations and maintenance of these structures are integral to the flood hazard mitigation efforts of communities. These agencies must be considered the communities regional partners in hazard mitigation. These agencies also operate under the same constraints as communities do including budgetary and staffing constraints and numerous competing priorities. The following lists recommendations for activities to be undertaken by these other agencies or jointly with these other agencies. Implementation of these recommendations will require that all parties work together to develop solutions.

Regional Issues

Maintenance and operations of MA DOT infrastructure: lack of maintenance by MA DOT of Route 16 continues to impact drainage and flooding conditions in Everett. When catch basins and drain lines along Route 16 are not properly maintained, water backs up and flows into the Everett system instead, causing flooding.

DCR Dam Operations: Lowering the level of the Mystic River prior to storm events to increase flood storage capacity causes erosion and scouring of exposed river banks in Everett.

Amelia Earhart Dam: Owned by DCR, the dam has a high impact on public safety on the City and is estimated to need \$5 million in repairs to bring it into top operating condition.

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Climate Change and Sea Level Rise – The entirety of Massachusetts’s coastal environment faces potential risk from Climate Change and associated sea level rise. Models incorporating current trends indicate a gradual rise in global temperature, with a consequent increase in the volume of water in the world’s ocean due to thermal expansion as the water warms and the addition of water from melting ice sheets and glaciers. Projections for sea level rise by the end of this century range from four to 33 inches. Higher temperatures and higher sea levels will result in a greater frequency and intensity of storms and higher flood levels.

Adaptation to climate change is not formally part of the FEMA hazard mitigation planning process, which relies primarily on historic hazard trends rather than future projections to characterize risks and vulnerability to natural hazards. Most state and local planners now understand that the potential future changes to the state’s storm damage profile caused by climate change will likely be well outside of historic trends. Under the state’s Global Warming Solutions Act work has begun to develop a statewide approach to climate adaptation that incorporates the best available information (such as LIDAR) to map and model sea level rise data related to coastal hazards and disseminate this information for use in hazard mitigation planning and local land use policy. At the regional level, MAPC has developed a Regional Climate Change Adaptation Strategy that will provide a planning framework and implementation guidance for municipalities to undertake more proactive climate adaptation measures. Clearly these efforts should be integrated with the Hazard Mitigation planning in those communities.

Process for Setting Priorities for Mitigation Measures

The decisions on priorities were made at a meeting of the local committee. The method used was to reach consensus through discussion, rather than taking a vote. Priority setting was based on local knowledge of the hazard areas, including impacts of hazard events and the extent of the area impacted and the relation of a given mitigation measure to the City’s identified goals.

MAPC staff attended the FEMA Benefit-Cost Analysis Training Course on October 31-November 1, 2005 and on October 24-25, 2007. Staff also attended the August, 2014 Mitigation Planning Workshop. Information from these trainings was shared with local officials in order to help them understand the role of a benefit/cost analysis in developing and evaluating potential mitigation projects.

Based on information gained from the Benefit-Cost Analysis trainings and a review of the STAPLEE criteria (a checklist for evaluating social, technical, administrative, political, legal, economic and environmental issues), MAPC asked the local committee to take into consideration factors such as the number of homes and businesses affected, whether or not road closures occurred and what impact closures had on delivery of emergency services and the local economy, anticipated project costs, whether the City currently had the technical and administrative capability to carry out the mitigation measures, whether any environmental constraints existed, and whether the City would be able to justify the costs relative to the anticipated benefits.

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The listing of high, medium, and low potential mitigation measures is provided in the sections below and summarized in Table 21.

High Priority Mitigation Measures

Flooding, Drainage Infrastructure, and Dams Hazard Related

Resolve ownership and legal issues of the Island End Culvert that will allow culvert cleaning and drainage ditch upgrade. Mitigation of the culvert issue will allow progress on flooding issues at Vale Street, Spring Street at Route 16 and Second Street and Lower Broadway.

Amelia Earhart Dam repairs: take all necessary steps to help ensure that MA DCR completes repairs to the dam as soon as possible.

Install appropriate stormwater management measures (BMPs) at Springvale, Madison and Elm Streets: the storm drain outfall from this area runs towards Chelsea and Chelsea Creek, going from a 10 inch line in Everett to an 8 inch line in Chelsea, with subsequent backup problems during higher precipitation events. This can be addressed by either reducing the amount of stormwater entering the system, as the City attempted with its stormwater BMP grant application, or by addressing the Island End tidal gate, where about 50% of the water drains to, in addition to Chelsea Creek drainage.

Relieve the flooding at Elm Street due to infrastructure failure: this is another area impacted by the undersized Chelsea Creek drain line noted above and the failed Island End culvert.

Flooding of Tremont and Elton Street area: dredging the creek streambed that drains this area remains a top priority, but is problematic due to contamination of the creek, land ownership, activity and use limitations.

Complete the reconstruction of Lower Broadway: Flooding associated with the Island End culvert and failed infrastructure; replacing catch basins and installing new drain lines will help alleviate some of the flooding associated with the Island End culvert in this area.

Complete updating Chapter 9 of the Everett General Ordinances- Flood Damage Prevention.

Measures to Ensure Compliance with NFIP

The City should consider participating in the FEMA Community Rating System (CRS) program to lower flood hazard risk, raise community awareness and quality for lower flood hazard insurance premiums.

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Floodplain Management: Continue to enforce the Floodplain Zoning District (Section 470) and associated building regulations for floodplain areas. Update this district to remain consistent with FEMA guidelines and floodplain mapping.

Floodplain Mapping: Maintain up to date maps of local FEMA identified floodplains.

Wind Related Hazards

Massachusetts communities must follow the State Building Code, which has enhanced its wind related hazard regulations under the Code, beginning with the 7th Edition.

Prevention: Continue to implement the State Building Code, which contains clearly delineated requirements for new construction relative to structural resistance to wind related hazards.

Maintenance: Consider implementing the following actions to keep trees from threatening lives, property and public infrastructure during windstorm events.

- Identify potentially hazardous trees in critical areas.
- Identify Emergency Management staff to remove hazardous trees.

Maintenance and Readiness: Ensure that emergency services are available.

- Update and maintain plans for managing emergency response activities.
- Identify appropriate shelters for people who may need to evacuate due to loss of electricity and heat and make their locations known to the public.
- Make sure that critical facilities such as police and fire stations and school area accessible and equipped.
- Maintain access to equipment that can clear streets can be quickly cleared of debris to ensure safe passage of public safety vehicles and public traffic.
- Ensure that warning, notification and communication systems are in readiness.

Winter Storm Related Hazards

Maintenance and Mitigation:

- Consider partnering with agencies such as FEMA and MEMA to design and implement programs that reduce the risk to public infrastructure from severe winter storms.
- Develop relationships with utility providers and DPW to document known hazards.
- Evaluate public buildings and critical facilities for the potential to withstand high winds.

Maintenance and Readiness:

- Update and maintain plans for managing all winter storm emergency response activities.

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- Maintain snow removal equipment and adequate supplies of de-icing materials ready for deployment.

Fire Related Hazards

Prevention and Outreach

Consider increasing communication, coordination and collaboration between property owners and the Fire Department to address fire related hazards.

- Encourage single-family and two-family residences to have fire plans and practice evacuation routes.
- Require Fire Department to notify new business applications to ensure that appropriate fire and egress plans have been developed.
- Encourage fire stations to hold open houses to allow the public to visit see equipment and discuss fire prevention strategies.

Geologic Related Hazards

Prevention

Encourage seismic strength evaluations of critical facilities to identify vulnerabilities for mitigation of schools, public infrastructure, and other critical facilities to meet current seismic standards.

- Develop inventory of public buildings and critical infrastructure that do not meet current seismic standards.
- Develop inventory of buildings located areas subject to liquefaction during seismic events
- Consider amending zoning ordinance to require locating new structures away from areas subject to liquefaction during seismic events, or to mitigate for the chance of liquefaction.

Medium Priority Mitigation Measures

Flooding, Drainage Infrastructure and Dams Hazard Related

Bryant, Edyth and Fuller Street area flooding: work with Revere to investigate options to managing Route One tide gate operations to allow food water release during and after storm events.

FEMA Training: Key City staff should participate in MEMA or FEMA trainings related to hazard mitigation planning and implementation.

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Master Plan Update: Include a section on Climate Change Preparedness in the next update of the City's master plan, or adopt and implement a policy on climate change preparedness.

Public Education: Continue active public education programs related to flood and hurricane awareness and mitigation measures. Work with the Emergency Management Coordinator and the Everett Conservation Commission to disperse educational materials in the community and help organize attendance at information meetings. In proportion to the potential risk, consider creating educational information on other potential natural hazards impacting Everett such as winter storms, tornadoes, and earthquakes.

Prevention: To the greatest degree possible, the following actions should be considered to increase flooding preparedness and significantly reduce flood damage:

Public Works and Utilities:

- Protect or elevate ground-mounted transformers.
- Elevate vulnerable equipment, electrical controls and other equipment.
- Move building contents to a higher floor or store outside of floodplain.

Residences:

- Elevate existing residences above flood elevation on a new foundation.
- Relocate residences outside of floodplain;
- Store important documents and irreplaceable personal objects where they will not be damaged.
- Elevate or relocate furnaces, hot water heaters and electrical panels.
- Build and install flood shields for doors and openings (after evaluating whether the building can handle the forces) to prevent floodwaters from entering.
- Buy and install sump pumps with back up power.

Businesses:

- Elevate, flood proof, relocate or demolish buildings subject to repeated flood losses.
- Store important papers where they will not be damaged.
- Elevate or relocate furnaces, hot water heaters, electrical panels and other equipment.
- Build and install flood shields for doors and openings (after evaluating whether the building can handle the forces) to prevent floodwaters from entering.
- For drains, toilets and other sewer connections, install backwater valves or plugs.
- Elevate, relocate, protect or reduce the amount of equipment or inventory that can be flooded.
- Identify stored hazardous materials or other materials or chemicals that should be relocated or elevated in case of flooding.

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Wind Related Hazards

Structural projects: Consider requiring electrical utilities to use underground utilities whenever possible to reduce power outages from windstorms.

Public Awareness: Collect and distribute educational materials to residents and businesses for protecting life, property and the environment from windstorms and no power situations.

Retrofit Public Buildings and Critical Structures:

- To the greatest degree possible, evaluate public buildings and critical facilities for the potential to withstand high winds.
- Consider retrofitting vulnerable public buildings and critical facilities to withstand high winds.

Winter Storm Related Hazards

Structural Projects: Develop relationships with utility providers to relocate overhead utilities underground to minimize disruption of services, particularly power, due to severe winter storms.

Public Awareness:

- Collect educational materials about protecting life, property and the environment from severe winter storm events.
- Distribute educational materials to the public-particularly vulnerable populations-and businesses, regarding winter storm safety and winter evacuation routes during road closures due to winter storms.

Fire Related Hazards

Maintenance and Readiness: Evaluate and update evacuation routes as needed, assess bridges and streets to support for their capability to support fire apparatus ingress and encourage rehabilitations and retrofit as needed.

Geologic Related Hazards

Reduction of nonstructural and structural earthquake hazards: To the greatest degree possible, encourage the reduction of nonstructural and structural earthquake hazards in homes, schools, businesses, and government offices.

- Assess slopes that are potentially vulnerable to failure.
- Provide information to government, building and school facility managers and teachers on securing bookcases, filing cabinets, electrical equipment, light fixtures and other objects that can cause injuries and block exits.

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- Encourage homeowners and renters to use “*Is Your Home Protected from Earthquake Disaster? A Homeowner’s Guide to Earthquake Retrofit*” (Institute for Business and Home Safety, 1999) for economical and efficient mitigation techniques. <http://www.disastersrus.org/emtools/earthquakes/earthquake.pdf>.

Drought

Promote drought tolerant landscape design through measures such as:

Incorporate the use of drought tolerant native species into development landscape regulations.

Using permeable driveways and surfaces to promote groundwater infiltration and reduce stormwater runoff.

Extreme Temperatures

Green Buildings and Parking areas to reduce urban heat island impacts: plant trees to shade buildings, parking areas and public ways; encourage the use of green roofs or cool roofing products to reflect sun and heat away from a building.

Create a database to track vulnerable, at-risk people in the community such as the elderly and homeless.

Multi-Hazard Mitigation Measures

Upgrade EOC Communications Reliability: Phone and internet communications during and following a hazard event are critical for staying in touch with citizens, state and federal agencies, and critical sources of up-to-date information on conditions.

Intercommunication Capability: Frequently DPW and Emergency Management staffs need to be able to directly communicate during a hazard event in order to ensure coordination. The City will unify two-way radio communication in order to allow interoperability between these departments.

Emergency Power Generators: Upgrade all generators as needed; provide alternative fuel sources and generator power source flexibility.

Update the CEMP: While the CEMP is not a hazard mitigation document, an up-to-date and effective CEMP can contribute to reducing hazard vulnerabilities in the City. The current Everett CEMP is being updated. The plan should have an annual update and be available to all relevant municipal staff.

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Analysis of Mitigation Projects

An analysis of the proposed mitigation projects, using STAPLEE criteria as outlined on page 62, has been completed and is summarized in Table 23.

- For Table 22, the following symbols apply to indicate degree of Hazard Mitigation Alternative Acceptability:
- = Acceptable
 - = Somewhat Acceptable

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TABLE 23. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
Flooding – High Priority Alternatives								
Resolve ownership and legal issues of the Island End Culvert.	•	•	•	•	•	•	•	High
Amelia Earhart Dam repairs	•	•	•	•	•	•	•	High
Install appropriate stormwater management measures (BMPs) at Springvale, Madison and Elm Streets	•	•	•	•	•	•	•	High
Relieve the flooding at Elm Street due to infrastructure failure	•	•	•	•	•	•	•	Moderate
Flooding of Tremont and Elton Street area: dredge drainage creek	•	•	•	•	•	•	•	High
Complete the reconstruction of Lower Broadway	•	•	•	•	•	•	•	Moderate
Complete updating zoning ordinance	•	•	•	•	•	•	•	Low

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TABLE 23. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
FEMA CRS	•	•	•	•	•	•	•	Low
Enforce Floodplain Zoning	•	•	•	○	•	•	•	Low
Maintain up to date FEMA maps	•	•	•	•	•	•	•	Low
Wind – High Priority Alternatives								
Enforce State Building Code	•	•	•	•	•	•	•	Low
ID hazardous trees	•	•	•	•	•	•	•	Low
ID staff and remove trees	•	•	•	•	•	○	•	Moderate
Update and maintain emergency response activities	•	•	•	•	•	•	•	Low
ID appropriate shelters due to loss of utilities and make shelter locations known	•	•	•	•	•	•	•	Low
Maintain access to debris clearing equipment	•	•	•	•	•	•	•	Low
Maintain warning and notification systems	•	•	•	•	•	•	•	Low

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TABLE 23. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
Winter Storms– High Priority Alternatives								
Partner with FEMA/MEMA to reduce risk to public infrastructure	•	•	•	•	•	•	•	Low
Document known hazards with utility	•	•	•	•	•		•	Low
Evaluate public buildings for wind risk	•	•	•	•	•	○	•	Moderate
Update winter emergency response plans	•	•	•	•	•	•	•	Low
Maintain snow removal equipment and de-icing supplies	•	•	•	•	•	•	•	Low
Fires-High Priority Alternatives								
Single /two-family fire plans and practice evacuation routes	•	•	•	•	•	•	•	Low
Notify new businesses re fire and egress plans	•	•	•	•	•	•	•	Low
Hold fire station open houses	•	•	•	•	•	•	•	Low

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TABLE 23. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
Geologic- High Priority Alternatives								
Develop inventory of public buildings re seismic standards	•	•	○	•	•	•	•	Moderate
Develop inventory of public buildings in liquefaction areas	•	•	○	•	•	•	•	Moderate
Amend zoning to site away from liquefaction areas or mitigate	•	•	•	○	•	•	•	Moderate
Flooding- Medium Priority Alternatives								
Options for Route One tide gate management	○	•	•	○	•	•	○	Moderate
FEMA Training for key City staff	•	•	•	•	•	•	•	Low
Master Plan update re climate preparedness	•	•	•	•		•	•	Moderate
Public education program	•	•	•	•	•	•	•	Low
Public Works (PW): protect or elevate ground-mounted transformers	•	•	•	•	•	•	•	Moderate

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TABLE 23. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
PW Elevate other vulnerable equipment	•	•	•	•	•	•	•	Moderate
Move building contents to higher floor or outside flood plain	•	•	•	•	•	•	•	Moderate
Residences (R) Elevate existing residences outside flood plain	○	•	•	○	•	•	•	High
R Relocate outside flood plain	○	○	•	○	•	○	•	High
R Store important items in elevated areas	•	•	•	•	•	•	•	Low
R Elevate home utilities	•	•	•	•	•	○	•	Moderate
R Install flood shields	•	•	•	•	•	•	•	Moderate
R Install sump pumps with backup power	•	•	•	•	•	•	•	Moderate
Business (B) Elevate or modify repeat flood loss buildings	•	•	•	○	•	○	•	High

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TABLE 23. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
Store important paper in elevated area	•	•	•	•	•	•	•	Low
B Elevate heating and electrical utilities	•	•	•	•	•	•	•	High
B Install flood shields	•	•	•	•	•	•	•	Moderate
B Install backwater drain valves and plugs	•	•	•	•	•	•	•	Moderate
B Protect equipment and inventory from flooding	•	•	•	•	•	•	•	Low
B ID stored hazardous materials and relocate to above flood plain	•	•	•	•	•	•	•	Moderate
Wind- Medium Priority Alternatives								
Require use of underground utilities	•	•	•	•	•	•	•	High
Collect and distribute windstorm protection information	•	•	•	•	•	•	•	Low

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TABLE 23. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
Evaluate public buildings for high wind vulnerability	•	•	•	•	•	•	•	Moderate
Retrofit public buildings to withstand high winds	•	•	•	○	•	○	•	High
Winter Storms- Medium Priority Alternatives								
Relocate overhead utilities underground	•	•	•	○	•	○	•	High
Flooding- Lower Priority Alternatives								
GIS wetlands mapping	•	•	•	•	•	•	•	Moderate
Outfall mapping	•	•	•	•	•	•	•	Moderate
Earthquakes/Landslides- Lower Priority Alternatives								
Municipal building earthquake options	•	•	•	•	•	•	•	Low
Reduce non-structural and structural hazards	•	•	•	•	•	•	•	Moderate
Wind Lower Priority Alternatives								
Continue to Enforce State Building Code	•	•	•	•	•	•	•	Low

**CITY OF EVERETT HAZARD MITIGATION PLAN
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TABLE 23. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
Develop and implement tree inventory, outreach and removal program	•	•	•	•	•	•	•	Moderate
Drought-Lower Priority Alternatives								
Incorporate the use of drought tolerant native species into development landscape regulations	•	•	•	•	•	•	•	Low
Using permeable driveways and surfaces to promote groundwater infiltration and reduce stormwater runoff.	•	•	•	•	•	•	•	Moderate
Extreme Temperatures- Lower Priority Alternatives								
Green Buildings and Parking areas to reduce urban heat	•	•	•	•	•	•	•	Moderate

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TABLE 23. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
island impacts								
Create a database to track vulnerable, at-risk people in the community such as the elderly and homeless.	•	•	•	•	•	•	•	Low

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Introduction to Potential Mitigation Measures (Table 24)

Description of the Mitigation Measure – The description of each mitigation measure is brief and cost information is given only if cost data were already available from the community. The cost data represent a point in time and would need to be adjusted for inflation and for any changes or refinements in the design of a particular mitigation measure.

Priority – The designation of high, medium, or low priority was done at the meeting of the Local Multiple Hazard Community Planning Team meeting. The designations reflect discussion and a general consensus developed at the meeting but could change as conditions in the community change. In determining project priorities, the local team considered potential benefits and project costs. Benefits were considered as follows:

High benefit: Action will result in a significant reduction of hazard risk to people and/or property from a hazard event;

Medium benefit: Action will result in a moderate reduction of hazard risk to people and/or property from a hazard event;

Low benefit: Action will result in a low reduction of hazard risk to people and/or property from a hazard event.

Implementation Responsibility – The designation of implementation responsibility was done by MAPC based on a general knowledge of what each municipal department is responsible for. It is likely that most mitigation measures will require that several departments work together and assigning staff is the sole responsibility of the governing body of each community.

Time Frame – The time frame was based on a combination of the priority for that measure, the complexity of the measure and whether or not the measure is conceptual, in design, or already designed and awaiting funding. Because the time frame for this plan is five years, the timing for all mitigation measures has been kept within this framework. The identification of a likely time frame is not meant to constrain a community from taking advantage of funding opportunities as they arise.

Potential Funding Sources – This column attempts to identify the most likely sources of funding for a specific measure. The information on potential funding sources in this table is preliminary and varies depending on a number of factors. These factors include whether or not a mitigation measure has been studied, evaluated or designed, or if it is still in the conceptual stages. MEMA and DCR assisted MAPC in reviewing the potential eligibility for hazard mitigation funding. Each grant program and agency has specific eligibility requirements that would need to be taken into consideration. In most instances, the measure will require a number of different funding sources. Identification of a potential funding source in this table does not guarantee that a project will be eligible for, or selected for funding. Upon adoption of this plan, the local committee responsible for its implementation should begin to explore the funding sources in more detail.

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Additional information on funding sources – The best way to determine eligibility for a particular funding source is to review the project with a staff person at the funding agency. The following websites provide an overview of programs and funding sources.

Army Corps of Engineers (ACOE) – The website for the North Atlantic district office is <http://www.nae.usace.army.mil/>. The ACOE provides assistance in a number of types of projects including shoreline/streambank protection, flood damage reduction, flood plain management services and planning services.

Massachusetts Emergency Management Agency (MEMA) – The grants page <http://www.mass.gov/dem/programs/mitigate/grants.htm> has a useful table that compares eligible projects for the Hazard Mitigation Grant Program and the Flood Mitigation Assistance Program.

United States Department of Agriculture – The USDA has programs by which communities can get grants for firefighting needs. See the link below for some example.

<http://www.rurdev.usda.gov/rd/newsroom/2002/cfg.html>

Abbreviations Used in Table 24

FEMA Mitigation Grants includes:

FMA = Flood Mitigation Assistance Program.

HMGP = Hazard Mitigation Grant Program.

PDM = Pre-Disaster Mitigation Program

ACOE = Army Corps of Engineers.

MHD = Massachusetts Highway Department.

EOT = Executive Office of Transportation.

DCR = Department of Conservation and Recreation

DHS/EOPS = Department of Homeland Security/Emergency Operations

EPA/DEP (SRF) = Environmental Protection Agency/Department of Environmental Protection (State Revolving Fund)

USDA = United States Department of Agriculture

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<p style="text-align: center;">Table 24 Everett High and Medium Priority Potential Mitigation Measures</p>						
Hazard Area	Mitigation Measure	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
High Priority						
1. Flood Hazard	Resolve ownership and legal issues of the Island End Culvert.	Structural Projects	Public Works	2016-2020	\$250,000	Everett/Utility
2. Flood Hazard	Amelia Earhart Dam repairs	Structural Projects	DCR	2016-2020	\$5 million	DCR
3. Flood Hazard	Install appropriate stormwater management measures (BMPs) at Springvale, Madison and Elm Streets	Structural Projects	Public Works	2016-2018	\$175,000	Everett/FEM A
4. Flood Hazard	Relieve the flooding at Elm Street due to infrastructure failure	Structural	Public Works	2016-2017	\$200,000	Everett/FEM A
5. Flood Hazard	Flooding of Tremont and Elton Street area: dredge drainage creek	Structural	Public Works	2016-2018	\$500,000	Everett/FEM A
6. Flood Hazard	Complete the reconstruction of Lower Broadway	Structural	Public Works	2016-2018	\$1.3 million	Everett/MWR A

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**Table 24
Everett High and Medium Priority Potential Mitigation Measures**

Hazard Area	Mitigation Measure	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
7. Flood Hazard	Complete updating zoning ordinance	Prevention	Public Works	2016-2018	\$15,000 staff time	Everett
8. Flood Hazard	Enforce Floodplain Zoning	Prevention	Building Department	2016-2020	\$10,000/year staff time	Everett
9. Flood Hazard	Maintain up to date FEMA maps	Prevention	Conservation	2016-2020	Staff cost of \$1,000 per year	Everett
10. Wind Hazard	Enforce State Building Code	Prevention	Building Department	2016-2020	Staff cost of \$15,000 per year	Everett
11. Wind Hazard	ID hazardous trees	Prevention	Conservation/DPW/	2016-2020	Staff cost of \$1,000 per year	Everett
12. Wind Hazard	ID staff and remove trees	Prevention	Conservation/Planning	2016-2020	Staff cost of \$2,000 per year	Everett/DCR
13. Wind Hazard	Update and maintain emergency response activities	Prevention	Emergency Management	2016-2020	Staff cost of \$1,500 per year	Everett

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Table 24 Everett High and Medium Priority Potential Mitigation Measures						
Hazard Area	Mitigation Measure	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
14. Wind Hazard	ID appropriate shelters due to loss of utilities and make shelter locations known	Emergency Services	Emergency Management	2016-2020	\$1,000 per incident	Everett
15. Wind Hazard	Maintain access to debris clearing equipment	Emergency Services	Public Works	2016-2018	\$1,000 per year staff time	Everett
16. Wind Hazard	Maintain warning and notification systems	Prevention	Public Works	2016-2020	\$5,000 per year	Everett
17. Winter Storms	Partner with FEMA/MEMA to reduce risk to public infrastructure	Prevention	Fire/EM	2016- 2020	\$5,000	Everett/ FEMA
18. Winter Storms	Document utility hazards with utility	Prevention	Fire/EM	2016-2017	\$10,000	Everett/ NStar
19. Winter Storms	Evaluate public buildings for wind risk	Prevention	Public Works	2016-2018	\$25,000	Everett
20. Winter Storms	Update winter emergency response plans	Emergency Services	Public Works	2016-2018	\$10,000	Everett/ FEMA
21. Winter Storms	Maintain snow removal equipment and de-icing supplies	Emergency Services	Public Works	2016-2020	\$200,000 per year	Everett/ FEMA

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Table 24 Everett High and Medium Priority Potential Mitigation Measures						
Hazard Area	Mitigation Measure	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
22. Fires	Single and two-family fire plans and practice evacuation routes	Prevention	Fire	2016-2019	\$50,000	Everett/ FEMA
23. Fires	Notify new businesses re fire and egress plans	Prevention	Fire	2016- 2017	\$2000 per year staff time	Everett/ FEMA
24. Fires	Hold fire station open houses	Public Education	Fire	2016-2020	\$1,000 yr staff time	Everett
25. Geologic	Develop inventory of public buildings re seismic standards	Prevention	Planning/Fire	2016-2020	\$20,000	Everett
26. Geologic	Develop inventory of public buildings in liquefaction areas	Prevention	Planning/Fire	2016-2020	\$20,000	Everett
27. Geologic	Amend zoning to site away from liquefaction areas or mitigate	Prevention	Planning	2016-2020	\$40,000 staff time	Everett
Medium Priority						
28. Flood Hazard	Options for Route One tide gate management	Structural	Conservation	2016-2020	\$5,000	Everett/ Revere/EPA
29. Flood Hazard	FEMA Training for key City staff	Prevention	Conservation/ DPW/EM/Planning	2016-2020	\$10,000	FEMA

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**Table 24
Everett High and Medium Priority Potential Mitigation Measures**

Hazard Area	Mitigation Measure	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
30. Flood Hazard	Master Plan update re climate preparedness	Prevention	Conservation/ Planning	2016-2020	\$75,000	Everett/ FEMA
31. Flood Hazard	Public education program	Public Education	Fire Department	2016-2018	\$5,000	Everett
32. Flood Hazard	Public Works: protect or elevate ground-mounted transformers	Structural	Public Works	2016-2020	\$25,000 per transformer to elevate	Everett/ FEMA
33. Flood Hazard	Public Works: Elevate other vulnerable equipment	Prevention	Public Works	2016-2020	\$1,000 per foot	Everett/ FEMA
34. Flood Hazard	Move building contents to higher floor or outside flood plain	Prevention	Public Works	2016-2020	<\$5,000	Everett/ FEMA
35. Flood Hazard	Businesses/Residences: Elevate existing structures above flood plain	Prevention	Businesses, Residential	2016-2020	\$30,000 - \$100,000	Property owner/FEMA
36. Flood Hazard	Businesses/Residences: Relocate business or home outside flood plain	Prevention	Businesses, Residential	2016-2020	\$30,000 - \$250,000	Property owner/FEMA
37. <u>Flood Hazard</u>	<u>Businesses/Residences:</u> <u>Store important items in</u> <u>elevated areas</u>		Businesses, Residential	2016-2020	<\$2,000	Property owner

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**Table 24
Everett High and Medium Priority Potential Mitigation Measures**

Hazard Area	Mitigation Measure	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
38. <u>Flood Hazard</u>	<u>Businesses/Residences:</u> <u>Elevate utilities</u>	Prevention	Businesses, Residential	2016-2020	\$1,000 per foot	Property owner/FEMA
39. <u>Flood Hazard</u>	<u>Businesses/Residences:</u> <u>Install flood shields</u>	Prevention	Businesses, Residential	2016-2020	<\$5,000	Property owner
40. <u>Flood Hazard</u>	<u>Businesses/Residences:</u> <u>Install sump pumps with backup power</u>	Prevention	Businesses, Residential	2016-2020	<\$5,000	Property owner
41. <u>Flood Hazard</u>	<u>Businesses/Residences:</u> <u>Elevate or modify repeat flood loss buildings</u>	Prevention	Businesses, Residential	2016-2020	\$5,000 - \$500,000	Property owner/FEMA
42. Flood Hazard	<u>Businesses/Residences:</u> Install backwater drain valves and plugs	Prevention	Business, Residential	2016-2020	\$5,000 - \$25,000	Property owner
43. Flood Hazard	Businesses: Protect equipment and inventory from flooding	Prevention	Businesses	2016-2020	\$1,000 – \$25,000	Property owner
44. Flood Hazard	Businesses: Identify stored hazardous materials and relocate to above flood plain	Prevention	Businesses	2016-2020	\$1,000 - \$50,000	Property owner
45. Wind Hazard	Require use of underground utilities	Structural	Building Department	2016-2020	\$1,000 per foot	Everett
46. Wind Hazard	Collect and distribute windstorm protection information	Public Education	Emergency Management	2016-2017	\$1,500 staff time	Everett

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**Table 24
Everett High and Medium Priority Potential Mitigation Measures**

Hazard Area	Mitigation Measure	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
47. Wind Hazard	Evaluate public buildings for high wind vulnerability	Prevention	Fire	2016-2017	\$20,000	Everett/ FEMA
48. Wind Hazard	Retrofit public buildings to withstand high winds	Prevention	Emergency Management/Public Works	2016-2020	\$10,000 - \$500,000	Everett/ FEMA
49. Winter Storms	Relocate overhead utilities underground	Structural	Utility	2016-2020	\$1,000 per foot	Utility
50. Winter Storms	Collect winter storm protection information	Public Education	Emergency Management	2016-2017	\$1,000 staff time	Everett
51. Winter Storms	Distribute winter storm information	Public Education	Emergency Management	2016-2020	\$1500 staff time	Everett
52. Fire Hazard	Evaluate and update evacuation routes as needed	Maintenance and Readiness	Fire	2016-2017	\$10,000 staff time	Everett/ FEMA
53. Geologic Hazard	Reduce non-structural and structural hazards	Prevention	Building Department/Planning	2016-2020	\$5,000 staff time	Everett/ FEMA
54. Multi Hazard	Upgrade EOC reliability	Emergency Services	Fire/Police	2016- 2020	\$50,000	
55. Multi Hazard	Update generators as needed	Maintenance and Readiness	Fire/Emergency Management	2016-2020	\$10,000 per generator	Everett/ FEMA
56. Multi Hazard	Update the CEMP	Maintenance & Readiness	Fire/Emergency Management	2016-2017	\$15,000 staff time	Everett

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VII. PLAN ADOPTION AND MAINTENANCE

Plan Adoption

The adoption certificate for the City of Everett Hazard Mitigation Plan 2016 was voted by the City Council on September 12, 2016 and signed by the Mayor on September 19, 2016. See Appendix D for documentation. The plan was approved by FEMA on October 21, 2016 for a five-year period that will expire on October 21, 2021. See FEMA letter of plan approval attached in Appendix E.

Plan Maintenance

Although many of the recommended mitigation measures from the City's 2008 Hazard Mitigation Plan have been implemented, since that plan was adopted there has not been an ongoing local process to guide implementation of the plan or integrate it with other City plans and programs. Such a process is needed over the next five years for the implementation of this plan update, and will be structured as described below.

MAPC worked with the Everett Hazard Mitigation Planning Team to prepare this plan. This group will continue to meet on an as-needed basis to function as the Local Hazard Mitigation Implementation Group, with the Fire Chief designated as the coordinator. Additional members could be added to the local implementation group from businesses, non-profits and institutions. The City will conduct public participation during the next 5-year planning cycle. Updates and reviews of the plan will be publicly noticed, and the current plan will be available to the public on the City's website, with email and mailing address for submitting comments. Any public comments received will be reviewed by the Everett Hazard Mitigation Team and incorporated appropriately in the next plan update. The public will be invited to attend all meetings in accordance with the Massachusetts Open Meeting Law.

Implementation and Evaluation Schedule

Bi-Annual Survey on Progress– The coordinator of the Hazard Mitigation Implementation Team will prepare and distribute a biannual survey in years two and four of the plan. The survey will be distributed to all of the local implementation group members and other interested local stakeholders. The survey shall be designed to help evaluate the plan and will poll the members on any changes or revisions to the plan that may be needed, progress and accomplishments for implementation, and any new hazards or problem areas that have been identified.

This information will be used to prepare a report or addendum to the local hazard mitigation plan. The Hazard Mitigation Implementation Team will have primary responsibility for tracking progress and updating the plan.

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Develop a Year Four Update – During the fourth year after initial plan adoption, the coordinator of the Hazard Mitigation Implementation Team will convene the team to begin to prepare for an update of the plan, which will be required by the end of year five in order to maintain approved plan status with FEMA. The team will use the information from the year four biannual review to identify the needs and priorities for the plan update.

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

At this point, the Hazard Mitigation Implementation Team may decide to undertake the update themselves, contract with the Metropolitan Area Planning Council to update the plan or to hire another consultant. However the Hazard Mitigation Implementation Team decides to update the plan, the group will need to review the current FEMA hazard mitigation plan guidelines for any changes. The update of the Everett Hazard Mitigation Plan will be forwarded to MEMA and DCR for review and to FEMA for approval.

Integration of the Plans with Other Planning Initiatives

Upon approval of the Everett Hazard Mitigation Plan by FEMA, the Local Hazard Mitigation Implementation Team will provide all interested parties and implementing departments with a copy of the plan and will initiate a discussion regarding how the plan can be integrated into that department’s ongoing work. At a minimum, the plan will be reviewed and discussed with the following departments:

- Fire / Emergency Management
- Police
- Public Works / Highway
- Engineering
- Planning and Community Development
- Conservation
- Parks and Recreation
- Health
- Building

The Hazard Mitigation Plan will be integrated into other city plans and policies as they are updated and renewed, including the Everett Comprehensive Plan, Open Space Plan, Comprehensive Emergency Management Plan, and Capital Investment Program. Each of these is updated on separate and independent schedules, and the Everett Hazard Mitigation Team coordinate with them and ensure that this plan update is integrated with the other City plans as the opportunity arises.

**CITY OF EVERETT HAZARD MITIGATION PLAN
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Other groups that will be coordinated with include large institutions, Chambers of Commerce, land conservation organizations and watershed groups. The plans will also be posted on a community's website with the caveat that local team coordinator will review the plan for sensitive information that would be inappropriate for public posting. The posting of the plan on a web site will include a mechanism for citizen feedback such as an e-mail address to send comments.

CITY OF EVERETT HAZARD MITIGATION PLAN 2016 PLAN UPDATE

VIII. LIST OF REFERENCES

In addition to the specific reports listed below, much of the technical information for this plan came from meetings with City department heads and staff.

City of Everett, General Ordinances

City of Everett, Zoning Ordinance

City of Everett, Comprehensive Emergency Management Plan

City of Everett, Open Space and Recreation Plan, 2010

FEMA, Local Mitigation Plan Review Guide; October 1, 2011.

FEMA, Flood Insurance Rate Maps for Everett, MA, 2010

MA Coastal Hazards Commission, Preparing For the Storm: Recommendations for Management of Risk from Coastal Hazards in Massachusetts May 2007.

MA Emergency Management Agency, State *Hazard Mitigation Plan*, 2013

MassGIS, MacConnell Land Use Statistics, 2005

Metropolitan Area Planning Council, Geographic Information Systems Lab

Metropolitan Area Planning Council, Regional Plans and Data

NOAA, National Climate Data Center

The Tornado History Project

U.S. Census, 2010

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**CITY OF EVERETT HAZARD MITIGATION PLAN
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**APPENDIX A
MEETING AGENDAS**

CITY OF EVERETT HAZARD MITIGATION PLAN 2016 PLAN UPDATE



Don Boyce
DIRECTOR



Edward M. Lambert Jr.
COMMISSIONER



Marc D. Draisen
EXECUTIVE DIRECTOR

THE COMMONWEALTH OF MASSACHUSETTS

Deval Patrick, Governor

MASSACHUSETTS EMERGENCY MANAGEMENT AGENCY

400 WORCESTER ROAD, FRAMINGHAM, MA 01702-5399 508-820-2000 FAX 508-820-1404

DEPARTMENT OF CONSERVATION AND RECREATION

251 CAUSEWAY STREET, SUITE 600-900, BOSTON, MA 02114-2104 617-626-1250 FAX 617-626-1351

METROPOLITAN AREA PLANNING COUNCIL

60 TEMPLE PLACE, 6TH FLOOR, BOSTON, MA 02111 617-451-2770 FAX 617-482-7185

Metro Boston Hazard Mitigation Planning Team

First Meeting

Wednesday, April 13, 10:00 AM

Everett City Hall, Keverian Room (3rd floor)
484 Broadway (Route 99), Everett

AGENDA

METRO BOSTON HAZARD MITIGATION PLANNING TEAM

Boston
Brookline
Cambridge
Chelsea
Everett
Malden
Medford
Somerville

10:00 WELCOME & INTRODUCTIONS

10:10 OVERVIEW OF HAZARD MITIGATION PLANNING & GRANTS

- State Hazard Mitigation Plan & FEMA Grants–Sarah White, MEMA
- FEMA Hazard Mitigation Program and Grants – Nan Johnson, FEMA
- Regional & Local Mitigation Plans - Martin Pillsbury, MAPC

10:30 UPDATING THE METRO BOSTON HAZARD MITIGATION PLAN

- FEMA Requirements & Grant Eligibility
- Review of Scope of Work & Schedule –MAPC
- Questions & Discussion – Local issues & Priorities

11:00 GETTING STARTED: MAPPING AND CRITICAL FACILITIES DATABASE FOR THE METRO BOSTON PLAN UPDATE

- Susan Brunton, GIS Analyst, MAPC

11:20 NEXT STEPS

11:30 ADJOURN

If you have any questions please contact Martin Pillsbury at MAPC:
617-451-2770, ext. 2012 or mpillsbury@mapc.org

**CITY OF EVERETT HAZARD MITIGATION PLAN
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**Everett Natural Hazard Mitigation Plan Renewal
April 24, 2012
Everett City Hall
9- 11 AM
Agenda**

1. Welcome and Introductions
2. Project Overview (*Sam Cleaves, MAPC*)
3. Survey Handout and Ortho Map Markup of Hazardous Areas/ Conversation:

What has changed from 2008 PDM Plan?

Review past Areas of Concern and Potential Areas of Development, Priority Projects

Plan Update:

- What floods? How often? Any new mitigation studies done? What mitigation measures have been done or planned for? High or low priority?
- Other hazards: Brush fires, dams, earthquake, high winds? What areas? Dam studies available?
- Map known future development areas? Type, size, status of permitting

4. Review Draft Project Goals: See over
5. Discuss Project Outreach: See over
6. Review mitigation projects: community actions and new priority projects/costs
7. Next Steps: Follow up with individuals as needed, continue information gathering, set priority mitigation projects and costs, maximize community collaboration on projects

Project Overview - MAPC received a grant to prepare natural hazards *Pre-Disaster Mitigation Plan* for the communities of Boston, Brookline, Cambridge, Chelsea, Everett, Malden, Medford and Somerville. MAPC is working with the eight communities to update their plans to mitigate potential damages of natural hazards such as floods, winter storms, hurricanes, earthquakes and wild fires, before such hazards occur. The federal *Disaster Mitigation Act of 2000* requires that all municipalities adopt a *Pre-Disaster Mitigation Plan* for natural hazards in order to remain eligible for FEMA Disaster Mitigation Grants.

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Public Participation Options

1. MAPC presents at a public meeting – existing board or commission- Planning Board and City Council.
2. Post on City website with a set public review period.
3. Distribute to specified organizations or boards/commissions for their review.

Draft Sample Goals

1. Prevent and reduce the loss of life, injury, public health impacts and property damages resulting from all major natural hazards.
2. Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.
3. Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.
4. Prevent and reduce the damage to public infrastructure resulting from all hazards.
5. Encourage the business community, major institutions and non-profits to work with the City to develop, review and implement the hazard mitigation plan.
6. Work with surrounding communities, state, regional and federal agencies to ensure regional cooperation and solutions for hazards affecting multiple communities.
7. Ensure that future development meets federal, state and local standards for preventing and reducing the impacts of natural hazards.
8. Take maximum advantage of resources from FEMA and MEMA to educate City staff and the public about hazard mitigation.

**CITY OF EVERETT HAZARD MITIGATION PLAN
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**APPENDIX B
HAZARD MAPPING**

CITY OF EVERETT HAZARD MITIGATION PLAN 2016 PLAN UPDATE

The MAPC GIS (Geographic Information Systems) Lab produced a series of maps for each community. Some of the data came from the Northeast States Emergency Consortium (NESEC). More information on NESEC can be found at <http://www.serve.com/NESEC/>. Due to the various sources for the data and varying levels of accuracy, the identification of an area as being in one of the hazard categories must be considered as a general classification that should always be supplemented with more local knowledge. The documentation for some of the hazard maps was incomplete as well.

The map series consists of eight panels, as follows:

Map 1.	Population Density
Map 2.	Potential Development
Map 3.	Flood Zones
Map 4.	Earthquakes and Landslides
Map 5.	Hurricanes and Tornadoes
Map 6.	Average Snowfall
Map 7.	Composite Natural Hazards
Map 8.	Hazard Areas

Reduced-scale copies of the map series are included in this Appendix for general reference. Full sized higher resolution PDF's of the Revere maps can be downloaded from the MAPC File Transfer Protocol (FTP) website:

ftp://ftp.mapc.org/Hazard_Mitigation_Plans/maps/Everett/

Map1: Population Density – This map uses the US Census block data for 2010 and shows population density as the number of people per acre in seven categories with 60 or more people per acre representing the highest density areas.

Map 2: Potential Development – This map shows potential future developments, and critical infrastructure sites. MAPC consulted with city staff to determine areas that were likely to be developed or redeveloped in the future.

Map 3: Flood Zones – The map of flood zones used the FEMA NFIP Flood Zones as its source, from the current FIRM maps dated June 4, 2010. For more information, refer to the FEMA Map Service Center website <http://www.msc.fema.gov>. The definitions of the flood zones are described in detail on this site as well. The flood zone map for each community also shows critical infrastructure and municipally owned and protected open space.

Map 4: Earthquakes and Landslides – This information came from NESEC. For most communities, there was no data for earthquakes because only the epicenters of an earthquake are mapped.

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The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to <http://pubs.usgs.gov/pp/p1183/pp1183.html>.

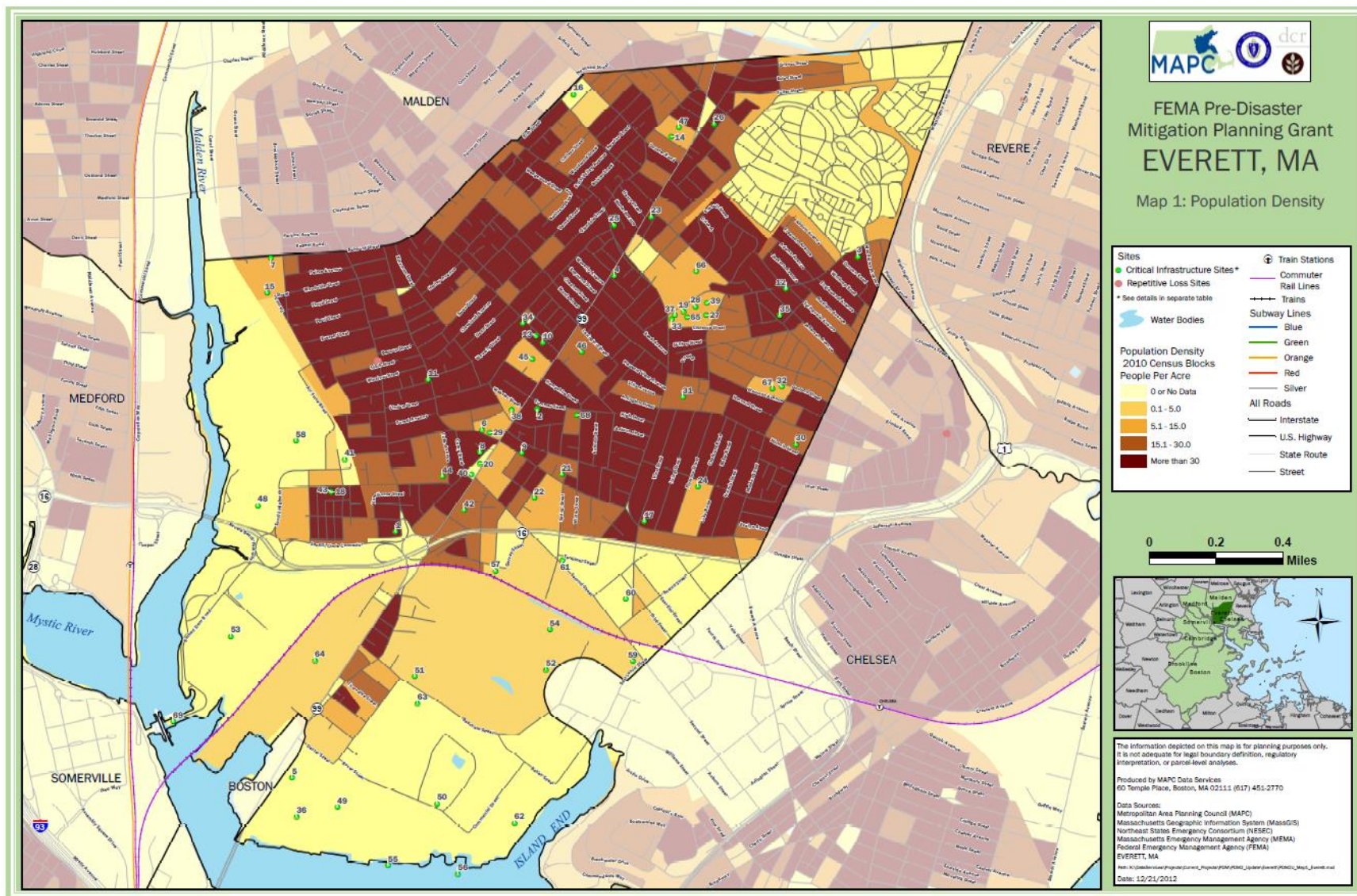
Map 5: Hurricanes and Tornadoes – This map shows a number of different items. The map includes the storm tracks for both hurricanes and tropical storms. This information must be viewed in context. A storm track only shows where the eye of the storm passed through. In most cases, the effects of the wind and rain from these storms were felt in other communities even if the track was not within that community. This map also shows the location of tornadoes with a classification as to the level of damages. What appears on the map varies by community since not all communities experience the same wind-related events. These maps also show the 100 year wind speed.

Map 6: Average Snowfall - - This map shows the average snowfall and open space. It also shows storm tracks for nor'easters, if any storms tracked through the community.

Map 7: Composite Natural Hazards - This map shows four categories of composite natural hazards for areas of existing development. The hazards included in this map are 100 year wind speeds of 110 mph or higher, low and moderate landslide risk, FEMA Q3 flood zones (100 year and 500 year) and hurricane surge inundation areas. Areas with only one hazard were considered to be low hazard areas. Moderate areas have two of the hazards present. High hazard areas have three hazards present and severe hazard areas have four hazards present.

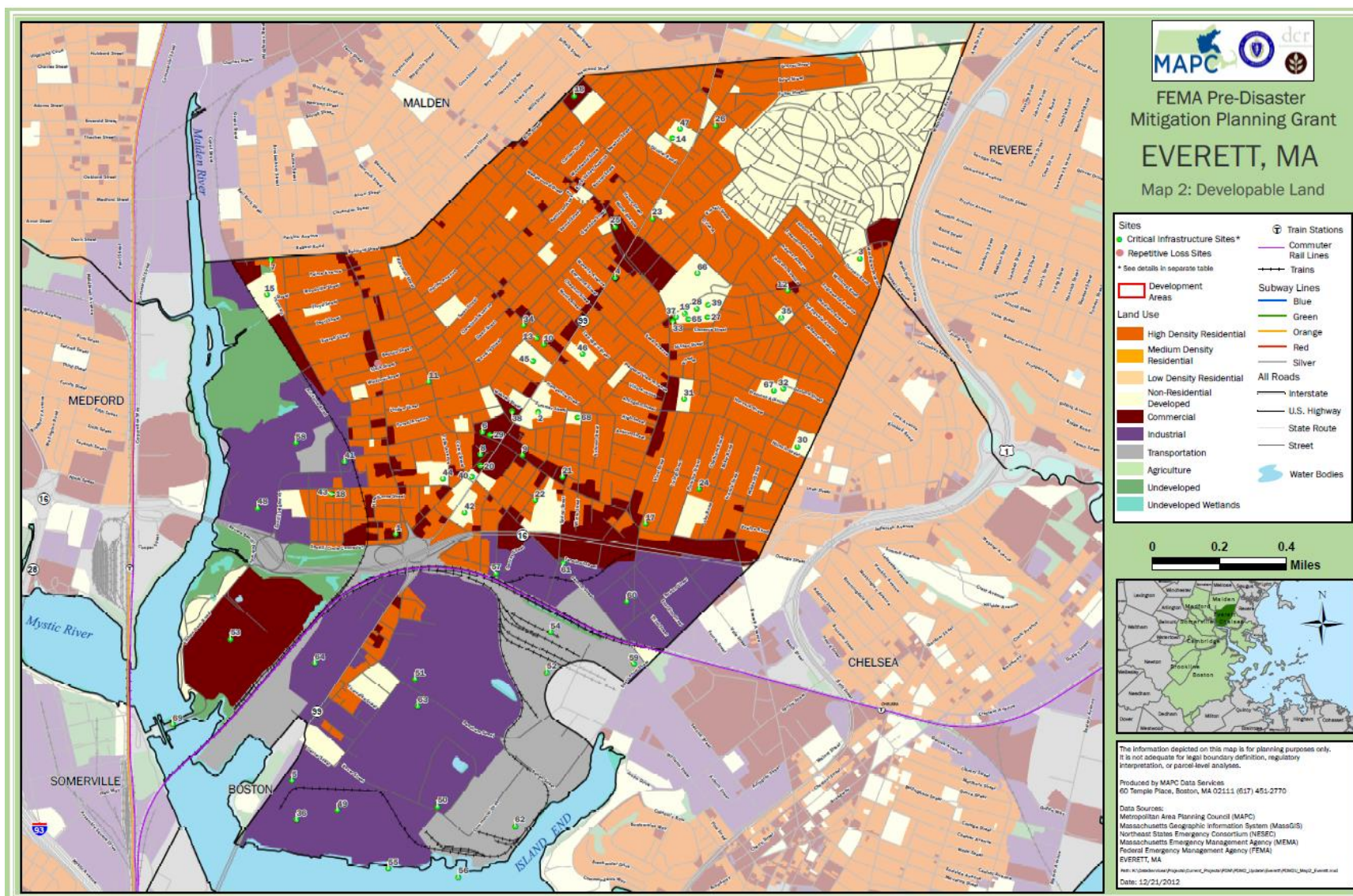
Map 8: Hazard Areas – For each community, locally identified hazard areas are overlaid on an aerial photograph dated April, 2008. The critical infrastructure sites are also shown. The source of the aerial photograph is Mass GIS.

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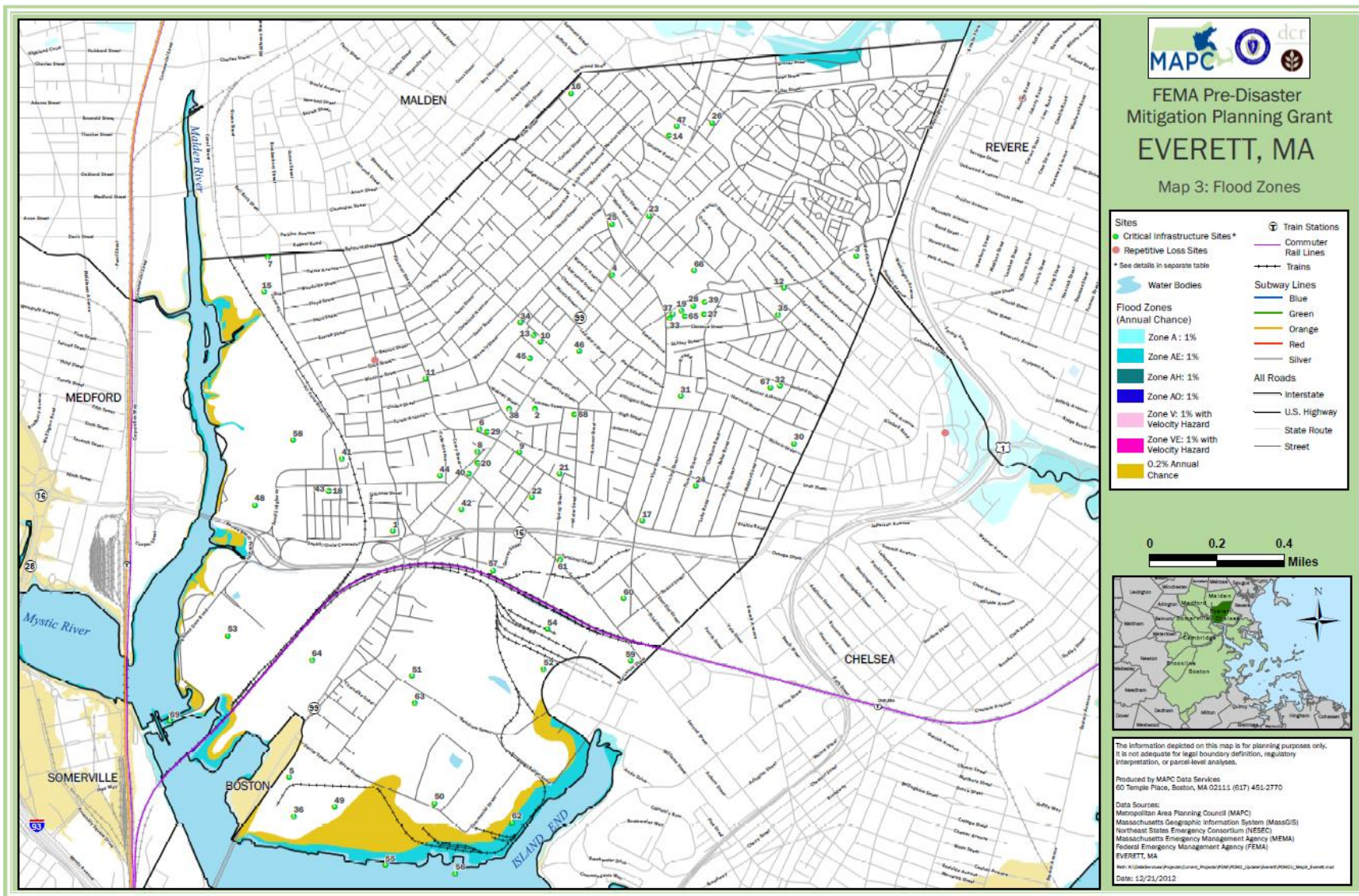
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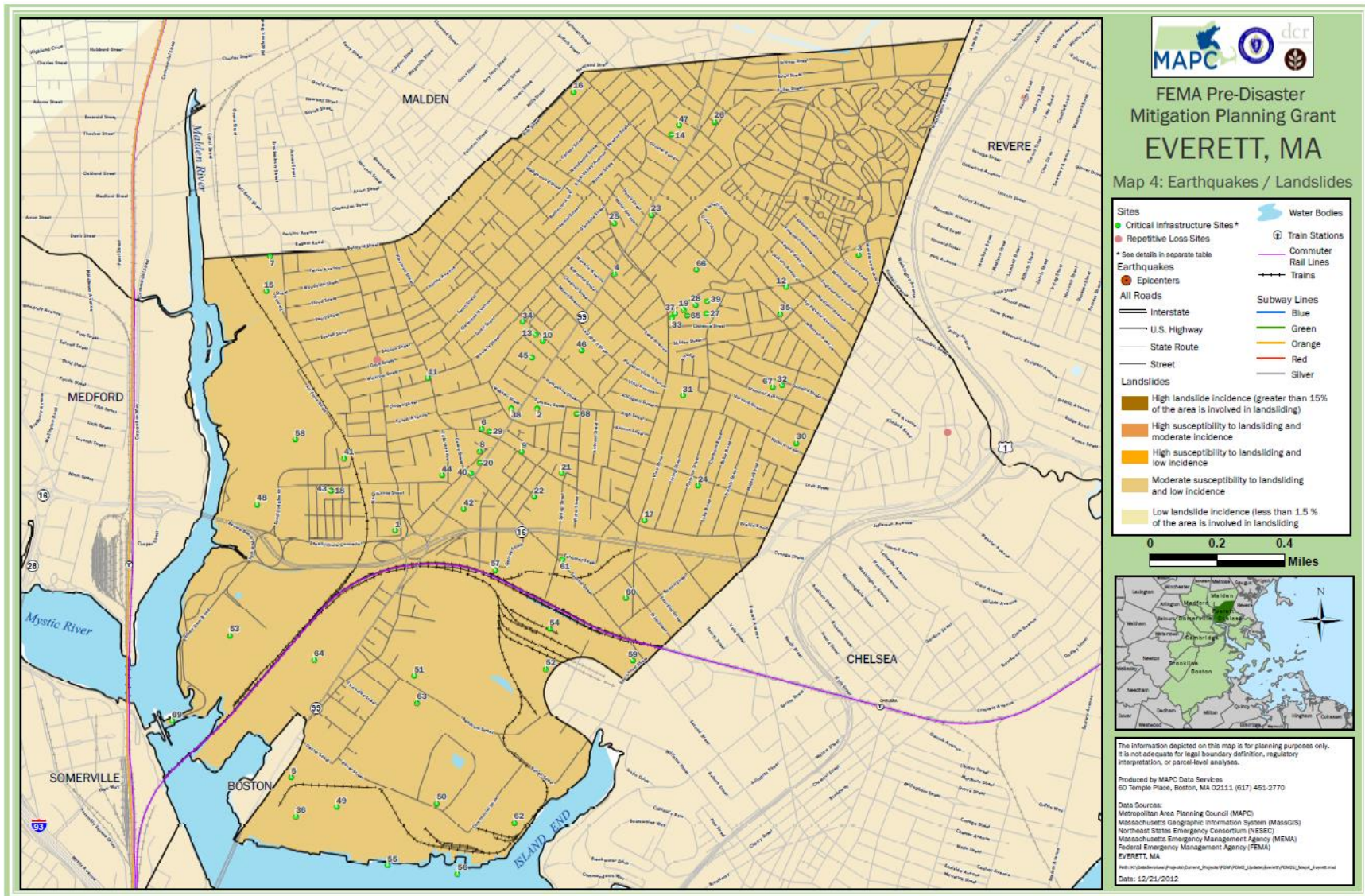


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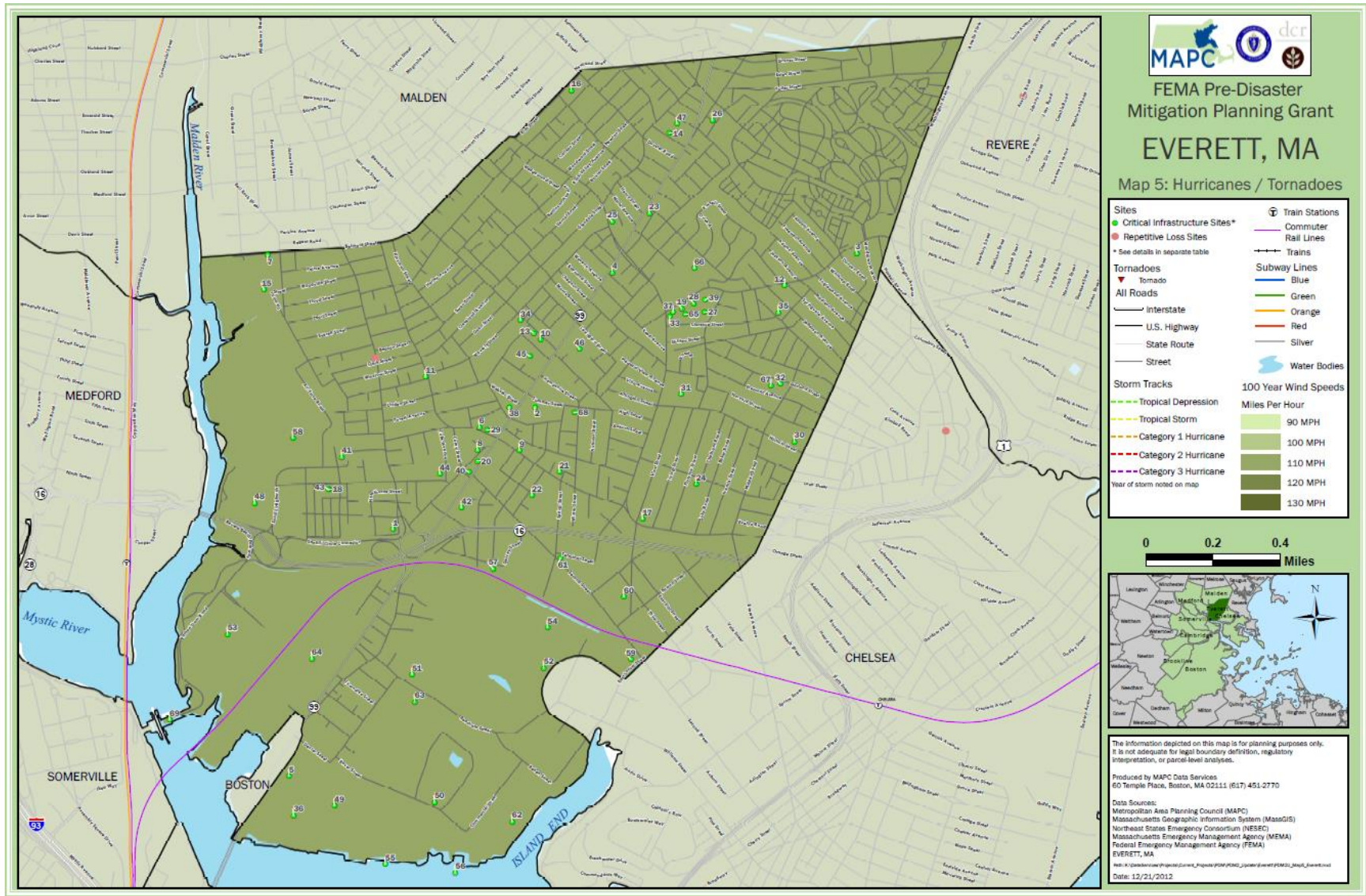
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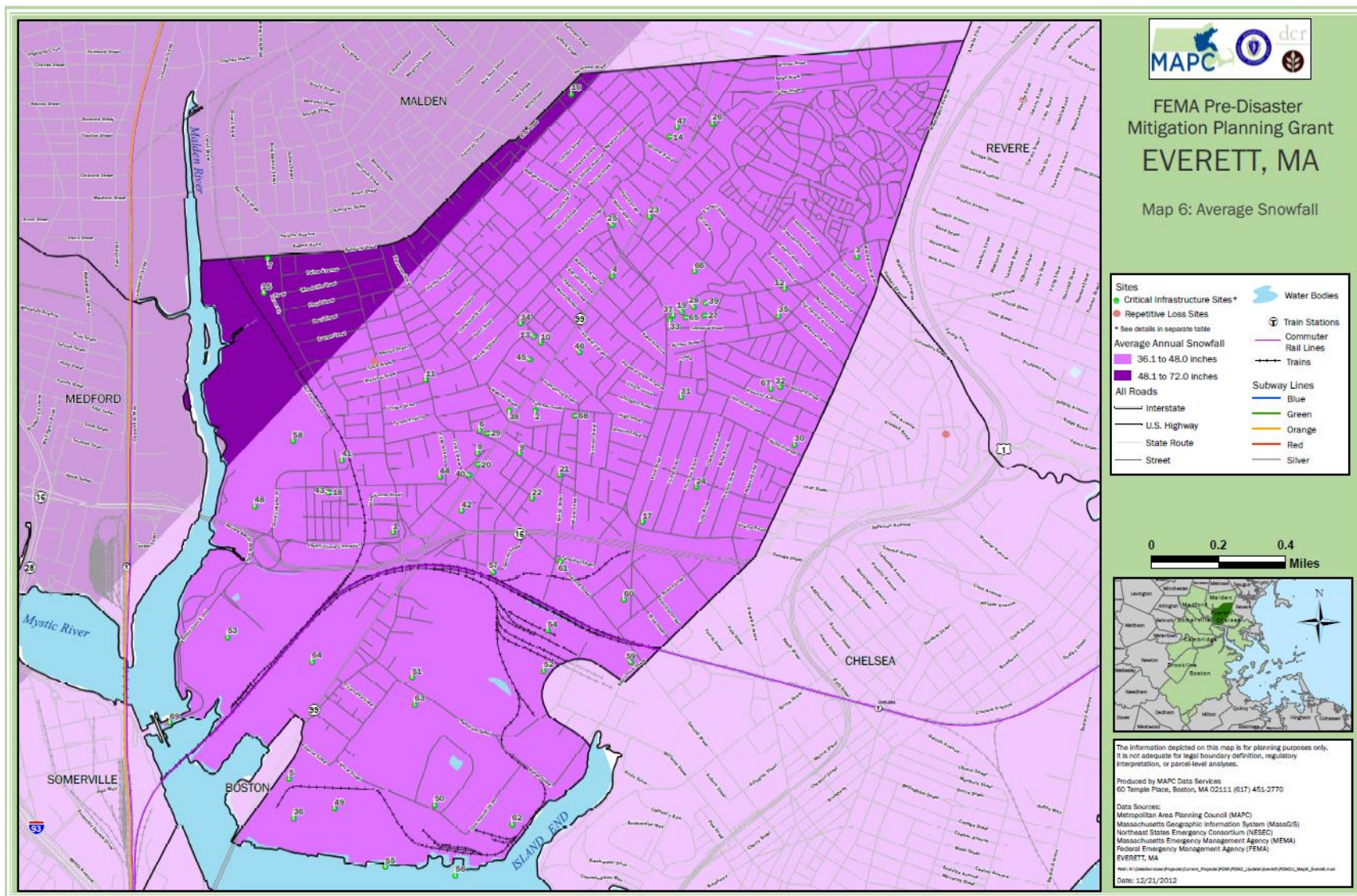


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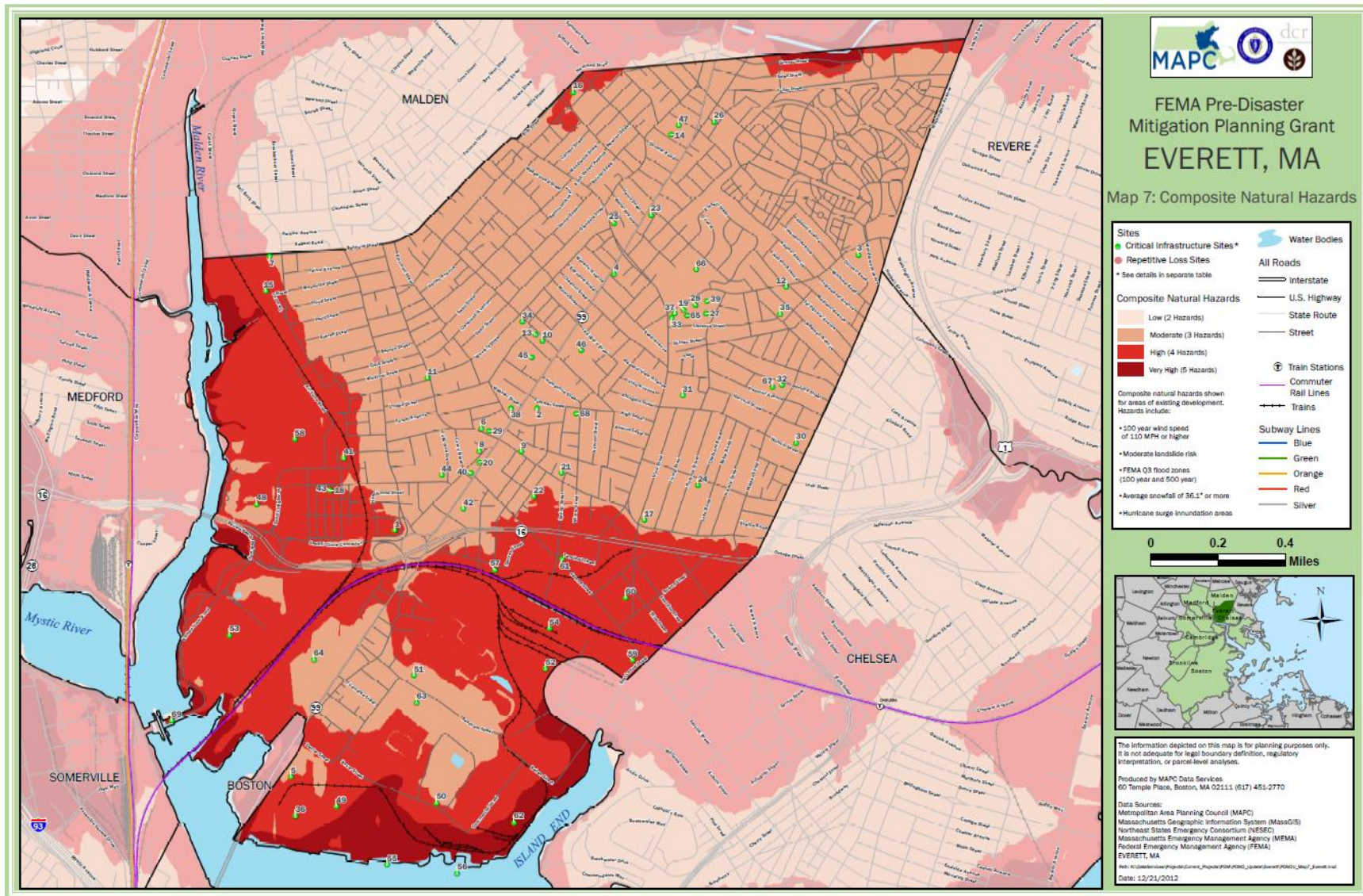


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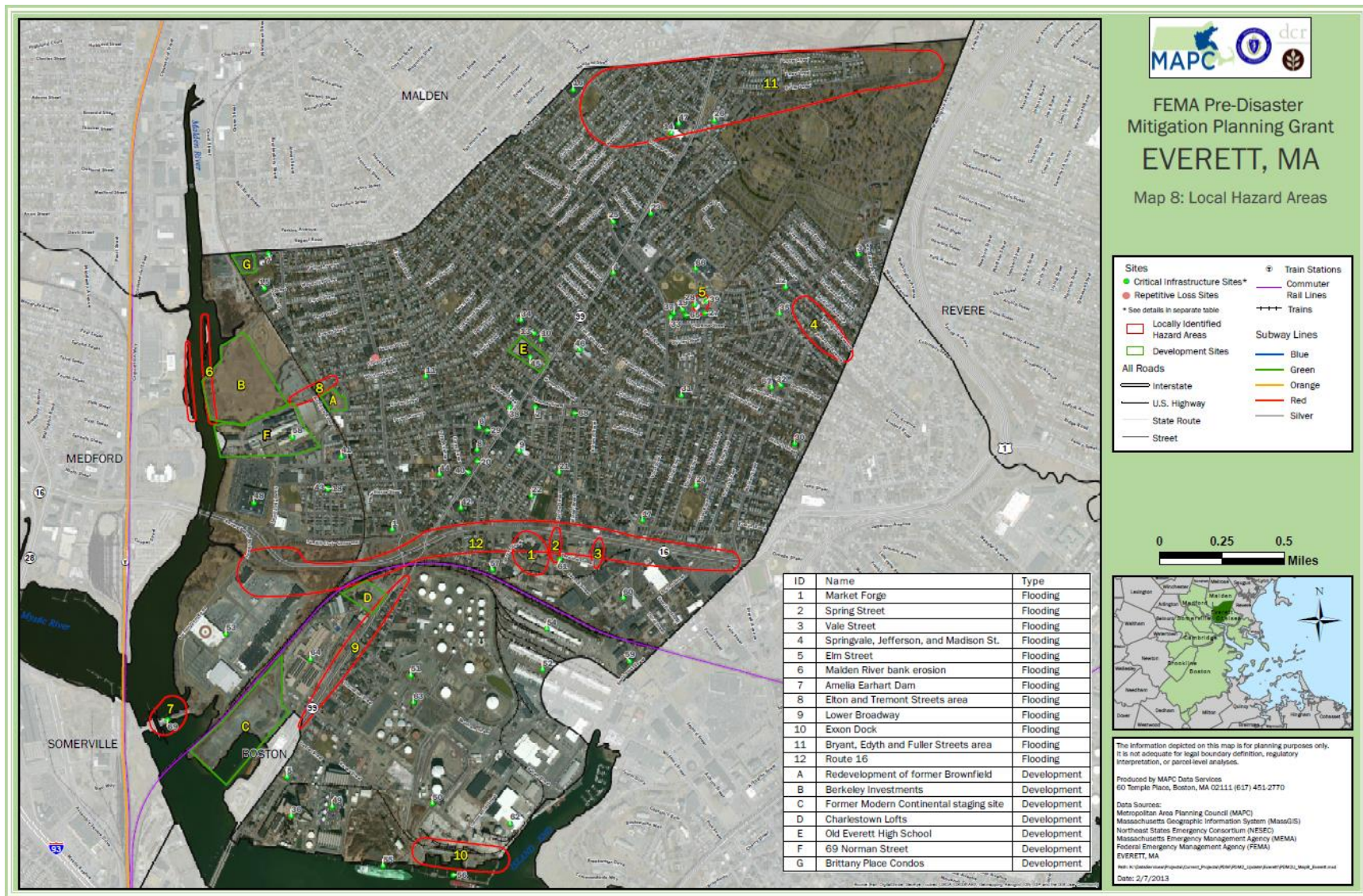
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**APPENDIX C
DOCUMENTATION OF THE PUBLIC PARTICIPATION PROCESS**

The draft Everett Natural Hazard Mitigation Plan was reviewed at two advertised and posted public meetings, an Everett Planning Board meeting and an Everett Conservation Commission meeting.

Following those meetings, the draft plan was posted for public review and comment on the Everett city website from May 6 – May 17, 2013. No public comments were received by MAPC.

**CITY OF EVERETT HAZARD MITIGATION PLAN
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Carlo DeMaria Jr.,
Mayor

City of Everett
Conservation Commission
Everett City Hall, Room 40
484 Broadway
Everett, MA 02149

Jon E. Norton
Chairman
Phone: 617-394-5004
FAX: 617-394-5002

Agenda for the meeting April 18, 2013

- 1. Minutes of the meeting March 21, 2013*
- 2. Public Hearing (9:15) for a Request for a Determination of Applicability filed by T & C Associates (Kyle Fair) regarding vegetation management on the Massachusetts Bay Commuter Railroad Right-of-Way in Everett.*
- 3. Metropolitan Regional Planning Council
re: Developing a natural character plan.
Sam Cleaver*
- 4. Communication from National Grid re:
work on electrical transmission lines on the Bike to the Sea path in Everett*
- 5. 69 Norman St.*
- 6. Adjournment*

**CITY OF EVERETT HAZARD MITIGATION PLAN
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City of Everett

PLANNING BOARD
484 BROADWAY

Frederick Cafasso-*Chairman*
Michael Bono
Nancy Koury
Anthony Medeiros
Leo Pizzano, Jr.
Lisa DellIsola- Clerk



Speaker George Keverian Room
3rd Floor-City Hall
Meetings
2nd & 4th Mondays
7:00PM

**Public Meeting Agenda
April 22, 2013 at 7:00pm
Speaker George Kevarian Room
3rd Floor, 484 Broadway Street
Everett City Hall**

- 1.**
Minutes for Approval: April 8, 2013
- 11.**
Approval Not Required: 373-393 Second Street
Subdivide one lot into two
- 111.**
Other Business
Presentation by MAPC: draft Everett Natural Hazard Mitigation plan
- IV.**
Adjournment

Please contact the Department of Planning and Development with any questions or concerns 617-394-2334

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**APPENDIX D
DOCUMENTATION OF PLAN ADOPTION**

**CITY OF EVERETT HAZARD MITIGATION PLAN
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CITY COUNCILNo. C0392-16

IN THE YEAR TWO THOUSAND AND SIXTEEN

**A Resolution Adopting the City of Everett Hazard Mitigation Plan 2016 Update
/s/Councilor John F. Hanlon, as President**

WHEREAS, the City of Everett, MA established a Committee to prepare the Hazard Mitigation Plan Update; and

WHEREAS, the *City of Everett Hazard Mitigation Plan 2016 Update* contains several potential future projects to mitigate potential impacts from natural hazards in the City of Everett, and

WHEREAS, a duly-noticed public meeting was held by the Planning Board on April 22, 2013, and

WHEREAS, the City of Everett authorizes responsible departments and/or agencies to execute their responsibilities demonstrated in the plan update,

NOW, THEREFORE BE IT RESOLVED that the Everett City Council adopts the *City of Everett Hazard Mitigation Plan 2016 Update*, in accordance with M.G.L. 40 §4 and the charter and ordinances of the City of Everett.

September 12, 2016

Passed in the City Council
11 yeas; 0 nays

September 19, 2016

Signed: Mayor Carlo DeMaria, Jr.

A true copy attest



A handwritten signature in black ink, reading "Michael Matarazzo".

Michael Matarazzo, City Clerk

**CITY OF EVERETT HAZARD MITIGATION PLAN
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**APPENDIX E
FEMA LETTER OF PLAN APPROVAL**

**CITY OF EVERETT HAZARD MITIGATION PLAN
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U.S. Department of Homeland Security
FEMA Region I
99 High Street, Sixth Floor
Boston, MA 02110-2132

FEMA

NOV 17 2016

Kurt Schwartz, Director
Massachusetts Emergency Management Agency
400 Worcester Road
Framingham, MA 01702-5399

Dear Mr. Schwartz:

We would like to congratulate the City of Everett and the Commonwealth of Massachusetts for their dedication and commitment to mitigation planning. The Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) Region I Mitigation Planning Team has completed its review of the City of Everett Hazard Mitigation Plan 2016 Update and determined it meets the requirements of 44 C.F.R. Pt. 201.

With this plan approval, the City of Everett is eligible to apply to the Massachusetts Emergency Management Agency for mitigation grants administered by FEMA. Requests for mitigation funding will be evaluated individually according to the specific eligibility requirements identified for each of these programs. A specific mitigation activity or project identified in your community's plan may not meet the eligibility requirements for FEMA funding; even eligible mitigation activities or projects are not automatically approved.

Approved mitigation plans are eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Complete information regarding the CRS can be found at <http://www.fema.gov/national-flood-insurance-program-community-rating-system>, or through your local floodplain administrator.

The City of Everett Hazard Mitigation Plan 2016 Update must be reviewed, revised as appropriate, and resubmitted to FEMA for approval within **five years of the plan approval date of October 21, 2016** in order to maintain eligibility for mitigation grant funding. We encourage the City to continually update the plan's assessment of vulnerability, adhere to its maintenance schedule, and implement, when possible, the mitigation actions proposed in the plan.

**CITY OF EVERETT HAZARD MITIGATION PLAN
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Kurt Schwartz
Page 2

NOV 17 2016

Once again, thank you for your continued dedication to public service demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please do not hesitate to contact Melissa Surette at (617) 956-7559.

Sincerely,



Paul F. Ford
Regional Administrator

PFF: ms

cc: Joy Duperrault, SHMO and NFIP Coordinator
Sarah White, Mitigation Grants Supervisor, MEMA
Beth Dubrawski, Hazard Mitigation Contract Specialist, MEMA

Enclosure