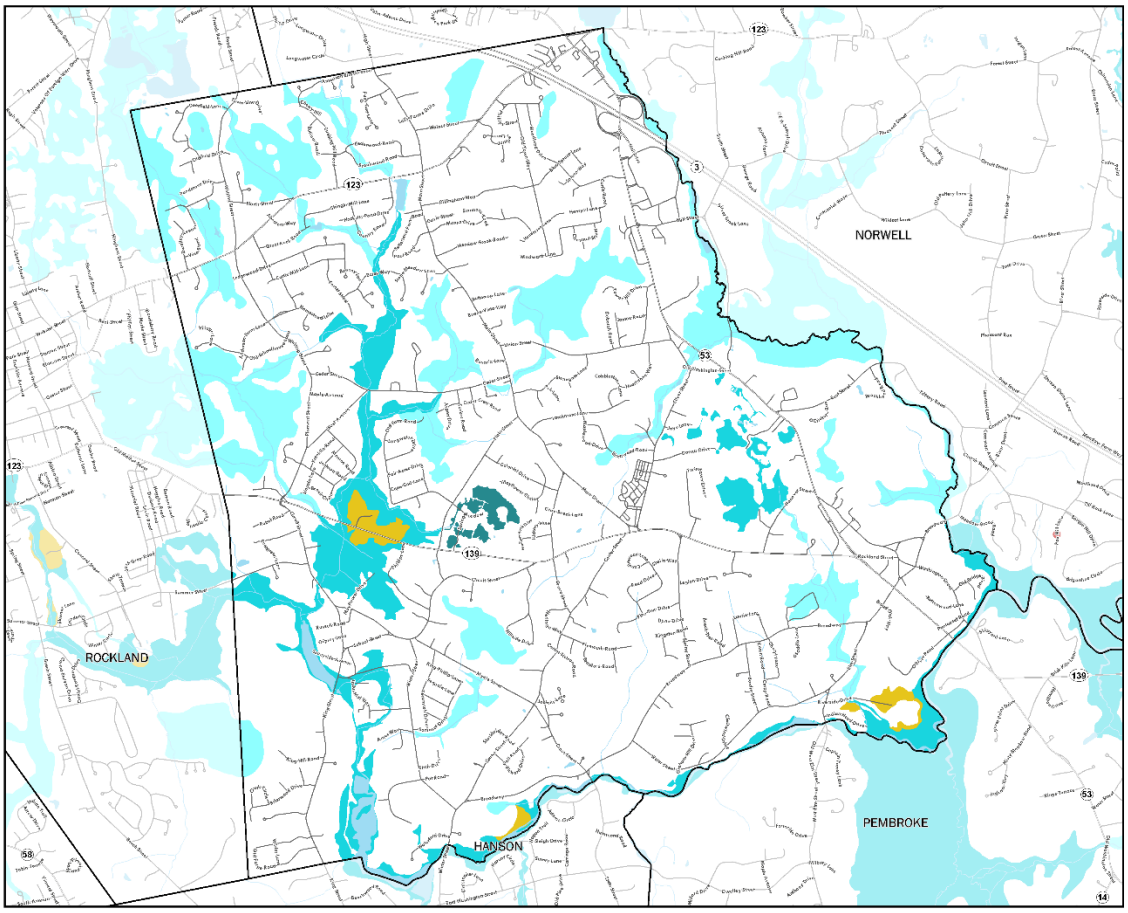
TOWN OF HANOVER
HAZARD MITIGATION PLAN



MAPC
METROPOLITAN AREA PLANNING COUNCIL

Final Plan
Adopted June 27, 2016

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ACKNOWLEDGEMENTS AND CREDITS

This plan was prepared for the Town of Hanover 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.

MAPC Officers

President:	Lynn Duncan
Vice President:	Keith Bergman
Secretary:	Shirronda Almeida
Treasurer:	Taber Keally
Executive Director:	Marc. D. Draisen

Credits

Project Manager:	Martin Pillsbury
Lead Project Planner:	Joan Blaustein
Mapping/GIS Services:	Eliza Wallace

Massachusetts Emergency Management Agency

Director:	Kurt N. Schwartz

Department of Conservation and Recreation

Commissioner:	Leo Roy

Hanover Local Hazard Mitigation Plan Committee

Jeffrey Blanchard	Fire Chief/Emergency Management Director
Victor Diniak	Department of Public Works Superintendent
Tony Marino	Director of Community Services
Troy Clarkson	Town Manager
Peter Matchak	Town Planner

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TOWN OF HANOVER HAZARD MITIGATION PLAN

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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. This is the Town of Hanover's first Hazard Mitigation Plan.

Planning Process

The -planning process for the Hanover Hazard Mitigation Plan was led by the Hanover Local Hazard Mitigation Planning Committee, composed of staff from a number of different Town departments. This committee discussed where the impacts of natural hazards most affect the town, goals for addressing these impacts, and hazard mitigation measures that would benefit the town.

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 Town takes to mitigate them. Two advertised public meetings were held, the first on March 26, 2015 with the Hanover Local Emergency Planning Committee (LEPC) and the second public meeting was held on June 4, 2015 in conjunction with a yearly resident's forum on emergency management topics of interest. The draft plan also was posted on the town's website for public review and comment for a ten day period following the June 4, 2015 public meeting. 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 town website and make comments. The public was given time to ask questions and comment at all public meetings.

Risk Assessment

The hazard mitigation plan assesses the potential impacts to the Town from flooding, high winds, winter storms, brush fires and geologic hazards. Flooding, driven by hurricanes, nor'easters and other storms, clearly presents the greatest hazard to the Town.

The Hanover Local Hazard Mitigation Committee identified four areas where flooding has been a consistent concern. These areas total 231 acres or 2.3% of the Town's land area. Flooding impacts approximately 233 structures worth nearly an estimated $49,243,045.

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 it its review and permitting of new development.
    - Review zoning regulations to ensure that the bylaw 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 Town 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. Educate the public about natural hazards and mitigation measures that can be undertaken by property-owners.

9. Take maximum advantage of resources from FEMA and MEMA to educate town staff and the public about hazard mitigation.

Hazard Mitigation Strategy – The Hanover Local Hazard Mitigation Committee identified a number of mitigation measures that would serve to reduce the town's vulnerability to natural hazard events. These mitigation measures build on what the town is already doing to maintain the drainage system to alleviate flooding, as well as putting into place additional measures to deal with brush fires, winter storms and high winds.

Plan Development Process

The process for developing Hanover's Hazard Mitigation Plan is summarized in Table 1 below.

Table 1 Plan Development Process	
Chapter	**Reviews**
III – Public Participation	The Hanover Local Committee placed an emphasis on public participation for the development of the Hazard Mitigation Plan. Outreach strategies included the use of social media and e-mail notifications. During plan development, the plan was presented to the Hanover LEPC and the general public at a special residents evening on emergency preparedness. The draft plan was presented at a public meeting of the Hanover Board of Selectmen, which was broadcast on local access cable television. The plan was also available on the Town's website for public comment.
IV – Risk Assessment	MAPC gathered the most recently available hazard and land use data and met with Town staff to identify local hazard areas and development trends. Town 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	Working with the Local Hazard Mitigation Committee, MAPC developed a list of existing mitigation measures that reflected current mitigation activities in the Town.
VII & VIII – Hazard Mitigation Strategy	A list of additional mitigation measures was developed, reviewed and assessed as to their relevance to Hanover. The Committee prioritized all of these measures based on how they fit with the needs and capacity of the Town to implement them.
IX – Plan Adoption & Maintenance	This section of the plan was developed to ensure a process for plan implementation as well as a process for the five year update.

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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. This is the Town of Hanover's first Hazard Mitigation Plan.

Federal hazard mitigation planning and grant programs are administered by the Federal Emergency Management Agency (FEMA) in collaboration with the states. These programs are administered in Massachusetts by the Massachusetts Emergency Management Agency (MEMA) in partnership with the Department of Conservation and Recreation (DCR). 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. At the time that the South Shore regional planning effort was initiated, Hanover chose not to participate. In 2014 they decided to undertake a hazard mitigation plan and received a grant to work with MAPC to prepare their first hazard mitigation plan.

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 Town of Hanover has experienced 18 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.

Table 2 Previous Federal/State Disaster Declarations		
DISASTER NAME (DATE OF EVENT)	**TYPE OF ASSISTANCE**	**DECLARED AREAS**
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
	FEMA Individual Household Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (10 projects)
December Blizzard (December 1992)	FEMA Public Assistance Project Grants	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk (7 projects)
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	All 14 Counties
May Windstorm (May 1996)	State Public Assistance Project Grants	Counties of Plymouth, Norfolk, Bristol (27 communities)
October Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk

Table 2 Previous Federal/State Disaster Declarations		
DISASTER NAME (DATE OF EVENT)	**TYPE OF ASSISTANCE**	**DECLARED AREAS**
October Flood (October 1996)-con't	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk (36 projects)
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 (19 projects)
(1998)	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	All 14 Counties
January Blizzard (January 22-23, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
Hurricane Katrina (August 29, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
May Rainstorm/Flood (May 12-23, 2006)	Hazard Mitigation Grant Program	Statewide
April Nor'easter (April 15-27, 2007)	FEMA Public Assistance Project Grants	Barnstable, Berkshire, Dukes, Essex, Franklin, Hampden, Hampshire, Plymouth

Table 2 Previous Federal/State Disaster Declarations		
DISASTER NAME (DATE OF EVENT)	**TYPE OF ASSISTANCE**	**DECLARED AREAS**
April Nor'easter (April 15-27, 2007)	zard 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, 2012	FEMA Public Assistance	Statewide
MA Severe winter storm, snowstorm and flooding (February 8-10, 2013)	FEMA Public Assistance	Barnstable, Berkshire, Bristol, Dukes, Essex, Franklin, Hampden, Hampshire, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk and Worcester counties
Blizzard of 2015 (January 26-28, 2015)	FEMA Public Assistance; Hazard Mitigation Grant Program	Statewide

(Source: database provided by MEMA)

FEMA Funded Mitigation Projects

Hanover has not received any FEMA mitigation grants because the Town was not eligible to apply. This plan will render the Town eligible to apply for grants.

Community Profile

The Town of Hanover is a pastoral/suburban community in Plymouth County which was first settled in 1649 and incorporated in 1727. The town's early economy was based on agriculture and lumbering. By the 18th century, the town had made itself a very self-sufficient community on a sturdy agricultural and industrial foundation, with a wealth of water power resources and a shipbuilding complex on the North River. The town was the site of the invention of the first tack-making machine, and making tacks and fireworks were among the industries of the later 19th century for Hanover. However, the most significant post-civil war movement was toward residential subdivision development as the main roads from Brockton and Boston were improved in the 20th century. Residents are proud of the Four Corners Section of Hanover, which retains its authentic period village character, and of their close-knit and friendly town.

With the opening of I-93, South Shore communities became much more accessible to Boston and Hanover's development as a bedroom community of commuters became more pronounced.

(Source: MA Department of Community Development)

Table 3: Hanover Population Characteristics, 2010
Population = 13,879
• 22.6% are under the age of 14 • 13.4% are over the age of 65 • 4.5% speak a language other than English • 0.7% live in group quarters
Number of occupied housing units = 4,709 • 87.4% are owner occupied
Source: U.S. Census, 2010, American Community Survey 2013

The Town maintains a website at http://www.hanover-ma.gov/

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III. PLANNING PROCESS AND 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 analyze and map the areas with the potential to experience natural hazards. The analysis incorporates the most recent plans, studies, reports and technical information for the study area. The 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.

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 plan update is an important on-going activity. Chapter IX includes more detailed information on plan implementation.

The Local Hazard Mitigation Planning Team

The Local Hazard Mitigation Planning Team is central to the planning process as it is the primary body tasked with developing a mitigation strategy for the community. Given this role, it is important that this committee include a diverse representation of community stakeholders and knowledgeable municipal staff.

In Hanover, the Local Hazard Mitigation Planning Team was composed of the individuals listed in Table 4. These were the individuals who provided MAPC with data and local knowledge of the various hazards. In addition, the Hanover Local Emergency Planning Committee (LEPC) included representatives from businesses and institutions in the town. The LEPC was also consulted with throughout the plan development process and the committee hosted the first public meeting as well. Local Hazard Mitigation Planning Team meetings were held on June 2, 2014, August 21, 2014, January 7, 2015, and May 13, 2015. Attendees at local meetings are shown in Table 5.

Continuing Public Participation

Following the adoption of this plan, 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 town's understanding of local hazards. As updates and a review of the plan are conducted by the Hazard Mitigation Implementation Team, these will be placed on the Town's web site, and any meetings of the Hazard Mitigation Implementation Team will be publicly noticed in accordance with town and state open meeting laws.

Table 4: Hanover Hazard Mitigation Planning Team

Name	**Representing**
Jeffrey Blanchard	Fire Chief/Emergency Management Director
Victor Diniak	Department of Public Works Superintendent
Tony Marino	Director of Community Services
Troy Clarkson	Town Manager
Peter Matchak	Town Planner

Table 5 **Attendance at Local Meetings**	
Name	**Representing**
June 2, 2014	
Jeffrey Blanchard	Fire Chief/Emergency Mgt. Director
Troy Clarkson	Town Manager
Victor Diniak	DPW Superintendent
James Gallagher	Fire Captain/EMS Coordinator
Tony Marino	Director of Community Services
Robert Murray	Facilities Engineering Manager
Barbara Stone	Deputy Fire Chief/Deputy Emergency Mgt. Director
Walter Sweeney	Chief of Police
Janine Smith	Director of Finance and Accounting
Attendance at Additional Project Meetings	
August 21, 2014 Data collection meeting	
Jeffrey Blanchard	Fire Chief/Emergency Mgt. Director
Victor Diniak	DPW Superintendent
Tony Marino	Director of Community Services
Peter Matchak	Planning Officer
January 7, 2014 – Map review meeting	
Jeffrey Blanchard	Fire Chief/Emergency Mgt. Director
Victor Diniak	DPW Superintendent
Tony Marino	Director of Community Services
Peter Matchak	Planning Officer
May 13, 2015 – Meeting to review goals, proposed mitigation measures.	
Greg Nihan	Police Department
Jeffrey Blanchard	Fire Chief/Emergency Mgt. Director
Victor Diniak	Hanover DPW
Heather Lamplough	Planning Department
Peter Matchak	Planning Department
Barbara Stone	Fire/EMA/LEPC

Public Participation

Public participation in the hazard mitigation planning process is important, both for plan development and for later implementation of the plan. Residents, business owners, and other community members are an excellent source for information on the historic and potential impacts of natural hazard events and particular vulnerabilities the community may face from these hazards. Their participation in this planning process also builds understanding of the concept of hazard mitigation, potentially creating support for mitigation actions taken in the future to implement the plan. To gather this information and educate residents on hazard mitigation, the Town hosted two public meetings, one during the planning process and one after a complete draft plan was available for review. Natural hazard mitigation plans unfortunately rarely attract much public involvement in the Boston region, unless there has been a recent hazard event. In order to fulfill the public participation requirements for plan development, MAPC and the town relied on a two pronged approach; utilizing the regular LEPC meetings and taking advantage of a unique public event hosted by the Hanover Emergency Management agency.

Public Meetings. The plan was first introduced to the public at a meeting of the Hanover Local Emergency Planning Committee on March 26, 2015 when it was still being drafted. A second public meeting was hosted by the Hanover Local Emergency Planning Committee on June 4. 2015, when the draft plan was available for review by the public. The draft plan was presented at a public meeting hosted by the Hanover Board of Selectmen on June 15, 2015. The meeting was televised live on Hanover Cable TV and is available for replay on the Town website.

Meeting notices were sent to the membership of the LEPC and posted on the Town's on-line calendar. An announcement of the public meeting was listed under the heading of Town News on the Town's home page, with a link to the flyer for the meeting. An announcement about the meeting and a link to the flyer was also posted on the Town's Facebook page.

Table 6: Attendance at Public Meetings

Public Meeting, March 26, 2015	
Jeffrey Blanchard	Fire/EMA/LEPC
Stephen Ingle	Joseph Ingle Bus Service
Michael Huban	Hanover Mall
Caitlin Flaherty	Hanover Mariner
Barbara Stone	Fire/EMA/LEPC
Victor Diniak	DPW
Peter Cook	Gem Gravure Company
Justin Reed	Fire/EMS/LEPC
Doug Forbes	MEMA
Greg Nihan	Hanover Police
Joan Blaustein	MAPC
Public Meeting, June 15, 2015	
Brian Barthelmes	Chair, Board of Selectmen

Susan Setterland,	Selectwoman
Robert O'Rourke	Selectmen
Joseph Salvucci	Selectmen
David Delaney	Selectman
Janice Smith	Finance Director
Jeff Blanchard	Fire Chief
Ann Lee	Administrative Assistant
Joan Blaustein	MAPC
Carol Mattes	Resident
Rick Mattes	Resident

The Board of Selectmen's meeting was televised live on Hanover Cable TV and is available for replay on the Town website.

Other Opportunities for Public Involvement

Review by Neighboring Communities and Stakeholders

Notice was sent to the following neighboring municipalities and organizations about the Hanover Hazard Mitigation Plan:

Town of Rockland
Town of Hanson
Town of Pembroke
Town of Norwell
The Cushing Centers
JBL Properties, Inc.
My Family Life Plan

Town Website

Draft copies of the Hanover Hazard Mitigation Plan were posted on the Town's website. Members of the public could access the draft document and submit comments or questions. No written comments on the draft plan were received by the Town.

Incorporation of Other Existing Plans and Studies
The Plan incorporates information from a number of other previously produced plans and studies as well as applicable regulatory documents. These include:

- Town of Hanover Annual Report for Fiscal Year ending June 30, 2013
- Town of Hanover Zoning Bylaws as adopted amended and approved including all amendments to May 2013.
- Town of Hanover, Comprehensive Emergency Management Plan
- Town of Hanover Open Space and Recreation Plan 2008-2012.

A full listing of the documents incorporated in the development of this plan is included in Section VIII – List of References.

Planning Timeline Summary

June 2, 2014	Meeting of the Hanover Local Hazard Mitigation Planning Committee
August 21, 2014	Meeting of the Hanover Local Hazard Mitigation Planning Committee
January 7, 2015	Meeting of the Hanover Local Hazard Mitigation Planning Committee
March 26, 2015	First public meeting, Hanover LEPC
May 13, 2015	Meeting of the Hanover Local Hazard Mitigation Planning Committee
June 4, 2015	Second public meeting, Hanover LEPC
June 15, 2015	Third public meeting hosted by the Board of Selectmen
September 28, 2015	Draft Plan Submitted to MEMA
April1 1, 2016	Revised Draft plan submitted to MEMA
May 2, 2016	Approvable Pending Adoption notice issued by FEMA
June 27, 2016	Final Plan Adopted by the Town

IV. RISK ASSESSMENT

The risk assessment analyzes the potential natural hazards that could occur within the Town of Hanover 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.

Risk Assessment Process

In order to determine Hanover's risk assessment, MAPC gathered the most recently available hazard and land use data and met with Town staff to identify local hazard areas and development trends. Town staff provided critical infrastructure to 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.

Overview of Hazards and Impacts

The 2013 Massachusetts Hazard Mitigation Plan provides an in-depth overview of natural hazards in Massachusetts. The 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, wildfires, and earthquakes. Previous state and federal disaster declarations since 1991 are summarized in Table 1.

Table 7 summarizes the hazard risks for Hanover. 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 modified to reflect local conditions in Hanover using the definitions for hazard frequency and severity listed below.

Table 7: Hazard Risks Summary

Hazard	Frequency		Severity	
	Massachusetts	Hanover	Massachusetts	Hanover
Flooding	High	High	Serious	Serious
Dam failures	Very low	Low	Serious	Serious
Coastal Hazards	High	Low	Serious	Minor
Tsunami	Very low	N/A	Extensive	N/A
Hurricanes	Medium	Medium	Serious	Serious
Tornadoes	Medium	Very low	Serious	Serious
Nor'easters	High	High	Serious	Serious
Thunder Storms	High	High	Minor	Minor
Winter - Snow/Blizzards	High	High	Minor	Extensive
Winter - Ice Storms	Medium	Medium	Minor	Minor
Earthquakes	Very low	Very low	Extensive	Serious
Landslides	Low	Very low	Minor	Minor
Brush fires	Medium	Medium	Minor	Minor
Extreme Temperatures	Medium	Medium	Minor	Minor
Drought	Low	Low	Minor	Minor

Source: Massachusetts State Hazard Mitigation Plan, 2013, modified for Hanover

Definitions used in the Commonwealth of Massachusetts State Hazard Mitigation Plan
Frequency Categorization
Very low: events that occur less frequently than once in 100 years (Less than 1% per year)
Low: events that occur from once in 50 years to once in 100 years (1% to 2% per year)
Medium: events that occur from once in 5 years to once in 50 years (2% to 20% per year)
High: events that occur more frequently than once in 5 years (greater than 20% per year).
Severity Categorization
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.

All of the hazards listed above are addressed in this local plan except for Tsunami, since Hanover is an inland community located five miles from the coast.

Flood Related Hazards

Flooding was the most prevalent serious natural hazard identified by local officials in Hanover. Flooding is generally the rising or overflowing of water onto normally dry land and can be caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms, among other causes. Global climate change has the potential to increase the frequency and severity of rainstorms and snowstorms, which would be a continuation of a trend observed over the past several decades.

Regionally Significant Floods

There have been a number of major floods that have affected the Metro Boston region over the last fifty years. Significant historic flood events that may have impacted Hanover included:

- March 1968
- The blizzard of 1978
- January 1979
- April 1987
- October 1991 (The Perfect Storm)
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007
- March 2010

Previous Occurrences and Extent of Flooding

The best available data on the previous occurrences of flooding are from the National Climatic Data Center, which are provided by county. Hanover is part of Plymouth County, for which historic flood events from 2005 through 2014 were compiled and are summarized in Table 8.

Table 8: Plymouth County Flood Events 2005-2014

Date	Deaths	Injuries	Property Damage
3/28/2005	0	0	$0
10/15/2005	0	0	$350,000
10/15/2005	0	0	$200,000
10/15/2005	0	0	$50,000
10/15/2005	0	0	$100,000
10/15/05	0	0	$140,000
10/25/2005	0	0	$35,000
12/09/2005	0	0	$40,000
5/13/2006	0	0	$500,000
5/13/2006	0	0	$0
6/7/2006	0	0	$30,000
6/23/2006	0	0	$2,000
8/20/2006	0	0	$5,000
10/28/2006	0	0	$10,000
3/2/2007	0	0	$10,000
3/17/2007	0	0	$8,000
4/15/2007	0	0	$25,000
2/13/2008	0	0	$0
3/8/2008	0	0	$5,000
3/8/2008	0	0	$0
9/27/2008	0	0	$50,000
5/24/2009	0	0	$0
8/29/2009	0	0	$0
3/14/2010	0	0	$16.15 m
3/29/2010	0	0	$8.07m
4/1/10	0	0	$0
7/13/2011	0	0	$5
8/10/2012	0	0	$30,000
5/11/2013	0	0	$0
5/11/2013	0	0	$0
6/7/2013	0	0	$0
9/3/2013	0	0	$0
3/30/2014	0	0	$0
3/30/2014	0	0	$0
10/22/2014	0	0	$0
11/17/2014	0	0	$0
TOTAL	**0**	**0**	**$1,590,005**

Source: NOAA NCDC

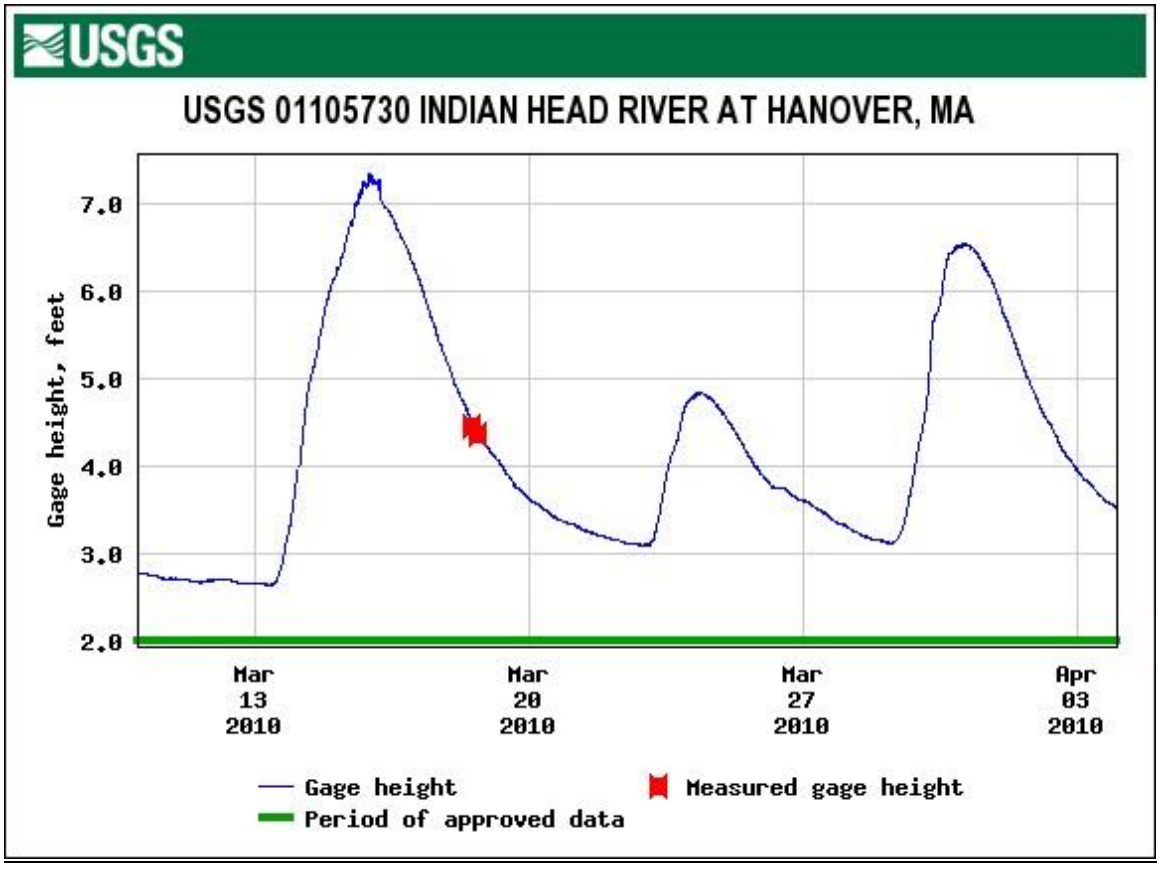
No deaths or injuries were reported and the total reported property damage in the county was $1.59 million dollars.

The most severe recent flooding occurred during the major storm of March 2010. King Street was closed for 2-3 days at the bridge at Forge Pond until the waters receded. The only damage was a small sinkhole in the road that was subsequently repaired. All of the houses on King Street and the roads off of King Street south of the bridge were impacted.

There was also significant puddling on Industrial Way as a result of this flooding. The fire department set up a mobile command post to ensure that the roads remained open. Many homes experienced basement flooding. The river overflowed its banks and reached the edge of neighboring properties on Pine Island Road and Brook Circle.

One indication of the extent of flooding is the gage height at the nearest streamflow gauging station. The United States Geological Survey (USGS) maintains a streamflow gauging station on the Indian Head River in Hanover. The figure below shows the peaks at that station for the three storms that occurred from March 13- 31, 2010. Gage height exceeded 7.0 feet after the first storm on March 16, and rose again to 6.5 feet after the third storm on March 31. Normal gage height in March is about 3 feet.

Figure 1: USGS Gage at Indian Head River



Source: US Geologic Survey, National Water Information System

Flooding Location, Impacts and Vulnerabilities

Hanover is subject to two kinds of flooding. The primary type of flooding is i*nland/riverine flooding* where the rate of precipitation and/or amount of stormwater runoff overwhelms the capacity of natural or structured drainage systems causing overflows. To a much lesser extent, Hanover can also be affected by coastal flooding where wind and tide leads to flooding along tidal waterways. Although Hanover is not a coastal community, it is bordered on the southeast by the North River which can be affected by tidal storm surges.

Information on flood hazard areas was taken from two sources. The first was the National Flood Insurance Rate Maps. The FIRM flood zones are shown on Map 3 in Appendix B and are defined below. The Flood Insurance Rate Maps used are the current approved maps from FEMA dated October 2013 which are the current regulatory maps in force.

Flood Insurance Rate Map Zone Definitions

Zone A: (Also known as Unnumbered A Zones): Special Flood Hazard Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations or depths are shown.

Zone AE: An area inundated by 1% annual chance flooding, for which Base Flood Elevations have been determined.

Zone AH: An area inundated by 1% annual chance flooding (usually an area of ponding), for which Base Flood Elevations have been determined; flood depths range from 1 to 3 feet.

Zone AO: Special Flood Hazard Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone.

Zone V: Coastal flood with velocity hazard (wave action); Base Flood Elevations have not been determined.

Zone VE: An area inundated by 1% annual chance flooding with a velocity hazard (wave action); Base Flood Elevations have been determined.

The second source of flooding information was discussions with local officials. The Locally Identified Areas of Flooding below were identified by Town 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 May 8," Locally Identified Hazard Areas".

Additional information of flood hazard areas was taken from the Town of Hanover Open Space and Recreation Plan 2008-2012. The section on flood hazard areas is reproduced below.

> "The most recent available Flood Insurance Rate Maps (FIRM) are from 1982 for the Town of Hanover. FIRM maps show the areas subject to flooding in town and they designate zones of flooding including information on the probable depth of maximum high water in the floodways.
>
> Because of Hanover's extensive river and tributary system, many flood hazard areas are spread throughout the town. All of the streams and brooks which are part of the Drinkwater River system have areas of potential flood hazard. On the west side of Hanover the Shingle Mill Brook, Cushing Brook, Ben Mann Brook, and the Torrey Brook present limited flood hazard as well as larger open wetland or swamp areas. Flooding from the Longwater Brook and French Stream is more confined to areas directly adjacent to the banks of the waterways. The Drinkwater river is also fed by Pine Island Swamp, Peg Swamp, Hell Swamp and Wampum Swamp, as well as an unnamed wetlands north of Route 139 between Plain Street and Grove Street and an area behind Cedar School, all of which are marked as areas of 100-year flood hazard. The last areas of flood hazard associated with the Drinkwater River system is a section of Beach Hill swamp on the western boundary of Town.
>
> Flood hazards associated with Third Herring Brook and the Indian Head River drainage areas are more limited than the Drinkwater river system. Molly Brook and Silver Brook drain into the Third Herring Brook with few areas of expansive flood hazard. The most notable exception is Old Pond Meadows along Third Herring Brook; however, the majority of this wetland is in the border town of Norwell. Iron Mine Brook, part of the Indian Head River Drainage area, has several wetland and swamp areas which present 100-year flood hazard. These wetland areas are located to the west of Route 53 between Hanover Street and Silver Street and surrounding the former cranberry bogs downstream. Other flood areas along the Indian Head River are limited, aside from a few small unnamed streams which could potentially flood areas where water drains into the Indian Head River. The last area marked on the FIRM and Floodway maps, below the Curtis Crossing Dam forming the headwaters of the North River, shows a wetland area subject to flooding in the southeast corner of Hanover.
>
> It should also be noted that there are a few wetland areas in Hanover which do not appear on the FIRM maps. The USGS topographic quadrangles which include Hanover show a wetland area between Colonial Drive and Main Street in the center of Hanover, a small wetland area northeast of the intersection of Whiting, Cedar and Pleasant streets, and an area equidistant between Forge Pond and the town line between Rockland and Hanover. Four other small wetland areas which are not included on the FIRM or Floodway maps are an area west of Bardin Street, an area northeast of the intersection of Center Street and Old Cross Street, an area south of Route 139 and west of Tindale Way, and an area north of the intersection of Grove Street and Main Street."

Additionally, the section of the open space and recreation plan that discusses environmental challenges addresses chronic flooding. The plan notes that Hanover drains to a river network in the western portion of town which then drains toward the North River. This results in two different types of flooding. The first type is major river flooding along the Drinkwater River and Forge Pond which occurs about every 25 years. The other is localized flooding where drainage networks empty into smaller rivers and streams and ditches. The problem is made worse by the dumping of yard waste which is a major factor in causing localized neighborhood flooding.

Locally Identified Areas of Flooding

1. Pleasant and Circuit Streets – These two streets can go under water. During storm events, the water flows rapidly and backs up at the culvert. Some of the homes on Brooks Circle are impacted, as are businesses. The homes in this area are on slabs so there is no basement flooding. The area does have groundwater issues. This area was heavily impacted during the storm of March 2010. The flooding here is also due to the overflow of the river. Flooding has resulted in a few failed septic systems. Although the culvert is undersized, the DPW does not believe that enlarging the culvert is needed.

2. King Street Bridge – The King Street Bridge is a bottleneck. Flooding here is related to the brook. This area is impacted by water draining from Rockland. There is a dam right after the bridge. Forge Pond rises quickly and the roadway can flood with 12-14 inches of water. Businesses on Industrial Way are impacted. The town has considered widening the channel but this would just push the problem further downstream. Forge Pond Dam needs to have work done and the town has completed a Phase I assessment.

3. CVS Plaza – The CVS and the stores behind it are impacted. The other businesses are at a lower elevation than the CVS. The issue is caused by street drainage when there is an intense storm (i.e. 4 inches of rain in an hour). However, this area is on a state highway and therefore it is unlikely to change. There is a day care center in the strip mall which floods.

4. King Street - King Street is subject to flooding which can cause access problems for residences. Depending on the severity of the storm, the road can be closed for 2-3 days. This has occurred approximately 4 times in the last 20 years.

Repetitive Loss Structures – There are no repetitive loss structures in Hanover.

Based on the record of previous occurrences flooding events in Hanover are a High frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in five years, or a greater than 20% chance per year.

Dam Failure

Dam failure can occur as a result of structural failure, independent of a hazard event, or as the result of a hazard event such as flooding associated with storms or an earthquake.

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. That said, Hanover has not experienced dam failure or the impacts from a dam failure.

A review with Town staff and information available from the Department of Conservation and Recreation (DCR) was used to identify dams in Hanover. DCR assesses the dams using the three hazard classifications below:

- 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 Hazards: 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.

The Town of Hanover owns four dams. These are:

Hackett's Pond Dam – This dam was recently rehabilitated using town funds.

The Forge Pond Dam – The Forge Pond Dam is slated for repairs but the work has not yet begun. There are trees growing out of the dam. The town recently completed a Phase I assessment of this dam.

Factory Pond Dam – In 2013 the Department of Conservation and Recreation ordered the town to repair or remove this dam due to significant structural defects including cracks in the concrete spillway walls, erosion, seepage and vegetation.

Curtis Crossing Dam - Curtis Crossing is an earth embankment and concrete/stone masonry structure that impounds the Indian Head River and Indian Head Reservoir. The structure is classified as an intermediate dam with a low hazard potential. The dam is in poor condition. An inspection and evaluation report was prepared in 2006 which noted a number of deficiencies. The report recommended design repairs and the development of a new operations and maintenance plan consistent with the new design features of the dam. There is no Emergency Action Plan for the dam because it is classified as having a low hazard potential.

There is an additional dam (the Peterson Pond Dam) which is owned by the Hanover Mall and is located on Third Herring Brook. It is an old earthen dam and if it were to fail, would probably flood a small bridge on Mill Street that leads into Norwell. If this bridge was flooded it would block access in and out of Norwell. At this point, the dam serves no purpose and should be considered for removal.

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 100 years (less than 1% per year).

Wind Related Hazards

Wind related hazards include hurricanes and tornadoes as well as high winds during severe rainstorms and thunderstorms. The typical wind speed in Hanover ranges from around 11 miles per hour to 14 over the course of the year, but independent of storm events, gusts of up to 40 mph can occur. As with many communities tree loss and falling limbs, including downed power lines, are a serious hazard in Hanover. Information on wind related hazards can be found on Map 5 in Appendix B.

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 from June to November.

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 the hurricane or tropical storm. There have been three tropical storms or hurricanes that have tracked through Hanover. There was a Category 2 hurricane which tracked through Hanover in 1991. There have also been two tropical storm tracks dated 1916 and 1923. The Town experiences the impacts of the wind and rain of hurricanes and tropical storms regardless of whether the storm track passed through the Town. The hazard mapping indicates that the 100 year wind speed is 120 miles per hour (see Map 5 in Appendix B). Hurricanes typically have regional impacts beyond their immediate tracks, and numerous hurricanes have affected the communities of eastern Massachusetts (Table 9).

Table 9 – 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, 2012

*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

Hanover is vulnerable to both the wind and rainfall that come with hurricanes. High winds can damage structures, bring down tree limbs and power lines, leading to blackouts and disruption of the transportation system and obstructions to emergency access. Rainfall associated with hurricanes can cause flooding in the town's rivers and streams, as well as localized drainage related flooding. The vulnerability analysis conducted using HAZUS-MH estimates $83.22 million in damages for a Category 2 Hurricane in Hanover, and $142.67 million for a Category 4 Hurricane. Other damages are also detailed in the analysis (see Table 18)

Based on records of previous occurrences, hurricanes in Hanover are a Medium frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard occurs from once in 5 years to once in 50 years, or a 2% to 20% chance per year.

Tornados

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:

- 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. Tornados are most common in the summer, June through August, and most form in the afternoon or evening.

Typically, there are 1 to 3 tornados in southern New England per year. The strongest tornado in Massachusetts history was the Worcester Tornado in 1953 (NESEC). The most recent tornado events in Massachusetts occurred in Springfield in June 2011 and in Revere in July 2014. The Springfield tornado caused significant damage and resulted in 4 deaths. The Revere tornado left 65 homes with substantial damages and 13 homes and businesses were uninhabitable.

Although there have been no recorded tornados within the limits of Hanover, since 1958 there have been ten tornados in Plymouth County recorded by the Tornado History Project. The strongest was a 2 on the Fujita scale and there was one fatality.

Table 10 – Tornado Records for Plymouth County

Date	Fujita	Fatalities	Injuries	Width	Length	Damage
9/7/1958	0	1	1	10	0.1	$500-$5,000
7/4/1964	1	0	0	10	2.3	$50,000-$500,000
6/9/1965	0	0	0	10	0.1	<$50,000
11/8/1967	2	0	0	17	0.1	$50-$500
8/9/1968	1	0	0	100	1	$500-$5,000
9/16/1986	1	0	0	50	0.1	$50,000-$500,000
7/10/1989	1	0	1	23	0.1	$5,000-$50,000
7/10/1989	0	0	0	23	0.1	$$5,000-$50,000
8/20/1997	0	0	0	10	0.10	$0
7/24/2012	0	0	0	15	0.03	$3,000

Another form of wind and rain related hazard is the microburst. This was mentioned at the public meeting on March 26, 2015 as a type of event which is rare and unpredictable but which is capable of causing extensive damage within a small area.

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 tornados 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

Source: Massachusetts State Hazard Mitigation Plan, 2010

Given their unpredictable track, tornados are a potential town-wide hazard in Hanover although the impact of any one event is typically limited to a particular area. Generally the town center area and the commercial corridor along Route 53 in the eastern portion of the town are more densely developed and would likely be subject to more damage in the event of a tornado. There have been no recorded tornados in Hanover, so there is no historical data with which to document damages.

Buildings constructed prior to current building codes may be more vulnerable to damages caused by tornadoes. Evacuation of impacted areas 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. Key routes may be blocked by downed trees and other debris, and widespread power outages are also typically associated with tornadoes.

Based on the record of previous occurrences since 1958, tornado events in Plymouth County would be 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.

Nor'easters

A northeast coastal storm, known as a nor'easter, is typically a large counter-clockwise wind circulation around a low-pressure center. Featuring strong northeasterly winds blowing in from the ocean over coastal areas, nor'easters are relatively common in the winter months in New England occurring one to two times a year. 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. These storms are accompanied by heavy rains or snows, depending on temperatures.

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/ oreaster

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

Many of the historic flood events identified in the previous section were precipitated by nor'easters, including the "Perfect Storm" event in 1991. More recently, blizzards in December 2010, October 2011, and February 2013 were large nor'easters that caused significant snowfall amounts.

The town of Hanover 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. Fallen limbs as well as heavy snow accumulation and intense rainfall can impede local transportation corridors, and block access for emergency vehicles.

The entire Town of Hanover could be at risk from the wind, rain or snow impacts from a nor'easter, depending on the track and radius of the storm, but due to its inland location the town has limited exposure to coastal hazards. Although not a coastal community subject to wave action (e.g., there are no V Zones), the North River in the southeast part of town is a tidal river which can be affected by coastal flooding where wind and tide leads to flooding along tidal waterways.

Based on the record of previous occurrences, nor'easters in Hanover 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).

Severe Thunderstorms

While less severe than the other types of storms discussed, thunderstorms and microbursts can lead to localized damage and represent a hazard risk for communities. A thunderstorm typically features lightning, strong winds, and rain and/or hail. Thunderstorms sometime give rise to tornados. On average, these storms are only around 15 miles in diameter and last for about 30 minutes. A severe thunderstorm can include winds of close to 60 mph and rain sufficient to produce flooding.

The best available data on previous occurrences of thunderstorms in Hanover is for Plymouth County through the National Climatic Data Center (NCDC). Between n the years 1995 and 2014 NCDC records show 77 thunderstorm events in Plymouth County (Table 11). These storms resulted in a total of $4.8 million in property damages. There was one death and 62 injuries reported.

Table 11-- Plymouth County Thunderstorm Events, 1995-2016

DATE	MAGNITUDE	DEATHS	INJURIES	DAMAGE
4/4/1995	0	0	0	-
9/14/1995	0	0	0	-
5/21/1996	90	0	60	4,000,000

6/22/1997	90	1	0	-
6/22/1997	50	0	0	-
7/18/1997	50	0	0	-
8/22/1997	50	0	0	-
6/26/1998	50	0	0	-
7/20/1998	50	0	0	-
7/2/1999	50	0	0	-
7/6/1999	60	0	0	-
7/25/1999	50	0	0	-
4/9/2000	50	0	0	-
6/2/2000	50	0	0	-
6/27/2000	50	0	0	-
7/18/2000	50	0	0	-
8/10/2000	50	0	0	-
7/15/2002	50	0	0	5,000
7/23/2002	50	0	0	1,000
8/2/2003	52	0	0	15,000
8/13/2003	50	0	0	10,000
8/16/2003	50	0	0	15,000
8/21/2004	50	0	0	5,000
8/5/2005	50	0	0	5,000
8/5/2005	50	0	0	20,000
8/14/2005	50	0	0	65,000
5/21/2006	50	0	0	50,000
6/20/2006	50	0	0	5,000
6/23/2006	50	0	0	5,000
7/21/2006	50	0	0	5,000
7/28/2006	50	0	0	10,000
8/2/2006	50	0	0	85,000
8/20/2006	50	0	0	5,000
6/1/2007	64	0	0	-
7/6/2007	50	0	0	-
7/29/2007	50	0	0	-
8/18/2007	50	0	0	-
10/19/2007	50	0	0	-
3/5/2008	50	0	0	2,000
8/16/2008	50	0	0	20,000
8/19/2008	50	0	0	32,000
9/9/2008	50	0	0	11,000
5/24/2009	50	0	0	1,000
7/31/2009	50	0	0	5,000

8/5/2009	50	0	0	1,500
4/22/2010	50	0	0	25,000
6/20/2010	59	0	2	50,000
6/27/2010	50	0	0	500
8/5/2010	50	0	0	15,000
7/13/2011	50	0	0	15,000
7/18/2011	50	0	0	45,000
7/23/2011	50	0	0	96,000
6/23/2012	50	0	0	35,000
7/1/2012	50	0	0	10,000
7/18/2012	50	0	0	25,000
8/10/2012	50	0	0	15,500
10/30/2012	88	0	0	125,000
6/17/2013	50	0	0	3,000
7/20/2013	50	0	0	10,000
TOTAL		**1**	**62**	**$4,848,500**

Source: NOAA, National Climatic Data Center Magnitude refers to maximum wind speed.

Severe thunderstorms are a town-wide hazard for Hanover. The Town 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, as well as obstruction of key routes and emergency access. 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 Hanover 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, including heavy snow, blizzards, and ice 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.

A blizzard is a winter snow storm with sustained or frequent wind gusts to 35 mph or more, accompanied by falling or blowing snow reducing visibility to or below ¼ mile. These conditions must be the predominant condition over a 3 hour period. Extremely cold temperatures are often associated with blizzard conditions, but are not a formal part of the definition. The hazard created by the combination of snow, wind and low visibility significantly increases, however, with temperatures below 20 degrees.

Winter storms are a combination hazard because they often involve wind, ice and heavy snow fall. The National Weather Service defines "heavy snow fall" as an event

generating at least 4 inches of snowfall within a 12 hour period. Winter storms are often associated with a Nor'easter, a large counter-clockwise wind circulation around a low-pressure center often resulting in heavy snow, winds and rain.

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. Until the cumulative storms of the winter of 2015, the most significant winter storm in recent history was the "Blizzard of 1978, " which resulted in over3 feet of snow and multiple day closures of roadways, businesses, and schools. Historically, severe winter storms have occurred in the following years:

Table 12: Severe Winter Storm Records for Massachusetts	
Storm	**Date**
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
Blizzards of 2015	January and February 2015

The winter of 2015 began with Winter Storm Juno on January 26-27 followed by three more major storms over a six week period. The end result was that on March 15, 2015 the recorded snowfall in Boston stood at 108.6 inches, the snowiest winter on record.

The impacts were felt in Hanover. Town staff had to assist with snow removal on the roofs of the High School and the Cedar School. The National Guard was called in to help shovel out hydrants and many private businesses and homeowners had to deal with snow removal on their roofs, roof collapses and ice dams. Falling snow and snow removal activities also resulted in damage to gas meters.

The Town of Hanover does not keep local records of heavy snow events. Data for Plymouth County, which includes Hanover, is the best available data to help understand previous occurrences and impacts of winter storms. According to the National Climate Data Center (NCDC) records, from 1996 to 2015 Plymouth Count experienced 51 heavy snowfall events, resulting in no deaths or injuries and $675,000 in property damage.

Table 13: Heavy Snow Events and Impacts in Plymouth County

DATE	TYPE	DEATHS	INJURIES	DAMAGE
1/2/1996	Heavy Snow	0	0	0
1/7/1996	Heavy Snow	0	0	4,300,000
1/10/1996	Heavy Snow	0	0	0
2/2/1996	Heavy Snow	0	0	0
2/16/1996	Heavy Snow	0	0	0
3/2/1996	Heavy Snow	0	0	0
3/2/1996	Heavy Snow	0	0	0
3/7/1996	Heavy Snow	0	0	0
4/9/1996	Heavy Snow	0	0	0
1/11/1997	Heavy Snow	0	0	0
2/16/1997	Heavy Snow	0	0	0
3/31/1997	Heavy Snow	0	0	0
4/1/1997	Heavy Snow	0	0	2,500,000
12/24/1998	Heavy Snow	0	0	0
1/14/1999	Heavy Snow	0	0	0
2/25/1999	Heavy Snow	0	0	0
3/15/1999	Heavy Snow	0	0	0
1/13/2000	Heavy Snow	0	0	0
1/20/2000	Heavy Snow	0	0	0
2/18/2000	Heavy Snow	0	0	0
1/20/2001	Heavy Snow	0	0	0
3/5/2001	Heavy Snow	0	0	0
3/26/2001	Heavy Snow	0	0	0
12/5/2002	Heavy Snow	0	0	0
3/16/2004	Heavy Snow	0	0	0

2/24/2005	Heavy Snow	0	0	0
12/13/2007	Heavy Snow	0	0	0
12/16/2007	Heavy Snow	0	0	0
1/27/2008	Heavy Snow	0	0	0
12/19/2008	Heavy Snow	0	0	5000
12/19/2008	Heavy Snow	0	0	3000
12/31/2008	Heavy Snow	0	0	0
1/18/2009	Heavy Snow	0	0	0
1/19/2009	Heavy Snow	0	0	0
2/3/2009	Heavy Snow	0	0	0
3/2/2009	Heavy Snow	0	0	0
12/19/2009	Heavy Snow	0	0	0
12/20/2010	Heavy Snow	0	0	0
1/12/2011	Heavy Snow	0	0	0
1/26/2011	Heavy Snow	0	0	0
1/21/2012	Heavy Snow	0	0	0
2/8/2013	Heavy Snow	0	0	0
3/7/2013	Heavy Snow	0	0	0
1/2/2014	Heavy Snow	0	0	0
1/21/2014	Heavy Snow	0	0	0
2/5/2014	Heavy Snow	0	0	0
2/15/2014	Heavy Snow	0	0	5000
2/15/2014	Heavy Snow	0	0	10000
1/26/2015	Heavy Snow	0	0	0
2/2/2015	Heavy Snow	0	0	0
2/8/2015	Heavy Snow	0	0	0
2/14/2015	Heavy Snow	0	0	0
3/5/2015	Heavy Snow	0	0	0
TOTAL		**0**	**0**	**$ 6,823,000**

Source: NOAA, National Climatic Data Center

Winter storms are a town-wide hazard in Hanover. Map 6 in Appendix B displays areas of average annual snowfall, which is in the range of 36.1-48 inches throughout the Town.

The impacts of winter storms are most significant on the transportation system. The Town must ensure that major roads remain passable and some storms may trigger local parking bans or local and statewide travel bans on major highways.

The Town's overall vulnerability to winter storms is primarily related to restrictions on travel on roadways, temporary road closures, school closures, and potential restrictions on emergency vehicle access. The area most heavily impacted would be the Route 53

corridor in the eastern part of town. Other vulnerabilities include power outages due to fallen trees and utility lines, and damage to structures due to heavy snow loads.

Based on the record of previous occurrences, winter storm events in Hanover 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).

Ice Storms

The ice storm category covers a range of different weather phenomena that collectively involve rain or snow being converted to ice in the lower atmosphere leading to potentially hazardous conditions on the ground. Hail size typically refers to the diameter of the hailstones. Warnings and reports may report hail size through comparisons with real-world objects that correspond to certain diameters:

Description	Diameter (inches)
Pea	0.25
Marble or Mothball	0.50
Penny or Dime	0.75
Nickel	0.88
Quarter	1.00
Half Dollar	1.25
Walnut or Ping Pong Ball	1.50
Golf ball	1.75
Hen's Egg	2.00
Tennis Ball	2.50
Baseball	2.75
Tea Cup	3.00
Grapefruit	4.00
Softball	4.50

While ice pellets and sleet are examples of these, the greatest hazard is created by freezing rain conditions, which is rain that freezes on contact with hard surfaces leading to a layer of ice on roads, walkways, trees, and other surfaces. The conditions created by freezing rain includes making driving particularly dangerous and emergency response more difficult.

Town-specific data for previous ice storm occurrences are not collected by the Town of Hanover. The best available local data is county level data through the National Climatic Data Center (NCDC). The NCDC does not have any occurrences of ice storms on record for Plymouth County. The closest recorded ice storms are for adjacent Middlesex County, which has four ice storms on record (see Table 14). No deaths or injuries were reported and the total reported property damage in the county was $3.1 million dollars.

NCDC records also include 37 hail events for Plymouth County from 1995 to 2014, with total damages recorded of $45,500.

Table 14 Middlesex County Ice Storm Events, 1998 –2008

BEGIN_DATE	EVENT_TYPE	DEATHS	INJURIES	DAMAGE
1/9/1998	Ice Storm	0	0	5,000
11/16/2002	Ice Storm	0	0	150,000
12/11/2008	Ice Storm	0	0	3,000,000
TOTAL		0	0	**3,155,000**

Source: NOAA, National Climatic Data Center.

Ice storms are a potential town-wide hazard in Hanover. The town's potential vulnerability to ice storms is principally related to ice accumulation on roadways, tree limbs and power lines. The weight of ice can cause tree limbs to fall which can in turn cause property damage and potential injuries, as well as obstructions to transportation corridors and access by emergency vehicles. In Hanover the area most vulnerable to this would be the heavily travelled Route 53 corridor in the eastern part of town. Fallen limbs and the weight of ice can also bring down power lines, causing localized power losses and posing potential injury hazards.

Ice storms in Massachusetts are considered to be high frequency events state-wide by the Massachusetts State Hazard Mitigation Plan, 2013. This hazard occurs more than once in ten years, with a greater than10 percent chance of occurring each year. However due to their lower occurrence in Hanover, locally they estimated to be medium frequency events that occur from once in 5 years to once in 50 years (2% to 20% per year).

Geologic Hazards

Geologic hazards include earthquakes, landslides, sinkholes, subsidence, and unstable soils such as fill, peat and clay. Although new construction under the most recent building codes will generally 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 in 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).

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:

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	

According to the State Hazard Mitigation Plan, New England experiences an average of five earthquakes per year. From 1668 to 1989, 355 earthquakes were recorded in Massachusetts (NESEC). Most have originated from the La Malbaie fault in Quebec or from the Cape Anne fault located off the coast of Rockport. The region has experienced larger earthquakes, including a magnitude 5.0 earthquake in 1727 and a 6.0 earthquake that struck in 1755 off the coast of Cape Anne. More recently, a pair of damaging earthquakes occurred near Ossipee, NH in 1940, and a 4.0 earthquake centered in Hollis, Maine in October 2012 was felt in the Boston area. Historical records of some of the more significant earthquakes in the region are shown in Table 15.

Table 15: Historical Earthquakes in Massachusetts or Surrounding Area, 1727-2013

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

Table 15: Historical Earthquakes in Massachusetts or Surrounding Area, 1727-2013

Location	Date	Magnitude*
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
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

There have been no recorded earthquake epicenters in Hanover. Information on earthquakes is included on Map 4 in Appendix B. Historical records of some of the more significant earthquakes in the region are shown in Table 13.

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.

Earthquakes are a potential town-wide hazard in Hanover. The Town has a mix of older buildings and newer buildings, some of which may have been built to higher seismic standards due to changes in the building codes. Potential earthquake damages in Hanover have been estimated using HAZUS-MH. Total damages are estimated at $246.46 million for a 5.0 magnitude earthquake and $1,195.75 million for a 7.0 magnitude earthquake. Other potential impacts are detailed in Table 19.

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 2013 classifies earthquakes as “very low” frequency events that occur less frequently than once in 100 years, or a less than 1% chance 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 or ocean waves over steepened slope; rock and soil slopes weakened through saturation by snow melt of heavy rains; earthquakes that 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.

There is no universally accepted measure of landslide extent but it has been represented as a measure of the destructiveness of a landslide. Table 15 represents the estimated intensity of a range of landslides. For a given landslide volume, fast moving rockfalls have the highest intensity while slow moving landslides have the lowest intensity. According to State data, the entire Town is classified as having a low risk for landslides.

Although potentially a town-wide hazard, there have been no landslides in Hanover. Should a landslide occur in the future, the type and degree of impacts would be highly localized, and the town's vulnerabilities could include damage to structures, damage to transportation and other infrastructure, and localized road closures. Injuries and casualties, while possible, would be unlikely given the low probability of this hazard.

Based on past occurrences as defined by the Massachusetts Hazard Mitigation Plan 2013, landslides are of Low Frequency events that can occur once in 50 to100 years (a 1% to 2% chance of occurring each year).

Table 16. Landslide Intensity

Estimated Volume (m^3)	**Expected Landslide Velocity**		
	Fast moving landslide (Rock fall)	Rapid moving landslide (Debris flow)	Slow moving landslide (Slide)
<0.001	Slight intensity		
<0.5	Medium intensity		
>0.5	High intensity		
<500	High intensity	Slight intensity	
500-10,000	High intensity	Medium intensity	Slight intensity
10,000 – 50,000	Very high intensity	High intensity	Medium intensity
>500,000		Very high intensity	High intensity
>>500,000			Very high intensity

Source: *A Geomorphological Approach to the Estimation of Landslide Hazards and Risks in Umbria, Central Italy*, M. Cardinali et al, 2002

Fire Related Hazards-Brush Fires

A brush fire is an uncontrolled fire occurring in a forested or grassland area. In the Boston Metro region these fires rarely grow to the size of a wildfire as seen more typically in the western U.S. As their name implies, these fires typically burn no more than the underbrush of a forested area. There are three different classes of wild fires:

- Surface fires are the most common type and burn along the floor of a forest, moving slowly and killing or damaging trees;
- Ground fires are usually started by lightning and burn on or below the forest floor;
- Crown fires spread rapidly by wind, jumping along the tops of trees.

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.

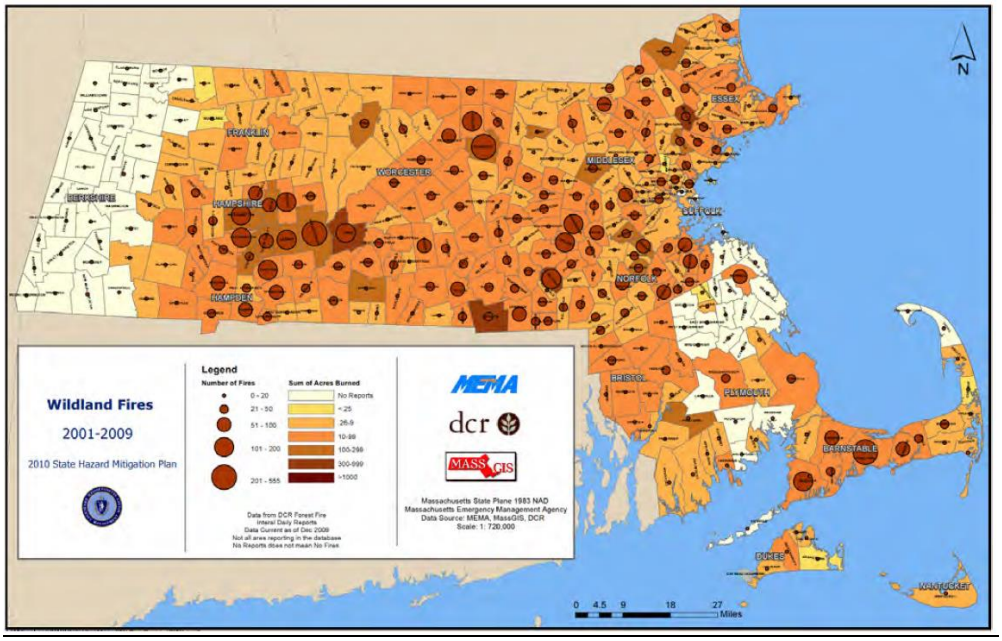
A wildfire differs greatly from other fires by its extensive size, the speed at which it can spread out from its original source, its potential to unexpectedly change direction, and its ability to jump gaps such as roads, rivers and fire breaks.

These fires present a hazard where there is the potential for them to spread into developed or inhabited areas, particularly residential areas where sufficient fuel materials might exist to allow the fire to spread to homes. Protecting structures from fire poses special problems, and can stretch firefighting resources to the limit.

If heavy rains follow a fire, other natural disasters can occur, including landslides, mudflows, and floods. If the wild fire destroys the ground cover, then erosion becomes one of several potential problems.

Wildfires in Massachusetts are measured by the number of fires and the sum of acres burned. The most recent data available for wildfires in Massachusetts, shown below in Figure 2 below, indicates that the wildfire extent in Hanover consists of 0-20 fires and no reported acreage burned for the period from 2001 to 2009.

Figure 2. MA Wildfires 2001-2009



Source: Massachusetts State Hazard Mitigation Plan 2013

The Hanover Fire Department responded to 10 natural vegetation fires, 5 forest, woods or wildland fires, 7 brush, or brush and grass mixture fires and 1 grass fire between July 1, 2012 and June 30, 2013. The Town considers all fires to be a serious natural hazard.

Because the entire town is classified as urban/wildlands interface, any wooded area presents the possibility of a rapidly developing fire. Even the swamps can burn. The Fire Chief has also identified larger tracts of wooded land in Rockland where fires could start and spread into Hanover. The town relies heavily on mutual aid to fight these fires. Discarded cigarettes are the most common cause of fires. The town needs fire-fighting equipment that is small enough to access walking trails and the town would like to buy a smaller truck.

Potential vulnerabilities to wildfire include injuries and loss of human life, damage to structures and other improvements, and impacts on natural resources. Given the immediate response times to reported wildfires in Hanover, the likelihood of injuries and casualties is minimal. None have been recorded in the past. Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

Based on past occurrences and the Massachusetts Hazard Mitigation Plan 2013, brushfires are of Medium frequency, events that can occur from once in 5 years to once in 50 years (2% to 20% probability per year).

Extreme Temperatures

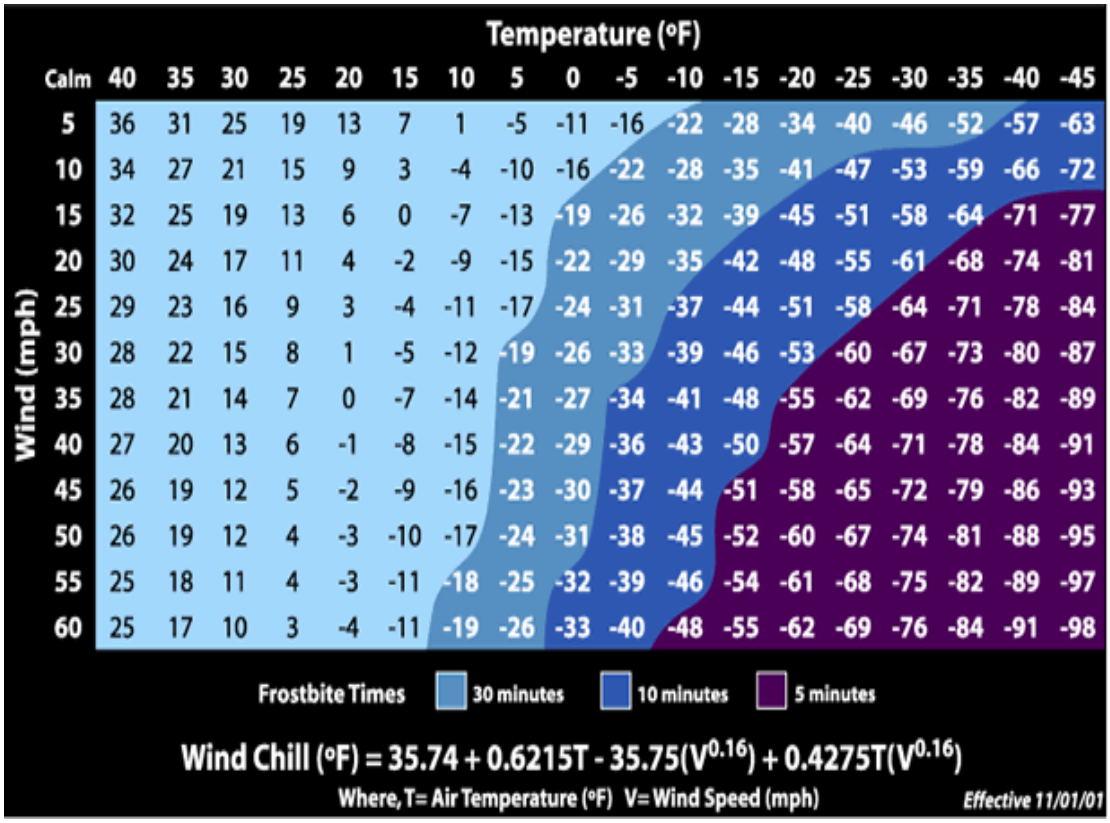
Extreme temperatures occur when either high temperature or low temperatures relative to average local temperatures occur. These can occur for brief periods of time and be acute, or they can occur over long periods of time where there is a prolonged period of excessively hot or cold weather.

Hanover 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 seasonal ranges for Massachusetts. The average temperatures for Massachusetts are: winter (Dec-Feb) Average = 31.8°F and summer (Jun-Aug) Average = 71°F. Extreme temperatures are a town-wide hazard.

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 3 below.

Figure 3 - Wind Chill Temperature Index and Frostbit Risk



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

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. The greatest vulnerability to the town would be a power outage during a winter storm, which could temporarily leave many residents without heat.

The Town of Hanover does not collect data for previous occurrences of extreme cold. The best available local data are for Plymouth County, through the National Climatic Data Center (NCDC). There is one extreme cold event on record in February 2015, which caused no deaths, injuries or property damage (see Table 16).

Table 17 – Plymouth County Extreme Cold and Wind Chill Occurrences

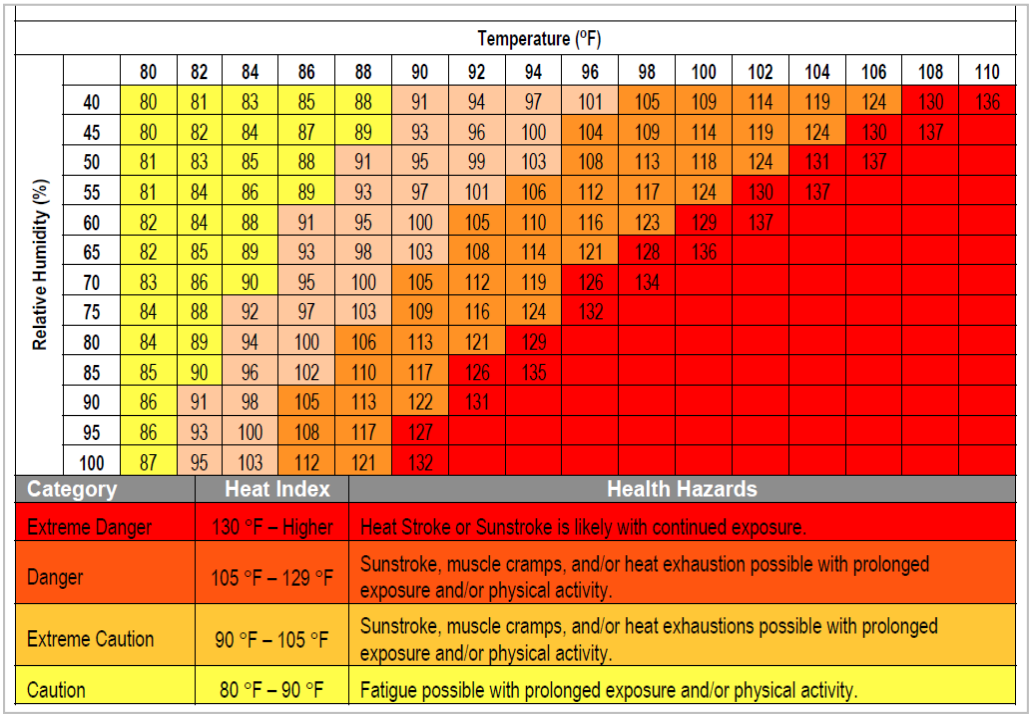
Date	Type	Deaths	Injuries	Property Damage
02/15/2015	Extreme Cold/wind Chill	0	0	0.00K

Source: NOAA, National Climatic Data Center

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 4) 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 above105 degree F.

Figure 4 Heat Index Chart



Relative Humidity (%) \ Temperature (°F)	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.

Extreme heat poses a potentially greater risk to vulnerable populations, including the elderly, children, and people with certain medical conditions, such as heart disease. In Hanover, 22.6 percent of the population is under the age of 14, and 13.4 percent are over 65. However, even young and healthy individuals can succumb to heat if they participate in strenuous physical activities during hot weather. Hot summer days can also worsen air pollution. With increased extreme heat, urban areas of the Northeast are likely to experience more days that fail to meet air quality standards.

The Town of Hanover does not collect data on excessive heat occurrences. The best available local data are for Plymouth County, through the National Climatic Data Center. There is one extreme heat event on record in July 2011, which caused no deaths, injuries or property damage (see Table 16).

Table 18 – Plymouth County Extreme Heat Occurrences

DATE	LOCATION	DEATHS	INJURIES	DAMAGE
07/22/2011	EASTERN PLYMOUTH	0	0	0
TOTAL		**0**	**0**	**0**

Source: NOAA, National Climatic Data Center

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.

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). This is considered the drought of record in Massachusetts.

Average annual precipitation in Massachusetts is 44 inches per year, with approximately 3 to 4 inch average amounts for each month of the 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 (1965), the statewide precipitation total of 30 inches was 68 percent of average.

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. Hanover is located in the Southeast Region. In Hanover drought is a potential town-wide hazard.

Five levels of drought have been developed to characterize drought severity: Normal, Advisory, Watch, Warning, and 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. Drought levels are declared on a regional basis for each of six regions in Massachusetts. County by county or watershed-specific determinations may also be made.

A determination of drought level is based on seven indices:

1. Standardized Precipitation Index (SPI) reflects soil moisture and precipitation.
2. Crop Moisture Index: (CMI) reflects soil moisture conditions for agriculture.
3. Keetch Byram Drought Index (KBDI) is designed for fire potential assessment.
4. Precipitation Index is a comparison of measured precipitation amounts to historic normal precipitation.
5. The Groundwater Level Index is based on the number of consecutive month's groundwater levels are below normal (lowest 25% of period of record).
6. 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).
7. The Reservoir Index is based on the water levels of small, medium and large index reservoirs across the state, relative to normal conditions for each month.

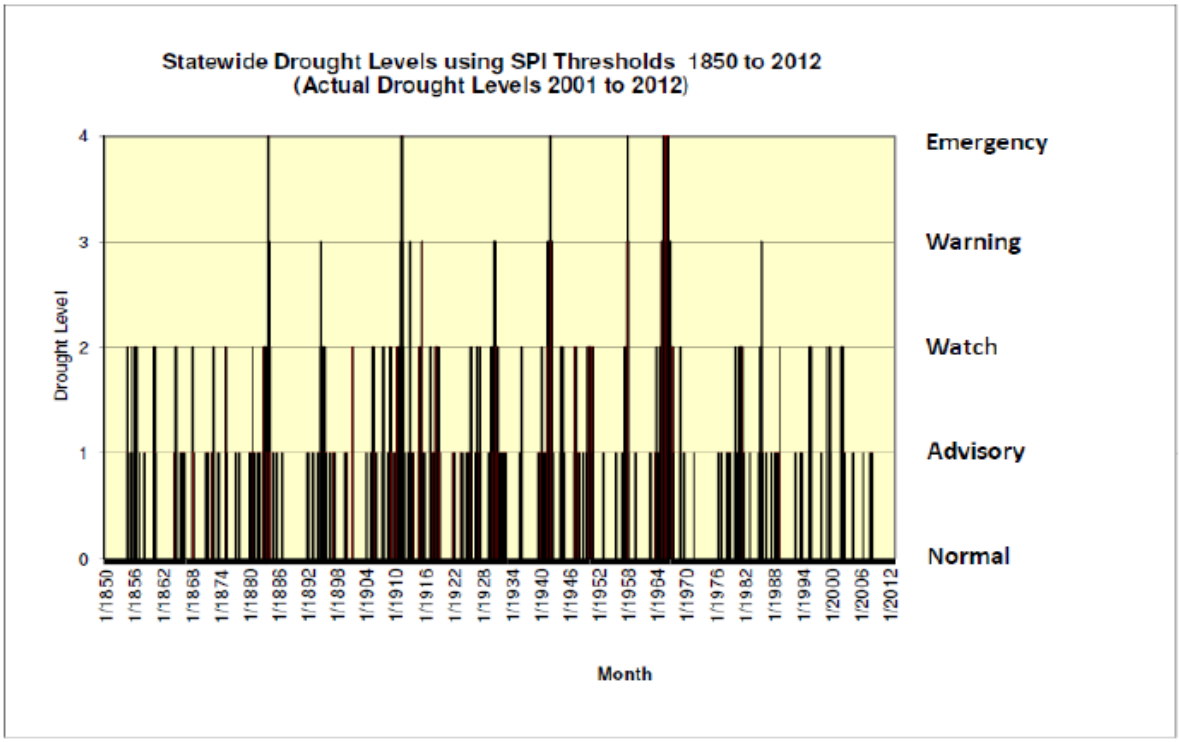
Determinations regarding the end of a drought or reduction of the drought level focus on two key drought indicators: precipitation and groundwater levels. These two factors have the greatest long-term impact on stream flow, water supply, reservoir levels, soil moisture and potential for forest fires.

Previous Occurrences

The town of Hanover does not collect data relative to drought events. Because drought tends to be a regional natural hazard, this plan references state data as the best available data for drought. The statewide scale is a composite of six regions of the state. Regional composite precipitation values are based on monthly values from six stations, and three stations in the smaller regions (Cape Cod/Islands and West).

Figure 5 depicts the incidents of drought levels' occurrence in Massachusetts from 1850 to 2012 using the Standardized Precipitation Index (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. Table 18 summarizes the chronology of major droughts since the 1920's.

Figure 5 - Statewide Drought Levels using SPI Thresholds 1850 – 2012



(Source: Mass. State Drought Management Plan 2013)

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 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 have occurred four times, 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.

Drought Watch

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

Table 19 - 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.

The town's vulnerability to drought could include impacts on water supply, agriculture, aquatic ecology, wildlife, and plant life. The town of Hanover depends on wells for its water supply, and prolonged drought could lower water tables and reduce the amount of water available from pumping wells. A severe drought could also increase the risk of wildfire on forested lands and other vegetated areas.

Probability of Future Occurrences

The state has experienced Emergency Droughts five times between 1850 and 2012. Even given that regional drought conditions may occur at a different interval than state data indicates, droughts remain primarily regional and state phenomena in Massachusetts. Emergency Drought conditions over the 162 period of record in Massachusetts are a Low Frequency natural hazard event that can occur from once in 50 years to once in 100 years (1% to 2% chance per year), as defined by the Massachusetts State Hazard Mitigation Plan, 2013.

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 20 shows the acreage and percentage of land in 33 categories. If all residential categories are aggregated, residential uses make up 33.24% of the area of the Town. (3,324.08 acres). The highest percentage use is forested land which comprises 34.77 % with 3,477.35 acres. 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.

Table 20: 2005 Land Use		
Land Use Type	**Acres**	**%**
Cropland	52.23	0.52
Pasture	72.53	0.73
Forest	3,477.35	34.77
Non-forested wetlands	334.35	3.34
Mining	0.00	0.00
Open land	32.80	0.33
Participatory recreation	103.30	1.03
Spectator recreation	0.00	0.00
Water recreation	0.0	0.00
Multi-family residential	142.53	1.43
High density residential (less than ¼ acre lots)	0.0	0.00
Medium density residential (¼ - ½ acre lots)	35.21	0.35
Low density residential (larger than ½ acre lot)	3,042.98	30.43
Very low density residential	103.36	1.03
Salt water wetlands	0.0	0.00
Commercial	387.17	3.87
Industrial	165.73	1.66
Urban open	21.10	0.21
Transportation	44.32	0.44
Waste disposal	0.0	0.00
Water	112.70	1.13
Cranberry bog	3.49	0.03
Powerlines	36.76	0.37
Saltwater sandy beach	0.00	0.00
Golf	0.0	0.00
Marina	0.00	0.00
Urban public	122.36	1.22
Cemetery	32.31	0.32
Orchard	0.0	0.00
Nursery	0.0	0.00
Forested wetlands	1,665.27	16.65
Junkyard	0.0	0.00
Brushland	13.01	0.13
Total	***10000.86***	***100.00%***

Economic Elements

Hanover is located just seventeen miles north of Plymouth and twenty-three miles southeast of Boston, with many residents commuting into the city for work. State highway Routes 3, 53, 123 and 139 traverse the northeastern corner of the Town. Route 53 is Hanover's

commercial development strip, home to the newly opened University Sports complex, and the Hanover Mall and Patriots Cinemas which are located near the junction of Route 3 and 53. The University Sports Complex is the largest indoor sports complex in New England. The complex contains eight indoor basketball courts and a large indoor turf field for football, soccer, baseball and lacrosse, as well as the Starland Sports and Fun Park. Hanover is also home to the South Shore YMCA's Emilson branch, which includes Laura's Center for the Arts, the Early Learning Center, Camp Gordon Clark and a variety of facilities including indoor and outdoor aquatic complexes, basketball courts, tennis courts, youth and adult fitness areas, a playground and more. Within the past decade Hanover's commercial strip has attracted national corporations such as Target, Wal-Mart, Dick's Sporting Goods, Five Guys and Wendy's.

Hanover continuously works to enhance its commercial and transportation infrastructure. MassDOT has recently completed the widening of Route 53 south from Route 3 and has finished the replacement of the Route 53 overpass bridge. Within FY 2015, MassDOT will begin widening Route 53 north to the Norwell line. Hanover is currently undergoing a Sustainable Waste Water Management Study along Route 53 to research the existing waste water treatment plant's capacity and the economics of developing a community waste water treatment plant to serve future economic growth along the Route 53 corridor. The town has also contracted with Vanasse Hangen Brustlin, Inc. (VHB) to extensively study the traffic operations of Route 53 in order to best plan for the continued expansion and development along Route 53 and overall growth of Hanover.

Historic, Cultural and Natural Resource Areas

The Town of Hanover is an historic New England community that was first settled in 1649 and incorporated as a Town in 1727. Before the official incorporation of the town, Hanover was a series of small villages that included Assinippi, Four Corners, Hanover Center, North Hanover, South Hanover and West Hanover. The Town's colonial economy was centered around agriculture and timber. In the 18th Century, shipbuilding and iron forging flourished along the banks of the North River. The Town of Hanover has one listing on the National Register of Historic Places and ten on the Massachusetts State Register of Historic Places. The Hanover Center Historic District, which encompasses the Town Hall, the John Curtis Free Library, the First Congregational Church, the Stetson House and the Hanover Cemetery, was listed on the National Register in 1996. Hanover has numerous open space properties including a number of water resources like rivers, streams, brooks, ponds and wetlands which provide both recreational opportunities for residents and a home for wildlife and plant species. Since 2006, Hanover has used CPA funding to purchase four open space properties, which amounts to an additional 374 acres of protected land in Hanover. Some of these properties were acquired in an effort to further the Hanover Greenway Project, which was initiated in 1999. The Hanover Greenway Project seeks to link numerous town, state and privately owned properties throughout Hanover to create a long, continuous walking trail. There are seven officially designated scenic roads throughout the town as well.

Development Trends

Hanover's predominant land use consists of housing, primarily low and moderate density. As a result of the town's zoning, the majority of the commercial land use is situated along the Route 53 corridor, which runs from north to south on the east side of town. Hanover's industrial land uses are located in the southwest corner of town, which contains the Fireworks District, where munitions were developed and tested from 1907 to 1970.

Over the last decade, Hanover has seen the redevelopment of older commercial properties, spurring new construction along the Route 53 corridor. Catering to the baby boomer population, Hanover has seen the development of three privately owned age-restricted housing communities for persons 55 years and older. Age-restricted developments are owner occupied and maintained through condo associations offering a communal atmosphere. The Hanover Affordable Housing Trust works diligently to develop affordable housing units within the community for a range of lifestyles and incomes.

Development trends throughout the metropolitan region are tracked by MAPC's Development Database, which provides an inventory of new development sites. The database tracks both completed developments and those currently under construction or planned. The database includes 7 developments in the Town of Hanover (Table 21).

The database also includes several attributes of the new development, including site acreage, housing units, and commercial space. The 7 developments in Hanover are sited on a total of 146 acres and include a total of 409 housing units, group quarters for 48 (assisted living), and 100 square feet of commercial space.

In order to characterize any change in the town's vulnerability associated with new developments, a GIS mapping analysis was conducted which overlaid the development sites with the FEMA Flood Insurance Rate Map. The analysis shows that only small portions of three of the sites are located within a flood zone.

Table 21 Summary of Hanover New Developments

DEVELOPMENTS	STATUS	ACRES	SINGLE FAMILY HOUSING	MULIT-_ FAMILY HOUSING	TOTAL HOUSING UNITS	GROUP QUARTERS	COMM (SQ FT)	PROJECT TYPE
All American Assisted Living	Completed	3.9	0	0	0	48	0	Assisted Living
Webster Village	Planned	15.4	0	0	76	0	0	40 B Residential
Kennedy Building	Planned	0	0	0	37	0	0	40B redevelopment of Kennedy Building
The Village at Seven Springs	Planned	0	0	130	130	0	0	Condos and Townhouses
Woodland Village	Planned	31.9	0	152	152	0	0	40B (in litigation)
Stable Ridge Estates	Planned	15	14	0	14	0	0	Single Family residential
Village Park	Planned	80	0	0	0	0	100	Permitted mixed use. Likely to be retail
TOTAL ALL PROJECTS		**146.2**	**14**	**282**	**409**	**48**	**100**	

Potential Future Development

MAPC consulted with Town 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 as lettered sites on Map 8, "Local Hazard Areas" and are described below

A. Stable Ridge Estates – This development has been permitted for 14 lots on 15 acres. Work on the roads will likely start in the fall of 2014.

B. Woodland Village – This 40B housing development has been in litigation for four years. If developed, it will likely consist of 200 rental units.

C. Village Park – This project was originally permitted for mixed-use and the original permit is still in place. However, it is unlikely to be developed under that permit and will most likely be a single use development such as a big box retail store. The site is 70-85 acres.

D. Village Commons/The Village at Seven Springs – This is a Planned Unit Development that will have 130 one, two and three bedroom market rate units. The project has been approved by the Planning Board, Zoning Board of Appeals and the Conservation Commission. Construction is projected to begin in the summer of 2015.

E. Webster Village – This is a 40B housing development consisting of 76 rental units. This project is expected to break ground during the 2015 construction season.

F. Merchants Row- This is a retail redevelopment opportunity which will likely include a retail component and restaurants.

G. Assisted Living – An assisted living facility has been permitted at the Hanover Mall.

H. The Kennedy Building - This is a "friendly" 40B which consists of the redevelopment of the Kennedy Building on the grounds of the Cardinal Cushing complex. It will consist of 37 affordable rental units.

I. Building 19 – The 20 acre site will most likely be redeveloped.

J. 1810 Washington Street – The town has approved a new retail center consisting of 15,000 square feet. Four buildings will be razed to facilitate redevelopment of the site.

K: The Cushing Land – This is land behind the Cardinal Cushing complex which is not being actively used as part of the school complex.

Vulnerability Assessment

The purpose of the vulnerability assessment is to estimate the extent of potential damages from natural hazards of varying types and intensities.

Future Development in Hazard Areas

Table 22 shows the relationship of these parcels to three 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 22
Relationship of Potential Development to Hazard Areas

Parcel	Landslide risk	Flood Zone	Brush Fire
A. Stable Ridge Estates	Low	NA	No
B. Woodland Village	Low	NA	No
C. Village Park	Low	26% in AE Zone	No
D. The Village at Seven Springs	Low	25% in AE Zone	No
E. Webster Village	Low	9% in A Zone	No
F. Merchant's Row	Low	NA	No
G. Assisted Living	Low	NA	Adjacent
H. Kennedy Building	Low	NA	No
I. Building 19	Low	NA	Adjacent
J. 1810 Washington Street	Low	NA	No
K. The Cushing Land	Low	10% in A Zone	No

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 23

Column 1: ID #: The first column in Table 8 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 A1-30 and 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.
>
> **Zone B and X** (shaded): Zones where the land elevation as been determined to be above the Base Flood Elevation, but below the 500 year flood elevation. These zones are not Special Flood Hazard Areas.
>
> **Zones C and X** (unshaded): Zones where the land elevation has been determined to be above both the Base Flood Elevation and 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 town 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 8: Hurricane Surge Category: The seventh 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).

Table 23 - Relationship of Critical Infrastructure to Hazard Areas

NAME	TYPE	Landslide Risk	Within FEMA Flood Zone	Within Locally Identified Flood Area	Average Annual Snow Fall	Hurricane Surge Areas
Bridge - Elm Street at Pembroke Line	Bridge	Low	No	No	36.1 - 48.0	0
Bridge - Columbia Road at Pembroke Line (state owned)	Bridge	Low	No	No	36.1 - 48.0	0
Bridge - Washington Street at Pembroke Line	Bridge	Low	No	No	36.1 - 48.0	0
Bridge - Broadway at Norwell Line	Bridge	Low	A Zone	No	36.1 - 48.0	3
Bridge - East Street at Norwell Line	Bridge	Low	A Zone	No	36.1 - 48.0	0
Bridge - Mill Street at Norwell Line	Bridge	Low	A Zone	No	36.1 - 48.0	0
Bridge - Washington Street over Route 3 (state owned)	Bridge	Low	No	No	36.1 - 48.0	0
Bridge - Pleasant Street (West Hanover)	Bridge	Low	A Zone	Pleasant and Circuit	36.1 - 48.0	0
Bridge - Circuit Street	Bridge	Low	AE Zone	No	36.1 - 48.0	0
Bridge - King Street (Forge Pond)	Bridge	Low	AE Zone	King Street Bridge	36.1 - 48.0	0
Dam - Forge Pond	Dam	Low	AE Zone	King Street Bridge	36.1 - 48.0	0
Dam - Factory Pond Dam	Dam	Low	AE Zone	No	36.1 - 48.0	0
Bridge - Broadway at Hanson Line	Bridge	Low	AE Zone	No	36.1 - 48.0	0
Dam - Curtis Crossing Dam	Dam	Low	AE Zone	No	36.1 - 48.0	2
Dam - Hackett's Pond Dam	Dam	Low	A Zone	No	36.1 -	0

Table 23 - Relationship of Critical Infrastructure to Hazard Areas

NAME	TYPE	Landslide Risk	Within FEMA Flood Zone	Within Locally Identified Flood Area	Average Annual Snow Fall	Hurricane Surge Areas
					48.0	
Pond Street Water Treatment Plant		Low	No	No	36.1 - 48.0	0
Cemetery Garage		Low	No	No	36.1 - 48.0	0
Water Distribution Garage		Low	No	No	36.1 - 48.0	0
DPW Highway Garage		Low	No	No	36.1 - 48.0	0
DPW Office		Low	No	No	36.1 - 48.0	0
Broadway Water Treatment Plant		Low	No	No	36.1 - 48.0	0
Beal Water Treatment Plant		Low	X Zone	No	36.1 - 48.0	1
Beal Well #1		Low	No	No	36.1 - 48.0	3
Beal Well #2		Low	No	No	36.1 - 48.0	3
Broadway #2 Well		Low	No	No	36.1 - 48.0	0
Broadway #1 Well		Low	No	No	36.1 - 48.0	0
Hanover St Well #1		Low	No	No	36.1 - 48.0	0
Hanover St Well #2		Low	No	No	36.1 - 48.0	0
Pond Street Well #1		Low	A Zone	No	36.1 - 48.0	0
Pond Street Well #2		Low	A Zone	No	36.1 -	0

Table 23 - Relationship of Critical Infrastructure to Hazard Areas

NAME	TYPE	Landslide Risk	Within FEMA Flood Zone	Within Locally Identified Flood Area	Average Annual Snow Fall	Hurricane Surge Areas
					48.0	
Pond Street Well #3		Low	A Zone	No	36.1 - 48.0	0
Pond Street Lime Building		Low	No	No	36.1 - 48.0	0
Pond Street Garage		Low	A Zone	No	36.1 - 48.0	0
Standpipe - Union Street Old		Low	No	No	36.1 - 48.0	0
Standpipe - Union Street New		Low	No	No	36.1 - 48.0	0
Standpipe - Walnut Hill		Low	No	No	36.1 - 48.0	0
Facility Maintenance Building		Low	No	No	36.1 - 48.0	0
Cedar School	School	Low	No	No	36.1 - 48.0	0
Hanover High School	School	Low	No	No	36.1 - 48.0	0
Hanover Middle School	School	Low	No	No	36.1 - 48.0	0
Center Elementary School	School	Low	No	No	36.1 - 48.0	0
Sylvester School	School	Low	No	No	36.1 - 48.0	0
Salmond School	School	Low	No	No	36.1 - 48.0	0
Recreation Center		Low	No	No	36.1 - 48.0	0
Fire Station #3		Low	No	Pleasant and	36.1 -	0

Table 23 - Relationship of Critical Infrastructure to Hazard Areas

NAME	TYPE	Landslide Risk	Within FEMA Flood Zone	Within Locally Identified Flood Area	Average Annual Snow Fall	Hurricane Surge Areas
				Circuit	48.0	
Fire Headquarters		Low	No	No	36.1 - 48.0	0
Town Hall		Low	No	No	36.1 - 48.0	0
John Curtis Free Library		Low	No	No	36.1 - 48.0	0
Hanover Police Headquarters		Low	No	No	36.1 - 48.0	0
Hanover Transfer Station		Low	No	No	36.1 - 48.0	0
Fire Station #2		Low	No	No	36.1 - 48.0	0
Fire Station #1		Low	No	No	36.1 - 48.0	0
South Shore Vocational School		Low	No	No	36.1 - 48.0	0
Power Substation - Water Street		Low	No	No	36.1 - 48.0	0
Power Substation - Phillips Street		Low	No	No	36.1 - 48.0	0
Cell Tower- Mayflower Drive		Low	AE Zone	No	36.1 - 48.0	0
Cell Tower - Police Station		Low	No	CVS Plaza	36.1 - 48.0	0
Cell Tower - Planet Subaru		Low	No	No	36.1 - 48.0	0
Cell Tower - Assinippi		Low	No	No	36.1 - 48.0	0
Cushing Residence		Low	No	No	36.1 -	0

Table 23 - Relationship of Critical Infrastructure to Hazard Areas

NAME	TYPE	Landslide Risk	Within FEMA Flood Zone	Within Locally Identified Flood Area	Average Annual Snow Fall	Hurricane Surge Areas
					48.0	
Roberts Animal Hospital		Low	No	No	36.1 - 48.0	0
Legion Elderly Housing		Low	No	No	36.1 - 48.0	0
St. Mary's Church		Low	No	No	36.1 - 48.0	0
Congregational Church		Low	No	No	36.1 - 48.0	0
St Andrews Church		Low	No	No	36.1 - 48.0	0
Bridge - Route 139 (state owned)	Bridge	Low	AE Zone	Pleasant and Circuit	36.1 - 48.0	0

Damage Assessments

An 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

> "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 Town of Hanover, 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 0.01% and 0.005% 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 Town, 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 more intense and frequent storms.

Table 24
Estimated Damages from Hurricanes

	100 year	500 year
Building Characteristics		
Estimated total number of buildings	4,566	4,566
Estimated total building replacement value (Year 2006 $) (Millions of Dollars)	2,141	2,141
Building Damages		
# of buildings sustaining minor damage	344	1,446
# of buildings sustaining moderate damage	31	434
# of buildings sustaining severe damage	1	60
# of buildings destroyed	0	41
# of households displaced	6	91
# of people seeking public shelter	1	18
Debris		
Building debris generated (tons)	3,546	28.042
Tree debris generated (tons)	4,296	12.84
# of truckloads to clear building debris	43	317
Value of Damages (Thousands of dollars)		
Total property damage	19,356.38	129,768
Total losses due to business interruption	646.29	12,910

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.

Table 25: Estimated Damages from Earthquakes		
	Magnitude 5.0	**Magnitude 7.0**
Building Characteristics		
Estimated total number of buildings	4,566	4,566
Estimated total building replacement value (Year 2006 $) (Millions of dollars)	2,141	2,141
Building Damages		
# of buildings sustaining slight damage	1,297	68
# of buildings sustaining moderate damage	562	693
# of buildings sustaining extensive damage	105	1,280
# of buildings completely damaged	18	2,522
Population Needs		
# of households displaced	62	2,772
# of people seeking public shelter	35	1,598
Debris		
Building debris generated (million tons)	0.04	0.50
Tree debris generated (million tons)	NA	NA
# of truckloads to clear building debris	1,520	20,120
Value of Damages (Millions of dollars)		
Total property damage	218.62	1,020.68
Total losses due to business interruption	27.84	175.07

Estimated Damages from Flooding

Methodology Used

MAPC did not use HAZUS-MH to estimate flood damages in Hanover. 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.

Hanover is 15.7 square miles or 10,048 acres. Approximately 231acres have been identified by local officials as areas of flooding. This amounts to 2.29% of the land area in Hanover. The number of structures in each flood area was estimated by applying the percentage of the total land area to the number of structures (4,566) in Hanover; the same number of structures used by HAZUS for the hurricane and earthquake calculations. HAZUS uses a value of $468,901 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 September 2002 publication, "State and Local Mitigation Planning how-to guides" (Page 4-13). The range of estimates for flood damages is $4,924,304 - $54,167,349. These calculations are not based solely on location within the floodplain or a particular type of storm (i.e. 100 year flood).

Table26: Estimated Damages from Flooding							
ID	**Flood Hazard Area**	**Approximate Area in Acres**	**% of Total Land Area**	**# of Structures**	**Replacement Value**	**Low Damage Estimate**	**High Damage Estimate**
1	Pleasant and Circuit	154	1.54%	70	$32,971,430	$3,297,143	$16,485,715
2	King Street Bridge	23	0.23%	11	$4,924,304	$492,430	$2,462,152
3	CVS Plaza	42	0.42%	19	$8,778,108	$877,810	$4,389,054
4	King Street	12	0.12%	5	$2,569,202	$256,920	$1,284,601
	Totals	231	2.30	233	$49,243,045	$4,924,304	$54,167,349

V. HAZARD MITIGATION GOALS

The Hanover Local Multiple Hazard Community Planning Team met on May 13, 2015. At that meeting, the team reviewed and discussed draft goals for the plan. This resulted in the team endorsing the following nine 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 bylaw 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 Town 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. Educate the public about natural hazards and mitigation measures that can be undertaken by property-owners.

9. Take maximum advantage of resources from FEMA and MEMA to educate town staff and the public about hazard mitigation.

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VI. HAZARD MITIGATION STRATEGY

The central component of a hazard mitigation plan is the strategy for reducing the community's vulnerabilities to natural hazard events. Responding to the analysis of risk, vulnerabilities, potential impacts, and anticipated future development, the process for developing this strategy is one of setting goals, understanding what actions the community is already taking that contribute to mitigating the effects of natural hazards and assessing where more action is needed to complement or modify existing measures. The following sections include descriptions of existing mitigation measures and descriptions of proposed new mitigation measures. All mitigation measures are evaluated by their benefits and potential costs to arrive at a prioritized list of action items.

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 (HMGP), the Pre-Disaster Mitigation program (PDM), and the Flood Mitigation Assistance (FMA) program. The three links below provide additional information on these programs.

https://www.fema.gov/hazard-mitigation-grant-program

https://www.fema.gov/pre-disaster-mitigation-grant-program

https://www.fema.gov/pre-disaster-mitigation-grant-program

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)

Existing Mitigation Measures

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 (LEPC).

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 all of the hazards discussed in this plan. The Town of Hanover has a CEMP dated November 13, 2014 which conforms to all of the state requirements.

Emergency Equipment – The Hanover Emergency Management Agency received three Federal and State grants and was able to purchase portable radio equipment, shelter supplies and office supplies to support the HEMA and LEPC.

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

The Hanover Local Emergency Planning Committee– the LEPC applied for and received full certification from the Commonwealth of Massachusetts State Emergency Response Commission. The LEPC has representation from twelve categories including Elected Local Officials, Law Enforcement, Emergency Management, Fire Service, Emergency Medical Services, Local Environmental, Hospital, Transportation, Media, Community Groups, Facilities using Extremely Hazardous Substances and Public Works. Certified LEPCs are eligible to receive grant funding to help support emergency management operations.

Existing Flooding Hazard Mitigation Measures

CEMP – The Hanover Comprehensive Emergency Management Plan contains a section on flooding. It lists seven generic mitigation measures:

- Identify areas in the community that are flood prone and define methods to minimize the risk. Review National Flood Insurance Maps.
- Disseminate emergency public information and instructions concerning flood preparedness and safety.
- Community leaders should ensure that their community is enrolled in the National Flood Insurance Program.
- Strict adherence should be paid to land use and building codes (e.g. Wetlands Protection Act) and new construction should not be built in flood-prone areas.
- Ensure that flood control works are in good operating condition at all times.
- Natural water storage areas should be preserved.
- Maintain plans for managing all flood emergency response activities including addressing potentially hazardous dams.

Town Storm Drain System- Street sweeping is done annually and is contracted out. Catch basin cleaning is also done annually. The town has identified areas that it checks in advance of a storm to ensure that the inlet screens are free of debris. Catch basin cleaning is contracted out. There are approximately 2,500 catch basins.

As sand is not used on Hanover's roads, the Town has not had a problem with clogged catch basins or stream sedimentation. Catch basins are cleaned annually.

The town experiences approximately 10-15 water main breaks annually. There is no particular pattern to these breaks and flooding is not a major issue related to the release of water. The town does have a regular program to ensure that valves and gates are operational.

Participation in the National Flood Insurance Program (NFIP) –Hanover participates in the NFIP with 56 policies in force as of April 30, 2015. FEMA maintains a database on flood insurance policies and claims. This database can be found on the FEMA website at http://www.fema.gov/business/nfip/statistics/pcstat.shtm.

The following information is provided for the Town of Hanover:

Flood insurance policies in force (as of April 30, 2015)	60
Coverage amount of flood insurance policies	$16,739,700
Premiums paid	$62,469
Total losses (all losses submitted regardless of the status)	14
Closed losses (Losses that have been paid)	10
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	4
Total payments (Total amount paid on losses)	$69,319.39

Zoning bylaw– The zoning bylaw for the Town of Hanover contains a number of provisions that mitigate flooding problems. The relevant section of the zoning bylaw is Section 6.700. These provisions include:

- Section 6.710: The Floodplain District includes all special flood hazard areas designated as Zone A, AE and AH on the Flood Insurance Rate Map.
- Section 6.720: All development must be in compliance with Chapter 131, Section 40; sections of the State Building Code which address floodplain issues, DEP Wetlands Protection Regulations, Inland Wetlands Restrictions and Title V.
- Section 6.740: Prohibits encroachments in the floodway as designated on the Flood Insurance Rate Map unless such encroachments shall not result in any increase in flood levels during the occurrence of the one hundred year flood.
- Section 6.750: Within Zone A the applicant shall obtain base flood elevation data and must prove that the building can meet elevation or flood-proofing requirements. Within Zone AH, there must be adequate drainage paths to guide floodwaters away from structures. In Zone A and AE if there is no regulatory floodway designated, the best available floodway data shall be used to prohibit encroachments that would result in increased flood levels.

Subdivision regulations – Section II C states that all proposed developments in the flood plain district shall be reviewed to determine whether they will be safe from flooding including utilities. Subdivision plans must also show base flood elevations. Section IV E addresses lot drainage and states that lots must be graded in such a way that the development of a lot will not cause detrimental drainage on another lot. Section V E contains specific requirements for drainage structures.

Appendix C references the Regulations and Standards Governing the Design/Construction of Detention Basins. These regulations mandate that the post-development runoff rate shall not exceed the pre-development runoff rate for the entire development and that runoff volume, after development, shall not cause receiving waters to experience higher flood levels due to excess runoff volume.

Existing Dam Failure Mitigation Measures

CEMP – The Hanover Comprehensive Emergency Management Plan contains a section on dam safety. It lists eight generic mitigation measures.

- Develop and conduct public education programs concerning dam hazards.
- Maintain up-to-date plans to deal with threat and actual occurrence of dam over-spill or failure.
- Emergency Management and other local government agencies should familiarize themselves with technical data and other information pertinent to the dams which impact their jurisdiction. This should include determining the probable extent and seriousness of the effect to downstream areas.
- Dams should be inspected periodically and monitored regularly.
- Repairs should be attended to promptly.

- As much as is possible burdens on faulty dams should be lessened through stream re-channeling.
- Identify dam owners.
- Determine minimum notification time for downstream areas.

Phase 1Assessments- The town recently completed a Phase I assessment of the Forge Pond Dam in order to determine what actions would be necessary to rehabilitate the dam.

Existing Wind Hazard Mitigation Measures

CEMP – The Hanover Comprehensive Emergency Management Plan contains a section on hurricanes. It lists four generic mitigation measures:

- Develop and disseminate emergency public information and instructions concerning hurricane preparedness and safety.
- Community leaders should ensure that Hanover is enrolled in the National Flood Insurance Program.
- Develop and enforce local building codes to enhance structural resistance to high winds and flooding. Build new construction in areas that are not vulnerable to direct hurricane effects.
- Maintain plans for managing all hurricane emergency response activities.

The Hanover CEMP outlines three generic mitigation measures for tornados.

- Develop and disseminate emergency public information and instructions concerning tornado safety, especially guidance regarding in-home protection and evacuation procedures, and locations of public shelters.
- Strict adherence should be paid to building code regulations for all new construction.
- Maintain plans for managing tornado response activities. Refer to the non-institutionalized, special needs and transportation resources listed in the Resource Manual.

Tree-trimming program – The town has a tree trimming program. The town does not have the equipment to grind stumps. Light brush is chipped with town owned equipment. The Town also outsources the grinding of a town-wide brush pile, typically twice a year. The Town lacks ready access to a bucket truck for tree trimming and removal of dangling limbs. Trimming is done through outsourced services as well as cooperative relationships with electric utilities.

Massachusetts State Building Code - The Town has adopted the Massachusetts State Building Code. The Massachusetts State Building Code contains detailed regulations regarding wind loads. The code's provisions are the most cost-effective mitigation measure against tornados given the extremely low probability of occurrence.

Existing Winter Storm Hazard Mitigation Measures

The Hanover CEMP outlines three generic mitigation measures for winter storms.

- Develop and disseminate emergency public information concerning winter storms, especially material which instructs individuals and families how to stock their homes, prepare their vehicles, and take care of themselves during a severe winter storm.
- Local governments should assume that winter will occur annually and budget fiscal resources with snow management in mind.
- Maintain plan for managing all winter storm emergency response activities.

Snow disposal – The Town undertakes regular plowing and snow/ice removal. Sodium chloride and liquid magnesium chloride are the two chemicals used for road treatment. The DPW works to clear roads and town owned parking lots to ensure the safe flow of traffic and emergency access for the Fire and Police Departments. Snow removal has not been a problem for the town, although extreme winters such as the winter of 2015 have required extraordinary measures to provide adequate access.

Existing Geologic Hazard Mitigation Measures

The Hanover CEMP outlines five generic mitigation measures for earthquakes.

- Community leaders in cooperation with Emergency Management Personnel should obtain local geological information and identify and assess structures and land areas that are especially vulnerable to earthquake impact and define methods to minimize the risk.
- Strict adherence should be paid to land use and earthquake resistant building codes for all new construction.
- Periodic evaluation, repair, and/or improvements should be made to older public structures.
- Emergency earthquake public information and instructions should be developed and disseminated.
- Earthquake drills should be held in schools, businesses, special care facilities, and other public gathering places.

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.

Existing Brush Fire Mitigation Measures

Subdivision/Development Review – The Fire Department participates in the review of new subdivisions and development/redevelopment projects to ensure that proper fire safety provisions are incorporated.

Brush fire equipment - Two of the four fire stations in Hanover have forest fire equipment. Station #4 (Headquarters) is home to Forest Fire Truck #2 and the North Hanover First Station (#1) is home to Forest Fire Truck #1.

Outdoor burning - Outdoor burning is regulated by the Department of Environmental Protection, which allows outdoor burning of brush, cane, forestry debris, etc. during an annual period usually from January 15th through May 1st under the supervision and control of the Fire Department. Permits are issued during the annual period each year between the hours of 9:30 a.m. and 2:00 p.m. The phone number to obtain a permit is: 781-826-7850.

The Hanover Fire Department web page has extensive information about outdoor burning permits, regulations and best practices at
http://www.hanoverfiredept.com/information/burning-permits

Local Capacity for Implementation

The Town of Hanover has recognized several existing mitigation measures that require implementation or improvements, and has the capacity within its local boards and departments to address these. The Planning Board will enforce the Floodplain District and update it as needed, as well as other Zoning provisions and Subdivision Regulations pertaining to new development. The Public Works Department will maintain and upgrade the town's stormwater management system and conduct regular street sweeping, catch basin cleaning and snow removal operations. The conservation Commission will enforce the local Wetlands Bylaw along with the state Wetlands Protection Act. The Fire Department will regulate outdoor burning and provide public education on fire safety. The Building Department will enfoce the State Building Code for new development and reconstruction projects.

Table 27- Hanover Existing Mitigation Measures			
Type of Existing Mitigation Measures	**Area Covered**	**Effectiveness/ Enforcement**	**Improvements/ Changes Needed**
MULTIPLE HAZARDS			
Comprehensive Emergency Management Plan (CEMP)	Town-wide.	Emphasis is on emergency response.	Plan is current. No changes needed at this time.
Massachusetts State Building Code	Town-wide.	Effective for new construction.	None.
The Hanover Emergency Management Agency received three Federal and State grants and was able to purchase portable radio equipment, shelter supplies and office supplies to support the HEMA and LEPC.	Town-wide.	Effective.	None.
Local Emergency Planning Committee (LEPC)	Town-wide.	A forum for cooperation on natural and manmade disasters.	The LEPC has received full certification from the Massachusetts State Emergency Response Commission.
FLOOD HAZARDS/DAMS			
Participation in the National Flood Insurance Program (NFIP)	Areas identified on FIRM maps.	There are 56 policies in force.	Encourage all eligible homeowners to obtain insurance.
Public Works Operations/Maintenance	Town-wide	Effective.	Continue with annual catch basin and street sweeping programs.
Town of Hanover Open Space and Recreation Plan 2008-2012	Town-wide.	Effective.	Plan has expired and needs to be updated.
Flood Plain District	Town-wide.	Effective.	Continue to enforce.
Flood related building restrictions.	Zoning Districts.	Effective.	Continue to enforce.
Wetland Bylaw	Town-wide.	Effective.	None.
Subdivision Rules and Regulations	Town-wide.	Effective.	None.
DCR Dam Safety Regulations	4 dams in Hanover.	Effective.	None.

Table 27- Hanover Existing Mitigation Measures			
Type of Existing Mitigation Measures	**Area Covered**	**Effectiveness/ Enforcement**	**Improvements/ Changes Needed**
Phase 1 Assessment for the Forge Pond Dam.	Forge Pond Dam and vicinity	Effective. Will be used to determine actions for dam rehabilitation.	None. Next phase would be implementation.
WIND HAZARDS			
CEMP	Town-wide.	Effective.	None.
The Massachusetts State Building Code	Town-wide.	Effective for most situations except severe storms.	None.
Tree trimming program	Town-wide.	Satisfactory.	The town lacks equipment to grind stumps and branches.
WINTER HAZARDS			
Snow Removal	Town-wide.	Effective under normal winter conditions.	None.
Snow disposal	Town-wide.	Effective under normal winter conditions.	None.
Road treatment with calcium chloride	Town-wide.	Effective.	None.
BRUSH FIRE HAZARDS			
Outdoor burning is regulated by the Dept. of Environmental Protection under the supervision of the Hanover Fire Department.	Town-wide.	Effective.	None.
Two of the four fire stations in the town have forest fire equipment.	Town-wide.	Effective.	Town lacks small vehicle for accessing hiking/walking trails
Subdivision/Development Review	Town-wide.	Effective.	None.
Public Education – The Fire Department has a web page with extensive information about outdoor burning, regulations and tips for homeowners.	Town-wide.	Effective.	None.
GEOLOGIC HAZARDS			
The Massachusetts State Building Code	Town-wide.	Effective.	None.

Proposed Hazard Mitigation Measures

Flood Hazard Mitigation Measures

A) ***Develop an education program to improve compliance with wetlands protection regulations*** - The dumping of yard waste was identified in the Hanover Open Space and Recreation Plan as a major cause of localized neighborhood flooding. According to the 2013 Town Report, the Conservation Commission investigated more than 36 complaints from residents as well as 14 additional incidents that resulted in 53 enforcement actions and violation review discussions. The Commission staff and members conducted 450 site inspections and believe that site inspections serve to educate home owners, real estate persons and others in regard to the type of resource areas on their property, yard care for proper protection and preservation of resource areas and buffer zones. The Town should develop an education program to improve compliance.

B) ***Implement the recommendations of the Forge Pond Dam Phase I assessment*** – The town needs to implement the recommendations of the Phase I assessment, which was s visual assessment of the dam. The next step will be a phase II assessment which is a little more in depth and the development of design plans and specifications to do the work. The work suggested by the Phase I assessment would preserve the integrity of the existing structure and make it less likely to breach. The town is currently in the process of doing a periodic follow-up phase I re-inspection as is required by the dam safety regulations. The remedial work is probably at least 2 years down the road and will likely be similar to work recently completed at the Factory Pond Dam with a cost of around $125,000.

C) ***Perform a hydraulic analysis of the Indian Head River Watershed –*** Perform a hydraulic analysis of Forge Pond, Factory Pond, the Indian Head River, and all relevant dams and bridges to plan for future improvements. The flooding on King Street is the result of increased stormwater runoff upstream and bottlenecks caused by the King Street Bridge and the Forge Pond Dam. The Town should perform a hydraulic analysis of the entire Indian Head River to determine the effectiveness of widening bridges and dams along the river.

D) ***Create a stormwater advisory committee*** – The creation of a stormwater committee is an additional flooding mitigation measure that the town can undertake. This committee would meet regularly to discuss issues and recommend projects to improve water quality and quantity.

E) ***Update the Open Space and Recreation Plan*** – One of the recommended mitigation measures for flooding is to develop an open space acquisition, reuse and preservation plan targeting hazard areas (F-21 Preserve Floodplains as Open Space, Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, FEMA, January 2013). The Town has an open space plan which, from the state perspective, expired in 2012. The Town should prepare an update to that plan which could also be done in conjunction with the Community Preservation Committee and an update of the master plan.

F) Create a dumping bylaw – The Town should consider passing and enforcing a bylaw that regulates dumping in streams and ditches.

Winter Storm Hazard Mitigation Measures

G) Assess options to retrofit public buildings to withstand snow loads and prevent roof collapse. This should include an analysis of school roofs to determine if any of them are particularly vulnerable.

H) Conduct winter weather risk awareness activities – This past winter the Hanover Fire Department used its web page to provide advisories about winter weather hazards such as damaged gas meters, snow removal from roofs and buried hydrants. The Town should expand its use of social media and prepare written materials on winter hazards that would be available at Town Hall and mailed to residents with tax bills.

Wind Related Hazards

I) Educate homeowners on the benefits of wind retrofits - This might include structural improvements such as shutters and hurricane clips. The Town's Building Department would be a logical place for this activity to occur.

Geologic Hazard Mitigation Measures

J) Implement seismic upgrades to the communications center – The Public Safety building should be reviewed to determine if changes are needed in order to be brought up to seismic standards. This review would help determine and address the potential for a collapse of the communications system that would impact the Town's ability to respond to emergencies after an earthquake.

Brush fire Hazard Mitigation Measures

K) Acquire a small brush truck - The Fire Department has indicated that they lack a small vehicle for accessing hiking/walking trails that could provide access into areas that are prone to brush fires. An additional piece of equipment such as a 4X4 Gator truck would add to the town's ability to fight these types of fires.

L) Installation of Dry Hydrants – Though there are many ponds and streams located throughout the Town, the Fire Department does not have easy access for their apparatus to draft water. The installation of dry hydrants at strategic locations will enhance the Department's ability to obtain water for firefighting purposes.

M) Map and maintain fire roads– Many of the trails that provided access to wooded areas have been blocked by development. Many of these trails need to have downed branches and trees removed to allow easy passage of brush trucks. Other trails are overgrown and in need of clearing. The Fire Department has indicated that an accurate mapping of useable trails is needed.

Prioritization of Mitigation Activities

The last step in developing the Town's mitigation strategy is to assign a level of priority to each mitigation measure so as to guide the focus of the Town's limited resources towards those actions with the greatest potential benefit. At this stage in the process, the Local Hazard Mitigation Committee has limited access to detailed analyses of the costs and benefits of any given measure, so prioritization is based on the committee member's knowledge of the existing and potential hazard impacts and an approximate sense of the costs associated with pursuing any given measure.

Prioritization occurred through discussion at a meeting of the local committee and through subsequent review by committee members and public comment. 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 Town's identified goals.

Through the discussion, the local committee also took 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 Town currently has the technical and administrative capability to carry out the mitigation measures, whether any environmental constraints existed, and whether the Town would be able to justify the costs relative to the anticipated benefits.

The table below demonstrates the prioritization. For each mitigation measure, the geographic extent of the benefiting area is identified as is an estimate of the overall benefit and cost of the measures. The benefits and costs were evaluated in terms of:

Benefits	
High	Action will result in a significant reduction of hazard risk to people and/or property from a hazard event.
Medium	Action will likely result in a moderate reduction of hazard risk to people and/or property from a hazard event.
Low	Action will result in a low reduction of hazard risk to people and/or property from a hazard event.
Costs	
High	Estimated costs greater than $50,000.
Medium	Estimated costs between $10,000 and $50,000.
Low	Estimated costs less than $10,000 or staff time.
Overall Priority	
High	Action very likely to have political and public support and necessary maintenance can occur following the project, and the costs seem reasonable considering likely benefits from the measure
Medium	Action may have political and public support and necessary maintenance has potential to occur following the project
Low	Not clear if action has political and public support and not certain that necessary maintenance can occur following the project

Table 28: Mitigation Measure Prioritization					
Mitigation Action	**Geographic Area**	**Benefit**	**Estimated Cost**	**Priority**	**Time Frame**
Flood Hazard Mitigation Measures					
A) Education program to improve compliance with wetlands regulations	Town-wide	High	Low	Medium	2016-2021
B) Implement recommendations of the Forge Pond Dam Phase 1 Assessment	Forge Pond Dam watershed	High	High	High	2016-2021
C) Perform a hydraulic analysis of the Indian Head River Watershed	Indian Head River watershed	High	Medium	High	2016-2018
D) Create a stormwater advisory committee	Town-wide	Medium	Low	Medium	2016-2021
E) Update the Open Space and Recreation Plan	Town-wide	Low	Low	Medium	2016-2018
F) Enact a dumping bylaw	Town-wide	Medium	Low	Low	2017-2019
Winter Storm Mitigation Measures					
G) Assess options to retrofit public buildings	Building specific	High	Medium to high	Medium	2016-2021
H) Conduct winter weather risk awareness activities	Town wide	Medium	Low	Medium	2016-2021
Wind Related Mitigation Measures					
I) Educate homeowners on the benefits of wind retrofits.	Town-wide	Low	Low	Low	2016-2021

Table 28: Mitigation Measure Prioritization					
Mitigation Action	**Geographic Area**	**Benefit**	**Estimated Cost**	**Priority**	**Time Frame**
Geologic Hazard Mitigation Measures					
J) Implement seismic upgrades to the communications center	Site specific	Medium	High	Low	2016-2021
Brush Fire Mitigation Measures					
K) Acquire a small brush truck	Town-wide	Medium	Medium	Medium	2016-2021
L) Install dry hydrants	Town-wide	Medium	Low	Medium	2017
M) Map and maintain fire roads	Town-wide	Medium	Low	Medium	2016-2021

Introduction to Potential Mitigation Measures (Table 29)

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 a meeting of the Local Hazard Planning Committee. 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.

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 for 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.

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.USnae.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.

Hazard Mitigation and Flood Mitigation Grants – This page provides information on the flood mitigation assistance grant program, the pre-disaster mitigation program and the hazard mitigation grant program.
http://www.mass.gov/eopss/agencies/mema/hazard-mitigation/grants/

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

http://www.rd.usda.gov/newsroom/news-release/usda-invites-applications-loans-fund-community-facility-projects

Abbreviations Used in Table 29

FEMA Mitigation Grants includes:
FMA = Flood Mitigation Assistance Program.
HMGP = Hazard Mitigation Grant Program.
PDM = Pre-Disaster Mitigation Program

ACOE = Army Corps of Engineers.

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

Mass DOT = Massachusetts Department of Transportation

MBTA = Massachusetts Bay Transportation Authority

DCR = MA Department of Conservation and Recreation

DHCD = MA Department of Housing and Community Development

Table 29. Potential Mitigation Measures

Mitigation Measure	Measure Type	Implementation Responsibility	Priority	Time Frame	Potential Funding Sources
Flood Hazard Mitigation Measures					
A) Education program to improve compliance with wetlands regulations	Public education and awareness	Conservation Commission	Medium	2016-2021	Town General Fund
B) Implement recommendations of the Forge Pond Dam Phase 1 Assessment	Structural	DPW	High	2016-2018	HMGP/PDM and Town General Fund
C) Perform a hydraulic analysis of the Indian Head River Watershed	Prevention	Planning/DPW	High	2016-2018	ACOE/Town General Fund/HMGP/PDM
D) Create a stormwater advisory committee	Prevention	Planning	Medium	2016-2021	Town General Fund
E) Update the Open Space and Recreation Plan	Prevention	Planning and Conservation	Medium	2016-2018	Town General Fund
F) Enact a dumping bylaw	Prevention	Planning and Conservation	Low	2017-2019	Staff time
Winter Storm Mitigation Measures					
G) Assess options to retrofit public buildings	Structural	Building Dept.	Medium	2016-2021	HMGP, PDM and Town General Fund
H) Conduct winter weather	Public education and awareness	Fire/Emergency Mgt.	Medium	2016-2021	Town General Fund

Table 29. Potential Mitigation Measures					
Mitigation Measure	**Measure Type**	**Implementation Responsibility**	**Priority**	**Time Frame**	**Potential Funding Sources**
risk awareness activities					
Wind Related Mitigation Measures					
I) Educate homeowners on the benefits of wind retrofits.	Public education and awareness	Building Dept.	Low	2016-2021	Town General Fund
Geologic Hazard Mitigation Measures					
J) Implement seismic upgrades to the communications center	Structural/emergency services protection	Building Dept./ Emergency Mgt.	Low	2016-2021	HMGP and Town General Fund
Brush Fire Mitigation Measures					
K) Acquire a small brush truck	Natural resource protection	Fire Dept.	Medium	2016-2021	USDA/Town General Fund/HMGP/PDM
L) Install dry hydrants	Natural resource protection	Fire Dept.	Medium	2017	USDA/Town General Fund/HMGP/PDM
M) Map and maintain fire roads	Natural resource protection	Fire Dept.	Medium	2016-2021	USDA/Town General Fund

Regional and Inter-Community Considerations

Some hazard mitigation issues are strictly local. The problem originates primarily within the municipality and can be solved at the municipal level (e.g. capacity issues in local drainage system). Other issues are inter-community issues that involve cooperation between two or more municipalities (e.g. upstream issues related to upstream flooding on a river or brook). 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 and Hazard Mitigation Coordination

Regional hazard mitigation issues vary with the nature of the community and are different in densely developed urban communities than in more suburban or rural communities. In many communities, mitigating natural hazards, particularly flooding, is more than a local issue. New development in an adjoining community can increase runoff in the neighboring community and yet the neighboring community cannot review new development proposals. The presence of state roads such as Route 3, Route 53 and Route 139, with their attendant drainage structures means that the host community does not have as much control over mitigation measures that may be necessary. Agencies such as MASS DOT 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. In the sections that follow, the plan includes recommendations for activities where cooperation with these other agencies may be necessary. Implementation of these recommendations will require that all parties work together to develop solutions.

Inter-Community Considerations

One of the major inter-community considerations involves the recommended mitigation strategy of preparing a hydraulic study of the Indian Head River watershed. This would involve multiple communities as well as non-profits like the North and South Rivers Watershed Association and the North River Commission.

Climate Change

The entirety of Massachusetts, and in particular the Commonwealth's coastal cities and towns, faces potential risk from climate change. Many of the natural hazards that communities face are likely to be exacerbated by climate change in future years. This is particularly true for flooding caused by extreme precipitation, flooding and extreme heat. For example, according to the 2012 report *When It Rains, It Pours – Global Warming and the Increase in Extreme Precipitation from 1948 to 2011,* intense rainstorms and snowstorms have become more frequent and more severe over the last half century in the northeastern United States. Extreme downpours are not happening 30 percent more often nationwide than in 1948. In other words, large rain or snow storms that happened once every 12 months, on average, in the middle of the 20th century, now happen every nine months.

Attempts to mitigate climate change or adapt to its potential impacts are largely outside the scope of this Hazard Mitigation Plan, which relies primarily on historic trends to assess

risk and vulnerability. The potential changes to the State's storm damage profile caused by Climate Change will be well outside of historic trends, making those trends uncertain predictors of future risk and vulnerability at best. Cities, towns, regional planning agencies and other regional and state agencies will need to advocate for a statewide response that includes using the best available information to map and model climate change data related to natural hazards and disseminate this information for use in hazard mitigation planning and land use policy development.

Lastly, in addition to understanding how the physical infrastructure will be impacted, it is important to identify how vulnerable populations may suffer greater impacts under future climate change scenarios. These populations could include the elderly, the very young, low-income groups, immigrants and the homeless, among others, and could disproportionately suffer the effects of extreme events, like flooding and heat waves, be least-equipped to adapt. Efforts should be undertaken to identify the locations of possible vulnerable populations. After identifying locations, strategies should be developed and implemented to educate, engage and include these populations in hazard and emergency response planning efforts.

New Development and Infrastructure

As part of the process of developing recommendations for new mitigation measures for this plan, the Town considered the issues related to new development, redevelopment, and infrastructure needs in order limit future risks. Taking into consideration the town's Floodplain Zoning District enforced for new development , the Wetlands Bylaw enforced by the Conservation Commission, the Comprehensive Plan, the town determined that existing Home Rule land use measures could be strengthened by undertaking the following measures: updating the Open Space Plan, establishing a Stormwater Committee, adopt a dumping bylaw. The town's focus on infrastructure includes implementing the Forge Pond Dam Phase 1 Assessment, seismic upgrades to the communications center, and evaluating the retrofitting of public buildings for snow loads.

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VII. PLAN ADOPTION AND MAINTENANCE

Plan Adoption

The Town of Hanover Hazard Mitigation Plan was adopted by the Board of Selectmen on June 27, 2016. See Appendix D for documentation. The plan was approved by FEMA on [date] for a five-year period that will expire on [date].

Plan Maintenance

MAPC worked with the Town of Hanover Hazard Mitigation Planning Team to prepare this plan. After the plan is adopted by the Town and approved by FEMA, this team will continue to meet to function as the Hazard Mitigation Implementation Team, with the Chief of the Hanover Fire Department designated as the coordinator. Additional members could be added to the local implementation group from businesses, non-profits and institutions, and other local stakeholders.

The Town will continue public participation during the next 5-year planning cycle. Any meetings to update and review the plan will be publicly noticed in accordance with Town and state open meeting laws, and the current plan will be available to the public on the Town's website.

Implementation Schedule

Mid-Term Survey on Progress – The coordinator of the Hazard Mitigation Implementation Team will prepare and distribute a mid-term survey in year three of the plan. The survey will be distributed to all of the local implementation group members and other interested local stakeholders. The survey 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 in order to evaluate its effectiveness in meeting the plan's goals and identify areas that need to be updated in the next plan. The Hazard Mitigation Implementation Team, coordinated by the Chief of the Hanover Fire Department, will have primary responsibility for tracking progress, evaluating, and updating the plan.

Begin to Prepare for the five-year Plan Update -- FEMA's approval of this plan is valid for five years, by which time an updated plan must be approved by FEMA in order to maintain the Town's approved plan status and its eligibility for FEMA mitigation grants. Because of the time required to secure a planning grant, prepare an updated plan, and complete the approval and adoption of an updated plan, the Hazard Mitigation Implementation Team should begin the process by Year 3 of the 5-year planning cycle. This will help the Town avoid a lapse in its approved plan status and grant eligibility when the current plan expires.

The t Hazard Mitigation Implementation Team will use the information from the Mid-Term progress review to identify the needs and priorities for the plan update and seek funding for the plan update process. Potential sources of funding may include FEMA Pre-Disaster Mitigation grants and the Hazard Mitigation Grant Program. Both grant programs can pay for 75% of a planning project, with a 25% local cost share required.

Prepare and Adopt an Updated Local Hazard Mitigation Plan – Once a grant or other resources have been secured to update the plan, the Hazard Mitigation Implementation Team may decide to undertake the plan 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 Hanover 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 Hanover Hazard Mitigation Plan by FEMA, the coordinator of the Hazard Mitigation Implementation Team, with support from other members of the 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 during the first six (6) months following plan adoption:

- Fire/Emergency Management
- Police
- Public Works
- Engineering
- Planning
- Recreation
- Health
- Building

Each participating department will track any actions to integrate any aspect of this plan into their planning and operations, and include these actions in the Mid-Term Survey and in the five year update of this plan.

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 the community's website with the caveat that the 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 to.

The Hanover Hazard Mitigation Plan will be integrated into other town plans and policies as they are updated and renewed, including the Hanover Comprehensive Plan, Open Space Plan, Comprehensive Emergency Management Plan, and Capital Investment Program.

VIII. LIST OF REFERENCES

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

Hanover Annual Report for Fiscal Year ending June 30, 2013

Hanover Zoning Bylaws as adopted amended and approved including all amendments to May 2013.

Hanover, Comprehensive Emergency Management Plan

FEMA, Flood Insurance Rate Maps for Plymouth County, Hanover, MA,

FEMA Hazard Mitigation Plan Review Guide, September 2011

FEMA, Local Multi-Hazard Mitigation Planning Handbook, 2013

FEMA, Mitigation Ideas- A Resource for Reducing Risk to Natural Hazards, 2013

MacConnell Land Use Statistics, Commonwealth of Massachusetts, 2005

Massachusetts Department of Community Development, Community Profiles

Massachusetts State Drought Management Plan 2013

Massachusetts State Hazard Mitigation Plans, 2010 and 2013

MA Office of Dam Safety, Inventory of Massachusetts Dams

Metropolitan Area Planning Council, Geographic Information Systems Lab

Metropolitan Area Planning Council, Regional Plans and Data

Nevada Seismological Library (NSL) 2005

New England Seismic Network, Weston Observatory, http://aki.bc.edu/index.htm

NOAA, National Climatic Data Center, data for Plymouth County, MA

Northeast States Emergency Consortium (NESEC)

U.S. Census, 2010 and American Community Survey, 2013

U.S. Geologic Survey, National Water Information System

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APPENDIX A
MEETING AGENDAS

Meeting Agenda
Local Natural Hazard Mitigation Plan
Town of Hanover
June 2, 2014, 10:00 – 11:30 AM

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1) Welcome and Introductions

2) MEMA Presentation on Hazard Mitigation Planning

- Questions and discussion

3) Overview of Project Scope (See attached summary)

1. PLANNING PROCESS AND COMMUNITY PARTICIPATION
2. HAZARD IDENTIFICATION, CRITICAL FACILITIES, AND VULNERABILITY ANALYSIS
3. ASSESSMENT OF EXISTING MITIGATION MEASURES
4. HAZARD MITIGATION STRATEGIES
5. LOCAL HAZARD MITIGATION PLAN MAINTENANCE
6. LOCAL HAZARD MITIGATION PLAN ADOPTION AND APPROVAL

4) Local Team Meeting #1 (Information Gathering)

a) Hazard Mitigation Planning Map Series and Digitized Ortho Photo Map
b) Identify Critical Facilities
c) Identify local hazards:
   i) Flood Hazard Areas
   ii) Fire Hazard Areas (brushfires./ wildfires)
   iii) Dams
   iv) Future Potential Development Areas
d) Review Plan Goals and Objectives
e) Discuss Public Involvement and Outreach
   i) Identify local stakeholders
   ii) Schedule first public meeting

5) Local Team Meeting #2 (Analysis and Review)

a) Review and finalize Critical Facilities
b) Review and finalize local hazard identification
c) Review vulnerability analysis
d) Review Existing Mitigation Measures
e) Discuss Potential Mitigation Measures

6) Local Team Meeting #3 (Recommendations and Draft Plan)

a) Review and finalize Potential Mitigation Measures
b) Prioritize Potential Mitigation Measures
c) Review draft plan
d) Schedule 2nd Public Meeting and outreach to stakeholders

7) Next Steps/Adjourn

Natural Hazard Mitigation Plan Public Meeting
Sponsored by the Hanover Local Emergency Planning Committee

March 26, 2015 10:00 AM
Hanover Town Hall First Floor Large Hearing Room

10:00 – 10:15 AM **Welcome and Introductions –**Jeffrey Blanchard, Fire Chief and Emergency Management Director, Hanover Fire Department.

10:15 – 10:30 AM **Overview of Natural Hazard Mitigation Planning Process –** Joan Blaustein, Metropolitan Area Planning Council, will present a PowerPoint presentation on the natural hazard mitigation planning process.

10:30 – 10:50 AM **Questions and Public Comment on Areas of Concern and Potential Mitigation Strategies –** Joan Blaustein will answer any questions and take comments from the public.

10:50 – 11:00 AM **Next steps in the process** – Joan Blaustein will describe the next steps in the plan development process.

Natural Hazard Mitigation Plan Public Meeting
Sponsored by the Hanover Local Emergency Planning Committee

May 13, 2015 10:00 AM

AGENDA

1) **Review of goals** – We will need the town to review the goals on Page 54 and either adopt or revise them.

2) **Review proposed hazard mitigation measures**. I have developed a list of potential mitigation measures. Many of these are taken from a FEMA publication "Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, January 2013. Selecting the potential mitigation measures is the single most important part of the plan and these are suggestions based on what I've heard at our meetings. If you have any projects that you think you want to submit a grant application for we will need to discuss these and make sure they are in the plan.

3) **Walk through of the plan** – I think it will be helpful to walk you through the plan so that you understand its structure and what information is in there prior to your full review.

4) **June 4 meeting** – we need to discuss how much time I will have and how the evening is being structured so I can develop a Power Point presentation and have the appropriate materials ready for that night.

APPENDIX B
HAZARD MAPPING

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 maps.

Map 1.	Population Density
Map 2.	Developable Land
Map 3.	Flood Zones
Map 4.	Earthquakes and Landslides
Map 5.	Hurricanes and Tornados
Map 6.	Average Snowfall
Map 7.	Composite Natural Hazards
Map 8.	Local 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 maps can be downloaded from the MAPC File Transfer Protocol (FTP) website at:

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

Map 1: 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 Town 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. 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.

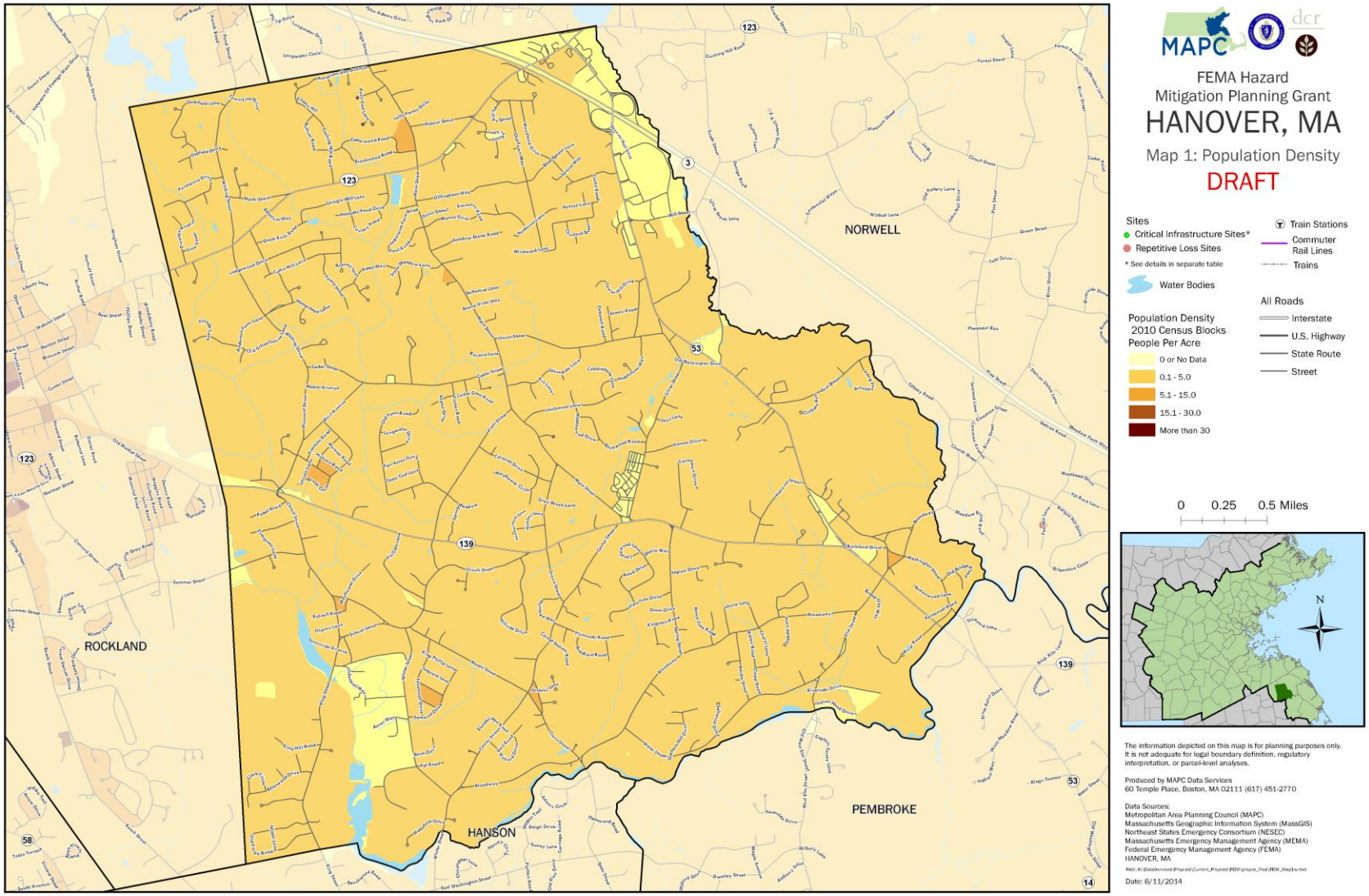
The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to http://pubs.usgs.gov/pp/p1183/pp1183.html.

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, 2010. The critical infrastructure sites are also shown. The source of the aerial photograph is Mass GIS.


MAPC
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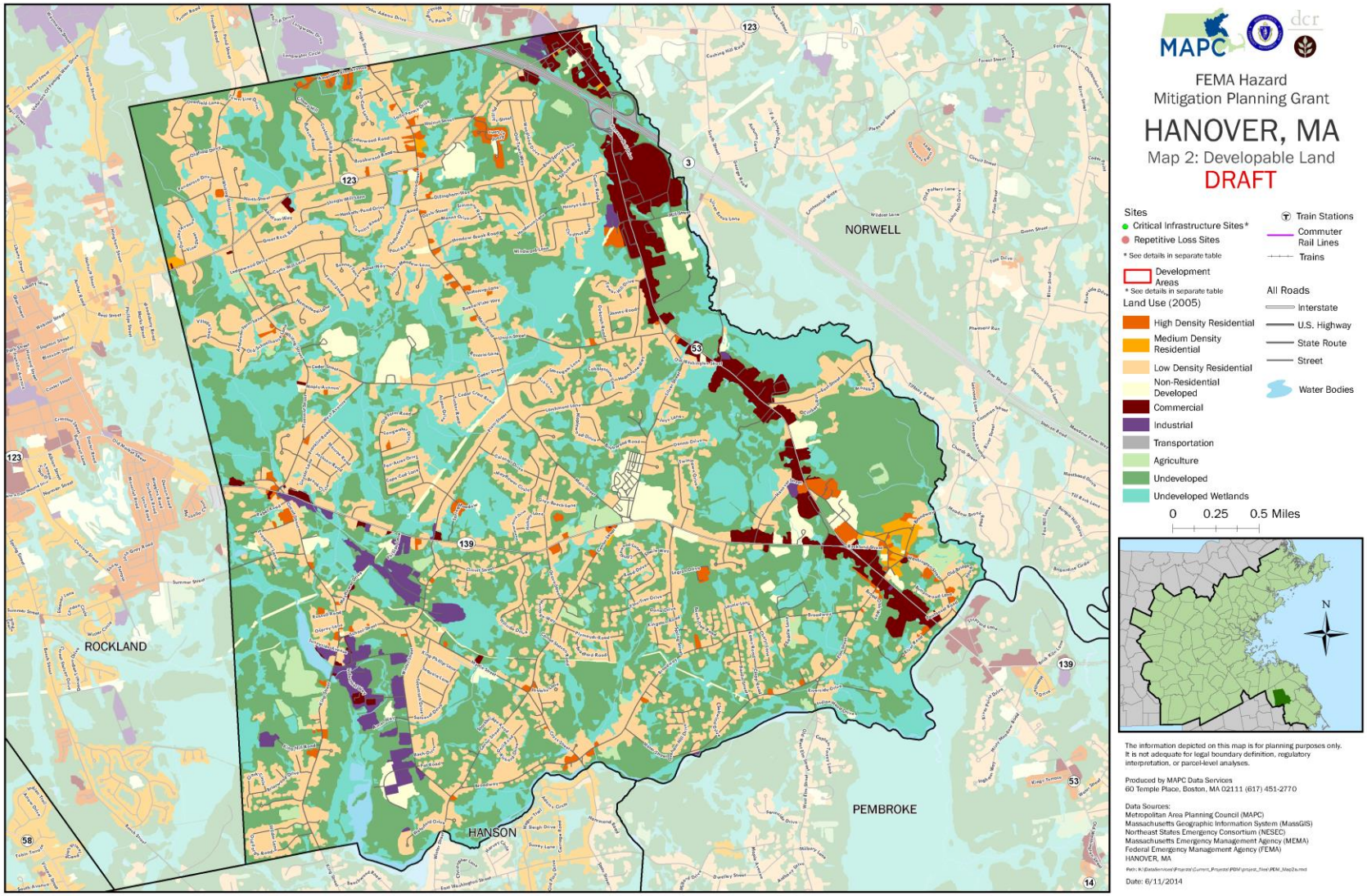
FEMA Hazard
Mitigation Planning Grant
HANOVER, MA
Map 1: Population Density
DRAFT
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Water Bodies
Train Stations
Commuter Rail Lines
Trains
All Roads
Interstate
U.S. Highway
State Route
Street
Population Density
2010 Census Blocks
People Per Acre
0 or No Data
0.1 - 5.0
5.1 - 15.0
15.1 - 30.0
More than 30
0 0.25 0.5 Miles
N
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.
Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
HANOVER, MA
Date: 6/11/2014
NORWELL
ROCKLAND
HANSON
PEMBROKE
123
3
53
139
58
14


MAPC
dcr
FEMA Hazard
Mitigation Planning Grant
HANOVER, MA
Map 2: Developable Land
DRAFT
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Development Areas
* See details in separate table
Land Use (2005)
High Density Residential
Medium Density Residential
Low Density Residential
Non-Residential Developed
Commercial
Industrial
Transportation
Agriculture
Undeveloped
Undeveloped Wetlands
Train Stations
Commuter Rail Lines
Trains
All Roads
Interstate
U.S. Highway
State Route
Street
Water Bodies
0 0.25 0.5 Miles
N
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HANOVER, MA
Date: 6/11/2014
NORWELL
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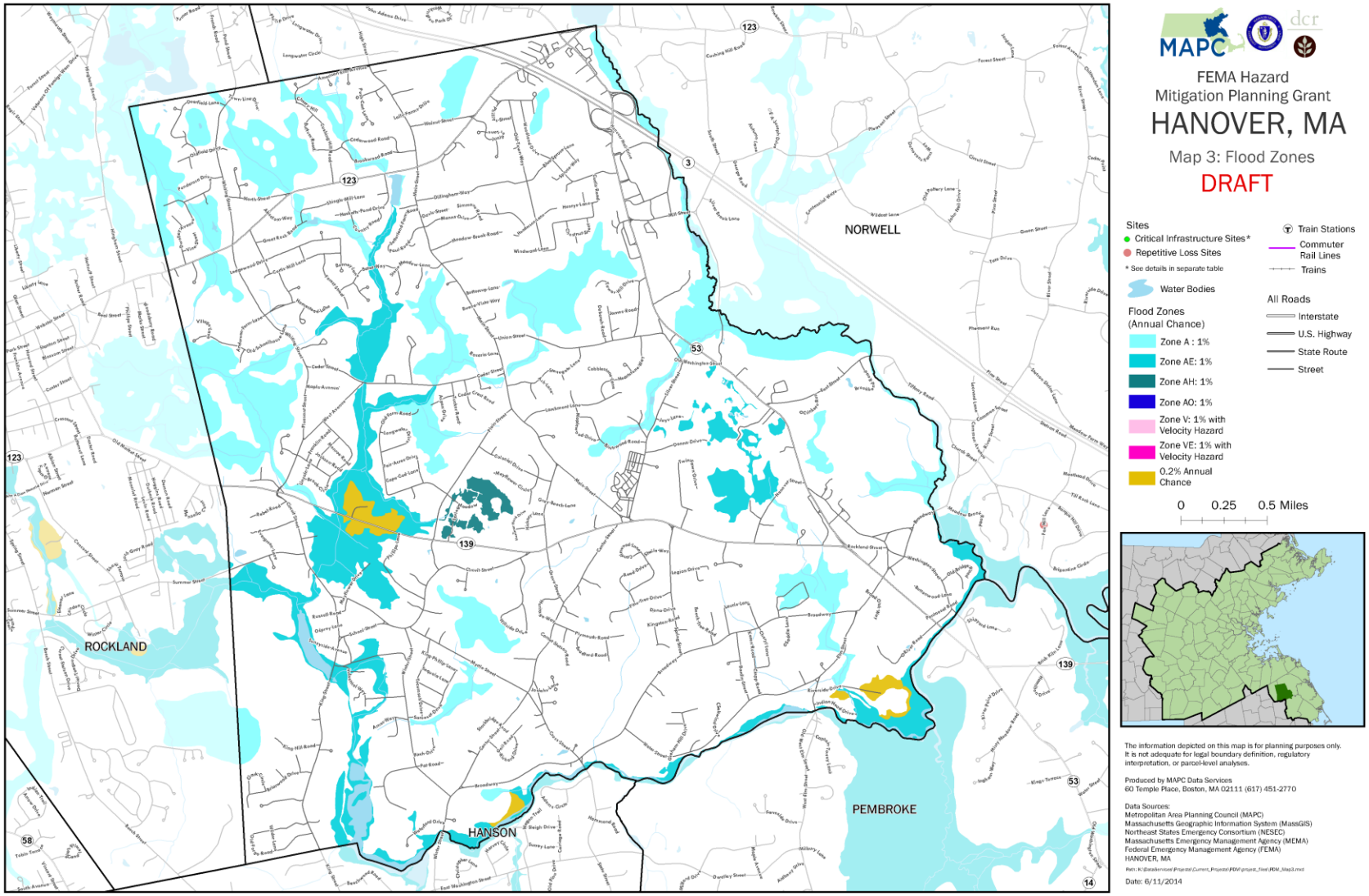
MAPC
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FEMA Hazard
Mitigation Planning Grant
HANOVER, MA
Map 3: Flood Zones
DRAFT
NORWELL
ROCKLAND
HANSON
PEMBROKE
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Water Bodies
Flood Zones
(Annual Chance)
Zone A : 1%
Zone AE: 1%
Zone AH: 1%
Zone AO: 1%
Zone V: 1% with Velocity Hazard
Zone VE: 1% with Velocity Hazard
0.2% Annual Chance
Train Stations
Commuter Rail Lines
Trains
All Roads
Interstate
U.S. Highway
State Route
Street
0 0.25 0.5 Miles
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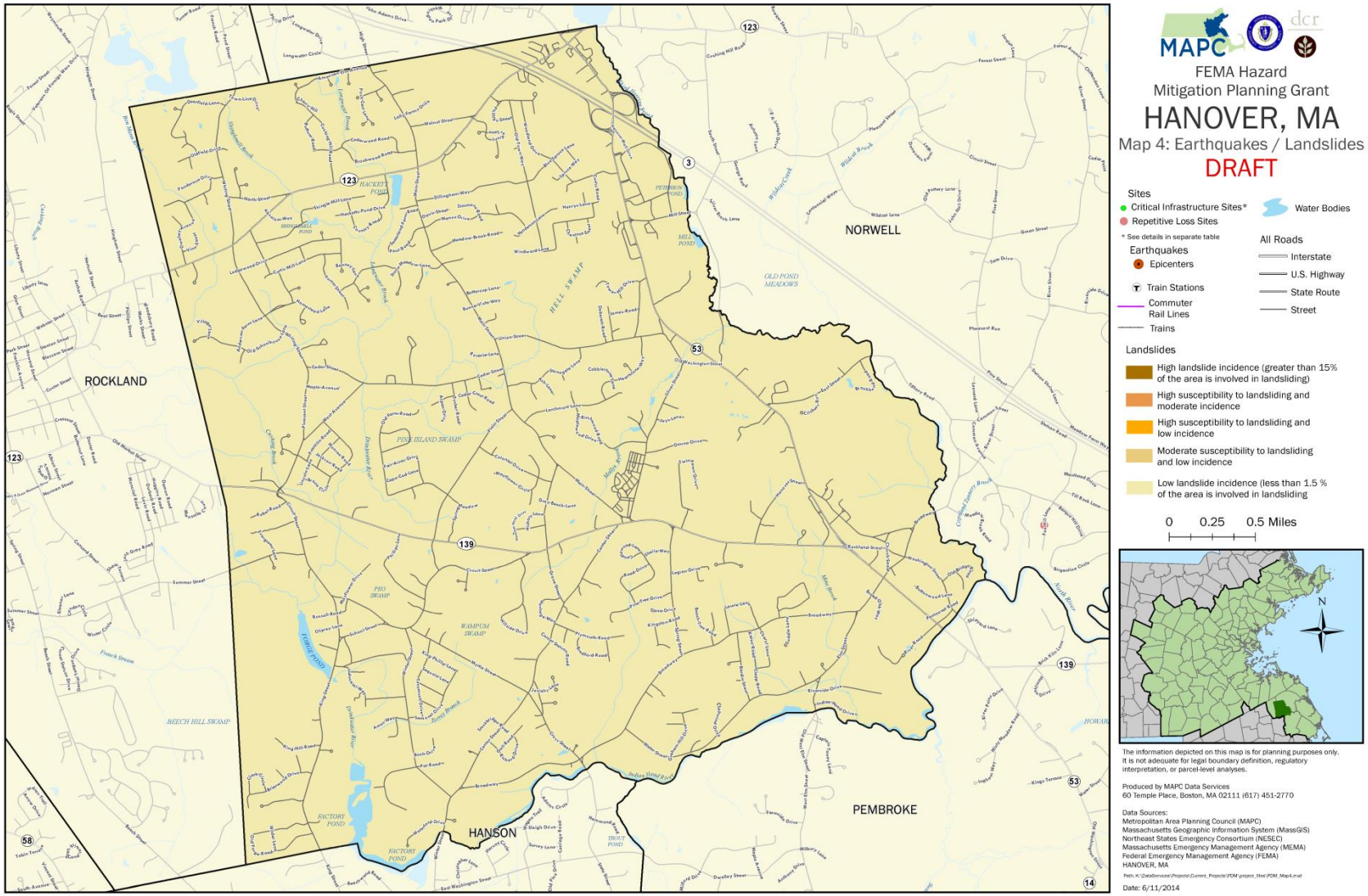
HANOVER, MA
Date: 6/11/2014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FEMA Hazard
Mitigation Planning Grant
HANOVER, MA
Map 4: Earthquakes / Landslides
DRAFT
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Earthquakes
Epicenters
Train Stations
Commuter Rail Lines
Trains
Water Bodies
All Roads
Interstate
U.S. Highway
State Route
Street
Landslides
High landslide incidence (greater than 15% of the area is involved in landsliding)
High susceptibility to landsliding and moderate incidence
High susceptibility to landsliding and low incidence
Moderate susceptibility to landsliding and low incidence
Low landslide incidence (less than 1.5 % of the area is involved in landsliding
0 0.25 0.5 Miles
N
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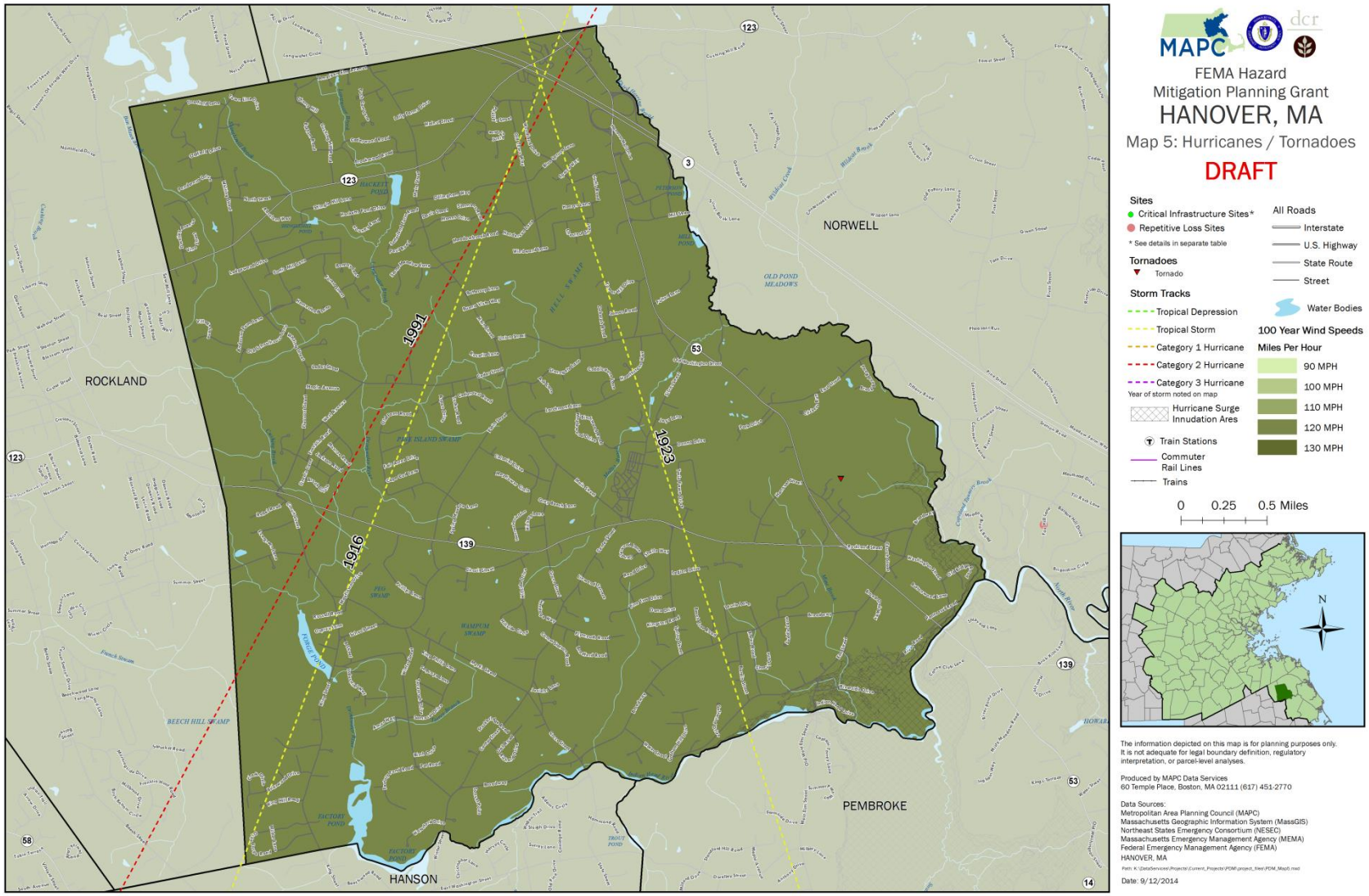
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
HANOVER, MA
Date: 6/11/2014
ROCKLAND
NORWELL
HANSON
PEMBROKE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FEMA Hazard
Mitigation Planning Grant
HANOVER, MA
Map 5: Hurricanes / Tornadoes
DRAFT
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Tornadoes
Tornado
Storm Tracks
Tropical Depression
Tropical Storm
Category 1 Hurricane
Category 2 Hurricane
Category 3 Hurricane
Year of storm noted on map
Hurricane Surge Innudation Ares
Train Stations
Commuter Rail Lines
Trains
All Roads
Interstate
U.S. Highway
State Route
Street
Water Bodies
100 Year Wind Speeds
Miles Per Hour
90 MPH
100 MPH
110 MPH
120 MPH
130 MPH
0 0.25 0.5 Miles
N
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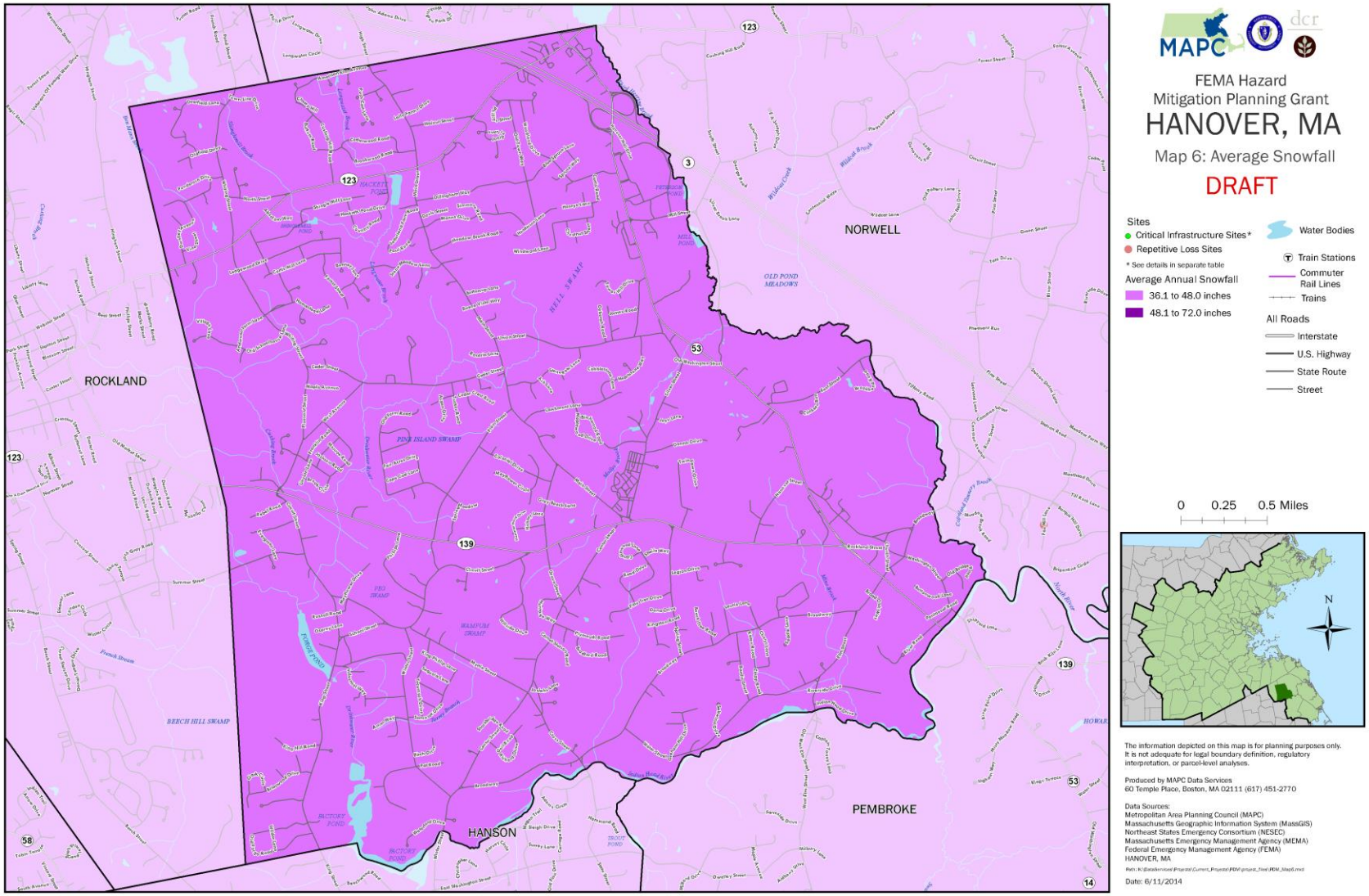
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
HANOVER, MA
Date: 9/12/2014
1991
1923
1916
ROCKLAND
NORWELL
PEMBROKE
HANSON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FEMA Hazard
Mitigation Planning Grant
HANOVER, MA
Map 6: Average Snowfall
DRAFT
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Average Annual Snowfall
36.1 to 48.0 inches
48.1 to 72.0 inches
Water Bodies
Train Stations
Commuter Rail Lines
Trains
All Roads
Interstate
U.S. Highway
State Route
Street
0 0.25 0.5 Miles
N
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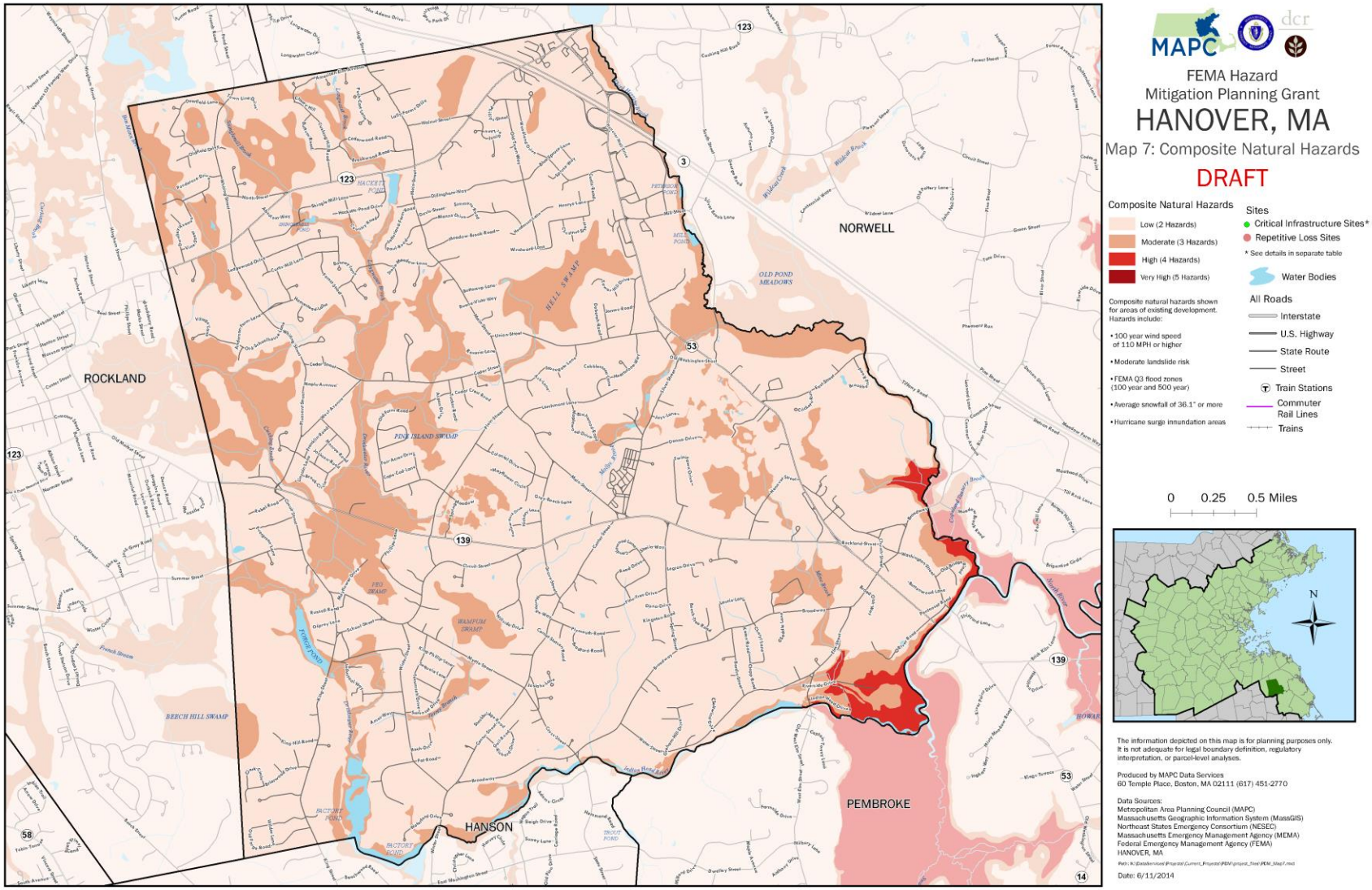
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FEMA Hazard
Mitigation Planning Grant
HANOVER, MA
Map 7: Composite Natural Hazards
DRAFT
Composite Natural Hazards
Low (2 Hazards)
Moderate (3 Hazards)
High (4 Hazards)
Very High (5 Hazards)
Composite natural hazards shown for areas of existing development. Hazards include:
• 100 year wind speed of 110 MPH or higher
• Moderate landslide risk
• FEMA Q3 flood zones (100 year and 500 year)
• Average snowfall of 36.1" or more
• Hurricane surge innundation areas
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Water Bodies
All Roads
Interstate
U.S. Highway
State Route
Street
Train Stations
Commuter Rail Lines
Trains
0 0.25 0.5 Miles
N
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Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
HANOVER, MA
Date: 6/11/2014
ROCKLAND
NORWELL
HANSON
PEMBROKE
HELL SWAMP
PINE ISLAND SWAMP
BEECH HILL SWAMP
OLD POND MEADOWS
123
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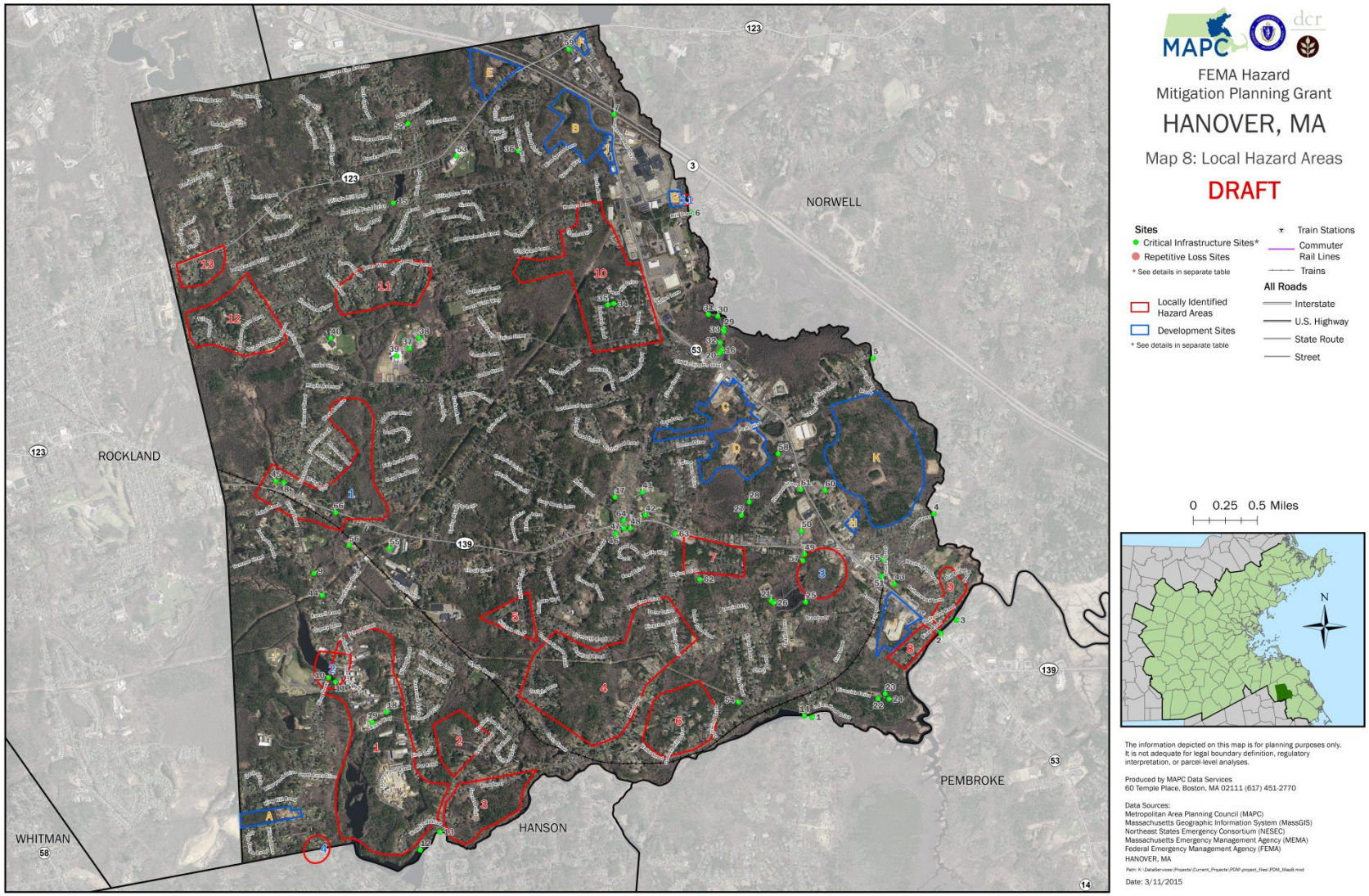
139
58
14


NORWELL
ROCKLAND
WHITMAN
HANSON
PEMBROKE
123
139
53
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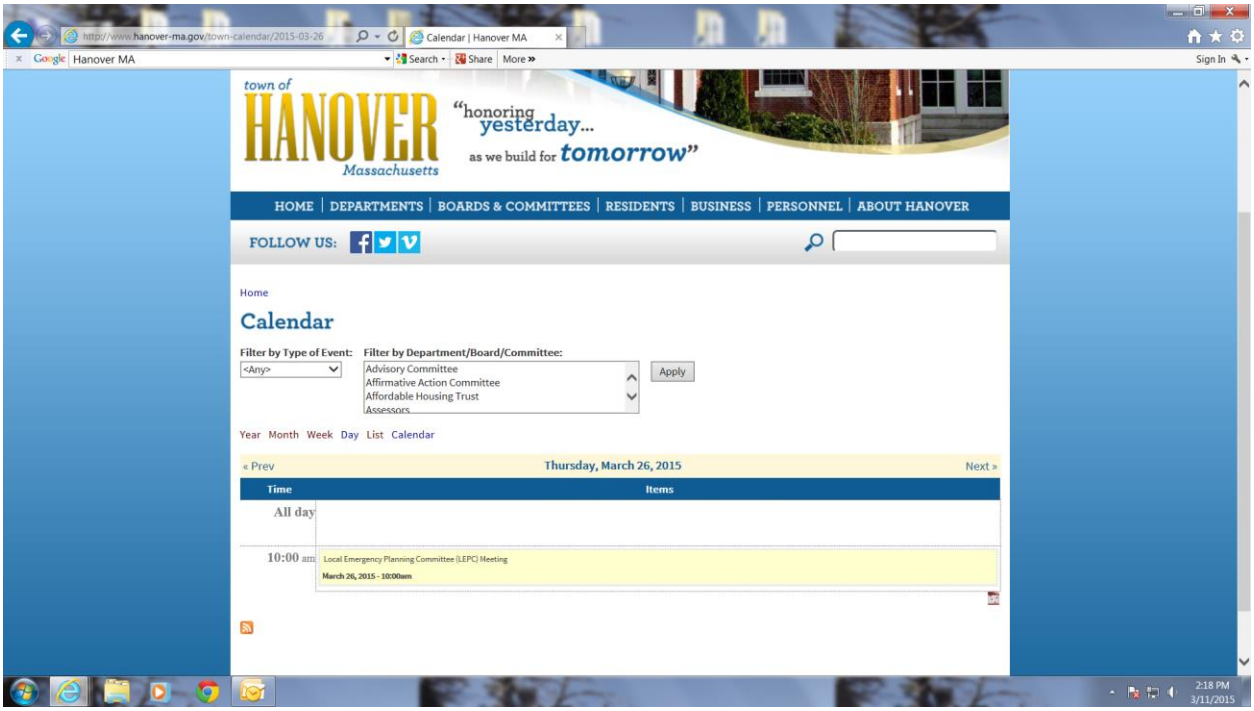
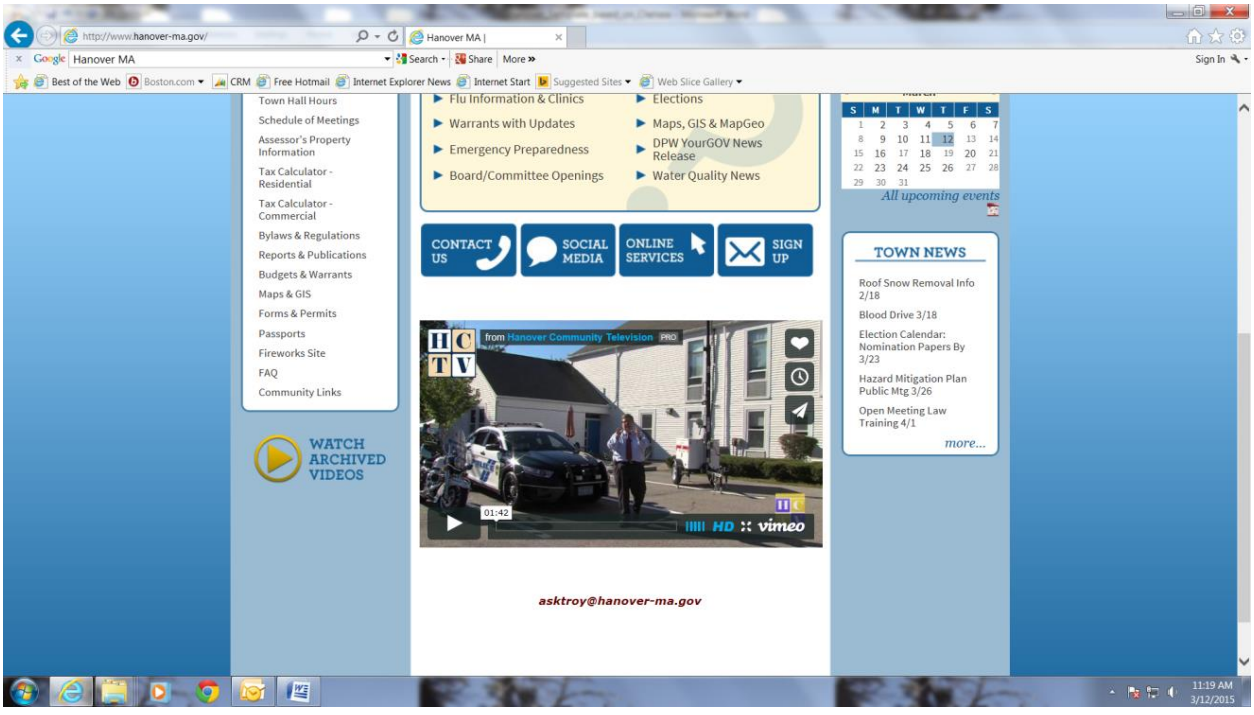
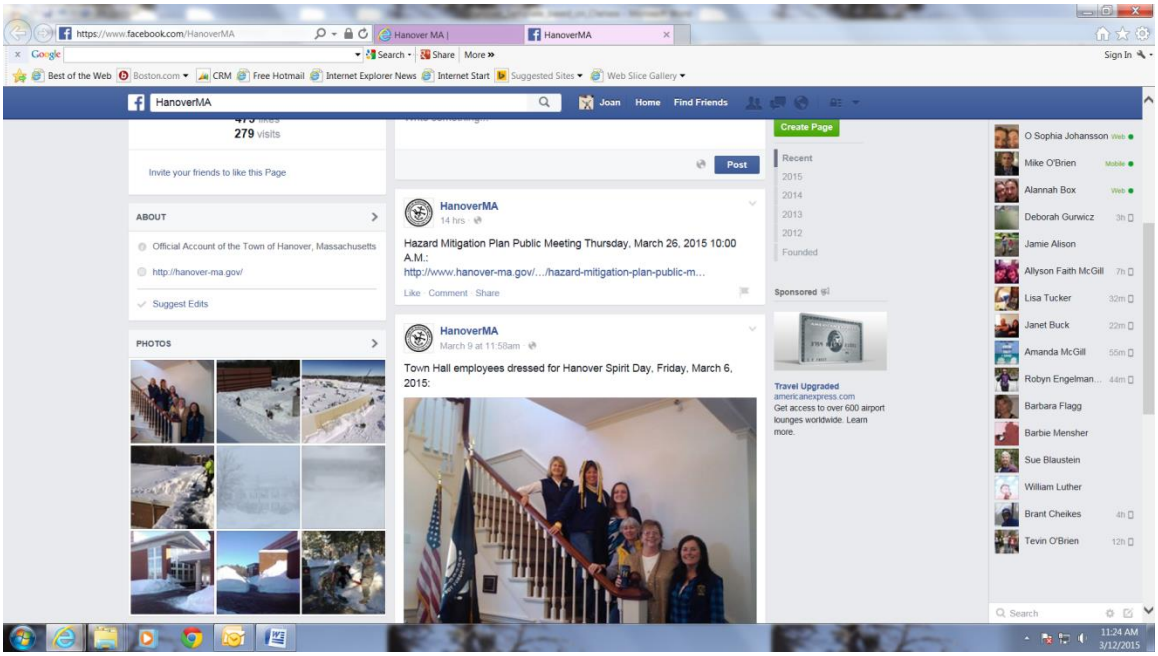
3
MAPC
dcr
FEMA Hazard
Mitigation Planning Grant
HANOVER, MA
Map 8: Local Hazard Areas
DRAFT
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Locally Identified Hazard Areas
Development Sites
* See details in separate table
Train Stations
Commuter Rail Lines
Trains
All Roads
Interstate
U.S. Highway
State Route
Street
0 0.25 0.5 Miles
N
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.
Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
HANOVER, MA
Date: 3/11/2015

APPENDIX C
DOCUMENTATION OF PUBLIC PARTICIPATION






https://www.facebook.com/HanoverMA
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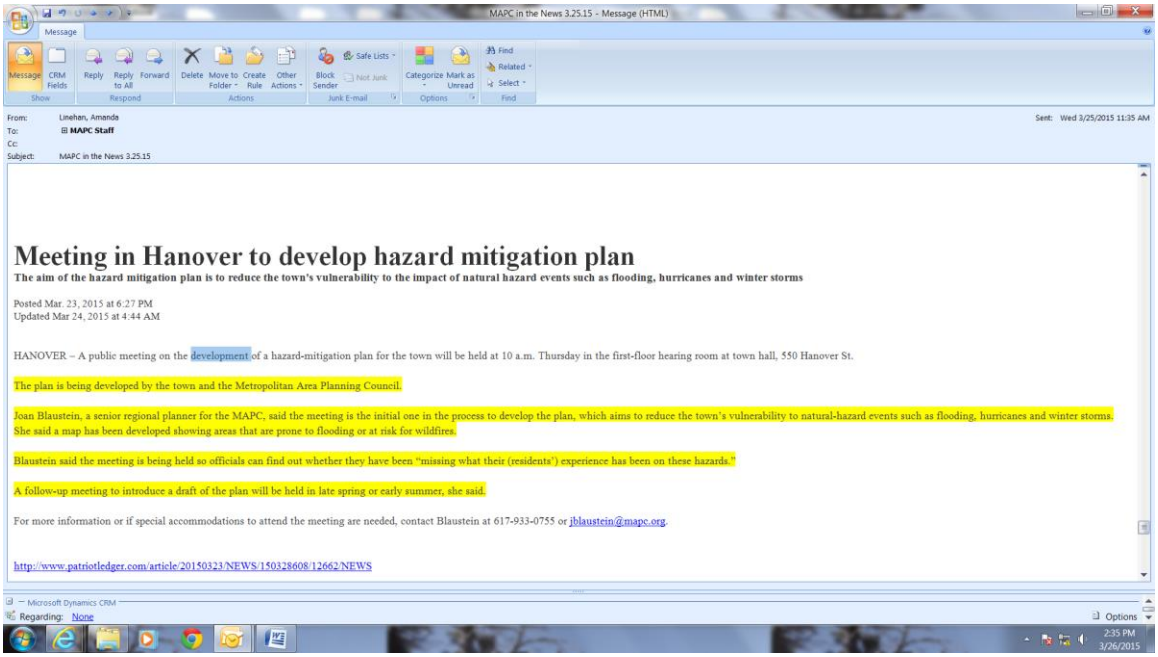
ABOUT
Official Account of the Town of Hanover, Massachusetts
http://hanover-ma.gov/
Suggest Edits
PHOTOS
Post
HanoverMA
14 hrs
Hazard Mitigation Plan Public Meeting Thursday, March 26, 2015 10:00 A.M.:
http://www.hanover-ma.gov/.../hazard-mitigation-plan-public-m...
Like · Comment · Share
HanoverMA
March 9 at 11:58am
Town Hall employees dressed for Hanover Spirit Day, Friday, March 6, 2015:
Create Page
Sponsored
Travel Upgraded
americanexpress.com
Get access to over 600 airport lounges worldwide. Learn more.
O Sophia Johansson
Mike O'Brien
Alannah Box
Deborah Gurwicz
Jamie Alison
Allyson Faith McGill
Lisa Tucker
Janet Buck
Amanda McGill
Robyn Engelman
Barbara Flagg
Barbie Mensher
Sue Blaustein
William Luther
Brant Cheikes
Tevin O'Brien
11:24 AM
3/12/2015


MAPC in the News 3.25.15 - Message (HTML)
From: Linehan, Amanda
To: MAPC Staff
Subject: MAPC in the News 3.25.15
Sent: Wed 3/25/2015 11:35 AM
Meeting in Hanover to develop hazard mitigation plan
The aim of the hazard mitigation plan is to reduce the town's vulnerability to the impact of natural hazard events such as flooding, hurricanes and winter storms
Posted Mar. 23, 2015 at 6:27 PM
Updated Mar 24, 2015 at 4:44 AM
HANOVER – A public meeting on the development of a hazard-mitigation plan for the town will be held at 10 a.m. Thursday in the first-floor hearing room at town hall, 550 Hanover St.
The plan is being developed by the town and the Metropolitan Area Planning Council.
Joan Blaustein, a senior regional planner for the MAPC, said the meeting is the initial one in the process to develop the plan, which aims to reduce the town's vulnerability to natural-hazard events such as flooding, hurricanes and winter storms. She said a map has been developed showing areas that are prone to flooding or at risk for wildfires.
Blaustein said the meeting is being held so officials can find out whether they have been "missing what their (residents') experience has been on these hazards."
A follow-up meeting to introduce a draft of the plan will be held in late spring or early summer, she said.
For more information or if special accommodations to attend the meeting are needed, contact Blaustein at 617-933-0755 or jblaustein@mapc.org.
http://www.patriotledger.com/article/20150323/NEWS/150328608/12662/NEWS
Microsoft Dynamics CRM
Regarding: None
Options
2:35 PM
3/26/2015

Jeffrey Blanchard

From: Jeffrey Blanchard
Sent: Wednesday, March 11, 2015 2:29 PM
To: Ed Callahan (Ed_Callahan@CBLProperties.com)
Subject: Hanover's Hazard Mitigation Plan
Attachments: 1st Public Meeting Flyer Hanover.pdf

Hi Ed. Please see the attached flyer with information on the upcoming meeting of the Hanover LEPC where there will be a presentation on the Hazard Mitigation Plan that is being developed. Please call me if you have any questions. My direct line is 781-826-7727. Jeff

Jeffrey Blanchard
Fire Chief
Emergency Management Director
Hanover Fire Department
32 Center Street
Hanover, MA 02339

Jeffrey Blanchard

From: Jeffrey Blanchard
Sent: Wednesday, March 11, 2015 2:27 PM
To: Jo Ann Simmons (mailto:jsimons@cushingcenters.org)
Subject: Hanover's Hazard Mitigation Plan
Attachments: 1st Public Meeting Flyer Hanover.pdf

Hi Jo Ann. Please see the attached flyer with information on the upcoming meeting of the Hanover LEPC where there will be a presentation on the Hazard Mitigation Plan that is being developed. I hope that you or a representative from Cardinal Cushing Centers will be able to attend. Please call me if you have any questions. My direct line is 781-826-7727. Jeff

Jeffrey Blanchard
Fire Chief
Emergency Management Director
Hanover Fire Department
32 Center Street
Hanover, MA 02339

Jeffrey Blanchard

From: Jeffrey Blanchard
Sent: Wednesday, March 11, 2015 2:24 PM
To: Patrick Kelleher (Pat@MyFamilyLifePlan.com)
Subject: Hanover Local Emergency Planning Committee (LEPC) Meeting
Attachments: 1st Public Meeting Flyer Hanover.pdf

Hi Pat. Please see the attached flyer with information on the upcoming meeting of the Hanover LEPC where there will be a presentation on the Hazard Mitigation Plan that is being developed. Please share this flyer with the Chamber. Please call me if you have any questions. My direct line is 781-826-7727. Jeff

Jeffrey Blanchard
Fire Chief
Emergency Management Director
Hanover Fire Department
32 Center Street
Hanover, MA 02339

Hanover officials draft hazard mitigation plan, map

Hanover Fire Chief Jeffrey Blanchard outlines some areas of potential hazard on a map of Hanover during a Local Emergency Planning Committee meeting March 26 at Town Hall. Wicked Local Staff Photo/Caitlin Flaherty

By Caitlin Flaherty
cflaherty@wickedlocal.com

Posted Apr. 1, 2015 at 4:44 PM

Disaster can strike at any moment, and communities can never be too prepared.

Town and state officials are working together to help develop a plan which aims to reduce the town's vulnerability to natural-hazard events such as flooding, hurricanes and winter storms. The map could also help the town receive grant funding.

Joan Blaustein, a senior regional planner for the Metropolitan Area Planning Council, presented a map to Hanover public safety officials during the Hanover Local Emergency Planning Committee Meeting Thursday morning.

The map has been developed to show areas prone to flooding or at risk for wildfires.

"It's not about emergency response, it's about permanently reducing or preventing loss of life or property damage before these disasters strike," Blaustein told officials at the start of the meeting.

Blaustein said she was "surprised" when making the map that Hanover is at risk for hurricane surges.

"Because of the North River you actually do have some areas affected by hurricane surges," she said.

However, Blaustein said Hanover does not have many flood areas. The only four areas that stood out were Pleasant and Circuit Street, the CVS plaza, King Street and the King Street bridge, she said.

"Not all of the flooding areas are based on the local flood plain. A lot is based on drainage," Blaustein said noting that cities and areas with a lot of concrete are especially vulnerable.

When creating the map, officials also identified the "critical areas that have a higher level of response" such as potential flood and brushfire areas near preschools or senior housing developments, Blaustein said.

After her presentation, Blaustein had Hanover public safety officials and business owners offer feedback and take a look at the map to identify any other areas of potential hazards.

Hanover Fire Chief Jeffrey Blanchard pointed out that although Hanover does not have a facility that houses large quantities of hazardous materials, it doesn't mean the town shouldn't be prepared.

Hazardous materials could mean anything that's potentially harmful to people as well as the environment such as gasoline, pesticides and fertilizers, he said.

"When you see a tanker driving down the street, unless it's carrying water, it's carrying something that, if released, is not good for you or for the environment," Blanchard said, noting that major routes run through town. "Hanover doesn't have a facility with those materials, but it doesn't mean there isn't a truck driving through delivering a shipment of those materials to a facility in another town.

Creating the map is key, officials said, because the hazard mitigation plan is a requirement for Hanover's Local Emergency Planning Committee to maintain its state certification, which allows the town to apply for certain grants.

"It not only makes you eligible for Federal Emergency Management Agency grants, but the hazard mitigation plan helps towns figure out strategies on fitting this into their overall capital improvement plans," Blaustein said.

The partnership with the state will also help the town, Blanchard said.

"They are great at getting the word out when something happens not only to the town but to the press," he said. "It's good to see the education component when something is coming our way, especially a weather event."

This was the first of two public meetings, Blaustein said, noting that they would hold the second one at a more convenient time for most people.

"We'll hold the second one in the evening," she said. "We do understand that members of the public have a hard time coming during the day."

Blaustein said she encouraged residents to email or call her if they have any questions. Reach Joan Blaustein by email at Jblaustein@mapc.org or by phone, 617-933-0755.

Follow Caitlin on Twitter @MarinerCaitlin.

http://hanover.wickedlocal.com/article/20150401/NEWS/150409276/?Start=1

TOWN OF HANOVER
BOARD OF SELECTMEN
550 HANOVER STREET

REGULAR MEETING
MONDAY, JUNE 15, 2015
7:00 PM

AGENDA FOR MEETING

7:00 p.m. Open Meeting/Open Forum
- Approve the Meeting Minutes of 5-4-15, 5-11-15 and 6-1-15 including Executive Session

7:05 p.m. Chief Blanchard Presentation from the MAPC on Hanover's Hazard Mitigation Plan

7:30 p.m. Representative DeCoste
- Legislative Priorities

Discussion/Action Items:

1. Approve &Sign Temporary Borrowing Notes
2. Approve Board/Committee Re-Appointments
3. Discuss the Honor Garden Committee

Town Manager Report: Follow up on weekly correspondence
Personnel Update

Open Forum:

Executive Session: in accordance with MGL 30A, Section 21, Subsection 2, to conduct strategy sessions in preparation for negotiations with nonunion personnel or to conduct collective bargaining sessions or contract negotiations with nonunion personnel.

Pending:
Compensation Study
Shaftel Property – Land Donation
Fireworks Site Committee

"Hanover, Honoring Yesterday As We Build For Tomorrow"

The topics listed above represent what the Chairman reasonably anticipates will be discussed at the time this notice was posted.

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APPENDIX D
DOCUMENTATION OF PLAN ADOPTION

TOWN OF HANOVER
BOARD OF SELECTMEN
550 HANOVER STREET, SUITE 29
HANOVER, MASSACHUSETTS 02339
781-826-5000 ext. 1084

Brian Barthelmes, Chairman
Susan Setterland, Vice Chair
Robert O'Rourke
David Delaney
John Tuzik

CERTIFICATE OF ADOPTION
BOARD OF SELECTMEN
TOWN OF HANOVER, MASSACHUSETTS

A RESOLUTION ADOPTING THE
TOWN OF HANOVER HAZARD MITIGATION PLAN

WHEREAS, the Town of Hanover established a Committee to prepare the *Town of Hanover Hazard Mitigation Plan*; and

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

WHEREAS, a duly-noticed public meeting was held by the Board of Selectmen on June 15, 2015, and

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

NOW, THEREFORE BE IT RESOLVED that the Town of Hanover BOARD OF SELECTMEN adopts the *Town of Hanover Hazard Mitigation Plan*, in accordance with M.G.L. 40 §4 or the charter and bylaws of the Town of Hanover.

ADOPTED AND SIGNED this Date. June 27, 2016

Brian E. Barthelmes, Chairman

Susan M. Setterland, Vice Chair

Robert S. O'Rourke, Selectman

David R. Delaney, Selectman

John C. Tuzik, Selectman

ANN F. NELSON LEE
NOTARY PUBLIC
COMMONWEALTH OF MASSACHUSETTS
My Comm. Expires December 3, 2021

ATTEST