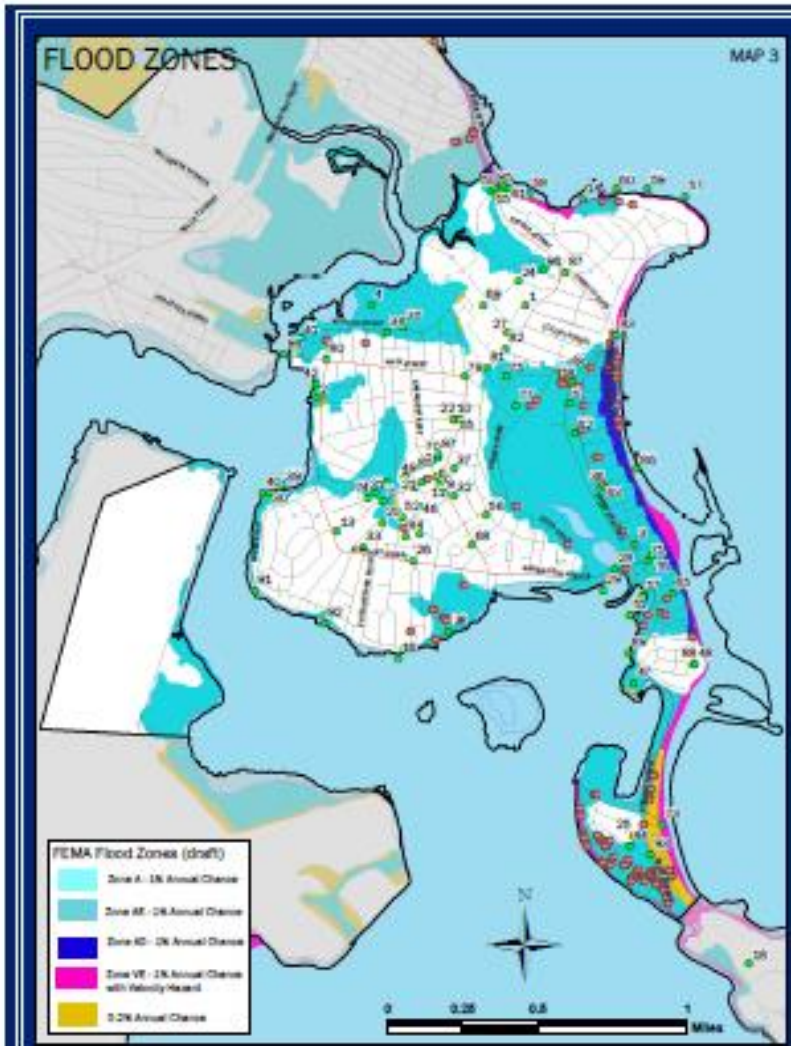
TOWN OF WINTHROP
HAZARD MITIGATION PLAN
2014 UPDATE



METROPOLITAN AREA PLANNING COUNCIL

FINAL PLAN APPROVED BY FEMA
August 3, 2015

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ACKNOWLEDGEMENTS AND CREDITS

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

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TOWN OF WINTHROP HAZARD MITIGATION PLAN
2014 UPDATE

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

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

Planning Process

Planning for the Winthrop Hazard Mitigation Plan update was led by the Winthrop 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 November 14, 2011 with the Winthrop Planning Board and the second on December 20, 2011 with the Town Council. The draft Plan also was posted on the Town's website for public review and comment for a ten day period following the two public meetings and completion of the first draft of the Plan. The Town Council meeting was televised live and re-broadcast. 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.

Preceding these meetings, a public, regional meeting of the North Shore Multiple Hazard Community Planning Team was held February 8, 2010 to re-introduce participating communities to the hazard mitigation planning process and to identify inter-community hazard mitigation issues. A follow-up inter-regional public meeting and Natural Hazard Mitigation workshop was held on September 14, 2011 in Danvers, sponsored by MEMA , MAPC and MA Coastal Zone Management.

A list of public comments can be found in Appendix C.

TOWN OF WINTHROP HAZARD MITIGATION PLAN
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Risk Assessment

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

Hazard Mitigation Goals

1. Ensure that critical infrastructure sites are protected from natural hazards.

2. Protect existing residential and business areas from flooding.

3. Maintain existing mitigation infrastructure in good condition.

4. Continue to enforce existing zoning and building regulations.

5. Educate the public about zoning, flooding and building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction.

6. Encourage future development in areas that are not prone to natural hazards.

7. Educate the public about natural hazards and mitigation measures.

8. Make efficient use of public funds for hazard mitigation.

9. Protect the Town's ability to respond to various natural hazard events.

Highlighted Potential Hazard Mitigation Actions

- Complete the Yirrell Beach seawall extension.
- Upgrade the storm drain system in the area between Winthrop Shore Drive and Lewis Lake.
- Add coastal storm surge and flooding protection for the Shirley Street neighborhood adjacent to Winthrop Shore Drive.
- Complete the drainage assessment at Ingleside Park and upgrade existing drainage infrastructure.
- Provide for more frequent maintenance of Town-owned drainage infrastructure.
- Finish mapping all stormwater outfalls and catch basins on GIS.
- Incorporate hazard education awareness, mitigation planning and natural hazard incentives into Town planning and community development operations.

Plan Review and Update Process

Table 1 Plan Review and Update

Chapter	Reviews and Updates
III – Public Participation	The Winthrop Local Committee placed an emphasis on public participation for the update of the Hazard Mitigation Plan, discussing strategies to enhance participation opportunities at the first local committee meeting. During plan development, the plan was presented to the Planning Board and the Town Council in public meetings. The Town Council's meeting was televised and re-broadcast. 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 changes in 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	The list of existing mitigation measures was updated to reflect current mitigation activities in the Town.
VII & VIII – Hazard Mitigation Strategy	Mitigation measures from the 2005 plan were reviewed and assessed as to whether they were completed, on-going, or deferred. The Local Committee determined whether to carry forward measures into the 2014 plan update or delete them. The 2014 Hazard Mitigation Strategy reflects both new measures and measures carried forward from the 2005 plan. The Committee re-prioritized all of these measures based on current conditions
IX – Plan Adoption & Maintenance	This section of the plan was updated with a new on-going plan implementation review and five year update process that will assist the Town in incorporating hazard mitigation issues into other Town planning and regulatory review processes and better prepare the Town to update the plan in 2019.

As indicated in more detail on Table 27, Winthrop made considerable progress on implementing mitigation measures identified in the 2005 Hazard Mitigation Plan. Many of the measures identified in that plan are now considered on-going aspects of the regular work of Town staff from the department head level to the regular work of Public Works staff. Individual projects have been incorporated into the Town's capital improvement plan and the Town continues to seek FEMA grant funding to implement the home elevation program. Moving forward into the next five year plan

implementation period there will be many more opportunities to incorporate hazard mitigation into the Town's decision making processes.

Winthrop will be increasing its integration of natural hazard mitigation into its community planning processes by building on priority mitigation actions included in this update of its original plan. The Town will begin to actively incorporate new hazard mitigation actions into its all of its land use, environmental, capital, and transportation planning efforts, building on the following core principles of sound hazard mitigation planning:

- Building on this plan update to continue assessing and mapping community risk;
- Creating local support for integration of natural hazard mitigation planning by increasing its hazard education and risk awareness outreach and education efforts;
- Integrating mitigation into local planning studies, bylaws and regulations;
- Incentivizing hazard mitigation best practices.

II. INTRODUCTION

Planning Requirements under the Federal Disaster Mitigation Act

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

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

In order to address multijurisdictional and regional issues, the participating municipalities were afforded the opportunity to meet with their neighboring communities during plan development. A public, regional meeting of the North Shore Multiple Hazard Community Planning Team was held February 8, 2010 to re-introduce participating communities to the hazard mitigation planning process and to identify inter-community hazard mitigation issues. MAPC has also produced a regional document that summarizes the issues and recommendations for the North Shore communities.

In addition, Winthrop was able to participate in a North Shore Natural Hazard Mitigation Plan Workshop held on September 14, 2011, sponsored jointly by MEMA, MA Coastal Zone Management and MAPC staff. The workshop was designed to help assist communities draft successful PDM plans, as well as providing a forum for sharing individual community plans on a regional basis; exploring inter-community questions, challenges and how to address them. See Appendix C for a list of those submitting comments on the draft 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 Winthrop has experienced 17 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)

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
October Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk (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,

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
		Hampshire, Plymouth
	Hazard Mitigation Grant Program	Statewide
Flooding (March, 2010)	FEMA Public Assistance FEMA Individuals and Households Program SBA Loan	Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Statewide
Tropical Storm Irene (August 27-28, 2011)	FEMA Public Assistance	Statewide
Hurricane Sandy (October 27-30, 2012)	FEMA Public Assistance	Barnstable, Bristol, Dukes, Nantucket, Plymouth, and Suffolk

(Source: database provided by MEMA)

FEMA Funded Mitigation Projects

Over the last 20 years the Town of Winthrop has received funding from FEMA for two mitigation project under the Hazard Mitigation Grant Program. These projects totaled $214,004, with $67,597.50 covered by FEMA grants and $5,000 by local funding. The projects are summarized in Table 3 below.

Table 3 FEMA-Funded Mitigation Projects
(Utilizing the Hazard Mitigation Grant Program)

Project Title	Scope of Work	Total Cost	Federal Funding	Local Funding
Point Shirley Storm Surge Impact Reduction Study	The proposed scope of work is for a storm surge impact study reduction study to mitigate flooding in the Point Shirley Area.	$20,000.00	$14,210.00	$5,000.00
Flood mitigation Utility Retrofit Project	Elevation of utilities above base flood elevation for 20 properties	$194,004.00	$53,387.50	$0.00

Source: database provided by MEMA

Community Profile

The Town of Winthrop is a municipality in Suffolk County, Massachusetts, United States. The population of Winthrop was 17,497 at the 2010 U.S. Census. It is an ocean-side suburban community in Greater Boston situated at the north entrance to Boston Harbor and is very close to Logan International Airport. The Town is a peninsula, 1.6 square miles (4.2 km^2) in area, connected to Revere by a narrow isthmus and to East Boston by a bridge over the harbor inlet to the Belle Isle Marsh Reservation. Settled in 1630, Winthrop is one of the oldest communities in the United States. It is also one of the smallest and most densely populated municipalities in Massachusetts. (Wikipedia)

Although it is located within five miles of downtown Boston, it has retained its reputation for being a safe and pleasant place to live. Winthrop is a close-knit, family oriented community where everything is within walking distance. There is a public bus route which travels throughout the Town and connects to the Orient Heights stop on the Blue Line of the MBTA There are numerous parks and playgrounds, six public beaches, four tennis courts, five athletic fields, a public landing for boats and an indoor skating rink. The Recreation Department offers supervised programs for children in the parks during the summer as well as various programs throughout the year for children and adults. There is a youth center as well as a senior center which both offer many activities and programs.

Additionally, active organizations include an active Medical Reserve Corps, Chamber of Commerce, Rotary, American Legion, Amvets, Little League, Soccer Association, Elks, Sons of Italy, Boy and Girl Scouts, Historical Society, Beautification Committees, Council on Aging, Winthrop Playmakers, three yacht clubs, and a golf club.

There is a newly-revitalized Winthrop Center with a multitude of shops as well as small clusters of stores in other sections of the Town. There are numerous physicians and dentists in the community as well as a community ambulance service. Public facilities include gas, sewer, water, electricity and cable to the entire Town and trash is collected weekly with provision for recycling.

(Narrative supplied by community from: MA Department of Housing and Community Development)

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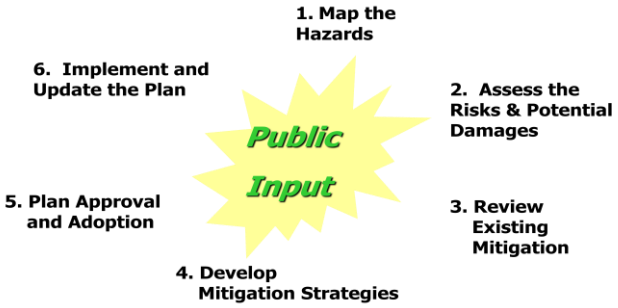
III. PUBLIC PARTICIPATION

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



1. Map the Hazards – MAPC relies on data from a number of different federal, state, and local sources in order to map the areas with the potential to experience natural hazards. This mapping represents a multi-hazard assessment of the municipality and is used as a set of base maps for the remainder of the planning process. A particularly important source of information is the knowledge drawn from local municipal staff on where natural hazard impacts have occurred, which is collected. These maps can be found in Appendix B.

2. Assess the Risks & Potential Damages – Working with local staff, critical facilities, infrastructure, vulnerable populations, and other features are mapped and contrasted with the hazard data from the first step to identify those that might represent particular vulnerabilities to these hazards. Land use data and development trends are also incorporated into this analysis. In addition, MAPC develops estimates of the potential impacts of certain hazard events on the community.

3. Review Existing Mitigation – Municipalities in the Boston Metropolitan Region have an active history in hazard mitigation as many have adopted flood plain zoning districts, wetlands protection programs, and other measures as well as enforcing the State building code, which has strong provisions related to hazard resistant building requirements. All current municipal mitigation measures must be documented.

4. Develop Mitigation Strategies – MAPC works with the local municipal staff to identify new mitigation measures, utilizing information gathered from the hazard identification, vulnerability assessments, and the community's existing mitigation efforts to determine where additional work is necessary to reduce the potential damages from hazard events. Additional information on the development of hazard mitigation strategies can be found in Chapter VII.

5. Plan Approval & Adoption – Once a final draft of the plan is complete it is sent to MEMA for the state level review and, following that, to FEMA for approval. Typically, once FEMA has approved the plan the agency issues a conditional approval with the condition being adoption of the plan by

the municipality. More information on plan adoption can be found in Chapter IX and documentation of plan adoption can be found in Appendix D.

6. Implement & Update the Plan – Implementation is the final and most important part of any planning process. Hazard Mitigation Plans must also be updated on a five year basis making preparation for the next plan update an important on-going activity. Chapter IX includes more detailed information on plan implementation.

Public participation occurred at four levels; the North Shore Multiple Hazard Community Planning Team (regional committee) and the Winthrop Multiple Hazard Community Planning Team (local committee). In addition, the Town held two advertised meetings open to the general public to present the plan and hear citizen input. Following the presentation of the draft plan at the two public meetings, the draft was placed on the Town website for ten days for public comment and questions. Comments are listed in Appendix C.

In addition, Winthrop was able to participate in a North Shore Natural Hazard Mitigation Plan Workshop held on September 14, 2011, sponsored jointly by MEMA, MA Coastal Zone Management and MAPC staff. The workshop was designed to help assist communities draft successful PDM plans, as well as providing a forum for sharing individual community plans on a regional basis; exploring inter-community questions, challenges and how to address them. See Appendix C.

Winthrop's Participation in the Regional Committee

On January 15, 2010, a letter was sent notifying the communities of the first meeting of the North Shore Regional Committee and requesting that the Chief Elected Official designate a minimum of two municipal employees and/or officials to represent the community. The following individuals were appointed to represent Winthrop on the regional committee:

Paul Flanagan Fire Chief and Emergency Management Director

The regional committee serves as an opportunity for neighboring communities to discuss hazard mitigation issues of shared concern. The North Shore Regional Committee met on February 8, 2010 at the Saugus Public Safety Building. At that meeting, representatives from each of the nine North Shore communities beginning the process of reviewing and revising their 2005 Natural Hazard Mitigation Plans were re-introduced to the following items:

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

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

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

The Local Multiple Hazard Community Planning Team

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

The Local Multiple Hazard Community Planning Team Meetings

On March 18, 2011 MAPC conducted the meeting of the Winthrop Local Committee. The purpose of the meeting was to review the existing plan and mitigation goals, including gathering information on local hazard mitigation issues, updating existing mitigation practices, and determining the status of mitigation measures from the 2005 plan. The meeting also included discussion of new or modified mitigation measures and a process for public involvement and outreach. Table 4 lists the attendees at each meeting of the team. The agenda for these meeting is included in Appendix A.

Table 4
Attendance at the Winthrop Local Committee Meeting

Name	**Representing**
March 18, 2011	
Mary Kelly	Chairman, Conservation Commission
Terence Delahunty	Police Chief
Eric Moore	Public Health Administrator
Paul Flanagan	Fire Chief/Emergency Management Director
Steven Calla	Director of Public Works
Dave Hickey	Department of Public Works

Public Meetings

The plan was introduced to the public at two public meetings, both while the draft plan was being completed. The public had an opportunity to provide input to the planning process during a meeting of the Winthrop Planning Board on November 14, 2011 held in the Winthrop Town Hall. The draft planning process was also introduced at a meeting of the Winthrop Town Council on December 20, 2011 at the Harvey School, which had originally been scheduled for December 6.

Both the Planning Board and Town Council meetings were advertised as public meetings. The attendance list for each meeting can be found in Table 5. In addition to staff and elected officials, approximately five people attended the Planning Board meeting and fifteen at the Town Council meeting. In addition, the plan was made available on the Town's website for public review following edits by the Winthrop Natural Hazard Mitigation Team. MAPC staff announced at both the Planning Board and Town Council public meetings that the draft plan would be available for comments and questions for a ten day posting period and encouraged Board members and public attendees to read the plan and submit comments.

Other Opportunities for Public Involvement

The draft plan was posted on the Town's website for 10 days for public comment. The posting was announced at both the Town Council and Planning Board meeting. The Town Council meeting outlining the draft plan, how to get involved and how to submit comment on the draft, was televised and re-broadcast. MAPC contacted organizations and individuals suggested by the Winthrop NHM Team and let them know that the draft plan was available on the Town website for comments and questions. A list of those comments and questions collected on the draft can be found in Appendix C.

Table 5
Attendance at Public Meetings

First Public Meeting

Name	Representing
Peter Roche	Winthrop Planning Board, Chairman
Joe Dow	Winthrop Planning Board
John Crosby	Winthrop Planning Board
Robert Carroll	Winthrop Planning Board
Gina DiMento	Winthrop Planning Board
David Stasio	Winthrop Planning Board
Vincent P.Zappulla	Winthrop Planning Board
Davis Proctor	Winthrop Planning Board, Associate Member
Sam Cleaves	MAPC
Members of the public	

Table 5 (continued)
Attendance at Public Meetings

Second Public Meeting

Name	Representing
Jeffrey Turco, Esq.	Winthrop Town Council, President
James Letterie	Winthrop Town Council, Vice President
Phillip R. Boncore, Esq.	Winthrop Town Council
J. Larry Powers	Winthrop Town Council
Paul Varone	Winthrop Town Council
Nicholas A. DelVento	Winthrop Town Council
Jean Maggio	Winthrop Town Council
Russell Sanford	Winthrop Town Council
Sam Cleaves	MAPC
Members of the public	

Planning Timeline

January 15, 2010	Letter to the municipalities initiating the project.
February 10, 2010	Meeting of the North Shore Regional Committee
March 18, 2011	Meeting of the Local Committee
November 14, 2011	First Public Meeting with the Planning Board
December 20, 2011	Second Public Meeting with the Town Council
January-March 2012	MAPC and Town review and complete draft plan
March 20, 2012	Draft Plan submitted to MEMA
December 3, 2012	Meeting with MAPC and MEMA on the plan
September-October 2013	MAPC coordinates with Town on revised draft plan
October 10, 2013	Revised Draft Plan Submitted to MEMA
April 2014	MAPC coordinates with Town on revised draft plan
April 3, 2014	Revised Draft Plan Submitted to MEMA
August 4, 2014	Revised Draft Plan Submitted to MEMA
April 7, 2015	Revised Draft Plan Submitted to FEMA
June 23, 2015	Plan Adopted by the Town of Winthrop
August 3, 2015	FEMA Approval of Plan (effective for 5 years)

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IV. Risk Assessment

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

Update Process

In order to update Winthrop's risk assessment, MAPC gathered the most recently available hazard and land use data and met with Town staff to identify changes in 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 (described below) and assessed the potential impacts of flooding using the latest data.

Overview of Hazards and Impacts

The Massachusetts Hazard Mitigation Plan 2010 (state plan) provides an in-depth overview of natural hazards in Massachusetts. The state plan indicates that Massachusetts is subject to the following natural hazards): floods, heavy rainstorms, nor'easters or winter storms, coastal erosion, tsunamis, hurricanes, extreme temperatures, tornados, wildfires, drought, landslides and earthquakes. Previous state and federal disaster declarations since 1991 are summarized in Table 1.

Table 6 summarizes the hazard risks for Winthrop. 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

Table 6 - Hazard Risks Summary

Hazard	Frequency		Severity	
	Massachusetts	Winthrop	Massachusetts	Winthrop
Flooding	High	High	Serious	Serious
Dam failures	Very Low	N/A	Serious	N/A
Coastal Hazards	High	High	Serious	Serious
Tsunami	Very low	Extensive	Extensive	Extensive
Winter storms	High	High	Minor	Minor
Hurricanes	Medium	Medium	Serious	Serious
Tornados	Medium	Medium	Serious	Serious
Wildland fires	Medium	High	Minor	Minor
Earthquakes	Very Low	Medium	Extensive	Serious
Landslides	Low	Very Low	Minor	Minor
Drought	Low	Low	Minor	Minor
Extreme Temperature	Medium	Medium	Minor	Minor

Source, Massachusetts State Hazard Mitigation Plan, 2013, modified for Winthrop

The statewide assessment was modified to reflect local conditions in Winthrop using the definitions for hazard frequency and severity listed below.

Definitions used in the Commonwealth of Massachusetts State Hazard Mitigation Plan

Frequency

Very low frequency: events that occur less frequently than once in 1,000 years (less than 0.1% per year)

Low frequency: events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year);

Medium frequency: events that occur from once in 10 years to once in 100 years (1% to 10% per year);

High frequency: events that occur more frequently than once in 10 years (greater than 10% per year).

Severity

Minor: Limited and scattered property damage; no damage to public infrastructure (roads, bridges, trains, airports, public parks, etc.); contained geographic area (i.e. one or two communities); essential services (utilities, hospitals, schools, etc) not interrupted; no injuries or fatalities.

Serious: Scattered major property damage (more than 50% destroyed); some minor infrastructure damage; wider geographic area (several communities); essential services are briefly interrupted; some injuries and/or fatalities.

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

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

Flood Related Hazards

Flooding can be defined as a rising and overflowing of water onto normally dry land. Floods can be slow or fast rising but generally develop over a period of days. Flooding often coincides with spring snow melt an can be a direct result of other frequent weather events in Massachusetts such as Nor'easters, heavy rainstorms, tropical storms and hurricanes. Floods are among the most frequent and costly natural disasters in terms of human hardship and economic loss-75% of federal disaster declarations are related to flooding. Property damage from flooding totals over $5 billion in the United States each year.

Winthrop is subject to three kinds of flooding: *coastal flooding* where wind and tide leads to flooding along tidal waterways: *inland/riverine flooding* where the rate of precipitation and/or amount of stormwater runoff overwhelms the capacity of natural or structured drainage systems causing overflows; *urban flooding* in which precipitation causes the water table to rise and leads to flooding of low-lying areas such as streets and underpasses. These types of flooding are often combined as storm events lead to large amounts of draining stormwater, which is blocked by the inland push of wind and tide driven water. Flooding was the most prevalent serious natural hazard identified by local officials in Winthrop.

Location

The area of Winthrop that floods the most frequently is Point Shirley. In addition to the eastern side of Point Shirley being directly impacted by ocean waves and storm surge, the western side of the Point is often impacted by the what local residents describe as the "Boston Harbor bathroom effect" in which tidal driven storm surge causes water build-up in the Harbor and causes flooding on the western side of Point Shirley. Another area that floods frequently is the residential area surrounding Lewis Lake. Lewis Lake drains approximately half of the Town. Homes in this area flood because the lake is silted up which reduces its capacity.

Flooding also occurs in the vicinity of Ingleside Park. The park is at sea level with a pipe that drains to the bay. There is a valve that shuts during heavy tides but the area may need a pump station as well. To help with flooding in this area, the Town has constructed dikes around two homes as a temporary solution. The south end of Yirrell Beach, in the vicinity of Wyman Street also experiences flooding because the seawall does not extend far enough. The road leading to the MWRA Deer Island waste water facility is also prone to flooding during larger storm events, with the frequency increasing due to sea level rise. Flood zones are shown on Map 3 in Appendix B.

Extending the seawall at Yirrell Beach to Deer Island remains the Town's top priority hazard mitigation measure. There is a seawall at Yirrell Beach that stops about 1,000 feet short of Deer Island. This seawall is occasionally breached which results in sand coming up over the wall. This sand has been removed by the MWRA. Because the seawall ends at Wyman Street, this street floods, which can affect up to 40 homes. In March of 2003, the Town had to remove four feet of gravel that had washed up on Wyman Street. The Town has trenched the street so that water flows away from the street but the longer term solution would be to extend the seawall 1,000 feet to Deer Island. The Town did apply for a FEMA hazard mitigation grant to extend the seawall but received funding for storm drain improvements associated with the current seawall only. A drainage study was conducted at Ingleside Park and the storm drain lines were cleaned in 2007, but this has not solved the problem of

the consistent flooding of the park and the Town is still considering structural and non-structural approaches. Winthrop has improved its storm drainage infrastructure capacity over the last several years with the purchase of its own street sweeping and catch basin trucks. It has also adopted a new storm water management ordinance to prevent and mitigate storm water runoff and has flood-proofed 17 repetitive loss properties, including the elevation of gas, electrical and heating lines. The Town is continuing to work with MA DCR and its own engineering consultant to improve Lewis Lake-working to having it dredged and increase its flood water storage capacity, upgrading the storm drain lines from Winthrop Shore Drive to the lake and replacing the old manual tide gate with a self regulating one. Some upgrades at the Pico Beach sewer pump station have been conducted, including a generator upgrade but the station needs more work and wet-well capacity issue, perhaps due to a groundwater Inflow and Infiltration (I and I) problem is still being analyzed. Finally, the seawall at Grandview Avenue has been upgraded and heightened by two feet, from just south of the intersection of Billows Street and Grandview Avenue to Coughlin Playground.

Information on flood hazard areas was taken from two sources. The first was the current National Flood Insurance Rate Maps, dated from September 25, 2009. The FIRM flood zones are shown on Map 3 in Appendix B. The second was discussions with local officials. The Locally Identified Areas of Flooding described below were identified by Town staff and other plan participants as areas where flooding is known to occur. These areas do not necessarily coincide with the flood zones from the FIRM maps. They may be areas that flood due to inadequate drainage systems or other local conditions rather than location within a flood zone. The numbers correspond to the numbers on Map 8, "Hazard Areas". The numbers do not reflect priority order.

<u>Locally Identified Areas of Flooding</u>

1) Yirrell Beach: coastal surge and flooding during storm events

2) Shirley Street Neighborhood: low-lying street area and adjacent seawall experience wave overtopping and flooding during storm events

3) Lewis Lake: Serves as drainage area for large part of downtown area. Lake overflows during storm events and causes flooding in adjacent areas.

4) Ingleside Park: Backup and flooding due to lack of storm water storage capacity and undersized drains. Floods during high tide events coinciding with high precipitation events of greater than 1 inch.

5) Lower Nahant Avenue: coastal surge, high tide and high precipitation events all cause backup in undersized drain lines and flooding within the adjacent neighborhood.

6A) Woodside seawall and headwall on Boston Harbor: coastal surge flooding during storm events

6B) Somerset seawall and headwall on Boston Harbor: coastal surge flooding during storm events

6C) Sargent Street seawall and headwall on Boston Harbor: coastal surge flooding during storm events

6D) Cottage Park seawall and headwall on Boston Harbor: coastal surge flooding during storm events

7) Coughlin Park: coastal erosion and flooding during higher northwest wind events and coastal storms

8) Flooding: Bayou Street Neighborhood- flooding due to undersized drainage line that backs up in high precipitation events

Previous Occurrences and Impacts

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

The most severe recent flooding occurred during the major storm of March 2010, when Suffolk County broke the record of 11 inches of rain set in 1953. During the month of March of 2010, a new total of 14.83 inches of rainfall accumulation was officially recorded by the National Weather Service (NWS). The weather pattern that caused these floods consisted of early springtime prevailing westerly winds that moved three successive storms, combined with tropical moisture from the Gulf of Mexico, across New England. Historically, NWS determined that March 2010 was the fourth wettest of any month since 1872.

Based on data from the National Weather Service, National Climatic Data Center, FEMA disaster declarations, the Suffolk County FIS, and local data sources, historic flood events from 1950 through April 30, 2014 were compiled and are summarized in Table 7. The table does not include events classified as Coastal Flood or Urban/Small Stream Floods.

Table 7: Suffolk County Flood Events 1950 – 4/30/2014

County	Date	DTh	Inj	PrD
SUFFOLK CO.	10/28/2006	0	0	8.00K
SUFFOLK CO.	09/01/2013	0	0	5.00K
SUFFOLK CO.	06/07/2013	0	0	0.00K
SUFFOLK CO.	09/18/1996	0	0	0.00K
SUFFOLK CO.	10/29/2012	0	0	15.00K
SUFFOLK CO.	05/13/2006	0	0	0.00K
SUFFOLK CO.	03/14/2010	0	0	10.700M
SUFFOLK CO.	08/25/2010	0	0	0.00K
SUFFOLK CO.	02/13/2008	0	0	5.00K
SUFFOLK (ZONE)	03/05/2001	0	0	15.000M
TOTAL		**0**	**0**	**25.733M**

Source: NOAA, National Climatic Data Center **Column Definitions:** 'Mag': Magnitude, 'Dth': Deaths, 'Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage

Previous Occurrences of Coastal Flooding

Town-specific data for previous -wide coastal flooding occurrences is not collected by the Town and county flooding data was used as the best available data for reviewing past events, calculating impacts and helping to determine future probability. Suffolk County, which includes Winthrop, experienced sixteen Coastal Flood events from 1950 – April 30, 2014. No deaths or injuries were reported and the total reported property damage was $3.11 million dollars. See Table 8.

Table 8. Suffolk County Coastal Flood Events 1950 – 4/30/2014

County/Zone	Date	Time	**Type**	**Dth**	**Inj**	**PrD**
SUFFOLK (ZONE)	01/03/2014	10:30	Coastal Flood	0	0	0.00K
SUFFOLK (ZONE)	01/02/2014	11:23	Coastal Flood	0	0	0.00K
SUFFOLK (ZONE)	03/07/2013	05:28	Coastal Flood	0	0	0.00K
SUFFOLK (ZONE)	02/09/2013	09:45	Coastal Flood	0	0	30.00K
SUFFOLK (ZONE)	06/03/2012	21:05	Coastal Flood	0	0	0.00K
SUFFOLK (ZONE)	06/04/2012	21:50	Coastal Flood	0	0	0.00K
SUFFOLK (ZONE)	10/29/2012	09:45	Coastal Flood	0	0	3.000M
SUFFOLK / PART OF NORFOLK...	01/31/2006	12:20	Coastal Flood	0	0	10.00K
SUFFOLK (ZONE)	11/23/2011	08:52	Coastal Flood	0	0	0.00K
SUFFOLK (ZONE)	12/27/2010	02:18	Coastal Flood	0	0	50.00K
SUFFOLK (ZONE)	03/14/2010	11:39	Coastal Flood	0	0	0.00K
SUFFOLK (ZONE)	01/02/2010	11:04	Coastal Flood	0	0	0.00K
SUFFOLK (ZONE)	10/18/2009	11:15	Coastal Flood	0	0	0.00K
SUFFOLK (ZONE)	04/16/2007	09:00	Coastal Flood	0	0	5.00K
SUFFOLK (ZONE)	04/17/2007	22:00	Coastal Flood	0	0	10.00K
SUFFOLK (ZONE)	04/15/2007	21:00	Coastal Flood	0	0	5.00K
TOTAL			**16**	**0**	**0**	**3.110M**

Source: NOAA, National Climatic Data Center **Column Definitions:** 'Mag': Magnitude, 'Dth': Deaths, 'Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage

Extent of flooding

The extent of flooding in Winthrop is indicated by recorded high water marks documented by the US Geological Survey for the Blizzard of 1978, the highest coastal flood on record. The USGS, in cooperation with the Army Corps of Engineers and the Massachusetts Department of Public Works, inventoried high water marks along the New England coast, including seven locations in the Town of Winthrop. The high water levels for these locations area summarized in table XX below.

Table 9 High Water Marks in Winthrop, Blizzard of 1978

Site No.	Elevation (ft-NGVD29)	Description
248	12.45	Lat 42°22'41", long 70058'22", Winthrop, Mass., Winthrop Beach, good wash line on seventh clapboard from ground at 65 Beach Street, halfway between seventh and eighth clapboard. Waves over seawall.
249	7	Lat 42°22'16", long 70°58'12", Winthrop, Mass., Cottage Hill, good drift line 1.8ft above base of chain link fence across street from Hadassah Way and Temple Tifreth Israel. Waves over seawall.
250	12.67	Lat 42°21'33", long 70°58'16", Winthrop, Mass., Point Shirley, good to fair debris line 1.8ft above sidewalk on chain link fence at 965 Bayview on corner. Waves over seawall.
251	11.04	Lot 42°21'26", long 70°58'16", Point Shirley, Mass., Boston Harbor, right side" of garage, brick ranch, at 25 Maryland Avenue. High-water-mark description and elevation furnished by the Massachusetts Department of Public Works.
252	11.1	Lat 42°21'27", long 70°58'20", Point Shirley, Mass., Boston Harbor, foundation and mail box at 80 Otis Street. High-water-mark description and elevation furnished by the Massachusetts Department of Public Works.
253	11.09	Lat 42021'27", long 70°58'20", Point Shirley, Mass., Boston Harbor, mail box near driveway of 82 Otis Street. High-water-mark description and elevation furnished by the Massachusetts Department of Public Works.
254	10.38	Lat 42°22'06", long 70°58'20", Cottage Hill, Mass., Crystal Cove, debris line at lower locker deck of Winthrop Yacht Club, 649 Shirley Street. High-water-mark description and elevation furnished by the Massachusetts Department of Public Works.

Source: Coastal Flood of Feb. 7, 1978 in ME, MA & NH, Russell A Gadoury, USGS Water Resources Investigations 79-61

Repetitive Loss Structures

There are 135 repetitive loss structures in Winthrop, an increase from the 126 structures identified in the 2005 plan. As defined by the Community Rating System (CRS) of the National Flood Insurance Program (NFIP), a repetitive loss property is any property which the NFIP has paid two or more flood claims of $1,000 or more in any given 10-year period since 1978. For more information on repetitive losses see http://www.fema.gov/business/nfip/replps.shtm.

The majority of the repetitive loss properties in Winthrop are single family homes, though many multi-family and several commercial structures can be found in the FEMA flood zone A and other areas identified for frequent flooding. Table 10 below shows the breakdown of structure type by FEMA designated and locally identified flood zones.

Table 10
Repetitive Loss Properties Summary

Flood Zone	**Single Family Residential Structures**	**Multi-Family Residential Structures**	**Commercial, Industrial, or Institutional Structures**	**Total Repetitive Loss Properties**
FEMA Zone A	78	30	0	108
FEMA Zone VE	7	0	0	7
FEMA .2% annual chance	8	2	0	10
Total: FEMA Flood Zones	**93**	**32**	**0**	**125**
Yirrell Beach	40	8	0	48
Shirley Street Neighborhood	12	13	0	25
Lewis Lake	3	2	0	5
Somerset seawall and headwall on Boston Harbor	0	0	0	0
Cottage Park seawall and headwall on Boston Harbor	0	0	0	0
Sargent Street seawall and headwall on Boston Harbor	0	0	0	0
Woodside seawall and headwall on Boston Harbor	0	0	0	0
Coughlin Park	0	0	0	0
Bayou Street Neighborhood	0	0	0	0
Ingleside Park	0	0	0	0
Lower Nahant Avenue	2	0	0	2
	0	0	0	0
Total: Locally Identified Areas of Flooding	**57**	**23**	**0**	**80**

Probability of Future Events

Flooding of all types in Winthrop are high frequency events as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 10 years.

Dams and Dam Failure

There are no dams located within the Town of Winthrop.

Mitigation Measures Already in Place – None.

Future Mitigation Measures – None are necessary due to the absence of dams.

Coastal Hazards

Erosion and flooding are the primary coastal hazards that lead to the loss of lives or damage to property and infrastructure in developed coastal areas. Coastal storms are an intricate combination of events that impact a coastal area. A coastal storm can occur any time of the year and at varying levels of severity. One of the greatest threats from a coastal storm is coastal flooding due to storm surge. This is the inundation of land areas along the oceanic coast and estuarine shoreline by seawaters over and above normal tidal action.

High winds, erosion, heavy surf, unsafe tidal conditions, and fog are ordinary coastal hazard phenomena. Some or all of these processes can occur during a coastal storm, resulting in an often detrimental impact on the surrounding coastline. Storms including northeasters and hurricanes, decreased sediment supplies, and sea-level rise contribute to these coastal hazards.

Hurricanes and Nor'easters

Hurricanes and Nor'easters are two storm types that impact the coast and coastal resources. For this report Hurricanes and Nor'easters are identified and analyzed as an atmospheric and winter related hazard.

A northeast coastal storm, known as a nor'easter, is typically a large counter-clockwise wind circulation around a low-pressure center often resulting in heavy snow, high winds, and rain. Frequently, Nor'easters are a coastal event for Massachusetts.

Hurricanes are relatively fast moving, rarely impacting the coast over multiple tidal cycles. When landfall is made, these concentrated, strong low-pressure systems usually pound south facing shores with high winds, precipitation, and storm surge. A Category 2 storm can cause millions of dollars in damage.

Characteristics or impacts of coastal storms

	Nor'easters	Hurricanes
Similarities		
	Economic Impacts Winds Surge and Wave Action Inland Flooding potentials	
Differences		
Duration	Lasting days on average	Lasting only hours
Season	October-May	August-October
Evacuations	Fewer coastal area evacuations, off season	Very populated coastal areas
Debris impacts	Less foliage	Full foliage

Source: Mass. State Hazard Mitigation Plan

More information on Hurricanes and Nor'easters is given under Wind Related Hazards.

Decreased Sediment Supplies

Coastal landforms such as coastal banks are essential to maintaining a supply of sediment to beaches and dunes. Where engineered structures are used to stabilize shorelines, the natural process of erosion is interrupted, decreasing the amount of sediment available and causing erosion to adjacent areas. Under conditions of reduced sediment, the ability of coastal resource areas such as dunes and beaches to provide storm damage prevention and flood control benefits is continually reduced. A major challenge is to ensure that regional sediment supplies are managed effectively and in ways that allow the beneficial storm damage prevention and flood control functions of natural coastal processes to continue— both for future projects and, where possible, existing coastal development.

Location

In Winthrop, there are many examples of both public and private infrastructure that are impacting sediment supplies to beaches. One area is the seawall along Winthrop Shore Drive (public infrastructure) and another is the private seawall along both sides of Shirley Street. Other areas with hard engineered infrastructure that may be impacting the supply of sediment to coastal beaches include Brewster and Grandview Avenues, Faunbar Avenue and Terrace Avenue.

Coastal Erosion and Shoreline Change

Coastal shorelines change constantly in response to wind, waves, tides, sea level fluctuation, seasonal and climatic variations, human alteration, and other factors that influence the movement of sand and material within a shoreline system. The loss (erosion) and gain (accretion) of coastal land is a visible result of the way shorelines are reshaped in the face of these dynamic conditions. Shorelines tend to change seasonally, accreting slowly during the summer months when sediments are deposited by relatively low energy waves and eroding dramatically during the winter when sediments are moved offshore by high-energy storm waves, such as those generated by nor'easters. Regardless of the

season, coastal storms typically cause erosion. With the anticipated change in climate an increase in intensity and frequency of storms is expected. This will, in turn, increase the likelihood of severe erosion episodes along the coast of Massachusetts.

Coastal erosion and shoreline change can result in significant economic loss through the destruction of buildings, roads, infrastructure, natural resources, and wildlife habitats. Damage often results from the combination of an episodic event with severe storm waves and dune or bluff erosion.

Some of the methods used by property owners to stop, or slow down, coastal erosion or shoreline change can actually exacerbate the problem. Attempting to halt the natural process of erosion with seawalls and other hard structures typically worsens the erosion in front of the structure, prevents any sediment behind the structure from supplying down drift properties with sediment and subjects down drift beaches to increased erosion. Without the sediment transport associated with erosion, some of the Commonwealth's and Winthrop's greatest assets and attractions – beaches, dunes, barrier beaches, salt marshes, and estuaries are threatened and will slowly disappear as the sediment sources that feed and sustain them are eliminated.

The Massachusetts Office Coastal Zone Management (CZM) has been collecting new data and studying and monitoring shoreline change. Additional information on shoreline change may be found in CZM's Fact Sheet on New Data on Shoreline Change online at
http://www.mass.gov/czm/hazards/index.htm or
http://www.mass.gov/czm/coastguide/online/index.htm

Location

Coastal Hazards are a Town-wide hazard in regard to hurricanes and nor'easters. In addition, many of the same areas in Winthrop vulnerable to coastal flooding are also subject to decreased sediment, coastal erosion and shoreline change including the following areas:

- Yirrell Beach
- Shirley Street Neighborhood
- Lower Nahant Avenue Neighborhood
- Coughlin Playground

Extent and Previous Occurrences

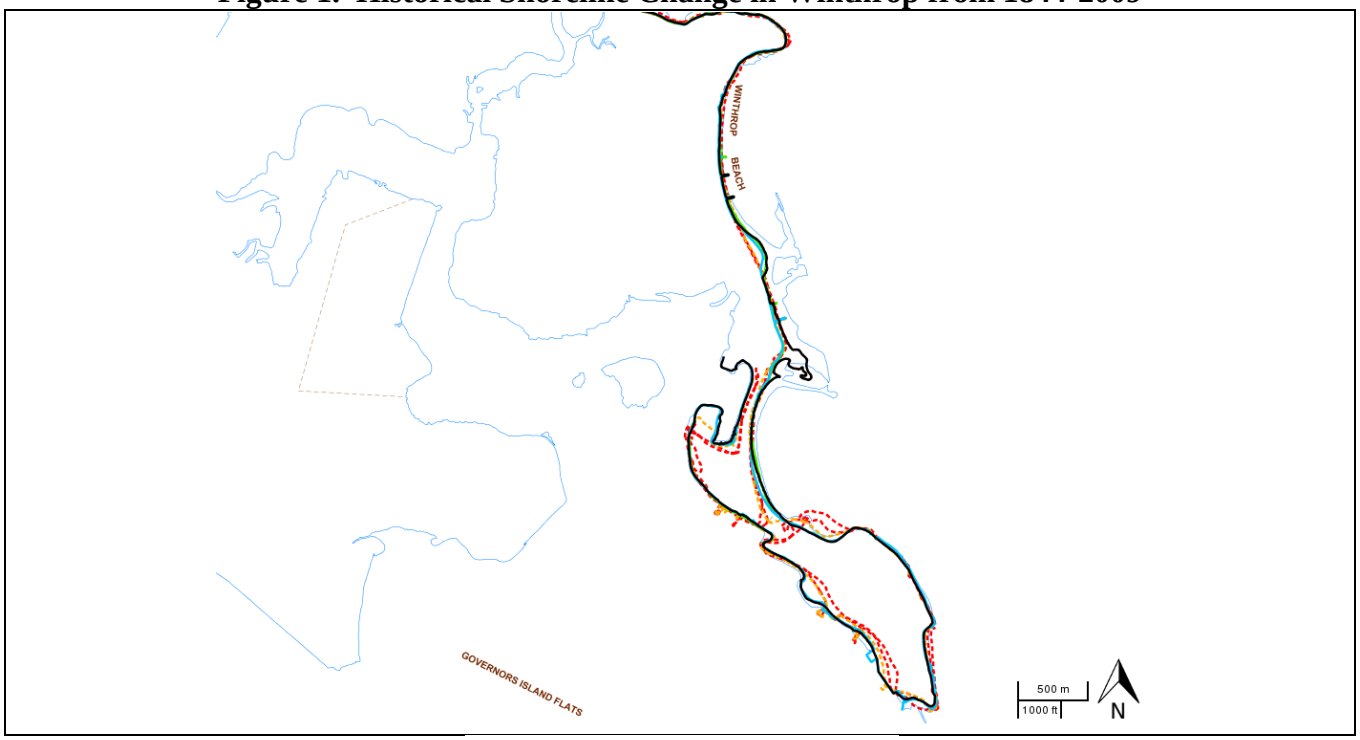
Erosion

Approximately 75 percent of the U.S. ocean shoreline is eroding. Massachusetts' ocean- facing shore is no exception. A study of shoreline change in Massachusetts by the U.S. Geological Survey, Woods Hole Oceanographic Institution Sea Grant Program, and Cape Cod Cooperative Extension reveals that approximately 68 percent, or 513 miles, of Massachusetts' ocean-facing shore exhibits a long-term erosion trend, 30 percent, or 226 miles, shows long-term accretion, and two percent, or 15 miles, shows no net change.

For the entire ocean-facing Massachusetts shore, from the mid -1800's to 1994, the long-term average annual shoreline change rate ranges between -0.58 and 0.75 feet per year.
Approximately 46 percent of the Massachusetts shore is eroding at one foot or less per year, while 22 percent of the shore is accreting at one foot or less per year. Eighty-one percent of the shore fluctuates

+/-2 feet per year. Based on other studies (Pilkey & Thieler, 1992), 75 percent of the U.S. ocean shore is eroding, with the U.S. East Coast eroding at an average rate of 2-3 feet per year (Leatherman, 1993). Thus, Massachusetts' average annual shoreline change rate is lower than the East Coast average.

Figure 1. Historical Shoreline Change in Winthrop from 1844-2009



Source: MA CZM Shoreline Change Project

Probability of Future Events

Coastal hazards, excepting Hurricanes, are classified as High frequency events as defined by Table 6. Coastal Hazards are hazard events that may occur more frequently than once in 10 years, (greater than 10% per year). Hurricanes, also described in Wind Related Hazards, are classified as Medium

frequency events, a hazard event that may occur from once in 10 years to once in 100 years (1% to 10% per year).

Atlantic Based Tsunami

The Federal Emergency Management Agency defines tsunami as a series of enormous seismic sea waves created by an underwater disturbance caused by geologic activity in the form of earthquakes, volcanic eruptions, underwater landslides or meteorites striking the Earth. A tsunami can move hundreds of miles per hour in the open ocean and smash into land with waves as high as 100 feet or more. Earthquake induced movement of the ocean floor most often generates tsunamis. If a major earthquake or landslide occurs close to shore, the first wave in a series could reach the shore in a few minutes, even before a warning is issued. Coasts that are at greater risk are areas less than 25 feet above sea level and within a mile of the shoreline.

Location

Tsunamis are a Town-wide hazard. Tsunami wave action over the shore is variable and mainly dependent of the combination of both submarine and land topography in the area and the orientation of the arriving waves. The extent of damage and impact from tsunami depends upon the source and severity of onset on the tide cycle. As such, all of Winthrop would be considered vulnerable to coastal inundation from tsunami. Tsunamis were listed in the Massachusetts Hazard Mitigation Plan starting in 2010 and Winthrop did not included Tsunamis in its 2005 Plan and does not have specific existing mitigation measures in place for the hazard.

Previous Occurrences

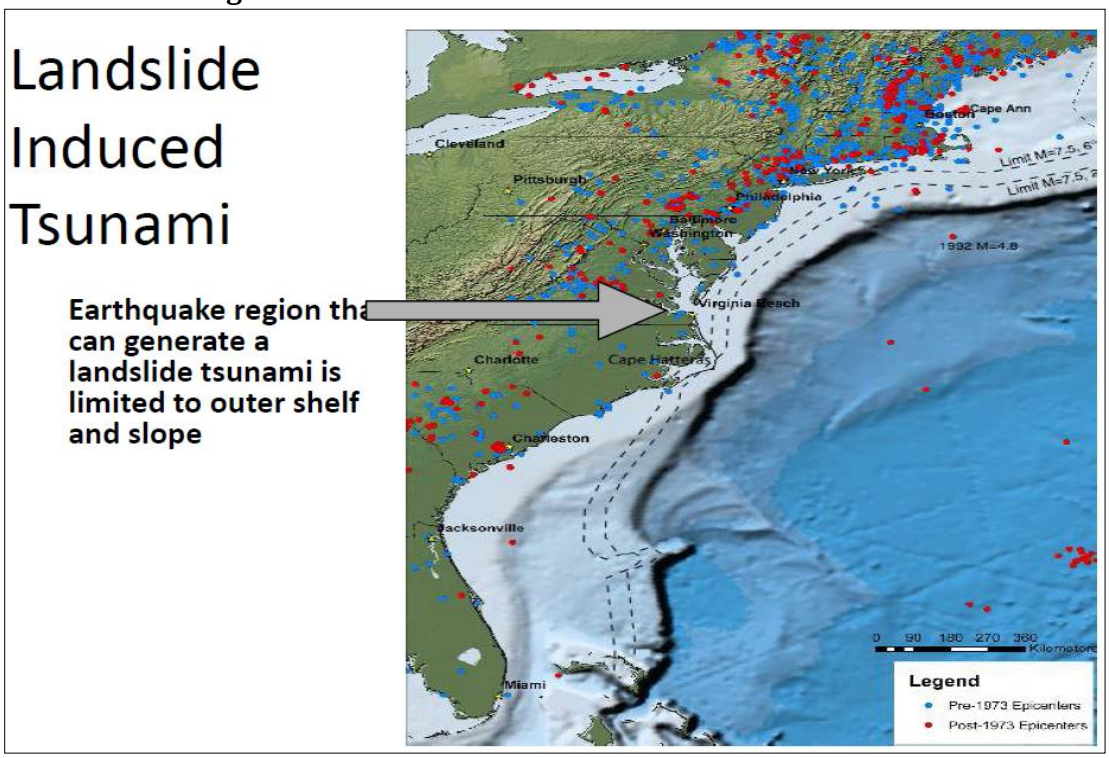
There have been no recorded instances of tsunamis in Suffolk County or Winthrop.

Probability of Future Occurences

According to the West Coast and Alaska Tsunami Warning Center (WCATWC), an Atlantic based tsunami threat level for the US east coast is low when compared to the US Pacific and Caribbean coasts. Although the probability is low, a tsunami threat does exist and it is not out of the realm of possibility for the Atlantic. Geophysics specialists and geologists from the U.S. Geologic Survey and the Woods Hole Oceanographic Institute have researched Georges Bank Lower Slope of the western North Atlantic and the relationship there between submarine landslides and earthquakes (see Figure 15). "The US Atlantic coast would be particularly vulnerable to devastation from tsunami because of the high density of population and infrastructure along its low lying coastal areas and estuaries."(Dr. Uri S ten Brink, et.al. Marine Geology 264, 2009, p.65) Further, Dr. ten Brink confirms that **"**the likelihood that a tsunami will hit this coast is fairly low. However, the most likely source will be a landslide that happens underwater at an area of about 215 miles offshore from Winthrop in an area known as the Continental Slope. This is the area that separates the very wide and shallow shelf. The shelf is about 100 to 150 meters deep from the deep ocean." The US Geologic Survey is researching the probability of a landslide on the Continental Shelf.

Based on this assessment, the probability of a future tsunami hazard event in Winthrop is very low, an event that could occur less frequently than once in 1,000 years, less than 0.1% per year.

Figure 2 - Atlantic Based Tsunami- Potential Threat



Wind Related Hazards

Wind-related hazards include hurricanes and tornados as well as high winds during severe rainstorms and thunderstorms. The typical wind speed in the Winthrop area 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. All of Winthrop would be susceptible to damage from wind related hazards. Wind related hazards are Town -wide hazards.

As with many communities, falling trees caused by high winds can down power lines and cause power outages. Hazardous situations can be mitigated by routine maintenance and care of street and park trees. Many cities operate on a 6-7 year pruning cycle, although this number is often closer to 10, due to lack of funding for forestry staff and crews. Trees are vulnerable to strong winds due to insufficient planting spaces and soil volumes. New standards for street tree plantings need to be developed and adopted as part of mitigation planning.

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

Hurricanes begin as tropical storms over the warm moist waters of the Atlantic, off the coast of West Africa, and Pacific Oceans near the equator. As the moisture evaporates, it rises until enormous amounts of heated, moist air are twisted high in the atmosphere. The winds begin to circle counterclockwise north of the equator or clockwise south of the equator. The center of the hurricane is called the eye.

Tropical cyclones (Tropical Depressions, Tropical Storms, and Hurricanes) form over the warm, moist waters of the Atlantic, Caribbean, and Gulf of Mexico. When water temperatures are at least 80° F, hurricanes can grow and thrive, generating enormous amounts of energy, which is released in the form of numerous thunderstorms, flooding rainfall, and, very damaging winds. The damaging winds help create a dangerous storm surge (rise in the water above the normal astronomical tide).

A Tropical Depression is declared when there is a low pressure center in the tropics with sustained winds of 25-33 mph. A Tropical Storm, which is given a name, is defined as having sustained winds from 34-73 mph. If sustained winds reach 74 mph or greater, it becomes a Hurricane.

Hurricanes can range from compact storms only 50 miles across, to huge storms, as much as 500 miles wide -- Hurricane Allen in 1980 took up the entire Gulf of Mexico. There generally are two source regions for the storms that have the potential to strike New England: 1) off the Cape Verde Islands near the west coast of Africa and 2) in the Bahamas. The Cape Verde storms tend to be very large in diameter, since they have a week or more to traverse the Atlantic Ocean and grow. Bahamas' storms tend to be smaller, but they can also be just as powerful and their effects can reach New England in only a day or two. (Source: 2010 Mass. Hazard Mitigation Plan)

The Saffir/Simpson scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential, which are combined to estimate potential damage. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf in the landfall region. All winds are using the U.S. 1-minute average, meaning the highest wind that is sustained for 1-minute. The following Saffir/Simpson Scale gives an overview of the wind speeds 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

Location

Hurricanes are a Town-wide hazard. A hurricane is strongest as it travels over the ocean and is particularly destructive to coastal property as the storm hits the land. Hurricanes generally occur between June and November. Falling trees are a big problem because they can cause power outages when they fall on power lines or block traffic. Information on historical hurricane and tropical storm proximity to Winthrop is shown on Map 5 in Appendix B. There have been no significant changes to address hurricane emergency response since 2005. The two major mitigation measures in place are adherence to the Massachusetts State Building Code and the Town's Comprehensive Emergency Management Plan which addresses hurricane hazards although primarily from a response perspective.

Hurricanes/Tropical Storms Previous Occurrences

There have been no tropical storms or hurricanes recorded to have passed directly through Winthrop. However, hurricanes typically have regional impacts beyond their immediate tracks, and numerous hurricanes have affected the communities of eastern Massachusetts. See Table 11, Hurricane Records for Eastern Massachusetts below for hurricanes that have impacted Winthrop. A hurricane or tropical storm track is the line that delineates the path of the eye of the hurricane or storm. The Town also feels the impacts of the wind and rain of other coastal storms and hurricanes, regardless of whether the track passes through the Town, and numerous hurricanes have affected the communities of eastern Massachusetts Storms that track west of the result in stronger winds in Winthrop, while those that pass to the east may bring more rainfall. The hazard mapping indicates that the 100 year wind speed is 110 miles per hour. Major tropical storms and hurricanes that passed near Winthrop are summarized in Map 5, Appendix B.

It is important to note that Hurricane Irene from August 21 – 30, 2011 and Hurricane Sandy from October 22 – 31, 2012 fortunately did not track directly over Winthrop. Hurricane Sandy was a Category 3 hurricane at its peak intensity and weakened to a Category 2 off the northeastern Atlantic coast. Hurricane Sandy became the largest Atlantic hurricane on record with winds spanning 1,100 miles. Strong tropical force winds from the northeast quadrant of the post tropical cyclone, Sandy developed into a super storm nor'easter that impacted Winthrop and Suffolk County. Winthrop closed the tidal gate on Winthrop Shore Drive at 7 A.M. on the morning of Sandy's arrival.

Winthrop Shore Drive, October 28, 2012, Hurricane Sandy
Photo: courtesy of *Winthrop Transcript*

Though local data for Winthrop is not collected by the Town, Hurricane Sandy had a per capita county wide impact of $9.31, with total public assistance issued for Suffolk County totaling $22,209,299 (Source: FEMA) .

News reports for Hurricane Sandy indicated key findings, as reported by the *Winthrop Transcript* on November 1, 2012: "(Fire Chief) Flanagan said there was some personal property damage such as electrical services being dismantled from homes and four boats breaking loose in the harbor. The chief also reported that at the peak of the storm 2,100 customers were without electrical power.

The Winthrop Fire Department staged fire apparatus and ambulances on Point Shirley during periods of high tides. Shirley Street at Tewksbury Street became impassable for a period of a few hours during Monday morning's high tide.

The chief also said that two telephone poles went down on Putnam Street while another pole broke off at the base on Veterans Road.

At 10 a.m. on Monday, Flanagan had the Medical Reserve Corps (MRC) open a shelter at the Cummings School in case of tidal concerns."

RecentFederal disaster declarations for hurricanes impacting Winthrop are shown in Table 12.

Table 11-Hurricane Records for Eastern Massachusetts

Hurricane Sandy	October 29-30, 2012
Tropical Storm Irene	August 28, 2011
Hurricane Earl	September 4, 2010
Hurricane Hanna	August 28, 2008 to September 8, 2008
Tropical Storm Barry	May 31, 2007 to June 5, 2007
Tropical Storm Hermine	August 27 - 31, 2004
Hurricane Bertha	July 5 - 17, 1996
Hurricane Bob	August 16 - 29, 1991
Hurricane Gloria	September 27,1985
Hurricane Donna	September 12, 1960
Hurricane Diane	August 17-19, 1955
Hurricane Edna*	September 11, 1954
Hurricane Carol*	August 31, 1954
Hurricane Doug	September 11-12, 1950
Great Atlantic Hurricane of 1944*	September 9 - 16, 1944
Great New England Hurricane*	September 21, 1938
Tropical Storm of 1923	October 15 – 19, 1923
Extratropical Storm of 1916	May 13 – 18, 1916
Hurricane of 1916	July 10 - 22, 1916
Hurricane of 1915	July 31, 1915 to August 5, 1915
Hurricane of 1908	May 24 - 31, 1908
Tropical Storm of 1902	June 12 - 17, 1902
Hurricane of 1897	September 20 - 25, 1897
Hurricane of 1888	August 14 - 24, 1888
Tropical Storm of 1888	September 6 -13, 1888
Hurricane of 1876	September 12 - 19, 1876
Hurricane of 1869	September 7 – 9, 1869
Hurricane of 1861	November 1 – 3, 1869

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

Table 12 - Hurricane Disaster Declarations-includes Winthrop

Disaster	Title	Dates
DR-751	Hurricane Gloria	9/27/1985
DR-914	Hurricane Bob	8/19/1991
EM-3252	Hurricane Katrina Evacuation	8/29/2005-10/1/2005
EM-3315	Hurricane Earl	9/1/2010-9/4/2010
EM-3350	Hurricane Sandy	10/29/12–10/30

Source: FEMA

Probability of Future Events

Hurricanes are classified as Medium frequency events for Winthrop as defined by the 2010 Massachusetts State Hazard Mitigation Plan. Hurricanes are hazard events that may occur from once in 10 years to once in 100 years (1% to 10% per year).

Tornados

A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. Because wind is invisible, you can't always see a tornado. A visible sign of the tornado is the dust and debris which can get caught in the rotating column made up of water droplets. Tornados are the most violent of all atmospheric storms.

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

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

Typically, there are 1 to 3 tornados somewhere in southern New England per year. Most occur in the late afternoon and evening hours, when the heating is the greatest. The most common months are June, July, and August, but the Great Barrington, MA tornado (1995) occurred in May and the Windsor Locks, CT tornado (1979) occurred in October. (2010 Mass. State Hazard Mitigation Plan)

Waterspout

A waterspout is a rapidly rotating column of air extending from the cloud base (typically a cumulonimbus thunderstorm) to a water surface, such as a bay or the ocean. There are two methods of formation.

First, unlike a tornado, waterspouts can form on a clear, sunny day if the right amount of instability and wind shear exists. These storms can have wind speeds ranging from 60 to 100 mph, but since they do not move very far, they can often be navigated around. These can become a threat to land if they do drift onshore.

A tornadic waterspout, on the other hand, is a true tornado that happens to be moving over water at the time (tornado over water). These form from the same processes that cause Tornados (see section above).

The National Weather Service issues a Special Marine Warning (SMW) for waterspouts over the coastal waters. They also issue a Tornado Warning (TOR) if a waterspout shows signs of moving toward land.

The Enhanced Fujita Tornado Scale

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). It is considerably more complicated than the original F-scale, and it allows surveyors to create more precise assessments of tornado severity.

Figure 3: Enhanced Tornado Fujita Scale

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

Location

Tornados are a Town -wide hazard. Tornados tend to be quite rare in eastern Massachusetts and there have been no recorded tornados in the Town of Winthrop. There have been no changes since the 2005 NHM Plan to address tornados in Winthrop beyond maintaining emergency shelter in the event that they were needed.

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

The Town does maintain American Red Cross certified emergency shelters at the Fort Banks School and the Cummings School if they were needed in case of evacuations due to tornados.

Previous Occurrences

Winthrop does not collect local data for tornado occurrence or related impacts to the community. Suffolk County data is the best available data to help understand previous occurrences, related impacts and the probability of future tornado hazard events. Suffolk County, which includes Winthrop, experienced one tornado event from 1950 – April 30, 2014. No deaths or injuries were reported for Suffolk County and there was no reported property damage (NOAA National Climate Data Center)

On Monday, July 28, 2014 a tornado struck the City of Revere, MA which is located adjacent to Winthrop. There were several minor injuries but no deaths. Property damage estimates are preliminary but public property damages are thought to be at least $2 million dollars with private estimates still incomplete. The tornado was F-2 in magnitude and was on the ground for approximately four minutes in Revere.

Probability of Future Tornado Events

Based on the record of previous occurrences since 1950, Tornado events in Winthrop are now a Medium frequency event as defined by the 2010 Massachusetts State Hazard Mitigation Plan. This hazard may occur from once in 10 years to once in 100 years, 1% to 10% per year.

Winter Storms

Snow and Blizzards

Snow is frozen precipitation in the form of a six-sided ice crystal. Snow formation requires temperatures to be below freezing in all or most of the atmosphere from the surface up to cloud level.

Snow can fall when surface temperatures are above freezing in a relatively shallow layer. In situations like this, the snow will not have enough time to melt before reaching the ground - though it will be quite wet with large flakes, the result of wet snowflakes sticking to one another.

Generally, ten inches of snow will melt into one inch of water. Sometimes the snow-liquid ratio may be much higher - on the order of 20:1 or 30:1. This commonly happens when snow falls into a very cold air mass, with temperatures of 20 degrees or less at ground-level. Blowing snow is wind driven snow that reduces visibility to six miles or less causing significant drifting. Blowing snow may be snow that is falling and/or loose snow on the ground picked up by the wind.

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.

A severe blizzard is categorized as having temperatures near or below 10 °F, winds exceeding 45 mph, and visibility reduced by snow to near zero.

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. The impact of heavy snowfall is to impair the flow of vehicles needed for day-to-day commuting, local businesses and public safety response. The average annual snowfall for the Town is 48.1 inches to 72 inches. See Map 6 for more information.

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

Figure 4. Northeast Snowfall Impact Scale

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: 2010 State Hazard Mitigation Plan

Location

Winter snow storms and extended cold weather are frequent hazards in New England and Winthrop. Snow and blizzards are Town-wide hazards. The impact of heavy snowfall is to impair the flow of vehicles needed for day-to-day commuting, local businesses and public safety response. Winthrop has experienced several record breaking storms since the 1978 storm and has developed training, techniques and practices to efficiently deal with these events.

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

The DPW works to clear roads as requested by emergency service providers and carries on general snow removal operations. The MA Department of Transportation removes snow from Winthrop Shore Drive. Since 2005, the Town has also reduced its use of sand, opting for 100% salt, which reduces the sand which must be swept from the streets once winter has passed.

The Town continues to ban on-street parking at nights during snow storm events and during snow removal to ensure that streets can be plowed and public safety vehicle access is maximized. The Town maintains a website on how to prepare and live with severe winter storms and weather. Information on winter storm related hazards can be found on Map 6 in Appendix B.

Previous Occurrences

The Town does not collect data on snow and blizzard events. The local committee related anecdotes about the Storm of 1978, which resulted in over 3 feet of snowfall and multiple day closures of roadways, businesses, and schools.

Historically, severe winter storms impacting Winthrop have occurred in the following years:

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

Suffolk County, which includes Winthrop, is the best available data to help understand previous occurrences, related impacts and the probability of future snow and blizzard hazard events. According to present NCDC records, the County has only experienced one blizzard between 1950 and4/30/ 2014, in 2013, which resulted in no deaths or property damage in Suffolk County. For the same time period, Suffolk County and Winthrop experienced 40 heavy snowfall events, resulting in 0 deaths, one injury and $9.572 million dollars in property damage. Using the NESIS scale for magnitude and the National Weather Service's definition of heavy snowfall (pg. 37), it can be deduced that Winthrop and heavily urbanized Suffolk County have experienced a minimum of 40 NESIS Category 3 heavy snowfall events since 1950.

See Tables 13 and 14 below for Blizzard and Heavy Snow events and impacts.

Table 13. Blizzard Events and Impacts in Suffolk County from 1950 – 4/30/2014 Northeast Snowfall Impact Scale

Location	Date	Time	T.Z.	Type	Dth	Inj	PrD
Totals:					0	0	0.00K
SUFFOLK (ZONE)	02/08/2013	18:00	EST-5	Blizzard	0	0	0.00K
Totals:				1	0	0	0.00K

Source: NOAA, National Climatic Data Center **Column Definitions:** 'Mag': Magnitude, 'Dth': Deaths, 'Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage

Table 14. Heavy Snow events and Impacts in Suffolk County from 1950 – 4/30/2014

Location	Date	Time	T.Z.	Type	Dth	Inj	Prd
Totals:					0	1	9.572M
SUFFOLK (ZONE)	01/02/2014	06:00	EST-5	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	02/05/2014	03:00	EST-5	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	12/17/2013	12:30	EST-5	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	03/06/1999	15:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	03/18/2013	22:00	EST-5	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	03/07/2013	06:00	EST-5	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	12/23/1997	09:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	01/14/1999	00:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	03/15/1999	00:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	02/25/1999	00:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	03/02/1996	10:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	03/07/1996	10:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	02/16/1996	13:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	01/15/1998	21:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	04/09/1996	18:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK	04/07/1996	18:00	EST	Heavy	0	0	0.00K

Location	Date	Time	T.Z.	Type	Dth	Inj	Prd
(ZONE)				Snow			
SUFFOLK / PART OF NORFOLK...	03/31/1997	22:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	04/01/1997	00:00	EST	Heavy Snow	0	1	2.500M
SUFFOLK (ZONE)	01/07/1996	17:00	EST	Heavy Snow	0	0	7.000M
SUFFOLK (ZONE)	01/02/1996	21:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	02/08/2013	12:00	EST-5	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	03/16/2004	16:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	03/05/2001	13:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	02/05/2001	14:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	01/20/2001	21:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	01/13/2000	06:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	02/18/2000	12:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	02/24/2005	18:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	02/21/2005	01:00	EST	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	01/26/2011	20:00	EST-5	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	12/19/2009	23:00	EST-5	Heavy Snow	0	0	0.00K

Location	Date	Time	T.Z.	Type	Dth	Inj	Prd
SUFFOLK (ZONE)	03/01/2009	23:00	EST-5	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	01/18/2009	06:00	EST-5	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	01/19/2009	03:00	EST-5	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	12/31/2008	10:00	EST-5	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	12/19/2008	13:54	EST-5	Heavy Snow	0	0	10.00K
SUFFOLK (ZONE)	02/22/2008	12:00	EST-5	Heavy Snow	0	0	0.00K
SUFFOLK (ZONE)	01/14/2008	04:30	EST-5	Heavy Snow	0	0	55.00K
SUFFOLK (ZONE)	12/16/2007	04:30	EST-5	Heavy Snow	0	0	7.50K
SUFFOLK (ZONE)	12/19/2007	16:00	EST-5	Heavy Snow	0	0	0.00K
Totals:				40	0	1	9.572M

Source: NOAA, National Climatic Data Center **Column Definitions:** 'Mag': Magnitude, 'Dth': Deaths, 'Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage

Ice Storms

Ice storm conditions are defined by liquid rain falling and freezing on contact with cold objects creating ice build-ups of 1/4th inch or more that can cause severe damage. An ice storm warning, now included in the criteria for a winter storm warning, is for severe icing. This is issued when 1/2 inch or more of accretion of freezing rain is expected. This may lead to dangerous walking or driving conditions and the pulling down of power lines and trees. A warning is used for winter weather conditions posing a threat to life and property.

Another form of freezing precipitation is ice pellets, which occur when snowflakes melt into raindrops as they pass through a thin layer of warmer air. The raindrops then refreeze into particles of ice when they fall into a layer of sub-freezing air near the surface of the earth.

Sleet occurs when raindrops fall into subfreezing air thick enough that the raindrops refreeze into ice before hitting the ground. Sleet is different from hail. Sleet is a wintertime phenomena; hail falls from convective clouds (usually thunderstorms) under completely different atmospheric conditions and often during the warm spring and summer months.

Location

Ice storms can arise in any part of the Town and are a Town-wide hazard. Expected impacts for all of Winthrop can include impaired transportation conditions, impaired delivery of emergency services,

iced trees and downed limbs, and loss of power due to ice coated lines or falling tree limbs. The addresses ice storms as a type of winter storms event and prepares for it by pre-treating roads with de-icing agents and checks backup power supplies at municipal service providers and emergency shelters. The Town did not specifically address ice storms as part of their 2005 Hazard Mitigation Plan.

Previous Occurrences

Local data on ice storm occurrence is not collected by Winthrop. The best available data is for Suffolk County. For Suffolk County including Winthrop, from 1950 to 2014 there have been no ice storm events in Suffolk County (NOAA NCDC). However the state has been impacted by several noteworthy ice storms, the most recent of which resulted in a Presidential Disaster Declaration FEMA-1813-DR MA.

Probability of Future Winter Storm Events

Based on the record of previous occurrences, Winter Storm events in Winthrop are High frequency event as defined by the 2010 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 10 years (greater than 10 % per year).

Wildland Fires

A wildland fire can be defined as any non-structure fire that occurs in the wildland. Three distinct types of wildland fire have been defined and include wildfire (naturally occurring or human caused), and prescribed fire. Many of these are highly destructive and can be very uncontrollable. They occur in forested, semi-forested or less developed area. Wildland fires can be caused by lightning, human carelessness, and arson

The Wildland Urban Interface (WUI) is the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. Urban and suburban development in or near wildland vegetation poses a major threat to habitat loss, wildlife populations, and wildfire damages. There are two reasons that the WUI has an increased risk to wildfire damages. The WUI is an area where protection of structures from wildfires is difficult, due to access and fire suppression issues. Regardless whether the fire is naturally occurring or otherwise, it is much more difficult to extinguish a fire in a rural area and the damage to homes may be much more severe. The second reason that the WUI is at most risk for wildfires is that human-caused fire ignitions are most common. In these areas homes are built in among densely wooded areas, therefore humans are more likely to start a fire that will easily spread to the surrounding forested areas with plentiful vegetative fuels.

A significant portion of new development occurs at low and medium density and tends to be more dispersed. Therefore, housing growth is particularly high in areas such as forests or adjacent to protected areas, which are vulnerable to wildfire. (2010 Mass. State Hazard Mitigation Plan)

Location and Previous Occurences

The Town averages less than five small grass and brush fires each year. Fire Chief Paul Flanagan confirmed that Winthrop loses "less than one acre per year to wild fires." Chief Flanagan reports that many years the town does not even have any brush fires and in the years when they do, they are small and quickly contained.

Winthrop is completely built out and all development consists of the redevelopment of existing properties, with no WUI areas in the community. Outdoor burning is allowed from January to April with a permit from the Fire Department. The Town listed no areas of concern for fire related hazards. The 2005 Hazard Mitigation Plan did not list any fire related areas of concern but wildland fires would be considered a Town-wide hazard due to its small size and relatively high density of development if a wildland fire were to occur and not be contained.

Probability of Future Wildfires

The probability of future Wildfires frequency is High, an event that can be expected to occur more frequently than once every 10 years, greater than 10% per year.

Geologic Hazards

Earthquakes

An earthquake is the vibration, sometimes violent, of the earth's surface that follows a release of energy in the earth's crust due to fault fracture and movement. A fault is a fracture in the earth's crust along which two blocks of the crust have slipped with respect to each other. Faults are divided into three main groups, depending on how they move.
Normal faults occur in response to pulling or tension: the overlying block moves down the inclined dip of the fault plane. Thrust (reverse) faults occur in response to squeezing or compression: the overlying block moves up the inclined dip of the fault plane. Strike-slip (lateral) faults occur in response to either type of stress; the blocks move horizontally along a vertical fault past one another. Most faulting along spreading zones is normal, along subduction zones is thrust, and along transform faults is strike-slip.

The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus). Earthquakes with focal depths from the surface to about 43.5 miles are classified as shallow. Earthquakes with focal depths from
43.5 to 186 miles are classified as intermediate. The focus of deep earthquakes may reach depths of more than 435 miles. The focuses of most earthquakes are concentrated in the crust and upper 20 miles of the Earth’s crust. The depth to the center of the Earth's core is about 3,960 miles, so even the deepest earthquakes originate in relatively shallow parts of the Earth's interior.

The epicenter of an earthquake is the point on the Earth's surface directly above the focus, and the focus is the area of the fault where a sudden rupture initiates. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth. Earthquakes beneath the ocean floor sometimes generate immense sea waves or tsunamis if the earthquake causes upward or downward movement of the sea floor. The tsunami originates where this movement takes place.

The cause of earthquakes in eastern North America is the forces moving the tectonic plates over the surface of the Earth. New England is located in the middle of the North American Plate. One edge of the North American plate is along the west coast where the plate is pushing against the Pacific Ocean plate. The eastern edge of the North American plate is at the middle of the Atlantic Ocean, where the

plate is spreading away from the European and African plates. New England's earthquakes appear to be the result of the cracking of the crustal rocks due to compression as the North American plate is being very slowly squeezed by the global plate movements.

Seismologists use a Richter Magnitude scale to express the seismic energy released by each earthquake, as well as the typical effects of earthquakes in various ranges, as shown below:

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

Location

Earthquakes are a Town-wide hazard. 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.

Previous Occurrences

The town does not collect data on earthquake events in Winthrop. The best available data was for historical earthquakes recorded at the state level. According to the 2010 State Hazard Mitigation Plan, New England experiences an average of five earthquakes per year. From 1627 to 1989, 316 earthquakes were recorded in Massachusetts. 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, of magnitude 6.0 to 6.5 in 1727 and 1755. Other notable earthquakes occurred here in 1638 and 1663 (Tufts University).

Winthrop experienced a small, 2.3 magnitude earthquake located 2 km from it on April 10, 2009. There was no data collected by the town or found that indicated any impacts associated with this event. On October 16, 1963 an earthquake occurred in eastern Massachusetts of magnitude 6.3 that caused a window to crack in Winthrop. (USGS)

Historical records of some of the more significant earthquakes in the region are shown in Table 15.

Table 15
Historical Earthquakes in Eastern Massachusetts, 1727-2013

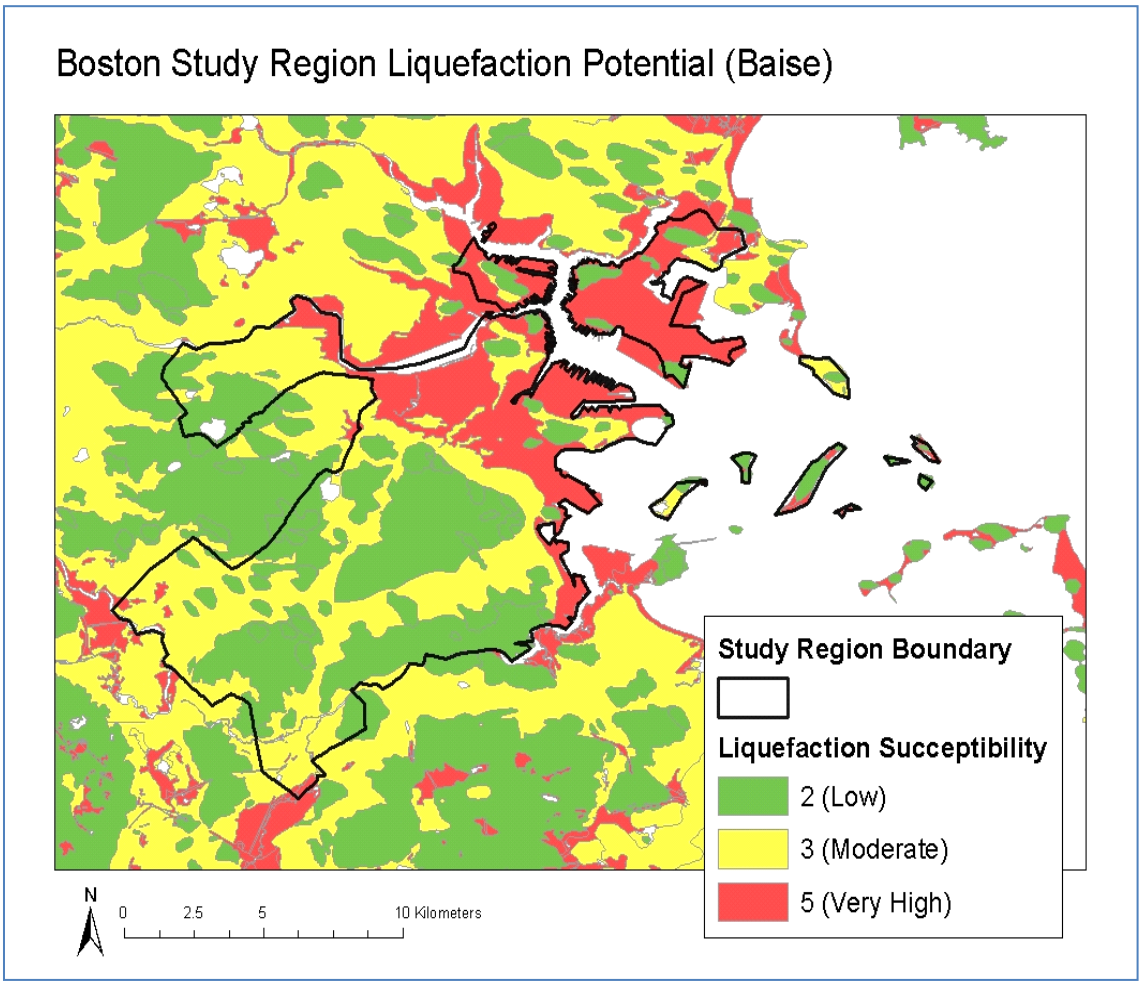
Location	Date	Magnitude*
MA - Cape Ann	11/10/1727	5
MA - Cape Ann	12/29/1727	NA
MA – Cape Ann	2/10/1728	NA
MA – Cape Ann	3/30/1729	NA
MA – Cape Ann	12/9/1729	NA
MA – Cape Ann	2/20/1730	NA
MA – Cape Ann	3/9/1730	NA
MA - Boston	6/24/1741	NA
MA - Cape Ann	6/14/1744	4.7
MA - Salem	7/1/1744	NA
MA - Off Cape 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
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

Source: Boston HIRA

Town officials feel that it would be useful to map the Cape Ann fault to increase public awareness of that significant earthquakes have occurred in the North Shore area historically, that the Town could be subject to earthquake damage and that it should be included in capital facilities planning. Liquefaction poses a risk in areas of soft clays or filled land, which are found in the northern portion of Winthrop (see Figure 5 below). During an earthquake event these soils may become unstable, effectively liquefying, destabilizing the buildings above and potentially leading to ruptured utilities, and other related impacts.

The Town has several un-reinforced, older masonry buildings which would be vulnerable in a severe earthquake. They include the Town hall, Town library, police station, both fire stations and the high school.

The Town enforces the MA State Building Code which is adequate in ensuring that new construction meets seismic standards. The Winthrop Fire Department also has three mobile, 5 kW generators and one mobile light towers to assist with emergency power loss response in case of an earthquake.



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

Figure 5. Boston Study Region Liquefaction

There have been no significant mitigation measures to address earthquake hazards since the 2005 NHM Plan, primarily because of the lower historical risk of a serious earthquake within the eastern MA region and because most mitigation resources are directed to flooding and coastal storm related issues. There have been no comments from the community regarding earthquakes

Probability of Future Earthquake Events

Figure 6, the Mass. State Seismic Map, indicates the relative risks for experiencing an earthquake in different areas of the state. Winthrop's risk is indicated to be in the .10 - .12 hazard range. The town's frequency of earthquake is projected to be Medium, with events that could occur from once every 10 years to once in 100 years (1% to 10% per year).

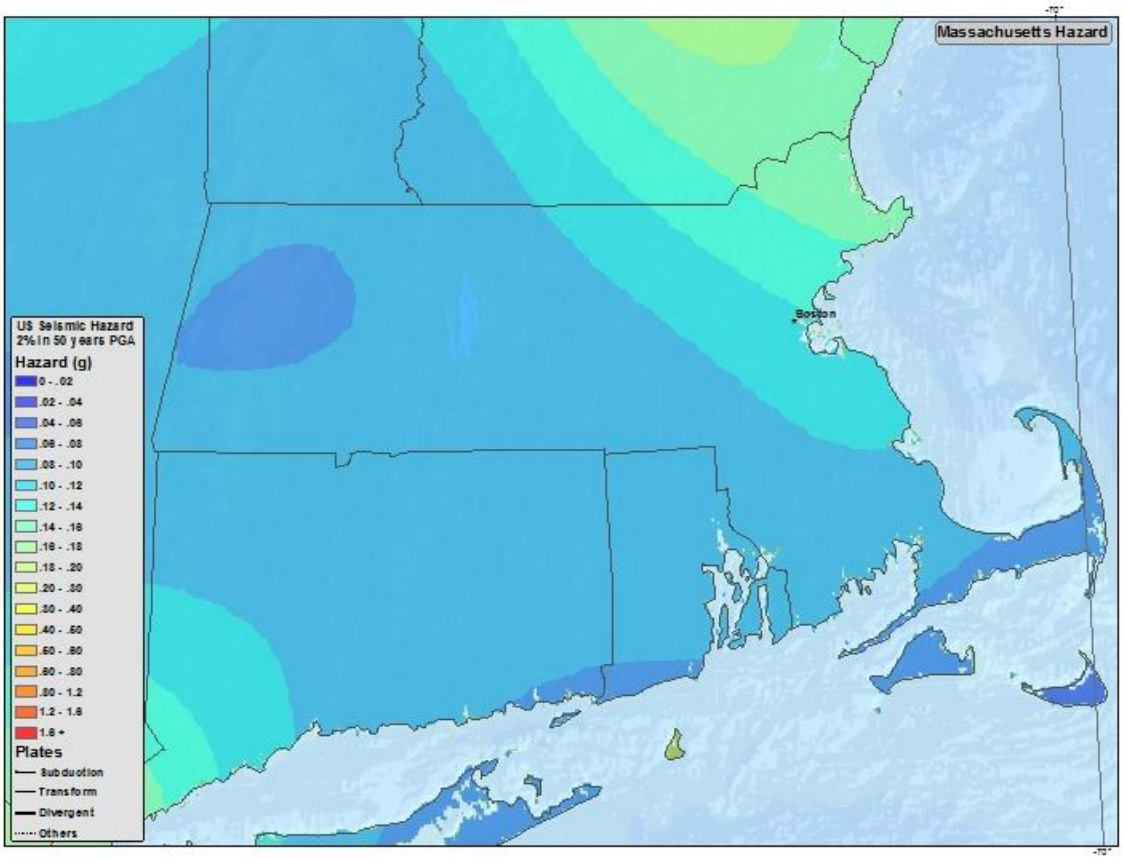


Figure 6 - 2014 Mass. State Seismic Hazard Map-Source: USGS

Landslides

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, such as: erosion by rivers, glaciers, or ocean waves created over steepened slopes; rock and soil slopes weakened through saturation by snowmelt or heavy rains; earthquakes created stresses that make weak slopes fail.

According to the USGS, "The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on an over steepened slope is the primary reason for a landslide, there are other contributing factors." Among the contributing factors are: erosion by rivers, glaciers, or ocean waves create over steepened slopes; rock and soil slopes weakened through saturation by snowmelt or heavy rains; earthquakes create stresses that make weak slopes fail; and excess weight from accumulation of rain or snow, and stockpiling of rock or ore, from waste piles, or from man-made structures. USGS scientists also monitor stream flow, noting changes in sediment load carried by rivers and streams that may result from landslides. All of these types of landslides are considered aggregately in USGS mapping of landslides. 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.

Location

The entire Town has been classified as having a moderate susceptibility for landslides, but with a low rate of incidence. Landslides are considered a town-wide hazard. The Town did not believe that landslides pose a significant risk to Winthrop and did not take actions regarding this hazard in the 2005 Plan. There have been no comments from the community regarding landslides. See Figure 7, indicating the risk for landslide incidence and susceptibility/incidence for the Northeastern United States, including New England and Winthrop. Map 4 in Appendix B shows further information on the incidence of landslide risk for Winthrop.

Previous Occurrences

Winthrop does not collect data on landslide occurrences and there was no anecdotal evidence of landslides ever having occurred in Winthrop. The best available data was for Suffolk County. Between 1950 and 2014, Suffolk County experienced no landslide events, or suffered any deaths, injuries or property damage from landslides. (NOAA USCS).

Probability of Future Occurrences

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

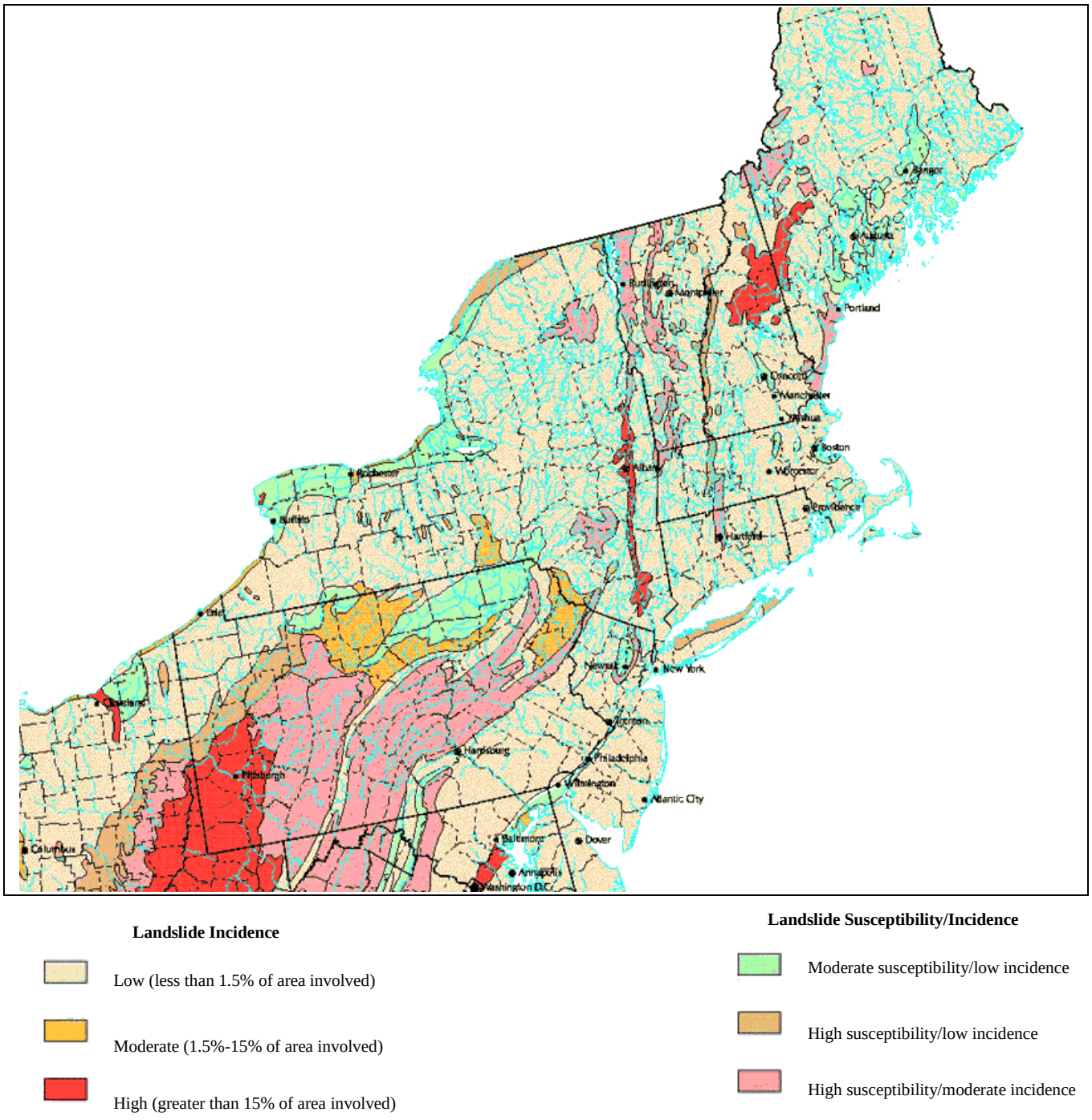


Figure 7. Landslide Overview Map of the Conterminous United States, by Dorothy H. Radbruch-Hall, Roger B. Colton, William E. Davies, Ivo Lucchitta, Betty A. Skipp, and David J. Varnes, 1982

Drought

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

In Massachusetts, droughts are caused by the prevalence of dry northern continental air and a decrease in coastal- and tropical-cyclone activity. During the 1960's, a cool drought occurred because dry air from the north caused lower temperatures in the spring and summer of 1962-65. The northerly winds drove frontal systems to sea along the Southeast Coast and prevented the Northeastern States from receiving moisture (U.S. Geological Survey Water-Supply Paper 2375, National Water Summary 1988-89--Floods and Droughts: Massachusetts Floods and Droughts). See Figure 8 below.

Figure 8. Principal Source and Pattern of Delivery of Moisture into Massachusetts:

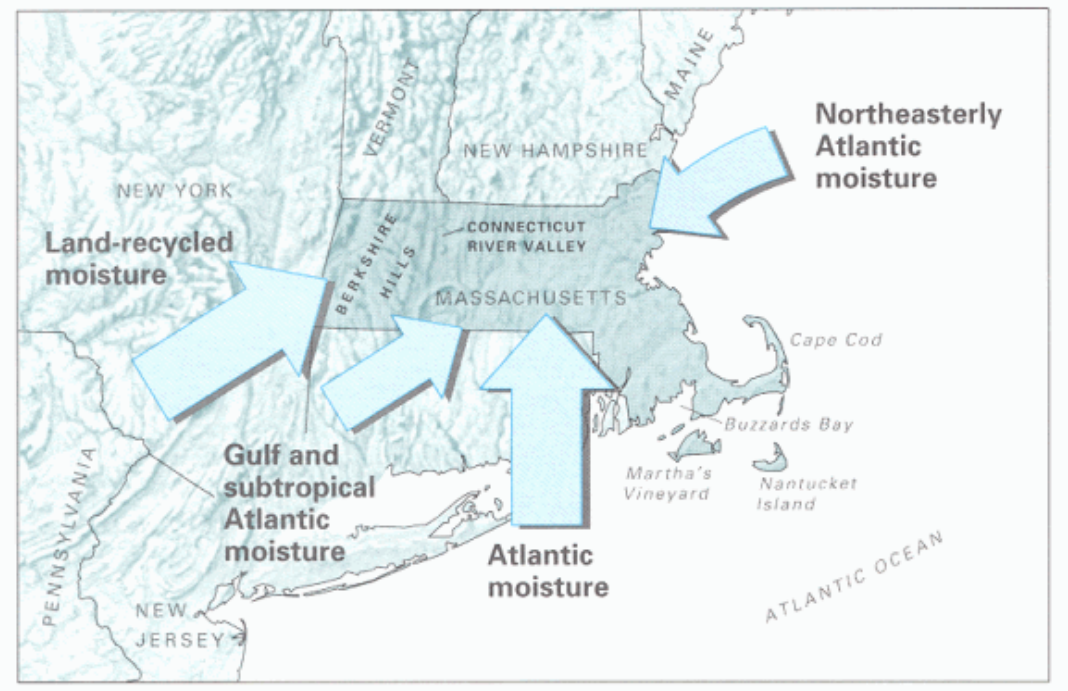


Figure 1. Principal sources and patterns of delivery of moisture into Massachusetts. Size of arrow implies relative contribution of moisture from source shown. (Source: Data from Douglas R. Clark and Andrea Lage, Wisconsin Geological and Natural History Survey.)

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

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. Winthrop is located in the Northeast Region.

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

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

Normal Advisory Watch
Warning Emergency

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

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

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

A determination of drought level is based on seven indices:

- Standardized Precipitation Index: The Standardized Precipitation Index (SPI) reflects soil moisture and precipitation conditions.
- Crop Moisture Index: The Crop Moisture Index (CMI) reflects short-term soil moisture conditions as used for agriculture.

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

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

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

See Table 16, Mass. Drought Indices: Source: Massachusetts Drought Management Plan, 2013

Location

Drought is a town-wide hazard. Drought did not exist as a natural hazard category within the state hazard mitigation plan when the town completed its first plan in 2005 and the plan does not contain any mitigation actions for drought in the 2005 plan.

Table 16. Mass. Drought Indices, Mass. Drought Management Plan- 2013

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

The Crop Moisture Index is subject to frequent change. The drought level for this indicator is determined based on the repeated or extended occurrence at a given level.

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

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

Previous Occurrences

Winthrop does not collect data relative to droughs. Because drought tends to be a regional natural hazard, this plan references state data as best available data for drought.

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

Figure 9 indicates incidents of drought levels' occurrence in Massachusetts using the SPI parameter alone. On a monthly basis, the state would have been in a Drought Watch to Emergency condition 11 percent of the time between 1850 and 2012. Table 17 summarizes the chronology of major droughts in Massachusetts since 1923.

Drought Emergency

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

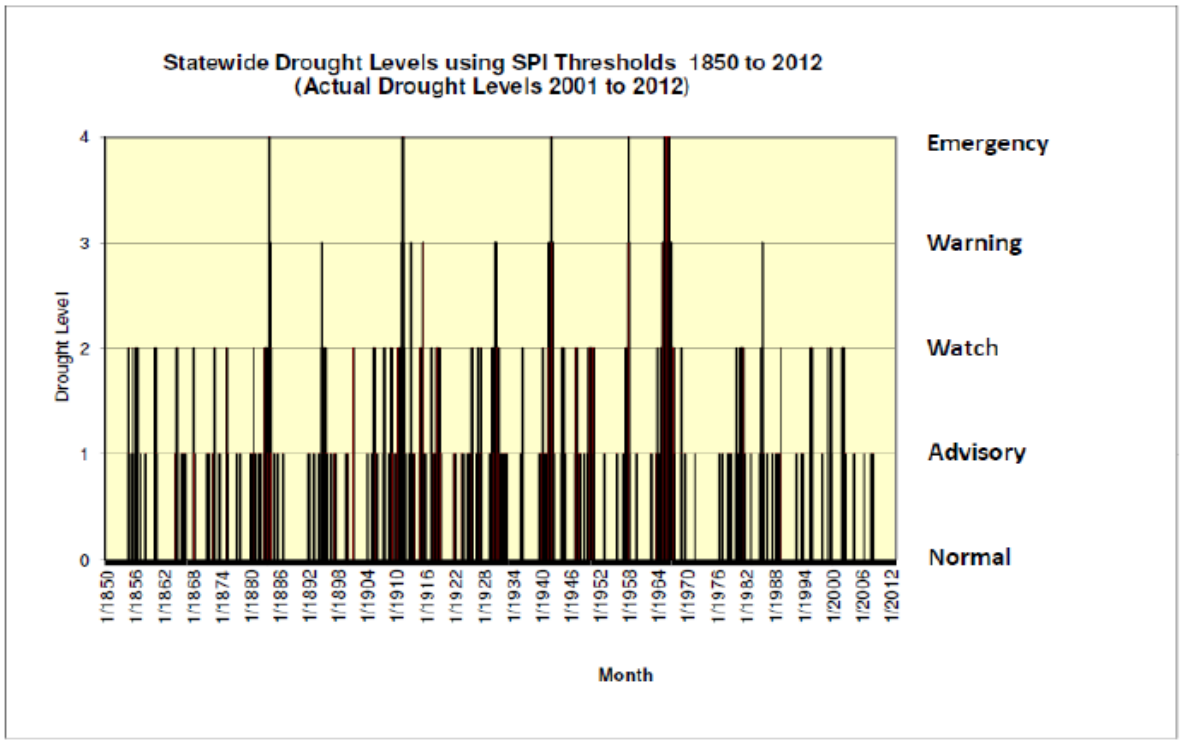
Drought Warning

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

Drought Watch

Drought Watches not associated with higher levels of drought generally would have occurred in three to four years per decade between 1850 and 1950. The drought Emergency dominated the 1960s. There were no drought Watches or above in the 1970s. In the 1980s, there was a lengthy drought Watch level of precipitation between 1980 and 1981, followed by a drought Warning in 1985. A frequency of drought Watches at a rate of three years per decade resumed in the 1990s (1995, 1998, 1999). In the 2000s,

Figure 9. Statewide Drought Levels using SPI Thresholds 1850 – 2012



(Source: Mass. State Drought Management Plan 2013)

Table 17. Chronology of major droughts in Massachusetts

Flood or drought	Date	Area affected (fig. 2)	Recurrence interval (years)	Remarks
Drought	1929-32	Statewide	10 to >50	Water-supply sources altered in 13 communities. Multistate.
Drought	1939-44	Statewide	15 to >50	More severe in eastern and extreme western Massachusetts. Multistate.
Drought	1957-59	Statewide	5 to 25	Record low water levels in observation wells, northeastern Massachusetts.
Drought	1961-69	Statewide	35 to >50	Water-supply shortages common. Record drought. Multistate.
Drought	1980-83	Statewide	10 to 30	Most severe in Ipswich and Taunton River basins; minimal effect in Nashua River basin. Multistate.
Drought	1985-88	Housatonic River basin	25	Duration and severity as yet unknown. Streamflow showed mixed trends elsewhere.

Drought Watches occurred in 2001 and 2002. The overall frequency of being in a drought Watch is 8 percent on a monthly basis over the 162-year period of record.

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

Extreme Temperatures

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

Winthrop has four well-defined seasons. The seasons have several defining factors, with temperature one of the most significant. Extreme temperatures can be defined as those, which are far outside of the normal ranges for Massachusetts.

The average temperatures for Massachusetts are: Winter (Dec-Feb) Average = 31.8°F
Summer (Jun-Aug) Average = 71°F

Extreme Cold
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.

Winthrop-Lowest recorded temperature: The lowest recorded temperature was -19°F in 1934.

Extreme Heat
The highest recorded temperature for Winthrop was 104°F in 1911.

From 1979-2003, excessive heat exposure caused 8,015 deaths in the United States. During this period, more people in this country died from extreme heat than from hurricanes, lightning, tornados, floods, and earthquakes combined. Because most heat-related deaths occur during the summer, people should be aware of who is at greatest risk and what actions can be taken to prevent a heat-related illness or death. At greater risk are the elderly, children, and people with certain medical conditions, such as heart disease.
However, even young and healthy individuals can succumb to heat if they participate in strenuous physical activities during hot weather. Some behaviors also put people at greater risk: drinking

alcohol; taking part in strenuous outdoor physical activities in hot weather; and taking medications that impair the body's ability to regulate its temperature or that inhibit perspiration.

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

Boston and Suffolk County will experience an increase in the number of days over 100°F., depending on whether a higher or lower greenhouse gas emission scenario is met. Source: USGCRP (2009)

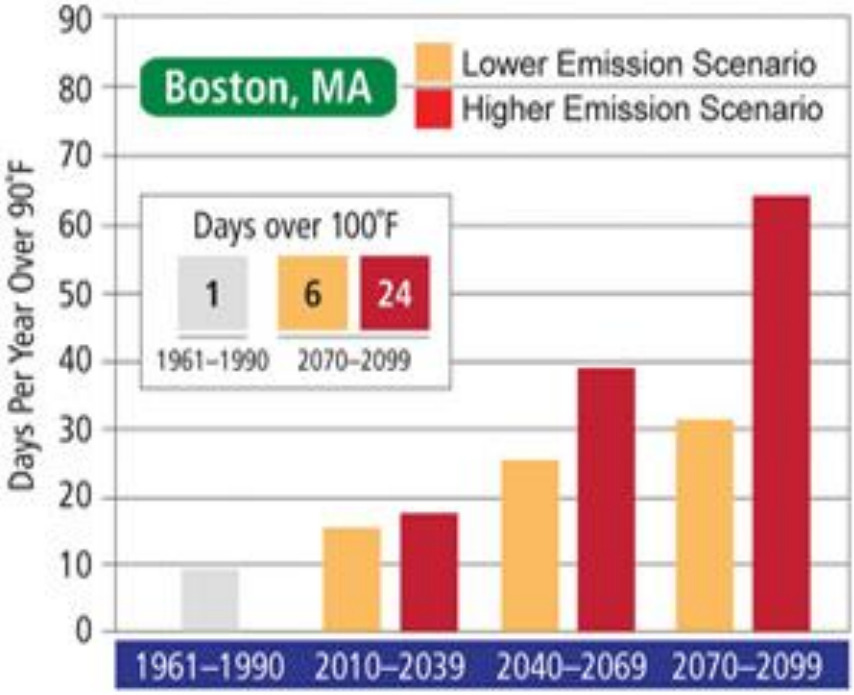


Figure 10.Projected Boston Days above 100 degrees F

Previous Occurrences-Excessive Heat

The town does not collect data on excessive heat occurrences. The best available data was for Suffolk County, including Winthrop. From 2000- April 30, 2014, there have been a total of 5 excessive heat events in Suffolk County, with no reported deaths, injuries or property damage resulting from excessive heat.

Table 18. Excessive Heat Occurrences in Suffolk County

County/Zone	Date	Time	T.Z.	Type	**Dth**	**Inj**	**PrD**

County/Zone	Date	Time	T.Z.	Type	**Dth**	**Inj**	**PrD**
SUFFOLK / PART OF NORFOLK.	12/17/2000	00:00	EST	Excessive Heat	0	0	0.00K
SUFFOLK / PART OF NORFOLK.	05/03/2001	00:00	EST	Excessive Heat	0	0	0.00K
SUFFOLK / PART OF NORFOLK	05/04/2001	00:00	EST	Excessive Heat	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	05/12/2001	00:00	EST	Excessive Heat	0	0	0.00K
SUFFOLK (ZONE)	07/22/2011	11:00	EST-5	Excessive Heat	0	0	0.00K
TOTAL				**5**	**0**	**0**	**0.00K**

Source: NOAA, National Climatic Data Center **Column Definitions:** 'Mag': Magnitude, ' Dth': Deaths, 'Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage

Previous Occurrences- Extreme Cold

Winthrop does not collect data for extreme cold occurrences. The best available data was for Suffolk County, including Winthrop. For the period 2000 – 2014, Suffolk County experienced one death caused by extreme cold in 2007.

Table 19. Extreme Cold and Cold/Wind Chill Occurrences in Suffolk County

County/Zone	Date	Time	T.Z.	Type	**Dth**	**Inj**	**Prd**
SUFFOLK (ZONE)	02/03/2007	22:00	EST-5	Extreme Cold/wind Chill	1	0	0.00K
SUFFOLK / PART OF NORFOLK...	07/14/1999	00:00	EST	Cold/wind Chill	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	07/08/2000	00:00	EST	Cold/wind Chill	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	10/09/2000	00:00	EST	Cold/wind Chill	0	0	0.00K
SUFFOLK / PART OF NORFOLK...	10/30/2000	00:00	EST	Cold/wind Chill	0	0	0.00K

Source: NOAA, National Climatic Data Center **Column Definitions:** 'Mag': Magnitude, 'Dth': Deaths, ' Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage

Probability of Future Occurrences- Extreme Temperatures

Extreme temperature events are projected to be Medium Frequency events based on past occurrences with both extreme cold and hot weather events happening from between once in ten years to once in 100 years. Due to projected climate change, extreme hot weather events over 100 degrees Fahrenheit may become more frequent and extreme cold weather events less frequent.

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 the five residential categories are aggregated, residential uses make up 48.88 % of the area of the Town (712.20 acres). The highest percentage use is multi-family residential which comprises 25.53 % with 371.95 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.

Regional Context, Natural Resources and Development

Geographically the Town forms the northern border of the entrance to Boston Harbor. As a peninsula, the Town is physically isolated from Revere and East Boston by the Belle Isle Inlet Tidal Marsh, the last urban estuary in the Greater Boston Area and the most significant regional environmental feature found in Winthrop. Winthrop is a part of the Mystic River Watershed, which is approximately 76 square miles and extends to twenty-one municipalities north and west of the City of Boston. Because of its location, it is one of the most urban and densely populated watersheds in Massachusetts.

Although physically isolated, the relative separation of Winthrop from other parts of Greater Boston is negated by severe impacts from two major regional institutions: Logan International Airport and a newly expanded and greatly enlarged and upgraded Deer Island Sewage Treatment Facility. Winthrop has only two land access routes that allow residents to travel in and out of Town. Some Deer Island traffic passes through Town and major air traffic approaches to Logan are frequent occurrences. The center of Winthrop is five (5) miles by road from the State House in Boston. Due to its proximity to Boston, Winthrop has special appeal as a residential community. Its North Shore location gives it not only easy access to Boston but also gives residents easy access to a number of ocean beaches, preserves and marinas. (Town of Winthrop Open Space & Recreation Plan 2005-2010)

Table 20 2005 Land Use

Land Type	Acres	Percent
Cropland	0	0
Pasture	0	0
Forest	2.10	0.14
Wetland	6.47	0.44
Mining	0	0
Open Land	42.14	2.89
Participation Recreation	43.17	2.96
Spectator Recreation	0	0
Water-based Recreation	0	0
Multifamily Residential	371.95	25.53
High Density Residential	340.25	23.35
Medium Density Residential	0	0
Low Density Residential	0	0
Very Low Density Residential	0	0
Saltwater Wetland	106.93	7.34
Commercial	71.58	4.91
Industrial	2.19	0.15
Urban Open	0	0
Transportation	199.45	13.69
Waste Disposal	2.32	0.16
Water	7.87	0.54
Cranberry Bog	0	0
Power line	0	0
Saltwater Beach	133.70	9.18
Golf Course	52.04	3.57
Marina	16.90	1.16
Urban Public	34.96	2.40
Cemetery	15.77	1.08
Orchard	0	0
Nursery	0.27	0.02
Forested Wetland	0.23	.016
Junkyards	0	0
Brush land/Succession	6.62	0.45
TOTAL	1,456.91	100

Primarily a residential community, Winthrop has a Town center with a number of businesses, including CVS/pharmacy, Michael's Mall, Samuel's Pharmacy and The Pizza Center. The Town center has always had a modestly vibrant business community. However, by the mid-1990s, large shopping malls in the nearby North Shore region of Massachusetts, especially Square One Mall in Saugus, began to drain away measurable amounts of business. A small business community still survives. The Town is divided into four unique business areas: the Shirley Street Business District, the Highlands District, the Center, and Magee's Corner District. (Wikipedia)

Recent and 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 five year time horizon. These areas are shown on Map 2, "Potential Development" and are described below. The letter for each site corresponds to the letters on Map 2.

A) Temple Israel: 32 unit assisted living development: conceptual stage

B) Crystal Cove: mixed use development-commercial and residential, 150 units of new housing-conceptual stage.

C) Belle Isle Bridge: due to be repaired 2011-2013 under the MA Accelerated Bridge Replacement program; will increase 1 foot in height.

Recent and Future Development in Hazard Areas

Table 21 shows the relationship of these parcels to two of the mapped hazards. This information is provided so that planners can ensure that development proposals comply with flood plain zoning and that careful attention is paid to drainage issues.

Table 21: Relationship of Potential Development to Hazard Areas

Parcel	Landslide risk	Flood Zone
Temple Israel	Moderate Susceptibility	100% in AE
Crystal Cove	Moderate Susceptibility	100% in AE
Belle Isle Bridge	Moderate Susceptibility	5.7469% in X500 (or 0.2% Annual Chance) 69.3801% in AE

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 22 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 22

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 22: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall	Hurricane Surge Areas (Category#)
1	11 - 54 Overlook Drive	Elderly Housing	Moderate Susceptibility	No	No	Low	0
2	Atlantis Marina	Marina	Moderate Susceptibility	AE	No	Low	2
3	Beach Fire Station	Fire Station	Moderate Susceptibility	AE	Shirley Street Neighborhood	Low	1
4	Belle Isle Marsh	Water Feature	Moderate Susceptibility	AE	No	Low	1
5	Bright Beginnings Learning Center	Child Care	Moderate Susceptibility	AE	Shirley Street Neighborhood	Low	1
6	Brown Drug Store	Pharmacy	Moderate Susceptibility	No	No	Low	0
7	CVS	Pharmacy	Moderate Susceptibility	AE	Ingleside Park	Low	2
8	Cell Tower At Expert Auto	Communication Tower	Moderate Susceptibility	AE	Shirley Street Neighborhood	Low	1
9	Cell Tower At Fellows Hall	Communication Tower	Moderate Susceptibility	No	No	Low	0
10	Cell Tower At St. Johns The Evangelist Church	Communication Tower	Moderate Susceptibility	No	No	Low	0
11	Cell Tower At United Methodist Church	Communication Tower	Moderate Susceptibility	No	No	Low	0
12	Arthur Cummings School	School	Moderate Susceptibility	No	No	Low	0
13	Children's Corner Preschool	Child Care	Moderate Susceptibility	No	No	Low	0
14	Concrete Seawall	Flood Protection	Moderate Susceptibility	VE	No	Low	0
15	Concrete Seawall	Flood Protection	Moderate Susceptibility	VE	No	Low	0
16	Cottage Park Yacht Club	Marina	No	AE	No	High	1
17	Crystal Cove Marina	Marina	No	AE	Shirley Street Neighborhood	High	0
18	Deer Island Sewer Treatment Plant	Sewer Treatment Facility	Moderate Susceptibility	No	No	Low	0
19	E B Newton	School	Moderate Susceptibility	No	No	Low	0
20	Evangelical Baptist Church	Place of Worship	Moderate Susceptibility	No	No	Low	2
21	Fire Headquarters	Fire Station	Moderate Susceptibility	No	No	Low	0
22	For Kids Only Extended Day in Parish School	Child Care	Moderate Susceptibility	No	No	Low	0

ID	NAME	TYPE	Landslide	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall	Hurricane Surge Areas (Category#)
23	Gorman/ Fort Banks Elementary School	School	Moderate Susceptibility	No	No	Low	0
24	Golden Drive	Special Needs	Moderate Susceptibility	No	No	Low	0
25	Holy Rosary Church	Place of Worship	Moderate Susceptibility	No	Yirrell Beach	Low	4
26	John Clark House (North Suffolk Mental Health)	Assisted Living	Moderate Susceptibility	No	No	Low	0
27	King Gardens	Elderly Housing	Moderate Susceptibility	No	No	Low	0
28	Lewis Lake Tidal Gate	Flood Prevention	Moderate Susceptibility	AE	Shirley Street Neighborhood	Low	1
29	Lodge Elks Marina	Marina	No	AE	Shirley Street Neighborhood	High	0
30	Loring Rd. Boat Ramp	Water Access	Moderate Susceptibility	AE	No	Low	1
31	Memorial Auditorium	School	Moderate Susceptibility	AE	Ingleside Park	Low	2
32	Mrs. Marley's Nursery School	Child Care	Moderate Susceptibility	No	No	Low	0
33	North Suffolk Mental Health	Special Needs	Moderate Susceptibility	No	No	Low	0
34	North Suffolk Mental Health	Assisted Living	Moderate Susceptibility	AE	No	Low	2
35	North Suffolk Mental Health	Assisted Living	Moderate Susceptibility	AE	No	Low	2
36	North Suffolk Mental Health	Assisted Living	Moderate Susceptibility	AE	Shirley Street Neighborhood	Low	1
37	Old Town Garage	Kennel	Moderate Susceptibility	No	No	Low	0
38	Pico Sewer Pump Station	Sewer Pumping Station	Moderate Susceptibility	AE	No	Low	1
39	Pier	Recreation	No	AE	No	High	0
40	Private Pier	Recreation	No	AE	No	High	0
41	Pleasant Court Sewer Pump Station	Sewer Pumping Station	Moderate Susceptibility	AE	No	Low	2
42	Pleasant Park Yacht Club	Marina	Moderate Susceptibility	AE	No	Low	2
43	Pleasant Times Day Care	Child Care	Moderate Susceptibility	No	No	Low	2
44	Point Shirley Association	Shelter	Moderate Susceptibility	AE	Yirrell Beach	Low	1
45	Police Station	Police Station	Moderate Susceptibility	No	No	Low	0
46	Post Office	Post Office	Moderate Susceptibility	No	No	Low	0
47	Public Landing	Water Access	Moderate Susceptibility	AE	Shirley Street Neighborhood	Low	2
48	Public Safety	Communication	Moderate	No	No	Low	0

ID	NAME	TYPE	Landslide	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall	Hurricane Surge Areas (Category#)
	Communication Tower	Tower	Susceptibility				
49	Recreation Center	After School Program	Moderate Susceptibility	No	No	Low	0
50	Revere St. Sewer Pump Station	Sewer Pumping Station	Moderate Susceptibility	AE	No	Low	2
51	Rice's Wharf	Marina	No	AE	Shirley Street Neighborhood	High	0
52	Samuel's Pharmacy	Pharmacy	Moderate Susceptibility	No	No	Low	2
53	School Age Express	Child Care	Moderate Susceptibility	No	No	Low	0
54	Skating Rink	Place of Assembly	Moderate Susceptibility	AE	Ingleside Park	Low	2
55	St John The Evangelist Church	Place of Worship	Moderate Susceptibility	No	No	Low	0
56	St John's Episcopal Church	Place of Worship	Moderate Susceptibility	No	No	Low	0
57	Stone Breakwater	Flood Prevention	No	VE	No	High	0
58	Stone Revetment	Revetment	Moderate Susceptibility	VE	No	Low	0
59	Stone Revetment	Revetment	No	VE	No	High	0
60	Stone Revetment	Revetment	No	VE	Lower Nahant Avenue	High	0
61	Stone Revetment	Revetment	Moderate Susceptibility	VE	No	Low	0
62	Temple Tifereth Israel	Place of Worship	Moderate Susceptibility	AE	Shirley Street Neighborhood	Low	1
63	Terri's Little Pumpkins	Child Care	Moderate Susceptibility	AE	Shirley Street Neighborhood	Low	1
64	Town Hall	Municipal Office	Moderate Susceptibility	No	No	Low	0
65	Union Congregational Church	Place of Worship	Moderate Susceptibility	AE	Shirley Street Neighborhood	Low	1
66	United Methodist Church	Place of Worship	Moderate Susceptibility	No	No	Low	0
67	Viking Gardens	Elderly Housing	Moderate Susceptibility	No	No	Low	2
68	Winthrop Country Day Learning Ctr.	Child Care	Moderate Susceptibility	No	No	Low	0
69	Winthrop DPW Building	Municipal Office	Moderate Susceptibility	No	No	Low	0
70	Winthrop EOC	Emergency Operations Center	Moderate Susceptibility	No	No	Low	0
71	Winthrop Traffic Control Point	Traffic Control Point	Moderate Susceptibility	AE	Shirley Street Neighborhood	Low	1
72	Work Inc.	Assisted Living	Moderate Susceptibility	No	Ingleside Park	Low	2

ID	NAME	TYPE	Landslide	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall	Hurricane Surge Areas (Category#)
73	Beach	Water Feature	Moderate Susceptibility	VE	Yirrell Beach	Low	2
74	Winthrop Middle School	School	Moderate Susceptibility	No	Ingleside Park	Low	4
75	Winthrop Senior Center	Senior Center	Moderate Susceptibility	AE	No	Low	1
76	Winthrop Place	Elderly Housing	Moderate Susceptibility	AE	Shirley Street Neighborhood	Low	1
77	Winthrop Sr. High	School	Moderate Susceptibility	AE	No	Low	1
78	Winthrop Traffic Control Point	Traffic Control Point	Moderate Susceptibility	AE	Shirley Street Neighborhood	Low	1
79	Winthrop Traffic Control Point	Traffic Control Point	Moderate Susceptibility	No	No	Low	0
80	Winthrop Traffic Control Point	Traffic Control Point	Moderate Susceptibility	No	No	Low	0
81	Winthrop Market Place	Grocery Store	Moderate Susceptibility	No	No	Low	2
82	Winthrop Traffic Control Point	Traffic Control Point	Moderate Susceptibility	No	No	Low	0
83	Winthrop Traffic Control Point	Traffic Control Point	Moderate Susceptibility	No	No	Low	0
84	Work Inc.	Assisted Living	Moderate Susceptibility	No	No	Low	0
85	Winthrop Library	Library	Moderate Susceptibility	No	No	Low	0
86	Winthrop Reservation	Water Feature	Moderate Susceptibility	VE	Shirley Street Neighborhood	Low	0
87	Winthrop Traffic Control Point	Traffic Control Point	Moderate Susceptibility	No	No	Low	0
88	Winthrop Water Tower	Water Tower	Moderate Susceptibility	No	No	Low	0
89	Winthrop Yacht Club	Marina	No	AE	Shirley Street Neighborhood	High	0
90	Winthrop Traffic Control Point	Traffic Control Point	Moderate Susceptibility	AO	No	Low	0
91	Private Pier	Pier	Moderate	AE	No	Low	0
92	Private Pier	Pier	Moderate Susceptibility	AE	No	Low	0
93	Taft's Avenue TCP	Traffic Control Point	Moderate Susceptibility	AE	Yirrell Beach	Low	2
94	Belle Isle Bridge	Bridge	No	AE	No	High	0
95	Pressure Reducing Valve Station	Water Related Facility	Moderate Susceptibility	AE	No	Low	2
96	Power Substation	Power Substation	Moderate Susceptibility	AE	Bayou Street Neighborhood	Low	2
97	Power Substation	Power Substation	Moderate Susceptibility	No	No	Low	0

Vulnerability Assessment

The purpose of the vulnerability assessment is to estimate the extent of potential damages from natural hazards of varying types and intensities. A vulnerability assessment and estimation of damages was performed for hurricanes, earthquakes, and flooding. The methodology used for hurricanes and earthquakes was the HAZUS-MH software. The methodology for flooding was developed specifically to address the issue in many of the communities where flooding was not solely related to location within a floodplain. HAZUS uses 2000 US Census data; it has not yet been updated with 2010 US Census data.

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 Winthrop, it does not capture all relevant information. In fact, the HAZUS training manual notes that the default data is "subject to a great deal of uncertainty."

However, for the purposes of this plan, the analysis is useful. This plan is attempting to only generally indicate the possible extent of damages due to certain types of natural

disasters and to allow for a comparison between different types of disasters. Therefore, this analysis should be considered to be a starting point for understanding potential damages from the hazards. If interested, communities can build a more accurate database and further test disaster scenarios.

Estimated Damages from Hurricanes

The HAZUS software was used to model potential damages to the community from a 100 year and 500 year hurricane event; storms that are .01% and .005% likely to happen in a given year and roughly equivalent to a Category 2 and Category 4 hurricane. The damages caused by these hypothetical storms were modeled as if the storm track passed directly through the 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 23
Estimated Damages from Hurricanes

	100 year	**500 year**
Building Characteristics		
Estimated total number of buildings	5,152	5,152
Estimated total building replacement value (Year 2002 $) (Millions of Dollars)	$1,489	$1,489
Building Damages		
# of buildings sustaining minor damage	730	1,870
# of buildings sustaining moderate damage	148	1,075
# of buildings sustaining severe damage	9	230
# of buildings destroyed	3	85
# of households displaced	70	647
# of people seeking public shelter	15	145
Debris		
Building debris generated (tons)	5,474	24,795
Tree debris generated (tons)	1,204	34,713
# of truckloads to clear building debris	170	857
Value of Damages (Thousands of dollars)		
Total property damage	$26,604.24	$201,429.32
Total losses due to business interruption	$3,055.56	$24,574.66

Estimated Damages from Earthquakes

Methodology Used

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 24
Estimated Damages from Earthquakes

	Magnitude 5.0	**Magnitude 7.0**
Building Characteristics		
Estimated total number of buildings	5,152	5,152
Estimated total building replacement value (Year 2002 $) (Millions of dollars)	$1,489	$1,489
Building Damages		
# of buildings sustaining slight damage	885	395
# of buildings sustaining moderate damage	319	1,486
# of buildings sustaining extensive damage	57	1,467
# of buildings completely damaged	8	1,753
Population Needs		
# of households displaced	96	4,132
# of people seeking public shelter	49	2,138
Debris		
Building debris generated (million tons)	0.010	0.38
Brick/wood debris generated (million tons)	0.0064	0.16
# of truckloads to clear building debris	520	15,320
Value of Damages (Millions of dollars)		
Total property damage	$86.09	$1230.52
Total losses due to business interruption	$7.72	$196.39

Estimated Damages from Flooding

Methodology Used

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

Winthrop's land area is 1.6 square miles or 1,024 acres. Approximately 369 acres have been identified by local officials as areas of flooding. This amounts to 25.33 % of the land area in Winthrop. The number of structures in each flood area was estimated by applying the percentage of the total land area to the number of structures (5,152) in Winthrop; the same number of structures used by HAZUS for the hurricane and earthquake calculations. HAZUS uses a value of $289,013.75 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 $37,687,393 - $188,436,965. These calculations are not based solely on location within the floodplain or a particular type of storm (i.e. 100 year flood).

Table 25: Estimated Damages from Flooding

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area	# of struc-tures	Replacement Value $	Low Damage Estimate $	High Damage Estimate $
1	Yirrell Beach	86.5275	5.9375	306	88,438,207	884,382	44,219,104
2	Shirley Street Neighborhood	180.3025	12.3722	637	184,101,759	1,841,0176	92,050,880
3	Lewis Lake	34.9662	2.3994	124	35,837,705	3,583,771	17,918,853
4	Ingleside Park	32.0254	2.1976	113	32,658,554	3,265,855	16,329,277
5	Lower Nahant Avenue	8.0665	0.5535	28	8,092,385	809,239	4,046,193
6A	Woodside seawall and headwall on Boston Harbor	0.9456	0.0649	3	867,041	86,704	433,521
6B	Somerset seawall and headwall on Boston Harbor	0.7773	0.0533	3	867,041	86,704	433,521
6C	Sargent Street seawall and headwall on Boston Harbor	0.8664	0.0594	3	867,041	86,704	433,521
6D	Cottage Park seawall and headwall on Boston Harbor:	0.6772	0.0465	2	578,028	57,803	289,014
7	Coughlin Park	14.1474	0.9708	50	14,450,688	1,445,067	7,225,344
8	Bayou Street Neighborhood	9.8795	0.6779	35	10,115,481	1,011,548	5,0577,41
	Totals	**369.18**	**25.33**	**1,304**	**$376,873,930**	**$37,687,393**	**$188,436,965**

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V. hazard Mitigation goals

The Winthrop Local Multiple Hazard Community Planning Team met on March 18, 2011. At that meeting, the team reviewed and discussed the goals from the 2005 Hazard Mitigation Plan for the Town of Winthrop.

The following nine goals were endorsed by the Committee for the 2014 update of the Winthrop Hazard Mitigation Plan:

1. Ensure that critical infrastructure sites are protected from natural hazards.

2. Protect existing residential and business areas from flooding.

3. Maintain existing mitigation infrastructure in good condition.

4. Continue to enforce existing zoning and building regulations.

5. Educate the public about zoning and building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction.

6. Encourage future development in areas that are not prone to natural hazards.

7. Educate the public about natural hazards and mitigation measures.

8. Make efficient use of public funds for hazard mitigation.

9. Protect the Town's ability to respond to various natural hazard events.

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VI. EXISTING MITIGATION MEASURES

Existing Multi-Hazard Mitigation Measures

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, hurricanes, Tornados, dam failures, earthquakes, and winter storms. Therefore, the CEMP is a mitigation measure that is relevant to all of the hazards discussed in this plan.

Communications Equipment – The Town utilizes the MBTA Police Mobile Command, a mobile communications center available to the Town through the MBTA. The Town has a Reverse 911 system in place, Code Red.

Emergency Management Website- The Town maintains an Emergency Management page on its website. There are links here to chemical emergency information, flood hazard recovery actions, hurricane preparedness and other information, how to enroll and utilize the CodeRed emergency notification system.

Emergency Power Generators – Emergency power generators are in place in the two Red Cross certified emergency shelters- the Fort Banks School and the Cummings School. Both of the fire stations have in-place electrical generating capacity, one using diesel fuel and the other Liquefied Natural Gas (LNG). The Town Hall is connected to the Emergency Operations Center (EOC) and both are served by the EOC LNG fueled generator. All sewer pumps stations have back up generation capacity and the DPW facility has a fixed diesel generator in place.

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

Hazardous Facilities Emergency Response Plans- Winthrop is home to the MWRA Deer Island waste water treatment facility. The plant stores and requires the largest amount of water treatment chemicals on the east coast of the United States, including sodium hyper chloride (bleach) and ammonia. The MWRA's emergency response plan is up to date.

– Winthrop is a member of a regional emergency planning committee with Chelsea, Everett, Lynn, Malden, Medford, Melrose, North Reading, Reading, Revere, Saugus, Somerville, Stoneham, Wakefield, Winchester and Woburn. The Town also maintains its own Local Emergency Planning Committee (LEPC).

In 1986, Congress passed the Emergency Planning and Community Right-to-Know Act, Public Law 99-499, commonly known as EPCRA or SARA Title III. Section 301(a) of the legislation required each governor to appoint a state emergency response commission (SERC) by April of 1987. Section 301(b) charged the SERCs with the responsibility of dividing the states into planning districts and Section 301(c) for appointing local emergency planning committees (LEPCs). In 1987, the Massachusetts State Emergency Response Commission, in compliance with the new legislation, designated each MEMA sub-area as planning districts and appointed a Local Emergency Planning Committee for each city and Town within them. The legislation required that the committees have representation from a specified number of interest groups.

The mission of an LEPC can be summarized as follows:

- A response plan must be written for responding to a hazardous material incident with the jurisdiction(s). It must also be reviewed annually.
- Emergency responders (police, fire, emergency medical services, public works, etc.) must be trained to levels indicated in the plan. At a minimum, first responders must be trained to the awareness level.
- The emergency response plan must be exercised at least once a year.
- The committee must create a system to collect, store, and respond to public requests.

Existing Flood Hazard and Coastal Hazard Mitigation Measures

National Flood Insurance Program (NFIP) – Winthrop participates in the NFIP with 1,093 policies in force as of the May 31, 2014. 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 Winthrop:

Flood insurance policies in force (as of May 31, 2014)	1,093
Coverage amount of flood insurance policies	$235,795,800
Premiums paid	$1,764,010
Total losses (all losses submitted regardless of the status)	1,151
Closed losses (Losses that have been paid)	977
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	174
Total payments (Total amount paid on losses)	$6,018,749.43

The Town complies with the NFIP by enforcing floodplain regulations, maintaining up-to-date floodplain maps, and providing information to property owners and builders regarding floodplains and building requirements. The Commissioner of Inspectional Services /Building Inspector enforces the floodplain regulations.

Since the 2005 plan, the policies in force have increased by 138 and the total losses have increased by 196. The total payments were $6,018, 749, which is $1,274,658more than reported in the 2005 plan.

Conservation Commission website page – The Town provides on information on wetlands, copies of Flood Insurance Rate Maps, locus maps, wetlands permit filing information, and links to the MA Association of Conservation Commission and then MAP DEP websites. Winthrop also has a page on its Town web site on Emergency Management that offers information on cold and winter weather preparedness, a link to the Local Emergency Planning Committee staffing page, chemical emergency preparedness and response, flooding response and FEMA contact information, hurricane preparedness information and CodeRED information.

Public Services Operations/Maintenance Activities – The Public Works Department actively maintains the Town's storm drain system. The following specific activities serve to maintain the capability of the drainage system through the reduction of sediment and litter build up and proper maintenance and repair.

- *Street sweeping* – Street sweeping is done by Winthrop, conducted five to seven times annually. The Town used to contract this service out.

- *Catch basin cleaning* –800 catch basins; each basin is cleaned every four years with clogged basins cleaned as needed. Winthrop has replaced several dysfunctional catch basins with new deep-sump basins over the last 10 years.

- *Roadway treatments* – Calcium Chloride only is used for snow/ice treatment.

- *Drainage maintenance*- The Town's catch basins and drain lines are not yet digitally mapped. The DPW tracks and records all catch basin maintenance. The DPW inspects streets and drainage systems once construction is completed. Private covenants for private, off-street drainage facilities are sometimes required through the permitting process. Routine maintenance and systematic replacement of drainage infrastructure part of the DPW's annual operating budget.

2010 Open Space and Recreation Plan- The Winthrop Open Space and Recreation Plan lists among its top priorities actions that can have a significant impact in reducing the impacts of flooding and stormwater. The Plan includes the following as priority goals: the improvement and upgrading of the Town's neighborhood parks and beaches and the preservation of open space and the expansion of passive recreational opportunities.

Conservation district zoning - The Town has a conservation district zone whose purpose is to protect the Town against the costs which may be incurred when unsuitable development occurs near water. The Town also has an environmental design review

provision which includes standards for ensuring that drainage will not adversely affect neighboring properties.

Environmental design review – The zoning bylaw requires that all special permit applications must undergo environmental design review by the Board of Appeals or Planning Board. Review standards include ensuring that removal of surface waters will not adversely affect neighboring properties or the public storm drainage system

Flood Hazard Control Regulations) -The Town also requires compliance with all provisions of the National Flood Insurance program. The Commissioner of Inspectional Services /Building Inspector enforces compliance with the NFIP regulations.

Special Development Overlay District (SDOD)- The SDOD encourages the redevelopment and reuse of existing nonresidential properties in Winthrop, allowing mixed use residential development within a flexible permitting schedule. The district does mandate that 20% of any redevelopment or reuse be retained as open space, making it a factor in being able to treat precipitation and stormwater onsite and prevent stormwater runoff.

Stormwater Management Ordinance – prohibits illicit connections or discharge into the Town's Municipal Separate Stormwater System (MS4)

Other Development Regulations- There are no prohibitions on mobile homes and the subdivision regulations are of limited value in restricting development in flood-prone areas because subdivision activity is limited due to the built-out nature of the community.

DCR dam safety regulations- There are no dams located within Winthrop.

Existing Wind Hazard Mitigation Measures

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

- Develop and disseminate emergency public information and instructions concerning hurricane preparedness and safety.
- Community leaders should ensure that Winthrop 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.
- Review National Flood Insurance Rate Maps and Hurricane Evacuation Maps for possible impact on the community.
- Maintain plans for managing all hurricane emergency response activities.

The Winthrop 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.

Massachusetts State Building Code – The Town enforces the Massachusetts State Building Code whose provisions are generally adequate to protect against most wind damage. The code's provisions are the most cost-effective mitigation measure against tornados given the extremely low probability of occurrence. If a tornado were to occur, the potential for severe damages would be extremely high.

Tree-trimming program – The Town performs 100% of its work to trim and remove trees as needed and grind stumps. Winthrop owns a bucket truck and mobile two wood chippers. National Grid maintains its power line corridors.

Existing Winter Hazard Mitigation Measures

Snow disposal – Regular plowing and snow/ice removal. Calcium chloride is used primarily for road treatments. Sand is very rarely used as it creates siltation and clean up problems. The DPW works to clear roads as requested or in an emergency for the Fire and Police Departments.

Existing Wildfire Hazard Mitigation Measures

Burn Permits – The Town fire department does allow outdoor burning by permit only.

Fire Response-Winthrop responds to a brush fire or marsh fire in the same manner as other fire calls. It does not have a dedicated Forestry Division.

Subdivision/Development Review – The Fire Department participates in the review of new subdivisions and development projects.

Existing Geologic Hazard Mitigation Measures

Massachusetts State Building Code – The Town enforces the State Building Code. It 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 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.

In the event of an earthquake and fires caused by it, 100 % of Winthrop is served by fire hydrants. The Town Fire Department has three mobile, 5Kw generators in case of power loss and a mobile light rack.

Existing Drought Hazard Mitigation Measures

Massachusetts Water Resources Authority (MWRA)- The Town purchases its drinking water from the MWRA and its wastewater is also treated by the MWRA at the Deer Island WWTP facility located directly south and adjacent to Winthrop. The MWRA, a public water authority created in 1985, provides water and waste water treatment to 61 communities and 2.5 million people in the Boston metro region. The MWRA provides extensive water demand management for its system, including drought management, under its federal National Pollutant Discharge Elimination System permit.

Existing Extreme Temperature Mitigation Measures

The Town maintains Red Cross-certified emergency shelters at the Cummings School and the Fort Banks School. These shelters are available to vulnerable people during power outages when heating or air conditioning is not available.

Table 26- Winthrop 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.	None. Plan is up to date.
Communications Equipment: • Reverse 911-Code Red • Member of NERAC and NEMWIC • MBTA Mobile Command Unit	Town-wide.	Effective	Mobile light tower needed.
Emergency Management Website page	Town-wide.	Effective.	Consider adding more information about NFIP availability and flooding preparedness.
Emergency Power Generators	Fort Banks School and Cummings School emergency shelters; both fire stations and DPW.	Effective.	Need to install back feed from Emergency Operations Center generator to Town Hall next door.
Massachusetts State Building Code	Town-wide.	Effective for new construction. Enforced by the Commissioner of Inspectional Services /Building Inspector.	Consider adding property owner incentives to exceed Building Code base flood elevation requirements.
Hazardous Facilities Emergency Response Plans	Town-wide.	Effective.	None.
Mystic Region	Town-wide	Regional forum and	None.

Type of Existing Mitigation Measures	Area Covered	Effectiveness/ Enforcement	Improvements/ Changes Needed
Emergency Management Planning Committee (REPC) and Winthrop Local Emergency Planning Committee		local committee for cooperation on natural and manmade disasters.	
FLOOD AND COASTAL HAZARDS/DAMS			
Participation in the National Flood Insurance Program (NFIP)	Areas identified on the FIRM maps.	There are 1,093 policies in force. Enforced by the Commissioner of Inspectional Services /Building Inspector	Encourage all eligible homeowners to obtain insurance; add more public outreach about NFIP program availability and new FIRM maps to Town website page; consider adding info about Community Rating System if applied for.
Conservation Commission website page	Town-wide.	Effective.	Provide FEMA flood preparedness and building info, link to possible CRS program and potential flood-proofing incentive programs.
Public Services Operations/Maintenance	Town Wide.	Effective.	Explore ways to increase infrastructure preventive maintenance and updating program. Create digital drainage infrastructure database.
2010 Open Space Plan	Town Wide.	Effective.	Target acquisition of open space parcels with flood storage capacity, habitat and recreational value near existing waterways.
Conservation District and Environmental Design Review	Town-wide.	Effective.	None.

Type of Existing Mitigation Measures	Area Covered	Effectiveness/ Enforcement	Improvements/ Changes Needed
Flood Hazard Control Regulations	Town-wide.	Effective. Enforced by the Commissioner of Inspectional Services /Building Inspector.	None.
Special Development Overlay District	Town-wide.	Effective.	None.
Stormwater Management Ordinance	Town-wide.	Effective.	Update to add construction and runoff controls.
Subdivision Rules and Regulations	Town-wide.	Somewhat Effective.	Consider referencing Stormwater Management Ordinance as standard if updated.
DCR dam safety regulations	NA	NA	There are no dams located within Winthrop.
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 and power line corridor maintenance.	Town-wide.	Satisfactory	More staff funding needed.
WINTER HAZARDS			
Snow Removal	Town-wide.	Somewhat Effective.	Plans to shift to liquid calcium chloride only.
Winter Hazards webpage	Town-wide.	Effective	None.
WILDFIRE HAZARDS			
Outdoor burning is allowed by permit only.	Town-wide.	Effective.	Brush fire truck, pump and hose needed.
Water availability: 100 % of Town is served by hydrants; tanker truck agreements in place	Town-wide.	Effective.	None.

Type of Existing Mitigation Measures	Area Covered	Effectiveness/ Enforcement	Improvements/ Changes Needed
with Fire District 5; authority to take water from surface supplies.			
Development Review	Town-wide.	Effective.	None.
GEOLOGIC HAZARDS			
The Massachusetts State Building Code	Town-wide.	Effective.	None.
Mobile generators and light pole for power/light backup	Town-wide	Effective.	Light tower and 2 5 kW mobile generators
DROUGHT HAZARDS			
MWRA Drought Management	Town-wide.	Effective.	Drought tolerant landscaping
EXTREME TEMP HAZARDS			
Town shelters	Town-wide.	Effective.	Green Buildings, Education and Awareness.

VII. Mitigation Measures from the 2005 plan

Review and Update Process

At a meeting of the Winthrop Hazard Mitigation Committee, Town staff reviewed the potential mitigation measures identified in the 2005 North Shore Regional Pre-Disaster Mitigation Plan Winthrop Annex and determined whether each measure had been implemented or deferred. Of those measures that had been deferred, the committee evaluated whether the measure should be deleted or carried forward into the Winthrop Hazard Mitigation Plan 2014 Update. The decision on whether to delete or retain a particular measure was based on the committee's assessment of the continued relevance or effectiveness of the measure and whether the deferral of action on the measure was due to the inability of the Town to take action on the measure.

Table 27- Potential Mitigation Measures from the 2005 Plan

Mitigation Measure	Priority	Implementation Responsibility	Time Frame	2014 Status	2014 Priority*
Extend the seawall at Yirrell Beach.	High	DPW and MWRA.	Years 1-3	Incomplete: Town applied for PDM grant but received funding only for storm drain upgrades.	High
Ingleside Park – review recommendations of study.	High	DPW.	Years 2-4	Incomplete: completed study and cleaned drainage lines; applied for but did not receive further funding; still a high priority.	High
Purchase street sweeping and catch basin cleaning equipment.	High	Town administrator, Town Meeting.	Years 2-3	Complete: purchased "clamshell" truck in 2005 and street sweeper in 2006.	NA
Require on-site detention of storm-water.	High	Planning Board.	Year 1	Complete: adopted stormwater bylaw in 2010.	NA

Mitigation Measure	Priority	Implementation Responsibility	Time Frame	2014 Status	2014 Priority*
Flood-proof the utilities of repetitive loss properties with FEMA grant.	Medium	DPW	Years 1-3	Partially complete: FEMA grant to elevate utilities of 20 homes.	High
Lewis Lake improvements.	Medium	DPW, DCR	Years 3-5	Partially complete: project is permitted and expected to finish in 2014.	High
Upgrade pump station at PICO.	Low	DPW	Years 4-5	Partially complete: generator upgrades completed but wet well and possible Inflow and Infiltration problems remain.	Medium
Repair and heighten Grandview Avenue seawall.	Low	DPW	Year 5	Complete	NA

*See page 91 for further project priority information.

Winthrop has made considerable progress on implementing mitigation measures identified in the 2005 Hazard Mitigation Plan. Many of the measures identified in that plan are now considered on-going aspects of the regular work of Town staff from the department head level to the regular work of Public Works staff. Individual projects have been incorporated into the Town's capital improvement plan and the Town continues to seek FEMA grant funding to implement the home elevation program.

Winthrop will be increasing its integration of natural hazard mitigation into its community planning processes by building on priority mitigation actions included in this update of its original plan. The Town will begin to actively incorporate new hazard mitigation actions into its all of its land use, environmental, capital, and transportation planning efforts, building on the following core principles of sound hazard mitigation planning:

- Building on this plan update to continue assessing and mapping community risk;
- Creating local support for integration of natural hazard mitigation planning by increasing its hazard education and risk awareness outreach and education efforts;
- Integrating mitigation into local planning studies, bylaws and regulations;
- Incentivizing hazard mitigation best practices.

See Section IX, Plan Adoption and Maintenance for more information on how the Town plans to increase its effort to successfully add a strong natural hazard mitigation element to its community planning work.

VIII. HAZARD Mitigation STRATEGY

What is Hazard Mitigation?

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

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

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

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

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

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

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

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. Other issues are inter-community issues that involve cooperation between two or more municipalities in a local area. There is a third level of mitigation which is regional; involving a state, regional, or federal agency or an issue that involves numerous municipalities across a wide area of the metropolitan region.

Regional Partners

In many communities, mitigating natural hazards, particularly flooding, is more than a local issue. The drainage systems that serve these communities are a complex system of storm drains, roadway drainage structures, pump stations and other facilities owned and operated by a wide array of agencies including but not limited to the Town of Winthrop, the Department of Conservation and Recreation (DCR), and Massachusetts Department of Transportation (MDOT). The planning, construction, operations, and maintenance of these structures are integral to the flood hazard mitigation efforts of communities. These agencies must be considered the communities regional partners in hazard mitigation. These agencies also operate under the same constraints as communities do, including budgetary and staffing constraints and numerous competing priorities. 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

The flooding situation at Point Shirley has regional impacts because it is the key access point for Winthrop emergency equipment to reach the Deer Island Sewage Treatment Plant. Because Deer Island is a regional facility, Winthrop public safety personnel must be able to get to the facility quickly. The extension of the seawall from Wyman Street to Deer Island would alleviate flooding that impacts residences and help to alleviate the roadway flooding that can impede access to Deer Island.

Sea Level Rise and Shoreline Environment – The coastal shoreline of the North Shore area is a dynamic environment where forces of sea-level rise, erosion and deposition of are constantly at work changing the shoreline profile. This process disregards municipal boundaries as sand and other materials are moved along the coast. Shoreline protection measures such as seawalls, jetties, and others have an impact on this process with the potential of building up materials in some areas while stripping it away from others. Municipalities along the North Shore should work to understand how these processes and others associated with sea level rise and storm surge are at work locally and consider

mutually beneficial means of protecting their shore side communities from the impacts of storm damage and sea-level rise. Winthrop should consider participating within a regional sea level rise action work group to help plan for and address sea level rise, storm surge and related climate adaptation issues on a regional basis.

Process for Setting Priorities for Mitigation Measures

The decision on priorities was made at a meeting of the local committee. The method used was to reach consensus through discussion, rather than taking a vote. Priority setting was based on local knowledge of the hazard areas, cost information and an assessment of benefits.

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

Based on information gained from the Benefit-Cost Analysis trainings and a review of the STAPLEE criteria (a checklist for evaluating social, technical, administrative, political, legal, economic and environmental issues) MAPC asked the local committee to take into consideration factors such as the number of homes and businesses affected, whether or not road closures occurred and what impact closures had on delivery of emergency services and the local economy, anticipated project costs, whether the Town had 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. **See** Table 28.

High Priority Mitigation Measures

Flooding, Drainage Infrastructure and Dams

Protect Infrastructure and Critical Facilities

- Yirrell Beach- Complete the Yirrell Beach project by extending the seawall to Deer Island approximately 1,000 feet. There is a seawall at Yirrell Beach that stops about 1,000 feet short of Deer Island. This seawall is occasionally breached which results in sand coming up over the wall. This sand has been removed by the MWRA. Because the seawall ends at Wyman Street, this street floods, which can affect up to 40 homes. In March of 2003, the Town had to remove four feet of gravel that had washed up on Wyman Street. The Town has trenched the street so that water flows away from the street but the longer term solution would be to extend the seawall 1,000 feet to Deer Island. The Town did apply for a FEMA hazard mitigation grant to extend the seawall but received funding for storm drain improvements associated with the current seawall only.

- Complete project to elevate utility lines for 20 homes in flood hazard areas. This was listed as a Medium Priority action in 2005. It is now listed as a High Priority action as the project has been funded using a FEMA grant and the Town considers it very important to complete the project.

- Finish upgrading Winthrop Shore Drive seawall. This is not a Town project as the seawall and Winthrop Beach are owned the state. It was included by the Town in the plan update because it is so integral to the Town as Winthrop Shore Drive is a gateway into the community and the beach provides multiple benefits including storm protection, recreation and tourism. The $18 million Nahant Causeway project involves reconstructing the roadway; new fencing and guard rails; restoration of the parking lot; beautification; and construction of a new boat ramp. The roadway work was mostly completed by 2013, but the project stopped when the contractor filed for bankruptcy. Another firm has since taken over and the project is now backing on track for completion this summer. Since the update process has begun, the state has added a beach nourishment component and will spend $22.5 million dollars to add about 500,000 cubic yards of sand. The work includes rebuilding groins, protective stone structures resembling jetties; sea wall repairs; reconstructing Winthrop Shore Drive; and adding new drainage, lighting, and a beachside sidewalk.

- Lewis Lake- Upgrade the drainage ditches by replacing them with drainage pipes. This action was listed as a Medium Priority mitigation action in the 2005 Plan. The Town is working with DCR to have Lewis Lake dredged to increase its flood water storage capacity, upgrading the storm drain lines from Winthrop Shore Drive to the lake and replacing the old manual tide gate with a self regulating one. The project is fully permitted. Lewis Lake is now listed as a High Priority action because some of the actions from the 2005 Plan that were thought to have been more urgent have been accomplished, such as adopting a storm water ordinance to require onsite detention and purchasing street sweeping and catch basin cleaning equipment. Also, with increased storm and intense precipitation events since the 2005 Plan, and with project permitting complete, Lewis Lake has taken on a new importance as a critical stormwater storage area for Winthrop.

- Ingleside Park: complete drainage assessment of the park and upgrade undersized drainage infrastructure. The park is at sea level with a pipe that drains to the bay. There is a valve that shuts during heavy tides but the area may need a pump station as well. To help with flooding in this area, the Town has constructed dikes around two homes as a temporary solution.

- Lower Nahant Avenue: replace undersized drainage line, upgrade existing Nahant Avenue drainage outfall headwall and install flapper valve.

- Boston Harbor Drainage Outfall Headwalls and Seawalls: Upgrade seawalls and headwalls at Woodside Street, Somerset Street, Sargent Street, and Cottage Park.

The south and west facing shores of Winthrop on Boston Harbor area are impacted during storm events by what local residents call the "Boston Harbor bathroom effect". Tidal storm surge combines with inland flooding, in which fresh water precipitation is unable to drain into the ocean due to wind, tide and storm surge driving seawater up into storm drain lines, trapping runoff and causing localized flooding in these neighborhoods. Seawalls and headwalls need to be elevated to protect against storm and tidal surge and allow storm drainage to take place during storm events.

Dams

- There are no dams located in Winthrop.

Measures to Ensure Compliance with NFIP and mitigate for Coastal Hazards

- The Town should consider participating in the FEMA Community Rating System (CRS) program to lower flood hazard risk, raise community awareness and quality for lower flood hazard insurance premiums. See information at: http://ma.stormsmart.org/home/community-rating-system-crs-primer/

- Floodplain District Management: Continue to enforce the Floodplain Zoning District and associated building regulations for floodplain areas. Update this district to remain consistent with FEMA guidelines and floodplain mapping. See more information on model bylaw development for MA coastal floodplains at: http://ma.stormsmart.org/2010/11/05/great-model-bylaw-for-managing-coastal-floodplain-development/

- Floodplain Mapping: Maintain up to date maps of local FEMA identified floodplains. The Town anticipates updated National Flood Insurance Rate maps in 2014.

- Acquisition of Vacant Flood Prone Lands: Acquire priority open space parcels, such as the Corinth Beach property acquired by the Town in the late 1980s, in floodplain and coastal surge areas in order to maintain flood storage and water infiltration capacity.

- Planning for future storm surge events due to sea level rise.

- Limiting or prohibiting development in areas along the coast subject to inundation by the 1-percent-annual-flood event with additional hazards associated with storm-induced waves, referred to as the V-Zone on Flood Insurance Rate Maps.

- Adopting coastal A-zones, areas of special flood hazard that extend inland and are subject to breaking waves between 1.5 and 3 feet, and ensuring they are mapped accurately.

Multi Hazard

- Emergency Power Generators: Install emergency power generator at Town Hall and Emergency Operations Center next door with a combined, LNG powered generator; provide alternative fuel sources and generator power source flexibility to other emergency generators as needed.

- Purchase new trailer-mounted light tower.

- Purchase two, 5kW trailer-mounted mobile generators.

- Work with MWRA to develop plan to transport water treatment chemicals to the Deer Island Waste Water Treatment Plant by barge, rather than by truck.

- Upgrade the police radio repeater unit at Winthrop Avenue Fire Station and upgrade the DPW narrow radio band repeater at the Town's main fire station.

- Assess and Map Community Risk through the following actions:
    - Develop and maintain a database to track community vulnerability to known hazards.
    - Establish a process to coordinate with regional, state and Federal agencies to maintain up-to-date hazard data, maps and assessments.
    - Identify the most at-risk critical facilities and evaluate potential mitigation techniques.

- Integrate Mitigation into Local Planning through the following actions:
    - Incorporate risk assessment and hazard mitigation principles into local capital improvement, master, and open space planning efforts.
    - Incorporate a stand-alone element for hazard mitigation into the local development, redevelopment and subdivision review process.
    - Determining and enforcing acceptable land uses to alleviate the risk of damage by limiting exposure in such hazard areas.
    - Involve citizens in all comprehensive planning activities that identify and mitigate hazards.
- Incentivize Hazard Mitigation through the following actions:
    - Waive permit fees for home construction or reconstruction related to mitigation.
    - Use tax abatements, public subsidies, and other incentives to encourage private mitigation practices.

- Increase Hazard Education and Risk Awareness through the following actions:
    - Include hazard mitigation and preparedness measures on the Town's website.

Host an annual public hazards workshop for Town residents, with speakers from MEMA, FEMA and private industry (such as insurance) on natural hazards and mitigation.

Winter Storms

- There were no high priority winter storm mitigation measures identified by plan participants.

Medium Priority Mitigation Measures

Flooding, Drainage Infrastructure and Dams

- Consider updating building permit process for constructing new homes located in V or A flood zones by offering homeowner incentives to add additional height above base flood elevation beyond what is required in the MA State Building Code. See how Hull, MA has done this at: http://www.mass.gov/czm/stormsmart/pilots/hull.htm.

- Master Plan Update: Include a section on Climate Change Preparedness in the next update of the Town 's master plan, or develop policy principles and actions for climate change preparedness.

- Increase preventive practices to reduce clogging and ensure proper functioning of drainage infrastructure by purchasing maintenance equipment and having the perform it own maintenance instead of contracting out. Winthrop would like to purchase a vactor truck, for cleaning clogged drain lines and cleaning catch basins

- Implement training for stormwater best management practices for employees.

- Bayou Street: replace undersized drainage line.

- Increase enforcement of existing wetlands bylaw to prevent encroachment of decks and other construction into resource areas. Consider adopting a non-criminal ticketing regulation.

- Complete Pico Beach pump station: finish adding wet well capacity and eliminate inflow and infiltration problems. This was a Low Priority action in 2005 but has moved up to being a Medium Priority as the Town has funded it and would like to complete the project.

Wind Related

- Update and implement the tree maintenance program with additional funding. Distribute information to property owners to reduce risk of tree failure to life,

property and utility systems; identify potentially hazardous trees in critical areas; increase tree program staffing as possible to identify and remove hazardous trees.

- Assess vulnerability to severe winds such as hurricane events by taking actions such as:
    - Developing and maintaining a database to track community vulnerability to severe wind.
    - Using GIS to map areas that are at higher risk to wind hazard associated with different hurricane conditions (e.g. Category 1, 2, 3 etc.).
    - Using HAZUS to quantitatively estimate potential losses from hurricane wind.

- Work with the local electrical utility provider and Town Department of Public Works to ensure the following actions are taken:
    - Informing the utility of the Town's updated tree maintenance program and establish standards for all tree pruning around utility lines;
    - Incorporating the inspection and management of hazardous trees into the drainage system maintenance process.
    - Inspecting utility poles to ensure they meet specifications and are wind resistant.
    - Upgrading overhead utility lines- e.g. adjust utility pole size, utility pole span widths, and/or line strength.
    - Using designed-failure mode for power line design to allow lines to fall or fail in small sections rather than as a complete system to enable faster restoration.
    - Installing redundancies and loop feeds.

- Tornados: Promote the construction of safe rooms by the following actions:
    - Requiring the construction of safe rooms in new schools, daycares and nursing homes.
    - Encouraging the construction of and use of safe rooms in homes and shelter areas of manufactured home parks, fairgrounds, shopping malls, or other vulnerable public structures.
    - Encouraging builders and homeowners to locate tornado safe rooms inside or directly adjacent to houses to prevent injuries due to flying debris or hail.
    - Making the following consulting guidance available to home and business owners on the Town's website, Town Hall and Library*:* FEMA P-320 *Taking Shelter from the Storm: Building a Safe Room for Your Home or Small Business* and International Code Council (IC)- 500 *Standard for the Design and Construction of Storm Shelters.*

Winter Storms

- Participate in a regional Sea Level Rise Action Work Group with neighboring coastal communities to draft and implement preparedness actions for winter storms, storm surge and associated sea level rise coastal hazards.

- Winthrop should partner with MEMA and FEMA to design and implement a winter storm preparedness program that reduces the risk to life, property and utility systems.

- Develop a partnership between utility providers and DPW to document known hazards.

- Protect buildings and infrastructure by retrofitting public buildings to withstand snow loads and prevent roof collapse.

- Using snow fences or "living snow fences" e.g. rows of trees or shrubs, to limit blowing and drifting snow over critical roadway segments.

- Identifying specific at-risk populations that may be exceptionally vulnerable in the event of long-term power outages.

Lower Priority Mitigation Measures

Flooding and Drainage Infrastructure

- Digitally map all storm drain outfalls and drain lines.

- Create and implement a wetlands, flooding, stormwater education and outreach program for Winthrop residents that incorporates new NFIP map and program information.

- Consider updating the Town's storm water ordinance to include preconstruction and post construction stormwater standards.

Geologic Related

- Public and Commercial Building Assessments: Develop an inventory and assess the earthquake vulnerability of all public and commercial buildings.

- Develop and implement a structural retrofitting program that prioritizes actions on the Town's older, un-reinforced masonry buildings.

- Landslides:
    - Complete an inventory of steep slope areas where critical facilities, other buildings and infrastructure, might be vulnerable to landslides, particularly in the event of an earthquake.

- Develop and maintain a database to track community vulnerability to landslides.

Wildfires

- Develop and maintain a database to track the location of any wildfire hazard event.
- Include the consideration of wildfire risk and mitigation in any comprehensive, capital, emergency response or open space planning efforts.
- Perform arson prevention cleanup activities in areas of abandoned or collapsed structures, accumulated trash or debris, and any area where spills or dumping may have occurred.
- Routinely inspect the functionality of fire hydrants.

Drought

Promote drought tolerant landscape design through measures such as:

- Incorporate drought tolerant native species into development landscape regulations.
- Using permeable driveways and surfaces to promote groundwater infiltration and reduce stormwater runoff.

Extreme Temperatures

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

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

Analysis of Mitigation Projects

An analysis of the proposed mitigation projects, using STAPLEE criteria as outlined on page 91, has been completed and is summarized in Table 28.

For Table 28, the following symbols apply to indicate degree of Hazard Mitigation Alternative Acceptability:

- = Acceptable
- = Somewhat Acceptable

TABLE 28 EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES

PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
Flooding – High Priority Alternatives								
Complete the Yirrell Beach project	•	•	•	•	•	•	•	High
Complete elevation of utility lines in flood hazard areas	•	•	•	•	•	•	•	High
Lewis Lake drainage	•	•	•	•	•	•	•	High
Winthrop Shore Drive Seawall	•	•	•	•	•	•	•	High
Ingleside Park	•	•	•	•	•	•	•	High
Lower Nahant Avenue	•	•	•	•	•	•	•	Moderate
Boston Harbor Drainage Outfall Headwalls and Seawalls	•	•	•	•	•	•	•	High
FEMA Community Rating System (CRS) program	•	•	•	•	•	•	•	Low

TABLE 28 EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES

PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
Floodplain District Management	•	•	•	•	•	•	•	Low
Floodplain Mapping	•	•	•	•	•	•	•	Low
Acquisition of Vacant Flood Prone Lands	•	•	•	•	•	•	•	High
Plan for storm surge events	•	•	•	•	•	•	•	Low
V- Zone development limits	○	•	•	○	•	•	•	Moderate
Add coastal A-zones	○	•	•	○	•	•	•	Moderate
Multi-hazard- High Priority Alternatives								
Emergency Power Generators	•	•	•	•	•	•	•	Moderate
Trailer-mounted light tower	•	•	•	•	•	•	•	Moderate
Purchase two, 5kW trailer-	•	•	•	•	•	•	•	Low

TABLE 28 EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES

PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
mounted mobile generators								
Plan to transport water treatment chemicals to the Deer Island Waste Water Treatment Plant by barge	●	●	●	○	●	○	●	Moderate
Upgrade radio repeaters	●	●	●	●	●	●	●	Moderate
Assess and Map Community Risk	●	●	●	●	●	●	●	Moderate
Integrate Mitigation into Local Planning	○	●	●	○	●	●	●	Moderate
Incentivize Hazard Mitigation	●	●	●	●	●	●	●	Moderate
Increase Hazard	●	●	●	●	●	●	●	Low

TABLE 28 EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES

PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
Education								
Flooding-Medium Priority Mitigation Measures								
Update building permit to add incentives for additional height above BFE for new homes in V or A flood zone	•	•	•	•	•	•	•	Low
Climate Change Master Plan update	•	•	•	•	•	•	•	Moderate
Increase drainage infrastructure preventive practices	•	•	•	•	•	•	•	Moderate
Implement training for stormwater best	•	•	•	•	•	•	•	Low

TABLE 28 EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES

PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
management practices								
Bayou Street drainage	•	•	•	•	•	•	•	Moderate
Increase enforcement of existing wetlands bylaw to prevent encroachment	•	•	•	○	•	•	•	Low
Complete Pico Beach pump station (wet well and I/I work)	•	•	•	•	•	•	•	Medium
Wind Related- Medium Priority Alternatives								
Update and implement the tree maintenance program	•	•	•	•	•	•	•	Moderate
Hurricanes: Assess vulnerability to severe winds	•	•	•	•	•	•	•	Moderate

TABLE 28 EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES

PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
Work with electrical utility and DPW on best practices	•	•	•	•	•	•	•	Low
Tornados: safe room best practices	•	•	•	•	•	•	•	Low
Winter Storms- Medium Priority Alternatives								
Regional Sea Level Rise Action Work Group	•	•	•	•	•	•	•	Low
Winter storm preparedness program with MEMA/FEMA	•	•	•	•	•	•	•	Low
Develop partnership between utilities and DPW	•	•	•	•	•	•	•	Low
Retrofit public buildings for snow loads	•	•	•	•	•	•	•	Moderate
Install snow fences	•	•	•	•	•	•	•	Moderate
ID at-risk	•	•	•	•	•	•	•	Low

TABLE 28 EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES

PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
populations subject to long term power outage impacts								
Flooding-Lower Priority Mitigation Measures								
Digitally map all storm drain outfalls and drain lines	•	•	•	•	•	•	•	Moderate
Flooding and Stormwater outreach program	•	•	•	•	•	•	•	Low
Update stormwater ordinance	•	•	•	•	•	•	•	Moderate
Geologic-Lower Priority Alternatives								
Develop an inventory and assess the earthquake vulnerability of all public	•	•	•	•	•	•	•	Low

TABLE 28 EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES

PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
and commercial buildings.								
Implement a structural retrofit program for town's priority at risk buildings	•	•	•	•	•	•	•	Low
Conduct an inventory of steep slope areas where landslides may be higher risk.	•	•	•	•	•	•	•	Low
Develop and maintain a database to track community vulnerability to landslides	•	•	•	•	•	•	•	Low
Wilfires-Lower Priority Alternatives								
Develop and maintain a wildfire	•	•	•	•	•	•	•	Low

TABLE 28 EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES

PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
database								
Include wildfire risk and mitigation in comprehensive planning	•	•	•	•	•	•	•	Low
Perform arson prevention activities	•	•	•	•	•	•	•	Low
Inspect fire hydrants on a routine basis	•	•	•	•	•	•	•	Low
Drought-Lower Priority Alternatives								
Incorporate drought tolerant species into regulations	•	•	•	•	•	•	•	Low
Require permeable driveways and surfaces to promote infiltration and reduce	•	•	•	•	•	•	•	Low

TABLE 28 EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES

PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
runoff								
Extreme Temperatures-Lower Priority Alternatives								
*Require Green Building and parking best practices	•	•	•	•	•	•	•	Low
Create and maintain a data base to track those vulnerable to extreme temperatures	•	•	•	•	•	•	•	Low

Introduction to Mitigation Measures Table

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

Hazard Area – Each mitigation measure is intended to address one or more of the natural hazard potentially impacting Winthrop, such as Flooding, Wind, Fire, and Earthquake. Where the proposed measure is intended to address a specific locally identified area of concern, this area is identified as well.

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. Hazard marked with an asterisk (*) can be used as either a stand-alone recommendation or can be performed within the comprehensive hazard assessment, mitigation, hazard mitigation incentives and hazard education and risk awareness recommendations made under the Multi-Hazard hazard heading.
Measure Type – There are six different types of pre-disaster mitigation measures identified by FEMA for which a community may apply for Hazard Mitigation funding.

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

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

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

for, or selected for funding. Upon adoption of this plan, the local committee responsible for its implementation should begin to explore the funding sources in more detail.

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

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

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

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

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

Abbreviations Used in Table 29

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

ACOE = Army Corps of Engineers.

MHD = Massachusetts Highway Department.

EOT = Executive Office of Transportation.

DCR = Department of Conservation and Recreation

DHS/EOPS = Department of Homeland Security/Emergency Operations

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

USDA = United States Department of Agriculture

Table 29: Potential Mitigation Measures

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
High Priority Mitigation Measures						
Flooding	Yirrell Beach project	Structural Projects	DPW	2014-2016	$600,000	Bonded/PDM
Flooding	Complete utility elevation project in flood hazard area	Structural Projects	DPW	2014-2015	$200,000	PDM
Flooding	Winthrop Shore Drive seawall	Structural Projects	DCR	2014-2016	$ 9 million	MA DCR
Flooding	Lewis Lake drainage	Structural Projects	DPW	2014-2016	$200,000	/Bonded/PDM
Flooding	Ingleside Park	Structural Projects	DPW	2014-2016	$250,000	General fund
Flooding	Lower Nahant Avenue	Structural Project	DPW	2014-2018	$25,000	General fund/PDM
Flooding	Boston Harbor Drainage Outfall Headwalls and Seawalls	Structural Project	DPW	2043-2018	$40,000 each: $200,000 total	General fund/PDM
Flooding	Consider CRS application	Structural Project	DPW	2016-2018	staff costs incorporated into budget, not to exceed $20,000	General fund

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
					per year to implement;	
Flooding	*Floodplain District Management	Public Information and Mapping; Flood Damage Reduction, Flood Preparedness	Conservation Commission and DPW	2014-2018	$5,000 per year staff	General fund
Flooding	*Floodplain mapping updates; Winthrop expects to receive new maps in 2014	Natural Resource Protection	Planning/ Conservation Commission	2014-2018	$5,000 per year	General fund
Flooding	Acquire/pre-serve vacant flood prone lands as or if they become available.	Natural Resource Protection	Planning/ Conservation Commission	2014-2018	Cost range of land purchases can range from $100,000 to $5 million. There is no specific parcel available at this time to assign a price range to.	Bonding/PDM
Flooding	*Plan for storm surge events.	Prevention	Planning/Conservation Commission	2014-2017	$25,000	General fund, MPTA

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Flooding	*Limit development in V-Zones.	Prevention	Planning/Conservation Commission	2014-2017	$25,000	General fund, MPTA
Flooding	*Adopt coastal A-Zones.	Prevention	Planning/Conservation Commission	2014-2017	$25,000	General fund, MPTA
Multi-hazard	Upgrade emergency generators: Hall/EOC	Emergency Services Protection	Fire/DPW	2014-2016	$75,000	General fund
Multi-hazard	Purchase new trailer-mounted light tower	Emergency Services Protection	Fire	2014-2016	$20,000	General fund
Multi-hazard	Purchase two, 5kW trailer-mounted mobile generators	Emergency Services Protection	DPW	2014-2017	$25,000	General fund
Multi-hazard	Develop plan to transport water treatment chemicals to the Deer Island Waste Water Treatment Plant by barge	Emergency Services Protection	Fire/Police/ EMD	2014-2017	$50,000	General fund/MWRA

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Multi-hazard	Upgrade radio repeater units	Emergency Services Protection	Police/DPW	2014-2017	$75,000	General fund
Multi-hazard	Assess and map community risk	Prevention	Planning/Conservation Commission	2014-2016	$50,000	General fund, MPTA/PDM
Multi-hazard	Integrate mitigation into local planning	Prevention	Planning/Conservation Commission	2016-2019	$100,000	General fund/MPTA/PDM
Multi-hazard	Incentivize hazard mitigation	Prevention	Planning/Conservation Commission	2016-2019	$25,000	General fund/MPTA/PDM
Multi-hazard	Increase hazard education and risk awareness	Public Education and Awareness	Planning/Conservation Commission/DPW	2014-2019	$10,000 per year staff time	DPW budget, general fund
Medium Priority						
Flooding	*Consider updating building permit to add incentives for additional height above BFE for new homes in V or A flood zones	Prevention	Planning/ Conservation/Building Depts.	2014-2018	$15,000 staff time	General fund

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Flooding	*Climate change master plan update or action plan	Prevention	Planning	2014-2018	$25,000	General fund
Flooding	Drainage preventive practices: vactor truck	Prevention	DPW	2014-2017	$180,000	General fund
Flooding	Stormwater best practices training	Prevention	DPW	2014-2018	$20,000	MPTA/General fund
Flooding	Upgrade Bayou Street drain line	Prevention	DPW	2014-2018	$20,000	DPE budget
Flooding	*Increase wetlands law enforcement practices	Natural Resource Protection	Conservation	2014-2018	$10,000 per year staff time	General fund
Flooding	Finish Pico Beach pump station project (wet well and I/I work)	Structural Project	DPW	2014-2017	$500,000	Bonded
Wind Related	Update tree maintenance program	Emergency Services	DPW	2014-2017	$15,000/year staff time	DPW budget
Wind Related	*Assess vulnerability	Prevention	Planning	2014-2016	$20,000	General fund, MPTA

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
	to severe winds					
Wind Related	Work to ensure electrical utilities are properly maintained	Emergency Services Protection	DPW	2014 - 2019	$5,000 staff time per year	DPW budget
Wind Related	Tornado safe room promotion and construction	Prevention	Planning/Building Department	2017-2019	$25,000	PDM
Winter Storms	*Regional Sea Level Rise Action Work Group participation	Prevention	Planning/DPW/Conservation Commission	2014-2018	$5,000 per year staff time	General fund
Winter Storms	Partner with MEMA and FEMA on Winter Storm Preparedness	Prevention	DPW/FEMA/MEMA/EMD	2014-2018	$5,000/year staff time	General fund
Winter Storms	Partner with utility to document hazard areas	Prevention	DPW/Utilities/EMD	2014-2018	$2,500/year staff time	DPW budget/utility
Winter Storms	Retrofit at-risk	Emergency	DPW	2017-2019	$250,000	PDM

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
	critical, public building roofs to withstand snow loads	Services Protection				
Winter Storms	Construct snow fences	Structural Project	DPW	2017-2019	$150,000	PDM
Winter Storms	*ID populations vulnerable to long term power outage	Prevention	Planning	2017-2019	$2,000 staff time	General fund, MPTA
Lower Priority Measures						
Flooding	Digitally map storm drains and outfalls	Prevention	DPW	2014-2018	$25,000	DPE budget
Flooding	*Wetlands and Stormwater Outreach program	Prevention/ Natural Resource Protection	Conservation Commission	2014-2018	$2,500 per year staff time	General fund
Flooding	*Update stormwater ordinance	Prevention	Planning	2014-2017	$5,000	General fund
Geologic Related **Earthquakes**	*Develop an inventory and assess the earthquake vulnerability of all public	Prevention	Fire/Plannning/EMD	2014-2016	$20,000	General fund/MPTA

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
	and commercial buildings.					
Earthquakes	Implement a structural retrofit program for town's priority at risk buildings	Structural	Fire/DPW/EMD	2017-2019	$1,000,000	PDM
Landslides	*Conduct an inventory of steep slope areas where landslides may be higher risk.	Prevention	Planning	2016-2017	$10,000	General fund, MPTA
Landslides	*Develop and maintain a database to track community vulnerability to landslides	Prevention	Planning/EMD	2017-2019	$10,000	General fund
Wildfires	* Develop and maintain a wildfire database	Prevention	Fire/EMD	2015-2016	$10,000	General fund
	*Include wildfire risk	Prevention	Planning	2014 - 2019	$5,000	General fund

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
	and mitigation in comprehensive planning					
	Perform arson prevention activities	Natural Resource Management	Fire	2014 - 2019	$2,000 per year	Fire Dept. budget
	Inspect fire hydrants on a routine basis	Emergency Services Protection	Fire	2014-2019	$2,000 per year	Fire Dept. budget
Drought						
	*Incorporate drought tolerant species into regulations	Prevention	Planning	2017-2019	$5,000	General fund
	*Require permeable driveways and surfaces to promote infiltration and reduce runoff	Prevention	Planning	2017-2019	$10,000	General fund
Extreme Temperatures						
	*Require Green Building and	Prevention	Planning	2014-2019	$10,000	General fund

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
	parking best practices					
	*Create and maintain a data base to track those vulnerable to extreme temperatures	Prevention	Planning/EMD	2014-2019	$2,000 per year	General fund

IX. Plan Adoption and Maintenance

Plan Adoption

The Winthrop Hazard Mitigation Plan was adopted by the Council on June 23, 2015. See Appendix D for documentation. The plan was approved by FEMA on August 3, 2015 for a five-year period that will expire on August 3, 2020.

Plan Maintenance

MAPC worked with the Winthrop Hazard Mitigation Planning Team to prepare this plan. This group will continue to meet on an as-needed basis to function as the Local Hazard Mitigation Implementation Group, with the Emergency Management Director/Fire Chief designated as the coordinator. Additional members could be added to the local implementation group from businesses, non-profits, and institutions.

Implementation Schedule

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

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

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

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

At this point, the Hazard Mitigation Implementation Team may decide to undertake the update themselves, contract with the Metropolitan Area Planning Council to update the

plan or to hire another consultant. However the Hazard Mitigation Implementation Team decides to update the plan, the group will need to review the current FEMA hazard mitigation plan guidelines for any changes. The update of the Winthrop 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

Initial Action following Town Adoption and FEMA Approval

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

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

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

Acting to Increase Hazard Mitigation Awareness and Planning into Winthrop's Planning and Community Development Process

The Town has incorporated several high priority mitigation actions into its plan update in order to help raise awareness of the increasing threat posed by natural hazards, integrate mitigation planning into local plans and bylaws and find ways to help offset the costs associated with hazard mitigation actions.

Those actions include the following broader objectives as cornerstones, followed by specific mitigation actions to implement them:

Building a Knowledge Platform

The Town will build on this plan update to begin creating local databases to track known hazards, working with regional, state and federal partners such as MAPC,

MEMA and FEMA to help it get started and maintain and up-to date hazard data, maps and assessments with as much local information as possible. Creating this information will help Winthrop identify its most at-risk facilities and vulnerable populations and help it select the most effective mitigation techniques.

Integration

Once a data framework has been started and relationships with regional, state and federal partners have begun to be established, the Town will be ready to present its case to Town residents and businesses on the need to incorporate hazard mitigation planning into all phases of the Town's operational and planning departments, including the following integration actions:

- Incorporating risk assessment and hazard mitigation principles into local capital improvement, master, and open space planning efforts.
- Incorporating a stand-alone element for hazard mitigation into the local zoning and subdivision review process.
- Adopting and enforcing acceptable land uses to alleviate the risk of damage by limiting exposure in hazard areas.

Outreach and Education

Accomplishing this integration successfully will mean the Town will need to begin to reach out to its residents early and in a consistent manner to present updated and relevant hazard information, building trust over time with area residents and businesses on the vital need to address hazard mitigation planning.

Two actions within this plan update are for the Town to place its latest Hazard Mitigation Plan, members of the Local Hazard Mitigation Implementation Team and meeting notices, links to MEMA and FEMA and other relevant agencies, mitigation funding incentives for homeowners and business owners, helpful hazard mitigation links and "tips" on a Hazard Mitigation web page of the Town's website. Another action is to hold annually, at minimum, a Natural Hazard Awareness Public Workshop with presentation of Town and regional hazard information, highlights from the Town's current Hazard Plan, and either academic, agency or another community's Hazard Mitigation Implementation Team on hand as speakers. The workshop should feature plenty of time for discussion and questions on local projects, costs, funding and lessons learned.

Incentives for Hazard Mitigation

Finding ways to help reduce the cost of hazard mitigation will be critical to the Town successfully adopting hazard mitigation measures. Impact fees for new development are not legal within Massachusetts, although the Zoning Reform Act now being debated by the Legislature has a clause that would allow it. Waiving permit fees, tax abatements, public subsidies and other funding must considered or made available.

StormSmart Coasts is a "resource for coastal decision makers looking for the latest and best information on how to protect their communities from weather and climate

hazards", and can be extremely helpful to Winthrop in all phases of learning and implementing effective natural hazard mitigation planning.

See : http://ma.stormsmart.org/.

X. 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. Additional sources are noted and referenced within the body of the plan.

FEMA Local Multi-Hazard Mitigation Planning Guidance, July 1, 2008

Town of Winthrop General Ordinances

Town of Winthrop Zoning Bylaw

Town of Winthrop, Subdivision Control Regulations

Town of Winthrop, Comprehensive Emergency Management Plan

2010 Winthrop Open Space and Recreation Plan

Commonwealth of Massachusetts, MacConnell Land Use Statistics, 2005

Metropolitan Area Planning Council, Geographic Information Systems Lab

Metropolitan Area Planning Council, Regional Plans and Data

United States Census Bureau, 2010 Census

2010 Massachusetts Hazard Mitigation Plan

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APPENDIX A
MEETING AGENDAS

Don Boyce
DIRECTOR

Richard Sullivan
COMMISSIONER

Marc D. Draisen
EXECUTIVE DIRECTOR

NORTH SHORE HAZARD MITIGATION PLANNING TEAM

Beverly
Lynn
Nahant
Peabody
Revere
Salem
Saugus
Swampscott
Winthrop

THE COMMONWEALTH OF MASSACHUSETTS

Deval Patrick, Governor

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

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600-900, BOSTON, MA 02114-2104 617-626-1250 FAX 617-626-1351

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

North Shore Hazard Mitigation Planning Team

First Meeting

Monday, February 8, 10:00 AM

Saugus Public Safety Building
2nd Floor Training Room
27 Hamilton Street, Saugus, MA
(Map & directions attached)

AGENDA

10:00 WELCOME & INTRODUCTIONS

10:05 OVERVIEW OF HAZARD MITIGATION PLANNING & GRANTS

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

10:20 UPDATING THE NORTH SHORE HAZARD MITIGATION PLAN

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

10:50 GETTING STARTED: MAPPING AND CRITICAL FACILITIES DATABASE FOR THE NORTH SHORE PLAN UPDATE

- Susan Brunton, GIS Analyst, MAPC

11:15 NEXT STEPS / ADJOURN

Winthrop Predisaster Mitigation Renewal Planning Meeting
March 18, 2011
Winthrop Town Hall
10 – 12
Agenda

1. Welcome and Introductions

2. Project Overview (*Sam Cleaves, MAPC*)

3. Survey Handout and Ortho Map Markup of Hazardous Areas/ Conversation:

   What has changed from 2005 PDM Plan?

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

   Plan Update:

   - What floods? How often? Any new mitigation studies done? What mitigation measures have been done or planned for? High or low priority?

   - Other hazards: Wildfires, dams, earthquake, high winds? What areas? Dam studies available?

   - Map known future development areas? Type, size, status of permitting

4. Review Draft Project Goals: See over

5. Discuss Project Outreach: See over

6. Review mitigation projects: community actions and new priority projects/costs

7. Next Steps: Follow up with individuals as needed, continue information gathering, set priority mitigation projects and costs, maximize community collaboration on projects

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Project Overview - MAPC received a grant to prepare natural hazards *Pre-Disaster Mitigation Plan* for the communities of Beverly, Lynn, Nahant, Winthrop, Winthrop, Salem, Saugus, Swampscott and Winthrop. MAPC is working with the nine communities to update their plans to mitigate potential damages of natural hazards such as floods, winter storms, hurricanes, earthquakes and wild fires, before such hazards occur. The federal *Disaster Mitigation Act of 2000* requires that all municipalities adopt a *Pre-Disaster Mitigation Plan* for natural hazards in order to remain eligible for FEMA Disaster Mitigation Grants.

Public Participation Options

1. Presentation by Town/Town staff to local groups.
2. MAPC presents at a public meeting – existing board or commission*
3. Post on Town/Town website with a set public review period.
4. Distribute to specified organizations or boards/commissions for their review.
5. Create a summary document and distribute in community

Draft Sample Goals

1. Prevent and reduce the loss of life, injury, public health impacts and property damages resulting from all major natural hazards.

2. Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.

3. Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.

4. Prevent and reduce the damage to public infrastructure resulting from all hazards.

5. Encourage the business community, major institutions and non-profits to work with the Town/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. Take maximum advantage of resources from FEMA and MEMA to educate Town staff and the public about hazard mitigation.

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 four panels with two maps each as follows:

Map 1.	Population Density
Map 2.	Potential Development
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.	Hazard Areas

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

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

Map1: Population Density – This map uses the US Census block data 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.

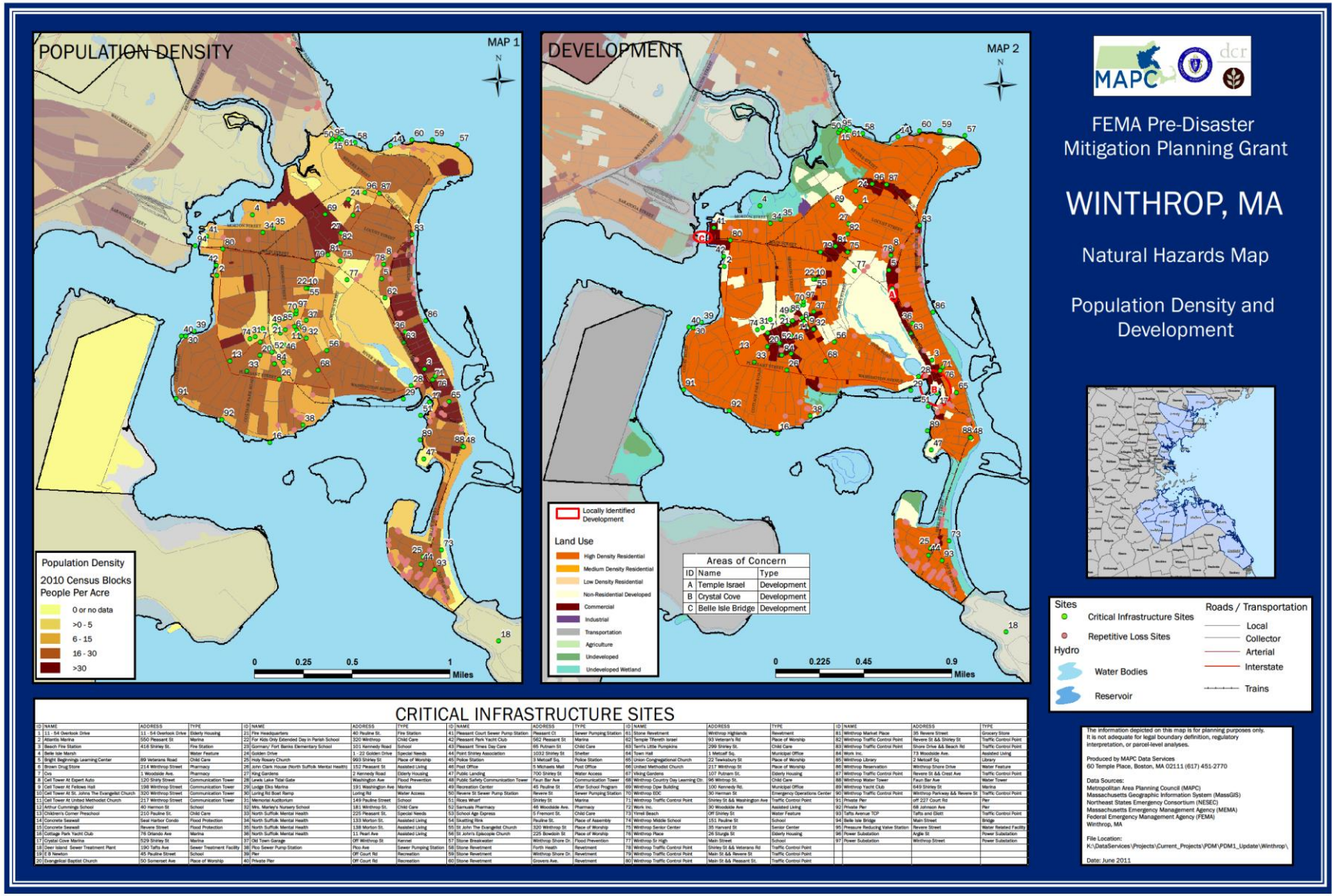
The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to http://pubs.usgs.gov/pp/p1183/pp1183.html.

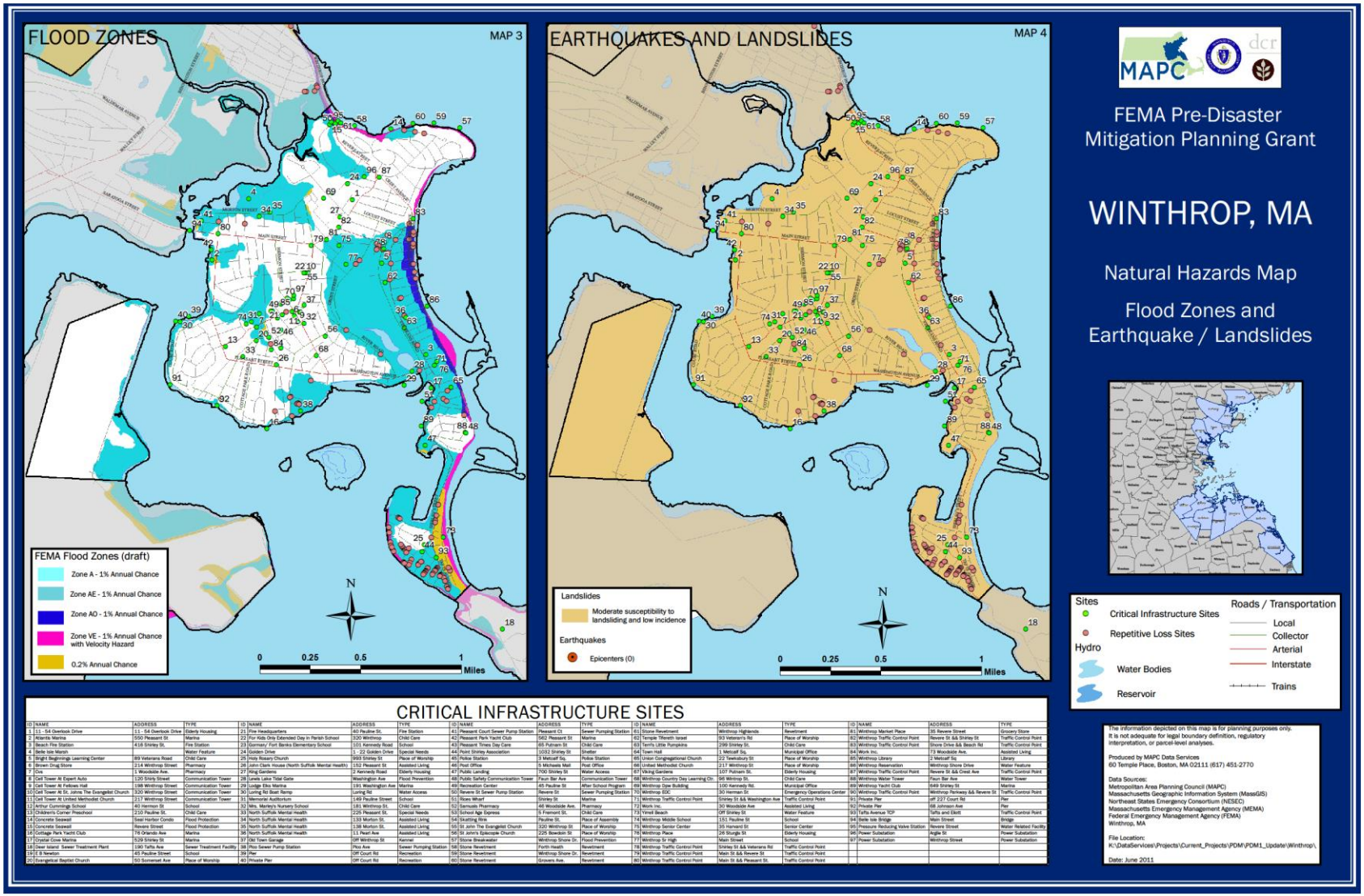
Map 5: Hurricanes and Tornados – This map shows a number of different items. The map includes the storm tracks for both hurricanes and tropical storms. This information must be viewed in context. A storm track only shows where the eye of the storm passed through. In most cases, the effects of the wind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

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

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

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


POPULATION DENSITY
MAP 1
DEVELOPMENT
MAP 2
MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
WINTHROP, MA
Natural Hazards Map
Population Density and Development
Population Density
2010 Census Blocks
People Per Acre
0 or no data
>0 - 5
6 - 15
16 - 30
>30
0 0.25 0.5 1 Miles
Locally Identified Development
Land Use
High Density Residential
Medium Density Residential
Low Density Residential
Non-Residential Developed
Commercial
Industrial
Transportation
Agriculture
Undeveloped
Undeveloped Wetland
0 0.225 0.45 0.9 Miles
Areas of Concern
ID Name Type
A Temple Israel Development
B Crystal Cove Development
C Belle Isle Bridge Development
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
CRITICAL INFRASTRUCTURE SITES
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)
Winthrop, MA
File Location:
K:\DataServices\Projects\Current_Projects\PDM\PDM1_Update\Winthrop\
Date: June 2011


FLOOD ZONES
MAP 3
EARTHQUAKES AND LANDSLIDES
MAP 4
MAPC
dcr
FEMA Pre-Disaster
Mitigation Planning Grant
WINTHROP, MA
Natural Hazards Map
Flood Zones and
Earthquake / Landslides
FEMA Flood Zones (draft)
Zone A - 1% Annual Chance
Zone AE - 1% Annual Chance
Zone AO - 1% Annual Chance
Zone VE - 1% Annual Chance with Velocity Hazard
0.2% Annual Chance
Landslides
Moderate susceptibility to landsliding and low incidence
Earthquakes
Epicenters (0)
N
0 0.25 0.5 1 Miles
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
CRITICAL INFRASTRUCTURE SITES
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interpretation, or parcel-level analyses.
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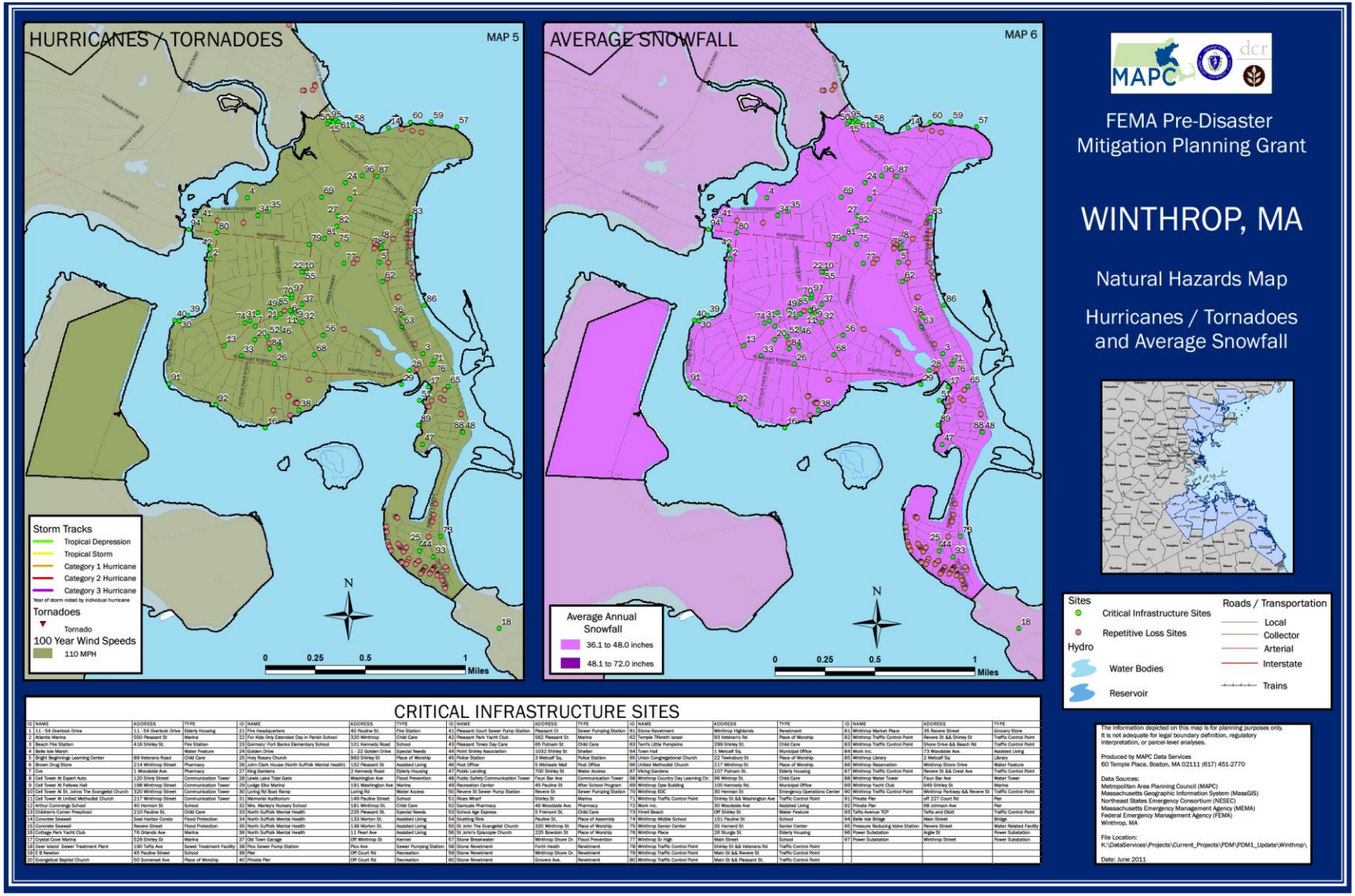
Winthrop, MA
File Location:
K:\DataServices\Projects\Current_Projects\PDM\PDM1_Update\Winthrop\
Date: June 2011


HURRICANES / TORNADOES
MAP 5
Storm Tracks
Tropical Depression
Tropical Storm
Category 1 Hurricane
Category 2 Hurricane
Category 3 Hurricane
Year of storm noted by individual hurricane
Tornadoes
Tornado
100 Year Wind Speeds
110 MPH
N
0 0.25 0.5 1 Miles
AVERAGE SNOWFALL
MAP 6
Average Annual Snowfall
36.1 to 48.0 inches
48.1 to 72.0 inches
N
0 0.25 0.5 1 Miles
MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
WINTHROP, MA
Natural Hazards Map
Hurricanes / Tornadoes and Average Snowfall
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
CRITICAL INFRASTRUCTURE SITES
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)
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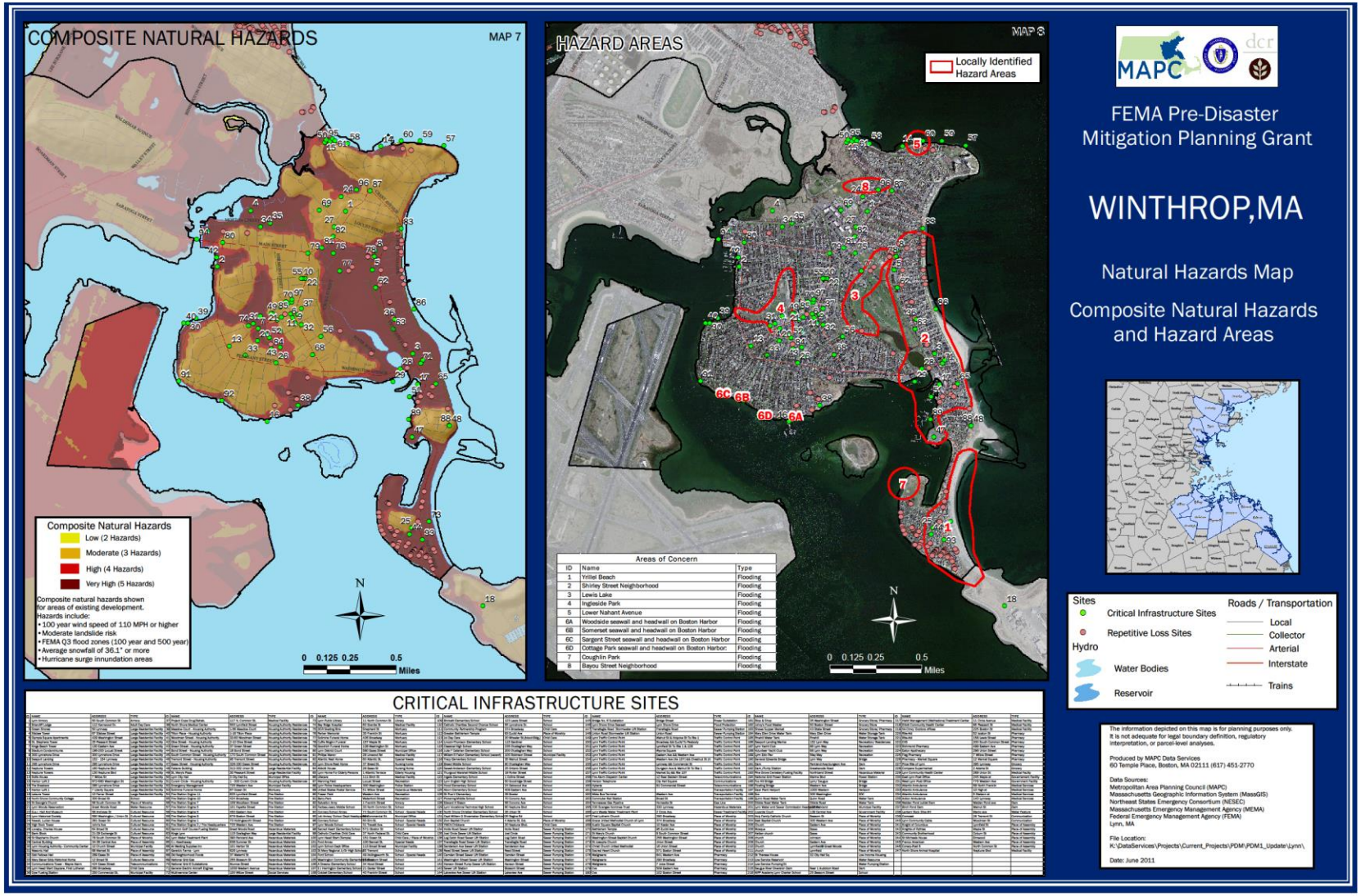
File Location:
K:\DataServices\Projects\Current_Projects\PDM\PDM1_Update\Winthrop\
Date: June 2011


COMPOSITE NATURAL HAZARDS
MAP 7
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
0 0.125 0.25 0.5 Miles
HAZARD AREAS
MAP 8
Locally Identified Hazard Areas
Areas of Concern
ID Name Type
1 Yirllel Beach Flooding
2 Shirley Street Neighborhood Flooding
3 Lewis Lake Flooding
4 Ingleside Park Flooding
5 Lower Nahant Avenue Flooding
6A Woodside seawall and headwall on Boston Harbor Flooding
6B Somerset seawall and headwall on Boston Harbor Flooding
6C Sargent Street seawall and headwall on Boston Harbor Flooding
6D Cottage Park seawall and headwall on Boston Harbor: Flooding
7 Coughlin Park Flooding
8 Bayou Street Neighborhood Flooding
0 0.125 0.25 0.5 Miles
MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
WINTHROP,MA
Natural Hazards Map
Composite Natural Hazards and Hazard Areas
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
CRITICAL INFRASTRUCTURE SITES
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)
Lynn, MA
File Location:
K:\DataServices\Projects\Current_Projects\PDM\PDM1_Update\Lynn\
Date: June 2011

APPENDIX C
DOCUMENTATION OF PUBLIC PARTICIPATION

TOWN OF WINTHROP
Planning Board
Town Hall
One Metcalf Square
Winthrop, MA 02152

RECEIVED
2011 NOV 10 P 4:15
TOWN CLERK
WINTHROP, MASS

Peter Roche, Chairman
David Proctor
John Crosby
Robert Carroll
Joe Dow
Vincent P. Zappulla
David Stasio, Esq.
Gina DiMento, Esq.

Tanji Daigneault, Secretary

Planning Board Meeting
November 14, 2011
Harvey Hearing Room
7:00 pm

- Hazard Mitigation Plan overview – PowerPoint Presentation by Sam Cleaves
- Discuss Old Business

Town Council Meeting
7:00 pm @ Harvey Hearing
December 6, 2011

RECEIVED
2011 DEC -1 P 4: 11
TOWN CLERK
WINTHROP, MASS.

- Call to Order
- Pledge of Allegiance
- Roll Call
- Minutes
  - July 19, 2011 – Town Clerk still pending
  - Fall Forum of October 18, 2011
  - November 15, 2011
  - November 21, 2011 – Special Meeting
- Public Comment
- Correspondence
  - Attorney Cipoletta letter regarding PPYC
- Committee Reports
  - Finance Committee

Presentation by MAPC – Metropolitan Area Planning Council – Sam Cleaves

- Town Manager's Report –
- Old Business
  - Supplemental Transfer from School $147K-tabled
  - Request from the Harbor Management Committee- RE: naming of the Ferry Terminal (tabled)
  - Financial Transfer Requests
    - Enterprise Accounts
    - 235 Court Road Drain Pipe Repairs
    - Town Manager Transfer requests
    - GFB Playground transfer
  - Fort Bank Access Road Issues –

- Motion by Councilor DelVento to amend sections 10.12.120 and 10.12.110 of Winthrop Municipal Code regarding left turns (Public Hearing)
- Town Manager request the Town Council to modify section 10.16.100 "Parking limited at certain streets during certain times"
- Evaluation – 3 month review of Council Clerk

Committee Appointments
License Commission – Held from November 21, Special Meeting
Paolo Franzese, Esq.

- New Business
  - Eminent Domain Taking-Governor's Park Condominium
  - Eminent Domain Taking-Governor's Park Condominium "Offer of payment pro tanto"
  - Financial Transfer Requests
    - Request for appropriation of $554,600 (water), $102,500 (sewer) for the financing construction, reconstruction or replacement of water/sewer mains on Somerset, Bellevue, Eleanor Court and Nahant streets.
    - Request for appropriation of $116,00 for Purchase of Street Lights
  - Committee Appointments
  - License Commission
    - Maureen L. Canavan, Esq. through 6/30/14
    - Maureen L. Canavan, Esq. – Vice Chairman
    - Donald J. Kearney – Chairman
- Discussion on budget projections
- Public Comment
- Adjournment

It is anticipated that the Council may go into Executive Session to conduct strategy sessions in preparation for negotiations with nonunion personnel or to conduct collective bargaining sessions or contract negotiations with nonunion personnel.

Public comments received: Comments on the draft plan posted to the Winthrop website, March 2102. Received comments were used to edit the final draft of the plan as submitted.

1)----- Original Message -----
From: Mary Lou Osborne <mlo84@comcast.net>
To: <plombardi@Town.winthrop.ma.us>
Date: Friday, March 9 2012 02:15 PM
Subject: re comments on Winthrop Natural Hazard Mitigation Plan

Hi Peter,

I was reading through the plan and noticed that the "community profile" as provided by MA Dept of Housing and Community Development (which ultimately comes from the Town of Winthrop) contains some dated information. It refers to the Knights of Columbus and Youth Commission, which haven't existed in Winthrop for some time. And, to me, the most glaring of the dated info is the existence of a hospital in the community. (See pp. 9-10 of plan) A community asset mapping exercise might help to correct this to even include mention of an active Medical Reserve Corps and a substance abuse prevention coalition, among other resources.

While this community profile info is really ancillary to the purpose of the plan, I am concerned that if this info doesn't get updated to MA Dept of Housing and Community Development the outdated info might be disseminated to other sources and maybe adversely affect grant opportunities in the future. For example, if you wanted to apply for a grant for some community medical resources and a funder thought we still had a functioning hospital in our community, that misinformation might possibly disqualify the Town for these resources.

I thought you might be the best person to address this.

Thanks,
Mary Lou Osborne

2) **From:** Kathleen B [sewsoquilt@yahoo.com]
Sent: Wednesday, March 14, 2012 8:37 PM
To: News and Announcements
Cc: Cleaves, Sam

Subject: Re: Winthrop National Hazard Mitigation Draft Plan for Public Comment

I have reviewed the contents of Winthrop's Natural Hazard Mitigation Draft Plan and I have a question regarding the Community Profile section on page 9. It states that

Winthrop has a "110 bed hospital with CCU and ICU facilities". Hasn't the Winthrop Hospital been closed for over 10-15 years now???

Thanks
Kathleen

3) From: Donofrio35@aol.com
Sent: Saturday, March 17, 2012 4:28 AM
To: Cleaves, Sam
Subject: Winthrop Mass Response

If these committee meetings took place in 2010 an beyond,
I find the following errors;

Pg. 10 Town Profile: There is NO 110 bed hospital nor was there one in 2005 It has been closed for over 10 years now.....

Pg. 12 Appointees on Regional Committee; Joseph Powers title, Paul Flanagan title

Later on you do refer correctly, Paul Flanagan, Winthrop Fire Chief

Dottie Donofrio
Pct. 4
Winthrop MA
GOD BLESS AMERICA

4)
Mr. Cleaves, I am certainly no expert in such matters as hazards mitigation plans. But I do live on what I consider a high flood threat area of the Town of Winthrop. That has given me a few chances to observe hazard threats in the 31 years I have lived here. I will just enumerate some issues contained in the MAPC Hazard Mitigation Plan for Winthrop, which is now posted on the Town website. I will include only comments I think most pertinent.

1) Page 19, States that Grandview Avenue seawall has been completed. This is untrue. A good deal of the southern end of the Town-liable wall was recapped after several years of residents trying to bring attention to the original wall failing to the point its internal metal rods were rusting and breaking, causing severe erosion of the concrete structure. There was a controversy over the Town Manager's choice to fund the new cap with money from the Town's Harbor Enterprise Fund. Funding of the recapping was prevented by elected Town selectmen for many years due to local politics. The reconstruction includes only a bit over 2/3 of the wall's total length from just south of the intersection of Bigelow St. and Grandview Ave. to Coughlin Playground. The uncapped section was subject to an Army Corps of Engineer-provided project during the 1990s in which riprap was put in place on the waterside of the wall, with a curbstone-high (one foot or less in height)

granite edging along the street surface. This riprap based project seems to be more appropriate to a largely tide- and wind-driven water action in which waves need to be broken. While northwest winds do drive water towards the street at that point, the one-foot height of the curbstone border provides little or no protection against harbor flooding as the new cap further south protects that section of Grandview Avenue. Fortunately, there is a slight rise to the inland terrain away from Grandview Avenue towards Triton Avenue, thus offering some protection to buildings in that region. The Army provided structure does not, however, provide protection to homes along the westerly portion of Bayview Avenue, which can be impacted by flooding from the harbor. This Army Corps scheme has been questioned by some residents ever since it was built.

2) P. 40 and other sections of this report treat the western side of Point Shirley mainly as being only slightly susceptible to storm surge flooding. There is mention of the Grandview Avenue seawall reconstruction as well as Coughlin Playground. Much of the flood threat to those areas is caused by what some local folks call the Boston Harbor "bathtub effect". A rising tide driven by a strong storm surge (especially if the surge runs before a wind out of the east or northeast) causes an influx of tidal water which the harbor has only a certain amount of ability to contain. When that water level reaches the maximum the harbor can hold, the situation becomes a natural overflow of water to the abutting land, thus the bathtub analogy. What is meant by saying this is that the writers of this report seem to be most concerned about Point Shirley's flooding from the ocean side of the peninsula, whcn in fact there are some smaller parts of the point that are totally flooded by the harbor overflow. This is also the situation at Coughlin Playground, about which the report seems to be overly concerned. Although it is a public facility, the Coughlin Playground is so large in acreage, its use by humans would need to be much greater than it is now to justify the expenditure of half a million to remedy the poor drainage that allows a mucky surface and surface flooding due to rain or melting snow. There are sections of the park that might be better justified for remedial treatment, such as the tot lot, tennis and basketball courts and the baseball diamond on the park's western side. Otherwise, the park is used mainly as a dog walk.

3) In Table 17 on Page 70, the report states that the Shore Drive seawall is the responsibility of the DPW, by which it appears to mean the Town of Winthrop DPW. This is an error. That entire area of Shore Drive, including the roadway, beach and waters offshore out to the north-south jetties known as the Five Sisters is the liability of the State of Massachusetts, specifically by the state Department of Conservation and Recreation (ex-Metropolitan District Commission - MDC).

Just figured these apparent errors in this document need to be pointed out if the MAPC expects anything to be done in response to the purported planning contained therein.

Tom McNiff
Grandview Avenue
Winthrop, MA 02152
woodeewood@yahoo.com

APPENDIX D
DOCUMENTATION OF PLAN ADOPTION

TOWN OF WINTHROP
OFFICE OF THE TOWN MANAGER

Town Hall, 1 Metcalf Square, Winthrop, MA 02152 Telephone: 617-846-1077 Fax: 617-846-5468

James McKenna
Town Manager

MOTION FOR ADOPTION

Submitted By: James McKenna, Town Manager Date: 5/28/15

CERTIFICATE OF ADOPTION
TOWN COUNCIL- TOWN OF WINTHROP, MASSACHUSETTS
A RESOLUTION ADOPTING THE TOWN OF WINTHROP HAZARD MITIGATION PLAN 2014 UPDATE

WHEREAS, the Town of Winthrop established a Committee to prepare the *Town of Winthrop Hazard Mitigation Plan 2014 Update*, and

WHEREAS, the *Town of Winthrop Hazard Mitigation Plan 2014 Update* contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Winthrop, and

WHEREAS, duly-noticed public meetings were held by the PLANNING BOARD on November 14, 2011 and by the TOWN COUNCIL on December 20, 2011, and

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

NOW, THEREFORE BE IT RESOLVED that the Town of Winthrop TOWN COUNCIL adopts the *Town of Winthrop Hazard Mitigation Plan 2014 Update* in accordance with M.G.L. 40 §4 or the charter and bylaws of the Town of Winthrop.

ADOPTED AND SIGNED this Date. 6/23/15

Name(s) PETER T. GILL
Title(s) PRESIDENT, WINTHROP TOWN COUNCIL
Signature(s)

; or take any action relative to thereto.

6-16-15

Motion by Councilor DelVento
2nd by Councilor Letterie
Passed Unanimously

A True Copy Attest:
Cindy Vitale
Town Clerk
Date: JUN 23 2015

APPENDIX E
FEMA LETTER OF PLAN APPROVAL

U.S. Department of Homeland Security
FEMA Region I
99 High Street, Sixth Floor
Boston, MA 02110-2132

FEMA

AUG 2 0 2015

Peter T. Gill, President
Town Council
Winthrop Town Hall
1 Metcalf Square
Winthrop, MA 02152

Dear Mr. Gill:

Thank you for the opportunity to review the Town of Winthrop Hazard Mitigation Plan 2014 Update. The Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) Region I has evaluated the plan for compliance with 44 C.F.R. Pt. 201. The plan satisfactorily meets all of the mandatory requirements set forth by the regulations.

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

Approved mitigation plans are eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Complete information regarding the CRS can be found at **www.fema.gov/business/nfip/crs.shtm**, or through your local floodplain administrator.

The Town of Winthrop Hazard Mitigation Plan 2014 Update must be reviewed, revised as appropriate, and resubmitted to FEMA for approval within **five years of the plan approval date of August 3, 2015** in order to maintain eligibility for mitigation grant funding. We encourage the Town to continually update the plan's assessment of vulnerability, adhere to its maintenance schedule, and implement, when possible, the mitigation actions proposed in the plan.

APPENDIX F
FEMA PLAN REVIEW TOOL

Guidance on Next Steps

The FEMA Plan Review Tool itemizes the sections of the plan that meet FEMA's requirements for Hazard Mitigation Plans. It also includes descriptions of potential plan improvements that should be considered for the next plan update, which is due five years after the approval of this plan, by August 3, 2020.

In order to have an approved plan by that date, the Town is advised to begin the planning process 15 to 18 months before the expiration of this plan. In order to procure a FEMA grant to conduct the next plan update, the town is advised to seek funding opportunities at least two years before this plan expires.

LOCAL MITIGATION PLAN REVIEW TOOL
Town of Winthrop, MA

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Town of Winthrop, MA	**Title of Plan:** Town of Winthrop Hazard Mitigation Plan 2014 Update	**Date of Plan:** "April 4, 2014 & August 4, 2014" Plan Adopted: 06/23/2015
Single or Multi-jurisdiction plan: SINGLE	**New Plan or Plan Update: UPDATE**	
Regional Point of Contact: Martin Pillsbury Manager of Environmental Planning Metropolitan Area Planning Council 60 Temple Place, Boston, MA 02111 617-451-2770, EXT. 2012 mpillsbury@mapc.org	**Local Points of Contact:** Peter T. Gill, Town Council President Town Hall - 1 Metcalf Square Winthrop, MA 02152 617-846-1078 James M. McKenna, Town Manager townmanager@town.winthrop.ma.us Paul E. Flanagan, Fire Chief/EMD 617- 846-3474 fire@town.winthrop.ma.us	

State Reviewer:	**Title:**	**Date:** 11/05/2013; Aug 2014; Oct 2014; Apr 2015
Marybeth Groff	Hazard Mitigation Planner	

FEMA Reviewer:	**Title:**	**Date:**
Caroline Williams Nan Johnson Brigitte Ndikum-Nyada	HM Community Planner (RSV) Region I Community Planner Community Planner	03/21/2014; 03/10/2015 3/10/2015 8/3/2015
Date Received in FEMA Region I	11/13/2013; 10/10/2014, 01/16/2015	
Plan Not Approved	Returned for Revisions – 3/10/2015	
Plan Approvable Pending Adoption	05/26/2015	
Plan Adopted by Jurisdiction	06/23/2015	
Plan Approved	08/3/2015	

SECTION 1: REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan (section and/or**	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Acknowledgements and Credits, p. 3; Section I, pp.7, 9-10; Section II, p. 11; Section III, pp. 18-21; Section VII, p. 93; Appendices A & C	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Section I, pp. 7, 9; Section II, p. 11; Section III, pp. 18-21; Appendices A & C	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section I, pp. 7, 9-10; Section II, p. 11; Section III, pp. 18-21; Appendices A & C	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Throughout plan; Sections IV, VI, VII; Section X, p. 130	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Section VII, p. 95; Section IX, pp. 126-129	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Section I, pp. 9-10; Section VII, pp. 94-95; Section IX, pp. 126-129	X	
ELEMENT A: REQUIRED REVISIONS			
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan (section and/or**	**Met**	**Not Met**
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Section I, p. 8; Section II, pp. 12-14; Section IV, pp. 22-77; Section VIII, pp. 97-99	X	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Section I, p. 8; Section II, pp. 12-14; Section IV, pp. 22- 77, 79 Section VIII, p. 98	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Section IV, pp. 22-77, 78-81 Section VIII, pp. 98-99, 102	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Section IV, pp. 25, 29 Section VII, p. 94	X	
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section VI, pp. 83- 92; Section VII, p. 93-95; Section VIII, p. 101	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Section IV, p. 25 Section VI, pp. 84, 86, 90-91; Section VII, pp. 99-100 Section VIII, p. 117	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Section I, p. 8; Section V, p. 82	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Section I, p. 8; Section VIII, pp. 97-125	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Section VIII, pp. 97-125	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Section VII, pp. 94-95; Section VIII, pp. 100-101, 104; Section IX, pp. 127-128	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or [illegible])	Met	Not Met
ELEMENT C: REQUIRED REVISIONS			
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section II, pp. 15-16; Section IV, pp. 25, 49, 68-71; Section VIII, p. 98;	X	
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Section I, p. 9-10; Section IV, p. 25; Section VII, pp. 93-95; Section VIII, pp. 97-125	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Section I, p. 9; Section VII, pp. 93-95; Section VIII, pp. 97-125	X	
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Community adopted plan on June 23, 2015. Signed adoption certificate is on page 144 of plan.	X	
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	N/A		
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 2: PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Plan Strengths

- The Town Council meeting addressing the plan was televised live and re-broadcast.
- Copies of a biannual survey will be prepared and distributed by the coordinator of the Hazard Mitigation Implementation Team to group members and stakeholders in years two and four of the five year plan cycle. Results will be used to prepare information to be added to the next updated HM plan.

Opportunities for Improvement

- A community's HM Plan's cover page is very important (first impression). Consider using a current and best available Floodplain Map (legible and of better quality) or use photograph of a successful mitigation project/action to showcase community's resilience to Natural Hazard.
- Title on header page information on page 121 of adopted plan, references an incorrect Plan Update year: *"Town of Winthrop Hazard Mitigation Plan **2013** PLAN UPDATE"*
- Note plan development roles carried out by identified members of the town hazard mitigation planning committee.
- Expand the opportunities for other communities to participate and provide input during future plan maintenance, evaluation and update. Include the abutting cities of Boston and Revere, and other municipalities along the north shore. Explain how this is carried out. In the current plan, regional and intercommunity concerns were discussed without connecting those to input from the associated municipalities.
- Explicitly identify the organizations, agencies, and businesses contacted by the assisting regional planning agency to solicit participation and input.
- Invite participation on the Local Hazard Mitigation Planning Team from local employers, businesses, and representatives of private, community, non-profit organizations, local businesses, and adjacent communities. Extending committee membership outside Town department staff would be helpful in representing multiple interests and viewpoints within the town's mitigation planning.
- Expand outreach to a variety of local organizations and participants in order to gather wider community input throughout the next 5 year cycle. Invite historic preservation organizations, academic institutions, and community groups representing vulnerable populations, in addition to the large institutions, Chambers of Commerce, land conservation organizations and watershed groups mentioned in the plan. Stakeholders could be directly invited to participate during plan implementation and the next update.
- List the dates when plan drafts were placed online and/or hard copies placed at public locations for review and comment. The planning process might benefit from expanding the time during which drafts are posted.
- Recommend the Town's approved local HM plan be continuously available on the official municipal website.
- Use authenticated sources of town information. (Wikipedia is not a reliable source.)

Element B: Hazard Identification and Risk Assessment

Plan Strengths

- The plan uses HAZUS to estimate community vulnerabilities from hurricanes and earthquakes. A separate described methodology was applied to estimate flood damages and provide a loss range for named sites.
- Specific critical facilities and infrastructure are identified within Locally Identified Areas of Flooding. The plan explains that these may be outside of designated floodplains.
- Specific facilities located within Hurricane surge areas are indicated.
- The document identifies North Winthrop as at-risk from substrate liquefaction during earthquakes and provides a related small north shore map.

Opportunities for Improvement

- Local vulnerability is best explained in an overall summary, rather than only as a site list and collection of facts. Clearly summarize potential community consequences of hurricane, northeaster storms, winter storm, tornado, earthquake, and landslide. A more focused presentation of town information may allow for a better understanding of specific issues and help the community identify promising mitigation activities.
- Actively solicit the involvement of stakeholders (beyond just local government staff) in the process to determine vulnerability, risk assessment, and priorities.
- Describe potential losses/impacts to the town by also including a variety of economic and social impacts.
- Attempt to resolve data gaps - such as for local historic hazard events, data to support estimates of hazard magnitude, and identification of at-risk areas. Clearly identify issues and propose methods to rectify these for the next plan update.
- Update the List of References. For example, Section X identified the outdated FEMA Local Multi-Hazard Mitigation Planning Guidance of July 1, 2008. This publication was superseded by the Local Mitigation Planning Handbook of March 1, 2013 and the Local Mitigation Plan Review Guide of October 1, 2011.
- Include map enlargements of crucial areas to illustrate important information.
- Identify any historic and cultural sites vulnerable to natural hazards.

Recommend using the **FEMA Region Webliography** when locating sources that may be useful for the Risk Assessment and Strategy. The published webliography page is located at: http://www.fema.gov/about-region-i/about-region-i/hazard-mitigation-planning-webliography

Element C: Mitigation Strategy

Plan Strengths

- The plan proposed changes to the building permit process to increase the height of first floors above and beyond the required base flood elevation (BFE).
- The plan recommends consideration that the town meets and applies to participate under the NFIP Community Rating System (CRS).

Opportunities for Improvement

A significant number of the plan's actions are not mitigation actions for natural hazards within Table 29: Potential Mitigation Measures (and as further explained on pages 97-105). Throughout the plan, mitigation is frequently confused with preparedness, response, normal operations and maintenance, and with plan implementation.

**Hazard mitigation is a sustained action taken to reduce or eliminate long-term risk to human life and property from hazards.*

- Preparedness and response actions may be included in a hazard mitigation plan, but should be properly identified. Consider separating these from mitigation actions in another table.
  - The actions listed within the plan as Emergency Services Protection measures do not reduce or eliminate damages to Emergency Services. Instead most of these are Emergency Services implementation (i.e. preparedness and response), such as purchasing light towers, radio repeaters, and upgrading generators. (Managing the transportation of chemicals is mitigating for man-made hazards, which should be clearly noted.)
  - Spill cleanups are a response item.
  - Drafting preparedness actions in a regional Sea Level Rise Action Work group is preparedness, not mitigation.
- It is recommended to move details of plan implementation, maintenance and normal operations from the mitigation action table to appropriate plan sections – and to label these correctly.
  - Existing town enforcement of existing codes, regulations, and other standing requirements would be mitigation actions only if new or expanded activities were initiated – this applies to current floodplain management/regulation.
  - Documenting conditions, inventorying, mapping, documenting and maintaining databases and digitizing data is record keeping, a normal operation or maintenance activity.
  - Debris removal is maintenance.
- Installation of snow fences is a *temporary* measure, which does not meet the definition of hazard mitigation.
- Items that identify, assess, or encourage are usually incompletely developed actions, which in some cases might instead be folded into a complete mitigation action as an initial step.

For guidance on mitigation actions, refer to Local Mitigation Planning Handbook, FEMA, March 2013 (printed web links are in this review's Resources section.) Within the Handbook, Table 6.1 Types of Mitigation Actions may be particularly useful. Consult with your State Hazard Mitigation Planner for further assistance.

- Provide details of the mitigation action's benefits to show how the assessment was made by the community under the prioritization criteria.

- Explain details about the acquisition of vacant flood prone land. Describe any program or policy either current or proposed.
- If historic buildings and environmentally sensitive areas are at-risk from the effects of natural hazards, expanding the mitigation strategy to include related actions. Describe how or if such mitigation actions may reduce impacts to the community's economy and social functions.
- More fully develop and explain the retrofitting of public buildings to withstand snow loads. Identify specific facilities and infrastructure along with proposed methods.
- In the description of NFIP participation, it is recommended to include further information on past and present enforcement activities, including monitoring, existing compliance issues and steps taken to resolve these.

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

Opportunities for Improvement

- Estimate redevelopment changes and potential trends. Estimate how and where changes may occur to increase or decrease local risk and vulnerabilities in locations known to have natural hazard impacts. Take into account changes in codes, standards, regulations, and policies, in addition to land use, zoning, and population changes.
- Utilize planning data from the local planning department, and reference sources including by date.
- Consider the following questions during the next update. What are the community's vulnerabilities to natural hazards that keep elected officials worried and awake at night? Do the mitigation goals and objectives still reflect the concerns of local residents, business owners, and officials? Have local conditions changed so that findings of the risk and vulnerability assessments should be updated? Are new sources of information available that will improve the risk assessment? If risks and vulnerabilities have changed, do the mitigation goals and objectives still reflect the risk assessment? What hazards have caused damage locally since the last edition of the HMP was developed? Were these anticipated and evaluated in the HMP or should these hazards be added to the plan? Are current personnel and financial resources at the local level sufficient for implementing mitigation actions? For each mitigation action that has not been completed, what are the obstacles to implementation? What are potential solutions for overcoming these obstacles? Are the changes in development related to community's vulnerability? Did the risk assessment integrate climate and resilience considerations? Was hazard Identification and risk analysis, take into account economic impact (looking at loss of businesses that do not return after a major catastrophic event (1 in 4 or 25%) and the grand list/tax implication due to loss of homes? For each mitigation action that has been completed, was the action effective in reducing risk? What mitigation actions should be added to the plan and proposed for implementation? If any proposed mitigation actions should be deleted from the plan, what is the rationale? Were the anticipated timeframes for completion accurate or needed adjustments? In evaluating the community's existing authorities, policies, programs and resources, how effective were they? And how is the community able to expand on and improve these existing policies and programs? See FEMA Local Planning

Handbook of March 2013 worksheet 7.2 for more examples**.**

B. Resources for Implementing Your Approved Plan

The Town of Winthrop is encouraged to do everything possible to maximize use of every 406 hazard mitigation opportunity when available during federally declared disasters. A better alignment and increasing the effectiveness of 406 and 404 mitigation funds, may greatly benefit the community.

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State Funds and Technical Assistance

The 2013 Massachusetts State Hazard Mitigation Plan addresses technical assistance for various mitigation activities as well as explaining the statewide approach to natural hazard mitigation. Section 17.6 identifies a number of potential funding sources for various mitigation activities.

The Massachusetts State Hazard Mitigation Officer (SHMO) and State Mitigation Planners can provide guidance regarding grants, technical assistance, available publications, and training opportunities.

Consider a variety of sources for grants, guidance, and partnerships, including academic institutions, non-profit foundations, community organizations, and businesses, in addition to governmental agencies.

Massachusetts Emergency Management Agency (MEMA)
http://www.mass.gov/eopss/agencies/mema/hazard-mitigation/

Department of Conservation and Recreation (DCR).
http://www.mass.gov/dcr/stewardship/mitigate/index.htm

Federal Funds and Technical Assistance

Federal agencies may support integrated planning efforts such as rural development, sustainable communities and smart growth, wildfire mitigation, conservation, etc.

Federal Grants resource center
http://reconnectingamerica.org/resource-center/federal-grant-opportunities/

Risk MAP: Technical assistance is available through Risk MAP to assist communities in identifying, selecting, and implementing activities to support mitigation planning and risk reduction; Attend any Risk MAP's discovery meetings that may be scheduled in the State (or neighboring communities with shared watersheds boundaries) in the future.

USDA, Natural Resources Conservation Service (NRCS)
Conservation Technical Assistance
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/cta

Financial Assistance
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/
Conservation Innovation Grant Programs
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs

HUD
Sustainable Housing and Communities Initiative
http://portal.hud.gov/portal/page/portal/HUD/program_offices/sustainable_housing_communities
CDBG Disaster Recovery Assistance
http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/drsi

FEMA publications
FEMA 2013 Hazard Mitigation Guidance**,** HMA Guidance, FEMA requirements regarding HMGP, PDM, and FMA grants. http://www.fema.gov/media-library/assets/documents/33634?id=7851

Mitigation Ideas, *A Resource for Reducing Risk from Natural Hazards*
Available upon request from FEMA Region 1
Through Risk MAP, FEMA has developed and released this new resource for helping communities identify actions to improve their disaster resiliency! *Mitigation Ideas: A Resource for Reducing Risk from Natural Hazards* presents ideas for how to mitigate the impacts of different natural hazards, from drought and sea level rise, to severe winter weather and wildfire. The document also includes ideas for actions that communities can take to reduce risk to multiple hazards, such as incorporating a hazard risk assessment into the local development review process.

Local Mitigation Planning Handbook, FEMA, March 2013
http://www.fema.gov/media-library/assets/documents/31598?id=7209

Local Mitigation Plan Review Guide, FEMA, October 1, 2011
http://www.fema.gov/media-library/assets/documents/23194

The publications below can be downloaded from http://www.fema.gov/library. Search in the FEMA library by title/number or use the web links below.

Managing Floodplain Development through the NFIP provides guidance to municipal officials considering changes to local regulations and zoning. A copy can be downloaded from
http://www.fema.gov/library/viewRecord.do?id=2108

FEMA P-762, *Local Officials Guide to Coastal Construction* assists building officials in understanding the connection between National Flood Insurance Program (NFIP) guidelines, the International Building Code, and the International Residential Code. The guide also explores building performance, real-life successes and failures following storm events while recommending design and construction "best practices".
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3647

FEMA P-55 *Coastal Construction Manual: Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas (4th ed.)* at http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1671
A 2-volume publication providing a comprehensive approach to planning, siting, designing, constructing, & maintaining homes in the coastal environment.
Volume I: hazard identification, siting decisions, regulatory requirements, economic implications, and risk management; audience- design professionals, officials.
Volume II: in-depth descriptions of design, construction, & maintenance practice; audience - design professional

FEMA B-797, *Hazard Mitigation Field Book – Roadways*
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=4271

FEMA P-787, *Catalog of FEMA Wind, Flood & Wildfire Publications, Training Courses & Workshops* (2012)
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3184

Flood Hazard Mitigation Handbook for Public Facilities
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3724

FEMA 386-6, *Mitigation Planning How To #6: Integrating Historic Property & Cultural Resource Considerations into Hazard Mitigation Planning*, provides guidance regarding how to involve community-based organizations in mitigation planning.
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1892

FEMA P-787, *Catalog of FEMA Wind, Flood & Wildfire Publications, Training Courses & Workshops* (2012)
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3184

FEMA P-754, Wildfire Hazard Mitigation Handbook for Public Facilities
http://www.fema.gov/media-library/assets/documents/16568?id=3723

The following FEMA publications are especially useful in public information/outreach programs and can be ordered in hard copy for public distribution.

FEMA P-737, *Home Builder's Guide to Construction in Wildfire Zones*
http://www.fema.gov/media-library/assets/documents/15962?id=3646

FEMA 232, *Homebuilders' Guide to Earthquake-Resistant Design and Construction* provides seismic design and construction guidance for one- and two-family light frame residential structures that can be utilized by homebuilders, homeowners, and other non-engineers.
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=2103

FEMA 347, *Above the Flood: Elevating your Flood-prone House*

This large publication (69 pages) could be placed in the reference section of a local public library or at a City or Town Hall for lending.
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1424

Private non-profit information sources
National Fire Protection Association (NFPA) Firewise Program http://www.firewise.org
NFPA codes and standards www.nfpa.org/freeaccess

Other Federal web resources

No Adverse Impact (NAI) How-To Guides
The intent of these How to Guides it to expand on the knowledge base within the original No Adverse Impact Toolkit and to provide specific tools for incorporating NAI floodplain management into local regulations, ordinances, requirements, design, standards and practices. Complete information about NAI can be found at:
http://www.floods.org/index.asp?menuID=460

Beyond the Basics: Best Practices in Local Mitigation Planning
DHS Coastal Hazards Center of Excellence developed the following: http://mitigationguide.org/. The purpose is to help communities develop and improve their local hazard mitigation plan. The site, which was created by the DHS Science and Technology Coastal Hazard Center of Excellence and the of North Carolina at Chapel Hill, also contains a self-assessment tool, sample community plans and place to share experiences and lessons learned.

U.S. Climate Resilience Toolkit - https://toolkit.climate.gov
Scientific tools, information, and expertise are provided to help people manage their climate-related risks and opportunities, and improve their resilience to extreme events. This aid assists planning through links to a wide-variety of web-tools covering topics including coastal flood risk, ecosystem vulnerability, and water resources among others. Experts can be located in the NOAA, USDA, and Dept. of Interior, as well as state climatologists. Case studies in resilience are presented, including six within New England states. The site is designed to serve interested citizens, communities, businesses, resource managers, planners, and policy leaders at all levels of government.