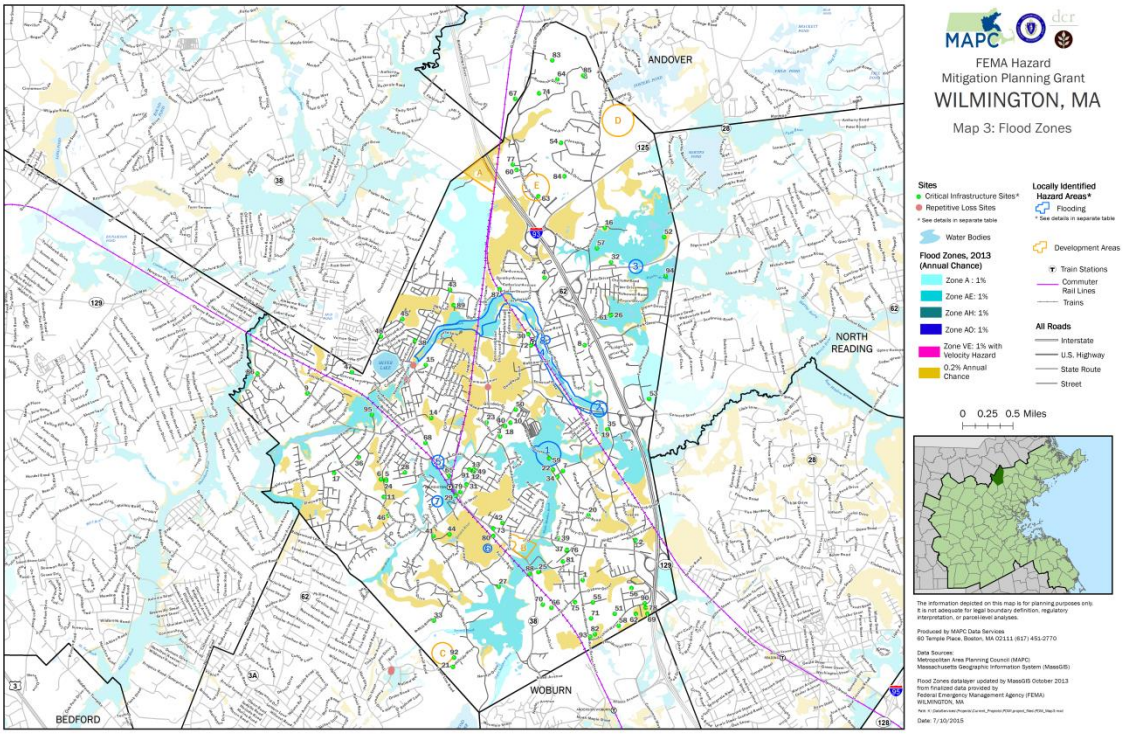
TOWN OF WILMINGTON
HAZARD MITIGATION PLAN UPDATE
2015



MAPC
METROPOLITAN AREA PLANNING COUNCIL

FINAL PLAN
Approval Pending Adoption
June 16, 2016

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TOWN OF WILMINGTON HAZARD MITIGATION PLAN
2015 UPDATE

ACKNOWLEDGEMENTS AND CREDITS

This plan was prepared for the Town of Wilmington 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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Paul Alunni	Engineering
Michael Woods	Public Works, Director
Al Spaulding	Inspector of Buildings & Zoning Enforcement Officer

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TOWN OF WILMINGTON HAZARD MITIGATION PLAN
2015 UPDATE

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I. EXECUTIVE SUMMARY

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

Planning Process

Planning for the Hazard Mitigation Plan update was led by the Wilmington Local Hazard Mitigation Planning Team, composed of staff from a number of different Town Departments. This team met on June 30, 2014, and September 29, 2014 and discussed where the impacts of natural hazards most affect the Town, goals for addressing these impacts, updates to the Town's existing mitigation measures and new or revised 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. The Town's Planning Board hosted two public meetings, the first on May 5, 2015 and the second on August 4, 2015, and the draft plan update was posted on the Town's website for public review. Key Town stakeholders and neighboring communities were notified and invited to review the draft plan and submit comments.

Risk Assessment

The Wilmington Hazard Mitigation Plan assesses the potential impacts to the Town from flooding, high winds, winter storms, brush fire, geologic hazards, extreme temperatures, and drought. Flooding, driven by hurricanes, northeasters and other storms, clearly presents the greatest hazard to the Town. These are shown on the map series (Appendix B).

The Wilmington Local Hazard Mitigation Planning Team identified 96 Critical Facilities. These are also shown on the map series and listed in Table 20, identifying which facilities are located within the mapped hazard zones.

A HAZUS-MH analysis provided estimates of damages from Hurricanes of category 2 and 4 ($16.425 million to $60.23 million as well as earthquakes of magnitudes 5 and 7 ($403.85 million to $3.9 billion). Flood damage estimates range from $689,350 to $3,446,752.

Hazard Mitigation Goals

The Wilmington Local Hazard Mitigation Planning Team identified the following hazard mitigation goals for the Town:

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

2. Build and enhance local mitigation capabilities to ensure individual safety, reduce damage to public and private property and ensure continuity of emergency services.

3. Increase cooperation and coordination among private entities, Town officials and Boards, State agencies and Federal agencies.

4. Increase awareness of the benefits of hazard mitigation through outreach and education.

Hazard Mitigation Strategy

The Wilmington Local Hazard Mitigation Planning Team identified a number of mitigation measures that would serve to reduce the Town's vulnerability to natural hazard events. One of the most important of these is the completion of drainage upgrade at Route 62 with North Reading, as per the Memo of Understanding between the two Towns signed in 2010. Another action includes drainage upgrades at Massachusetts Avenue, programmed and budgeted by the Town's Capital Improvement Plan, a process instituted following a comprehensive drainage study.

Overall, the hazard mitigation strategy recognizes that mitigating hazards for Wilmington will be an ongoing process as our understanding of natural hazards and the steps that can be taken to mitigate their damages changes over time. Global climate change and a variety of other factors impact the Town's vulnerability and in the future. Local officials will need to work together across municipal lines and with state and federal agencies in order to understand and address these changes. The Hazard Mitigation Strategy will be incorporated into the Town's other related plans and policies.

Plan Review and Update Process

Table 1 Plan Review and Update

Chapter	Reviews and Updates
III – Public Participation	The Local Hazard Mitigation Planning Team 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 discussed at two public meetings hosted by the Planning Board. 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 Wilmington Local Hazard Mitigation Planning Team.
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 2008 plan were reviewed and assessed as to whether they were completed, in-progress, or deferred. The Local Hazard Mitigation Planning Team determined whether to carry forward measures into the 2015 Plan Update or modify or delete them. The Plan Update's hazard mitigation strategy reflects both new measures and measures carried forward from the 2008 plan. The Local Hazard Mitigation Team 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 for the next comprehensive plan update.

As indicated on Table 25, Wilmington made some progress on implementing mitigation measures identified in the 2008 Hazard Mitigation Plan. Several projects have been completed, including renovating and adding flood proofing to the Brown's Crossing water pump station, adopting a new stormwater bylaw in 2010, replacing drainage culverts along Lawrence Street and adding brush fire fighting capacity by outfitting a Fire Department four-wheel drive pickup truck with a portable skid pump.

Other projects were partially completed, most notably drainage improvements at Concord Street and Lubber Brook and educating residents within the Mill Pond Dam (Burlington) inundation area about notification and evacuation procedures. These mitigation measures will be continued in this 2015 Plan Update

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.

Though not formally done in the 2008 Plan, the Town will document any actions taken within this iteration of the Hazard Mitigation Plan on challenges met and actions successfully adopted as part of the ongoing plan maintenance to be conducted by the Wilmington Hazard Mitigation Implementation Team, as described in Section IX, Plan Adoption and Maintenance.

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.

Federal hazard mitigation planning and grant programs are administered by the Federal Emergency Management Agency (FEMA) in collaboration with the states. These programs are administered in Massachusetts by the Massachusetts Emergency Management Agency (MEMA) in partnership with the Department of Conservation and Recreation (DCR).

Massachusetts has taken a regional approach and has encouraged the regional planning agencies to apply for grants to prepare plans for groups of their member communities. 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 Wilmington to update its local Hazard Mitigation Plans, which was first adopted in 2008 as part of a multijurisdictional plan. The local Hazard Mitigation Plan update produced under this grant are designed to individually meet the requirements of the Disaster Mitigation Act for each community while listing regional concerns and hazards that impact the Town or city creating the 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 Wilmington has experienced 20 natural hazards that triggered federal or state disaster declarations since 1991. These are listed in Table 2 below. The majority of these events involved flooding, while five were due to hurricanes or nor'easters, and four were due to severe winter weather.

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)
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
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

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
	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)	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

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
	Hazard Mitigation Grant Program	Statewide
Tropical Storm Irene (August 27-28, 2011)	FEMA Public Assistance	Statewide
Hurricane Sandy (October 27-30, 2012)	FEMA Public Assistance	Statewide
Severe snowstorm and Flooding (February 8-09, 2013	FEMA Public Assistance; Hazard Mitigation Grant Program	Statewide
Blizzard of 2015 (January 26-28, 2015)	FEMA Public Assistance; Hazard Mitigation Grant Program	Statewide

Source: database provided by MEMA)

FEMA Funded Mitigation Projects

The Town of Wilmington has not received funding from FEMA for mitigation projects under the Hazard Mitigation Grant Program (HMGP).

Community Profile

The Town of Wilmington is a suburban, industrial town occupying 17.2 square miles of the watershed of the Ipswich River. The Town was part of an unstable Colonial frontier during Queen Ann's War. The community's early agricultural economy broadened to include a saw mill established in 1702 by Daniel Snow. Formed as an independent Town in 1730, Wilmington has retained a high proportion of 18th century houses. The Baldwin apple is supposed to have been discovered in Wilmington in the 1790's on Butters Farm and, after some bitter disputes with other communities over whether that was the case, a monument was erected to duly commemorate the discovery.

The Middlesex Canal was completed in Wilmington in the early 19th century and residents were able to ship their produce to market. The largest shipments were of hops, since Wilmington had become one of the largest producers of hops in the state, growing 8,200 tons worth $2.2 million by 1837. An early railroad corridor connected Wilmington to Boston and Lowell in 1835 and to Andover in 1836; trolley lines were established in the late 19th century. The Town had a primarily agricultural economy, with residents growing fruit, vegetables and cranberries, but also had a number of

slaughterhouses. The major industry in Wilmington, however, was the Perry, Cutler and Company tannery. Since 1940 the population has more than quadrupled with particular growth between 1950 and 1965 after the completion of Route 128. Although the Town remained principally a farming community during the 18th, 19th and early 20th century, producing milk and eggs, suburban residential development has made a major impact on Wilmington.

(Narrative based on information provided by the Massachusetts Historical Commission and is taken from the Community Profile on the website maintained by the Department of Housing and Community Development).

The Town is governed by a Board of Selectmen with a Town manager. The Town operates under the open Town meeting format. The 2015 population was 22,325 people and there were 7,447 buildings. (2010 US Census)

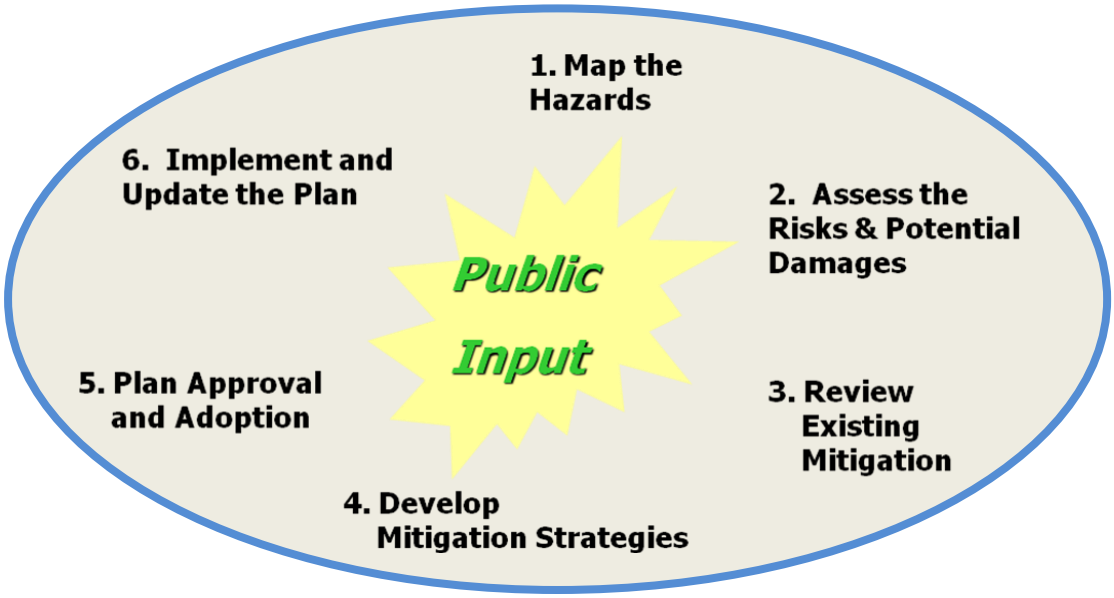
The Town maintains a website at http://www.Town.wilmington.ma.us/

III. PLANNING PROCESS AND PUBLIC PARTICIPATION

MAPC employs a six step planning process based on FEMA's hazard mitigation planning guidance 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. MAPC supports participation by the general public and other plan stakeholders through Regional and Local Hazard Mitigation Planning Teams, two public meetings hosted by the local Hazard Mitigation Team, posting of the plan to the Town's website, and invitations sent to neighboring communities, Town boards and commissions, the local chamber of commerce, and other local or regional entities to review the plan and provide comment.

Planning Process Summary

The six-step planning process outlined below is based on the guidance provided by FEMA in the Local Multi-Hazard Mitigation Planning Guidance. Public participation is a central element of this process, which attempts to focus on local problem areas and identify needed mitigation measures based on where gaps occur in the existing mitigation efforts of the municipality. By working on municipal hazard mitigation plans in groups of neighboring cities and Towns, MAPC is able to identify regional opportunities for collaboration and facilitate communication between communities. In plan updates, the process described below allows staff to bring the most recent hazard information into the plan, including new hazard occurrence data, changes to a municipality's existing mitigation measures, and progress made on actions identified in previous plans.



- 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.

- 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. MAPC drew on the following resources to complete the plan:

    - Town of Wilmington, General Bylaws
    - Town of Wilmington, Zoning Bylaw
    - Town of Wilmington Comprehensive Plan 2001
    - Town of Wilmington Comprehensive Water Resource Management Plan, 2009
    - Town of Wilmington Open Space Plan, 2015
    - Town of Wilmington Capital Improvement Program
    - Massachusetts State Hazard Mitigation Plan,2013
    - FEMA, Local Mitigation Plan Review Guide; October 1, 2011
    - FEMA, Flood Insurance Rate Maps for Middlesex County, MA, 2014
    - Massachusetts State Hazard Mitigation Plan.2013
    - Metropolitan Area Planning Council, GIS Lab, Regional Plans and Data.
    - New England Seismic Network, Boston College Weston Observatory, http://aki.bc.edu/index.htm
    - NOAA National Climatic Data Center, http://www.ncdc.noaa.gov/
    - Northeast States Emergency Consortium, http://www.nesec.org/
    - USGS, National Water Information System, http://nwis.waterdata.usgs.gov/usa/nwis
    - US Census, 2010

- Review Existing Mitigation – Municipalities in the Boston Metropolitan Region have an active history in hazard mitigation as most 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.

- 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.

- 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 (Approval Pending Adoption), 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.

- 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.

Local Plan Update Representatives

On February 28, 2014 a letter was sent notifying Wilmington of the first meeting regarding the plan update 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 Wilmington:

Richard McClellan	Chief, Fire Department, Emergency Management
Carole Hamilton	Planning Director (since retired; now Valerie Gingrich)

The Local Multiple Hazard Community Planning Team

MAPC worked with the local community representatives to organize a local Multiple Hazard Community Planning Team for Wilmington (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, civic organizations and citizens at large.

The Local Hazard Mitigation Planning Team is central to the planning process as it is the primary body tasked with developing a mitigation strategy for the community. The local team was tasked with working with MAPC to set plan goals, provide information on the hazards that impact the Town, existing mitigation measures, and helping to develop new mitigation measures for this plan update. The Local Hazard Mitigation Planning Team membership can be found in Table 5 below.

On June 30, 2014, MAPC and MEMA staff held a meeting with the Local Committee to outline the hazard mitigation planning and updating process at Wilmington Town Hall.

On September 29, 2014, MAPC conducted a meeting of the Wilmington Local Committee. The meeting was organized by then Planning Director Carole Hamilton. The purpose of the meeting was to review and develop hazard mitigation goals, review the status of mitigation measures identified in the 2008 hazard mitigation plan, identify new potential mitigation measures and to gather information on local hazard mitigation issues and sites or areas related to these. The meeting also covered measures to be carried forward from the previous plan and to prioritize new measures.

The following Table lists the attendees at each meeting of the team. The agendas for these meetings are included in Appendix A.

The agendas for these meetings are included in Appendix A.

Table 3
Membership of the Wilmington Hazard Mitigation Planning Team

Name	Representing
Gary Donovan	Deputy Fire Chief
Carole Hamilton/Valerie Gingrich	Planning Director
Michael Vivaldi	Assistant Planner
Joe Lobao	Wilmington Department of Public Works, Utilities Manager
Jamie Magaldi	Wilmington Department of Public Works, Operations Manager
Winifred McGowan	Assistant Planning Director/Conservation Agent
Paul Alunni	Engineering
Michael Woods	Public Works, Director
Al Spaulding	Inspector of Buildings & Zoning Enforcement Officer
Shelly Newhouse	Director of Public Health

Public Meetings

Public participation in the hazard mitigation planning process is important, both for plan development and for later implementation of the plan. Residents, business owners, and other community members are an excellent source for information on the historic and potential impacts of natural hazard events and particular vulnerabilities the community may face from these hazards. Their participation in this planning process also builds understanding of the concept of hazard mitigation, potentially creating support for mitigation actions taken in the future to implement the plan. To gather this information and educate residents on hazard mitigation, the Town hosted two public meetings, one during the planning process and one after a complete draft plan is available for review.

Natural hazard mitigation plans unfortunately rarely attract much public involvement in the Boston region, unless there has been a recent hazard event. One of the best strategies

for overcoming this challenge is to include discussion of the hazard mitigation plan on the agenda of an existing board or commission. With this strategy, the meeting receives widespread advertising and a guaranteed audience of the board or commission members plus those members of the public who attend the meeting. These board and commission members represent an engaged audience that is informed and up to date on many of the issues that relate to hazard mitigation planning in the locality and will likely be involved in plan implementation, making them an important audience with which to build support for hazard mitigation measures. In addition, these meetings frequently receive press coverage, expanding the audience that has the opportunity to hear the presentation and provide comment.

The public had an opportunity to provide input to the Wilmington hazard mitigation planning process during a meeting of the Planning Board, on May 5, 2015 held in the Town Hall. The draft plan update was presented at a Planning Board meeting held on August 4, 2015 in Wilmington Town Hall. Both meetings were publicized as regular meetings of the Planning Board according to the Massachusetts Public Meeting Law. The attendance list for each meeting can be found in Table 4. See public meeting notices in Appendix C.

Table 4
Wilmington Public Meetings

Name	**Representing**
Meeting #1 May 5, 2015	
Gary Donovan	Deputy Fire Chief
Valerie Gingrich	Planning Director
Michael Vivaldi	Assistant Planner
Jamie Magaldi	Wilmington Department of Public Works, Operations Manager
Joe Lobao	Wilmington Department of Public Works, Utilities Manager
Winifred McGowan	Assistant Planning Director/Conservation Agent
Paul Alunni	Engineering
Michael Woods	Public Works, Director
Al Spaulding	Inspector of Buildings & Zoning Enforcement Officer
Approximately 10 members of the public	
Meeting #2 August 4, 2015	
Gary Donovan	Deputy Fire Chief
Valerie Gingrich	Planning Director
Michael Vivaldi	Assistant Planner
Jamie Magaldi	Wilmington Department of Public Works, Operations Manager
Winifred McGowan	Assistant Planning Director/Conservation Agent
Paul Alunni	Engineering
Approximately 12 members of the public	

Local Stakeholder Involvement

The local Hazard Mitigation Planning Team was encouraged to reach out to local stakeholders that might have an interest in the Hazard Mitigation Plan including neighboring communities, agencies, businesses, nonprofits, and other interested parties. Notice was sent to the following organizations and neighboring municipalities inviting them to review the Hazard Mitigation Plan and submit comments to the Town:

Town of Andover
Town of Billerica
Town of Burlington
Town of North Reading
Town of Reading
Town of Tewksbury
City of Woburn

Wilmington Chamber of Commerce
Wilmington Conservation Commission
Wilmington Town Crier
Wilmington Department Heads

See Appendix C for public meeting notices.

Town Web Site

The draft Wilmington Hazard Mitigation Plan 2015 Update was posted on the Town's website following the second public meeting. Members of the public could access the draft document and submit comments or questions to the Town.

No comments were received from the public during the posting period.

Continuing Public Participation

Following the adoption of the plan update, the planning team will continue to provide residents, businesses, and other stakeholders the opportunity to learn about the hazard mitigation planning process and to contribute information that will update the Town's understanding of local hazard. As updates and a review of the plan are conducted by the Hazard Mitigation Implementation Team, these will be placed on the Town's web site,

and any meetings of the Hazard Mitigation Implementation Team will be publicly noticed in accordance with Town and state open meeting laws.

Planning Timeline

June 30, 2014	Meeting of the Metro Boston Regional Mitigation Committee
September 29, 2014	Meeting of the Wilmington Local Hazard Mitigation Planning Team
May 5, 2015	First Public Meeting with Wilmington Planning Board
August 4, 2015	Second Public Meeting with Planning Board
October 2, 2015	Draft Plan Update submitted to MEMA
March 29, 2016	Revised Plan Update submitted to MEMA
June 16, 2016	Approval Pending Adoption issued by FEMA

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IV. RISK ASSESSMENT

The risk assessment analyzes the potential natural hazards that could occur within the Town of Wilmington 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 Wilmington'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. MAPC also used FEMA's damage estimation software, HAZUS (described below).

Overview of Hazards and Impacts

The Massachusetts Hazard Mitigation Plan provides an in-depth overview of natural hazards in Massachusetts. Previous state and federal disaster declarations since 1991 are summarized in Table 2. Table 5 below summarizes the hazard risks for Wilmington. 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 Massachusetts State Hazard Mitigation Plan. The statewide assessment was modified to reflect local conditions in Wilmington using the definitions for hazard frequency and severity listed below. Based on this, the Town set an overall priority for each hazard. Wilmington is not coastal community and therefore not subject to coastal hazards, storm surge or tsunamis.

Table 5 - Hazard Risks Summary

Hazard	Frequency		Severity	
	Massachusetts	**Wilmington**	**Massachusetts**	**Wilmington**
Flooding	High	High	Serious	Serious
Dam failures	Very Low	Very Low	Extensive	Serious
Hurricane/Trop Storm	Medium	Medium	Serious	Serious
Tornadoes	Medium	Very Low	Serious	Serious
Thunderstorms	High	High	Minor	Minor
Nor'easter	High	High	Minor	Minor
Winter-Blizzard/Snow	High	High	Minor	Minor
Winter-Ice Storms	Medium	Medium	Minor	Minor
Earthquakes	Very Low	Very Low	Serious	Serious
Landslides	Low	Very Low	Minor	Minor
Brush fires	Medium	High	Minor	Minor

Extreme Temperatures	Medium	Medium	Minor	Minor
Drought	Low	Low	Minor	Minor

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

Definitions used in the Commonwealth of Massachusetts State Hazard Mitigation Plan

Frequency

Very low frequency: events that occur less frequently than once in 100 years (less than 1% per year)
Low frequency: events that occur from once in 50 years to once in 100 years (1% to 2% per year);
Medium frequency: events that occur from once in 5 years to once in 50 years (2% to 20% per year);
High frequency: events that occur more frequently than once in 5 years (Greater than 20% per year).

Severity

Minor: Limited and scattered property damage; limited damage to public infrastructure and essential services not interrupted; limited injuries or fatalities.
Serious: Scattered major property damage; some minor infrastructure damage; essential services are briefly interrupted; some injuries and/or fatalities.
Extensive: Widespread major property damage; major public infrastructure damage (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and/or fatalities.
Catastrophic: Property and public infrastructure destroyed; essential services stopped; numerous injuries and fatalities.

Flood Related Hazards

Flooding was the most prevalent serious natural hazard identified by local officials in Wilmington. Flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms. Global climate change has the potential to exacerbate these issues over time with the potential for changing rainfall patterns leading to heavier storms.

Regionally Significant Floods

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

- The blizzard of 1978
- January 1979
- April 1987
- October 1991 ("The Perfect Storm") Considered to be a 100-year storm.
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006

- April 2007
- March 2010
- December 2010

Local data for previous flooding occurrences are not collected by the Town of Wilmington. The best available local data is for Middlesex County through the National Climatic Data Center (see Table 6). Middlesex County, which includes the Town of Wilmington, experienced 76 flood events from 1996 –2015. No deaths or injuries were reported and the total reported property damage in the county was $40.83 million dollars.

Table 6 Middlesex County Flood Events, 1996-2014

Location	Date	Type	Deaths	Injuries	Property Damage
Totals:			0	0	40.830M
WESTERN MIDDLESEX (ZONE)	01/29/1996	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/17/1996	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/17/1996	Flood	0	0	0.00K
SOUTHEAST PORTIONS	09/18/1996	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	10/21/1996	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	10/22/1996	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	03/10/1998	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	03/11/1998	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	05/12/1998	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	06/14/1998	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	06/15/1998	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	06/17/1998	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/22/2000	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/23/2000	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/23/2000	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/23/2000	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	03/22/2001	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	03/22/2001	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	03/22/2001	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	03/23/2001	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	03/23/2001	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	03/31/2001	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/01/2001	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/01/2004	Flood	0	0	0.00K

Location	Date	Type	Deaths	Injuries	Property Damage
WESTERN MIDDLESEX (ZONE)	04/01/2004	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/02/2004	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/02/2004	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/02/2004	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/02/2004	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	04/15/2004	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	03/29/2005	Flood	0	0	0.00K
WESTERN MIDDLESEX (ZONE)	10/15/2005	Flood	0	0	100.00K
WESTERN MIDDLESEX (ZONE)	10/15/2005	Flood	0	0	100.00K
SOUTHEAST MIDDLESEX (ZONE)	10/15/2005	Flood	0	0	125.00K
COUNTYWIDE	05/13/2006	Flood	0	0	5.000M
COUNTYWIDE	05/13/2006	Flood	0	0	0.00K
WAKEFIELD	07/11/2006	Flood	0	0	2.00K
CAMBRIDGE	10/28/2006	Flood	0	0	5.00K
SAXONVILLE	04/16/2007	Flood	0	0	25.00K
FRAMINGHAM	02/13/2008	Flood	0	0	0.00K
MEDFORD	05/27/2008	Flood	0	0	3.00K
STONEHAM	06/24/2008	Flood	0	0	10.00K
WESTLANDS	06/29/2008	Flood	0	0	5.00K
EVERETT	08/10/2008	Flood	0	0	15.00K
SUDBURY	08/10/2008	Flood	0	0	40.00K
NORTH WOBURN	09/06/2008	Flood	0	0	15.00K
BILLERICA	12/12/2008	Flood	0	0	20.00K
HOLLISTON	03/14/2010	Flood	0	0	26.430M
FARM HILL	03/29/2010	Flood	0	0	8.810M
FARM HILL	04/01/2010	Flood	0	0	0.00K
WEST NEWTON	08/28/2011	Flood	0	0	5.00K
RIVER PINES	10/14/2011	Flood	0	0	0.00K
NORTH SOMMERVILLE	06/08/2012	Flood	0	0	0.00K
BEAVER BROOK	06/23/2012	Flood	0	0	0.00K
MELROSE	06/23/2012	Flood	0	0	0.00K
TUFTS COLLEGE	06/23/2012	Flood	0	0	0.00K
MALDEN	06/23/2012	Flood	0	0	0.00K
TUFTS COLLEGE	06/23/2012	Flood	0	0	15.00K

Location	Date	Type	Deaths	Injuries	Property Damage
NEWTON	07/18/2012	Flood	0	0	5.00K
NORTH WALTHAM	10/29/2012	Flood	0	0	0.00K
RIVER PINES	06/07/2013	Flood	0	0	0.00K
LOWELL	07/01/2013	Flood	0	0	0.00K
RIVER PINES	07/01/2013	Flood	0	0	0.00K
HARWOOD	07/23/2013	Flood	0	0	0.00K
FRAMINGHAM	09/01/2013	Flood	0	0	10.00K
CHELMSFORD CENTER	03/30/2014	Flood	0	0	35.00K
NORTH WALTHAM	03/30/2014	Flood	0	0	0.00K
GRANITEVILLE	03/30/2014	Flood	0	0	0.00K
CONCORD	07/27/2014	Flood	0	0	0.00K
NORTH LEXINGTON	08/31/2014	Flood	0	0	0.00K
FELCHVILLE	10/22/2014	Flood	0	0	20.00K
NEWTON LOWER FALLS	10/23/2014	Flood	0	0	0.00K
BOXBOROUGH	12/09/2014	Flood	0	0	0.00K
CLEMATIS BROOK	12/09/2014	Flood	0	0	5.00K
SOMERVILLE	12/09/2014	Flood	0	0	30.00K
NONANTUM	12/09/2014	Flood	0	0	0.00K
Totals:			0	0	40.830M

Source: NOAA, National Climatic Data Center

Overview of Town-Wide Flooding

While not a widespread problem in Wilmington, flooding certainly occurs in some parts of Town, particularly in areas where houses were built in or near wetlands. Many homeowners must deal with basement flooding during wet springs or in rainy spells. Maple Meadow Brook overflows Wildwood Street when the river is already high and a major rain occurs (Oct. 1996, June 1998, March 2001, May, June 2006, March 2010); the Ipswich River flows over Canal Street and the parking lot along Main Street built in its floodway. Lubbers Brook has flooded Concord Street during major rain events. There also is periodic flooding in other parts of Town. Basement flooding in Town is also a result of high groundwater.

Historically Wilmington's extensive wetland system is credited with retaining storm flows and absorbing runoff. As the Town develops, and more land is rendered impervious, the natural hydrology of the area will be altered so that less water is recharged into the ground, thus causing higher flood water levels and more rapid

runoff into Wilmington's brooks and streams. In addition, fragmentation of the wetlands will lessen their ability to store storm water, resulting in higher flood peaks and lower groundwater reserves. The Wilmington Conservation Commission has required recharge for roof runoff for houses in subdivisions as well as in the buffer zone to wetlands for many years. More importantly, the Town has implemented a storm water by-law, passed in 2009, which requires a major stormwater permit for any disturbance of land of 20,000 square feet or greater, as well as a residential footprint increase of 600 square feet or greater, with certain exceptions, in an effort to increase groundwater recharge and decrease flooding. A minor stormwater permit is also required for any land disturbance with exceptions. (Wilmington Open Space and Recreation Plan, 2015)

The Town of Wilmington is implementing a Comprehensive Water Resource Management Plan (CWRMP). The CWRMP received final approval from the Executive Office of Energy and Environmental Affairs (EEA) in June of 2009. The CWRMP addresses the Town's water supply, stormwater management, and wastewater needs for a planning period from 2009 to 2025. Stormwater and wastewater were once viewed as something to get rid of as soon as possible. The scientific community, however, now recognizes the deleterious effect this can have on streams, wetlands, and water supplies. Sewer lines can "dewater" aquifers by transporting more water outside of its basin than is recharged from precipitation and septic systems. Impervious surfaces and old stormwater systems send "run off" away quickly, exacerbating the problem by curtailing or eliminating crucial groundwater recharge to wetlands and waterways. Current stormwater systems increase peak flows of rivers, worsening flooding of downstream receptors. The CWRMP attempts to reverse these practices and change past mindset by placing a much higher value on stormwater and wastewater as water resources.

The CWRMP was initiated by EEA in response to the stressed conditions of the Ipswich River. The stress was caused by contributing factors: water withdrawals, loss of recharge from increased impervious surfaces, dewatering from sewer lines and ground water flowing along gravity sewer line beds. The river and its surrounding wetland and upland resources can no longer support the full, current and future, demands of the Town. The Ipswich is considered by the State as one of the most stressed river basins in Massachusetts. The CWRMP's goals are to address these issues while at the same time striking a balance between growth demands, and protection and restoration of the Ipswich River, its headwater tributaries, and Wilmington's drinking resources. (Wilmington Open Space and Recreation Plan, 2015)

In summary, flooding in the Town of Wilmington is primarily a result of precipitation and storm water run-off overwhelming the capacity of natural and structured drainage systems to convey water, causing it to overflow the system. Flooding in Wilmington is caused by precipitation associated with severe rainstorms, thunderstorms, Nor'easters, and hurricanes.

Potential Flood Hazard Areas

Information on potential flood hazard areas was taken from two sources. The first was the National Flood Insurance Rate Maps. The FIRM flood zones are shown on Map 3 in Appendix B and their definitions are listed below.

Flood Insurance Rate Map Zone Definitions

Zone A (1% annual chance) - Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs (base flood elevations) or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zone AE and A1-A30 (1% annual chance) - Zones AE and A1-A30 are the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the FIS by detailed methods. In most instances, BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

Zones X500 (.2% annual chance) - Zone X500 is the flood insurance rate zone that correspond to the 500-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs (base flood elevations) or depths are shown within this zone.

Zone VE (1% annual chance) - Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply

In addition, information on areas subject to flooding was provided by local officials. The Locally Identified Areas of Flooding described below were identified by Town staff as areas where flooding is known to occur. All of these areas do not necessarily coincide with the flood zones from the FIRM maps. Some 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, "Local Hazard Areas."

1. Wildwood Street/Meadow Brook: This area did not receive mitigation. Town staff indicated that this is a low-lying area that does flood during larger precipitation events but that fire access is not impeded and less than five homes are impacted. Culvert enlargement is not practical as the area is so low.

2. Concord Street: Another low lying road area noted in the 2008 Plan. Access to Route 93 is blocked when this road floods but is usually passable. Culvert replacement is not seen as practical by the Town due to low elevation.

3. Route 62- North Reading and Wilmington signed a memo of understanding in 2010 to mitigate this site but implementation has not occurred. Installing a larger culvert as planned would only move the problem to a downstream neighborhood.
4. Lubber's Brook: Lubber's Brook is a slow moving brook with a shallow slope. Due to its slope and sedimentation, it often overflows in heavy rains and impacts homes within its floodplain.

5. Main Street: No action has been taken by MA DOT to remediate since 2008 report. The area is not flooding but poor culvert design has led to sink holes in Wilmington House of Pizza parking area.

6. Butter Row- Flooding- A collapsed culvert on Butter's Row backs up and floods, impacting 6 houses. The Town has listed replacing the culvert in its FY 2015 Capital Improvements Plan and work was completed in August, 2015.

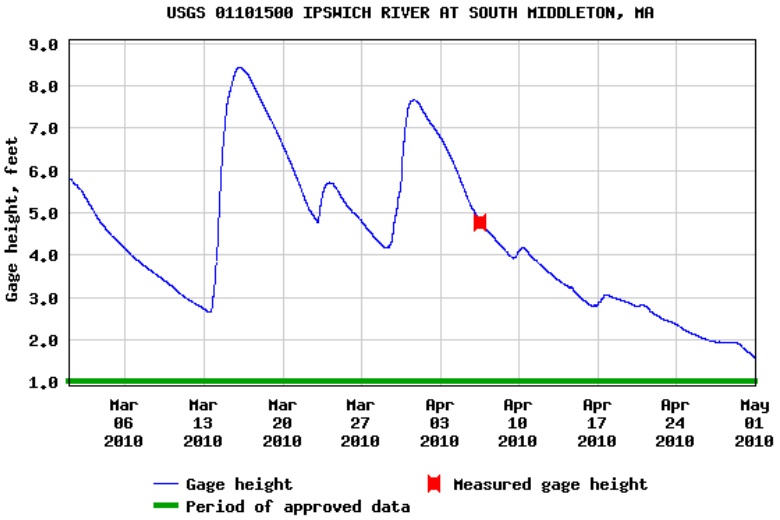
7. Flooding- An undersized storm drain surcharges onto Burt Road, impacting two garages, at a frequency of once a year.

8. North Street: Flooding- undersized/ partially blocked storm drain line surcharges onto the street, impacting one garage. Has been cleaned but continues to flood. Very low lying area with little drainage head; enlarging the culver would have little impact.

The most severe flooding since the previous plan occurred during March 2010, when a total of 14.83 inches of rainfall accumulation was recorded by the National Weather Service (NWS). The weather pattern that consisted of early springtime prevailing westerly winds that moved three successive storms, combined with tropical moisture from the Gulf of Mexico, across New England. Torrential rainfall caused March 2010 to be the wettest month on record.

One indication of the extent of flooding is the gage height at the nearest USGS streamflow gauging station, which is on the Ipswich River in South Middleton. The USGS gage height, shown in Figure 1, exceeded 8 feet on March 16, 2010 and exceeded 7 feet on March 31, 2010. Normal gage height in March is about 4 feet.

Figure 1- Ipswich River Gage Heights, March-April 2010



Source, US Geological Service, National Water Information System

Repetitive Loss Structures

As defined by 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.

There are three repetitive loss structures in Wilmington, the same as the 2008 plan. All of the properties are single family residences.
Table 7 summarizes the number and type of repetitive loss structures located within Wilmington and the number of losses and total claims associated with them.

Table 7- Summary of Repetitive Losses and Claims 1979- 2014

	Single Family Residential	Other Residential	Non-Residential	Total
Number of Properties	**3**	**0**	**0**	**3**
Number of	**6**	**0**	**0**	**6**

Losses				
Total Claims	**$44,771.03**		**0**	**$44,771.03**

Source: Department of Conservation and Recreation, FEMA Repetitive Loss data

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

Dams and Dam Failure

Dam failure can occur as a result of structural failure, independent of a hazard event, or as the result of the impacts of a hazard event such as flooding associated with storms or an earthquake. In the event of a dam failure, the energy of the water stored behind even a small dam can cause loss of life and property damage if there are people or buildings downstream. The number of fatalities from a dam failure depends on the amount of warning provided to the population and the number of people in the area in the path of the dam's floodwaters.

Dam failure is a highly infrequent occurrence but a severe incident could result in loss of lives and significant property damage. Since 1984, three dams have failed in or very near to Massachusetts, one of which resulted in a death. There have been no recorded dam breaches in Wilmington.

DCR defines dam hazard classifications as follows:

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

There are no dams in Wilmington. However, if the Mill Pond Dam on the Burlington Reservoir burst, the water would flow into Wilmington. The Emergency Action Plan for the Mill Pond Dam includes notification of the Wilmington Fire Department in the event of an emergency. Once that notification has been made, the Town of Wilmington is responsible for notifying residents. Any necessary evacuations are also the responsibility

of the Town of Wilmington. The plan includes a "Resident Evacuation/Notification Table which lists 17 residences on Main Street, 6 on Butters Row, 6 on Factory Street, one business on Eames Street and 27 residences on Chestnut Street.

Based on the record of previous occurrences dam failure in Wilmington is a Very Low frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur less frequently than once in 100 years (less than 1% chance per year).

Wind Related Hazards

Wind-related hazards include hurricanes, tropical storms, and tornadoes as well as high winds during Nor'easters and thunderstorms. As with many communities, falling trees that result in downed power lines and power outages are an issue in Wilmington. Information on wind related hazards can be found on Map 5 in Appendix B

Hurricanes and Tropical Storms

A hurricane is a violent wind and rainstorm with wind speeds of 74-200 miles per hour. A hurricane is strongest as it travels over the ocean and is particularly destructive to coastal property as the storm hits the land. The Town's entire area is vulnerable to hurricanes. Hurricanes occur between June and November. A tropical storm has similar characteristics, but wind speeds are below 74 miles per hour.

Since 1900, 39 tropical storms have impacted New England (NESEC). Massachusetts has experienced approximately 32 tropical storms, nine Category 1 hurricanes, five Category 2 hurricanes and one Category 3 hurricane. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. There has been one recorded storm tracks through Wilmington, a tropical storm in 1908. However, Wilmington experiences the impacts of hurricanes and tropical storms regardless of whether the storm track passes directly through the Town, and numerous hurricanes have affected the communities of eastern Massachusetts (see Table 8) The hazard mapping indicates that the 100 year wind speed in Wilmington is 110 miles per hour (see Appendix B).

Table 8- Hurricane Records for Massachusetts, 1938 - 2012

Hurricane Event	Date
Great New England Hurricane*	September 21, 1938
Great Atlantic Hurricane*	September 14-15, 1944
Hurricane Doug	September 11-12, 1950
Hurricane Carol*	August 31, 1954
Hurricane Edna*	September 11, 1954
Hurricane Diane	August 17-19, 1955
Hurricane Donna	September 12, 1960
Hurricane Gloria	September 27, 1985
Hurricane Bob	August 19, 1991

Hurricane Event	Date
Hurricane Earl	September 4, 2010
Tropical Storm Irene	August 28, 2011
Hurricane Sandy	October 29-30, 2012

*Category 3. Source: National Oceanic and Atmospheric Administration

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

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

Source: NOAA

Hurricanes typically have regional impacts beyond their immediate tracks. Falling trees and branches are a significant problem because they can result in power outages when they fall on power lines or block traffic and emergency routes. Hurricanes are a Town-wide hazard in Wilmington. Potential hurricane damages to Wilmington have been estimated using HAZUS-MH. Total damages are estimated at $16.42 million for a Category 2 hurricane and $60.23 Million for a Category 4 hurricane. Other potential impacts are detailed in Table 21.

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

Tornados

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. These events are spawned by thunderstorms and occasionally by hurricanes, and may occur singularly or in multiples. They develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. Most vortices remain suspended in the atmosphere. Should they touch down, they become a force of destruction. Some ingredients for tornado formation include:

- Very strong winds in the mid and upper levels of the atmosphere
- Clockwise turning of the wind with height (from southeast at the surface to west aloft)

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

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

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

Source: Massachusetts State Hazard Mitigation Plan, 2013

The frequency of tornadoes in eastern Massachusetts is low; on average, there are six tornadoes that touchdown somewhere in the Northeast region every year. The strongest tornado in Massachusetts history was the Worcester Tornado in 1953 (NESEC).
The most recent tornado events in Massachusetts were in Springfield in 2011 and in Revere in 2014. The Springfield tornado caused significant damage and resulted in 4 deaths in June of 2011. The Revere tornado touched down in Chelsea just south of Route 16 and moved north into Revere's business district along Broadway and ended near the intersection of Routes 1 and 60. The path was approximately two miles long and 3/8 mile wide, with wind speeds up to 120 miles per hour. Approximately 65 homes had substantial damages and 13 homes and businesses were uninhabitable.

Although there have been no recorded tornados within the limits of the Town of Wilmington, since 1956 there have been 17 tornadoes in surrounding Middlesex County recorded by the Tornado History Project. Two tornados were F3, three were F2 and twelve were F1.These 10 tornadoes resulted in a total of one fatality and six injuries and up to $7.7 million in damages, as summarized in Table 9.

Table 9 - Tornado Records for Middlesex County

Date	Fujita	Fatalities	Injuries	Width	Length	Damage
10/24/1955	1	0	0	10	0.1	$500-$5000

Date	Fujita	Fatalities	Injuries	Width	Length	Damage
6/19/1957	1	0	0	17	1	$5K-$50K
6/19/1957	1	0	0	100	0.5	$50-$500
7/11/1958	2	0	0	17	1.5	$50K-$500K
8/25/1958	2	0	0	50	1	$500-$5000
7/3/1961	0	0	0	10	0.5	$5K-$50K
7/18/1963	1	0	0	50	1	$5K-$50K
8/28/1965	2	0	0	10	2	$50K-$500K
7/11/1970	1	0	0	50	0.1	$5K-$50K
10/3/1970	3	1	0	60	35.4	$50K-$500K
7/1/1971	1	0	1	10	25.2	$5K-$50K
11/7/1971	1	0	0	10	0.1	$50-$500
7/21/1972	2	0	4	37	7.6	$500K-$5M
9/29/1974	3	0	1	33	0.1	$50K-$500K
7/18/1983	0	0	0	20	0.4	$50-$500
9/27/1985	1	0	0	40	0.1	$50-$500
8/7/1986	1	0	0	73	4	$50K-$500K

Source: The Tornado History Project

Buildings constructed prior to current building codes may be more vulnerable to damages caused by tornadoes. Evacuation of impacted areas may be required on short notice. Sheltering and mass feeding efforts may be required along with debris clearance, search and rescue, and emergency fire and medical services. Key routes may be blocked by downed trees and other debris, and widespread power outages are also typically associated with tornadoes.

Although tornadoes are a potential Town-wide hazard in Wilmington, tornado impacts are relatively localized compared to severe storms and hurricanes. Damages from any tornado in Wilmington would greatly depend on the track of the tornado. Generally the downtown, central and southwestern portions of the Town near Routes 38 and 62, are more densely developed and would likely be subject to more damage in the event of a tornado.

Based on the record of previous occurrences since 1950, Tornado events in Wilmington are a Medium frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur from once in 5 years to once in 50 years, or a 2% to 20% chance per year.

Nor'easters

A northeast coastal storm, known as a nor'easter, is typically a large counter-clockwise wind circulation around a low-pressure center. Featuring strong northeasterly winds blowing in from the ocean over coastal areas, nor'easters are relatively common in the winter months in New England occurring one to two times a year. The storm radius of a

nor'easter can be as much as 1,000 miles and these storms feature sustained winds of 10 to 40 mph with gusts of up to 70 mph. These storms are accompanied by heavy rains or snows, depending on temperatures.

Previous occurrences of Nor'easters include the following:

February 1978	Blizzard of 1978
October 1991	Severe Coastal Storm ("Perfect Storm")
December 1992	Great Nor'easter of 1992
January 2005	Blizzard/N or'easter
October 2005	Coastal Storm/Nor'easter
April 2007	Severe Storms, Inland & Coastal Flooding/Nor'easter
January 2011	Winter Storm/Nor'easter
October 2011	Severe Storm/Nor'easter
Blizzard of 2013	February 2013
Blizzard of 2015	January 2015

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

Wilmington is vulnerable to both the wind and precipitation that accompanies nor'easters. High winds can cause damage to structures, fallen trees, and downed power lines leading to power outages. Intense rainfall can overwhelm drainage systems causing localized flooding of rivers and streams as well as urban stormwater ponding and localized flooding.

The entire Town of Wilmington could be at risk from the wind, rain or snow impacts from a nor'easter, depending on the track and radius of the storm, but due to its inland location the Town would not be subject to coastal hazards.

Based on the record of previous occurrences, nor'easters in Wilmington are high frequency events as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20% per year).

Severe Thunderstorms

While less severe than the other types of storms discussed, thunderstorms can lead to localized damage and represent a hazard risk for communities. Generally defined as a storm that includes thunder, which always accompanies lightning, a thunderstorm is a storm event featuring lightning, strong winds, and rain and/or hail. Thunderstorms sometime give rise to tornados. On average, these storms are only around 15 miles in diameter and last for about 30 minutes.

A severe thunderstorm can include winds of close to 60 mph and rain sufficient to produce flooding The Town's entire area is potentially subject to severe thunderstorms. The Local Hazard Mitigation Team reported that an area of North Wilmington suffered from a severe thunderstorm and high wind in 2014 with major tree damage, a road closing and damage to two homes but not injuries. In 2011, high wind from a thunderstorm caused a tree to fall on the roof of a house on Buckingham Road with no injuries reported.

The Town does not keep records of thunderstorms, but estimates that at least six to eight occur each year.

The best available data on previous occurrences of thunderstorms in Wilmington is for Middlesex County through the National Climatic Data Center (NCDC). Between 1995 and April 30, 2015 NCDC records show 251 thunderstorm events in Middlesex County (Table 10). These storms resulted in a total of $2.7 million in property damages. There were 10 injuries and no deaths reported.

Table 10 Middlesex County Thunderstorm Wind Events, 1995-2015

LOCATION	BEGIN_DATE	EVENT_TYPE	MAGNITUDE	DEATHS	INJURIES	DAMAGE
MIDDLESEX CO.	04/04/1995	Thunderstorm Wind	58 kts.	0	0	0.00K
MIDDLESEX CO.	07/15/1995	Thunderstorm Wind	0 kts.	0	0	0.00K
MIDDLESEX CO.	07/15/1995	Thunderstorm Wind	0 kts.	0	0	0.00K
MIDDLESEX CO.	09/14/1995	Thunderstorm Wind	0 kts.	0	2	0.00K
MIDDLESEX CO.	09/14/1995	Thunderstorm Wind	0 kts.	0	0	0.00K
MIDDLESEX CO.	10/28/1995	Thunderstorm Wind	0 kts.	0	0	0.00K
MIDDLESEX CO.	10/28/1995	Thunderstorm Wind	0 kts.	0	0	0.00K
MIDDLESEX CO.	10/28/1995	Thunderstorm Wind	0 kts.	0	0	0.00K
MIDDLESEX CO.	07/08/1996	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	07/08/1996	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	02/22/1997	Thunderstorm Wind	52 kts.	0	0	0.00K
MIDDLESEX CO.	02/22/1997	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	07/09/1997	Thunderstorm Wind	50 kts.	0	0	1.00K
MIDDLESEX CO.	05/29/1998	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	05/29/1998	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	05/31/1998	Thunderstorm Wind	60 kts.	0	0	0.00K
MIDDLESEX CO.	05/31/1998	Thunderstorm Wind	60 kts.	0	1	10.00K
MIDDLESEX CO.	05/31/1998	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	05/31/1998	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	05/31/1998	Thunderstorm Wind	70 kts.	0	0	0.00K
MIDDLESEX CO.	05/31/1998	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	07/23/1998	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	09/15/1998	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	07/06/1999	Thunderstorm Wind	56 kts.	0	0	0.00K

LOCATION	BEGIN_DATE	EVENT_TYPE	MAGNITUDE	DEATHS	INJURIES	DAMAGE
MIDDLESEX CO.	07/06/1999	Thunderstorm Wind	65 kts.	0	0	0.00K
MIDDLESEX CO.	07/06/1999	Thunderstorm Wind	60 kts.	0	0	0.00K
MIDDLESEX CO.	07/23/1999	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	07/24/1999	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	07/25/1999	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	08/05/1999	Thunderstorm Wind	50 kts.	0	0	0.00K
MIDDLESEX CO.	06/02/2000	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	06/02/2000	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	06/27/2000	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	05/12/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	05/12/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	06/17/2001	Thunderstorm Wind	60 kts. E	0	0	0.00K
MIDDLESEX CO.	06/20/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	06/30/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	06/30/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	06/30/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	06/30/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	07/01/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	07/01/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	07/10/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	08/10/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	08/10/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	08/10/2001	Thunderstorm Wind	50 kts. E	0	0	0.00K
MIDDLESEX CO.	04/19/2002	Thunderstorm Wind	52 kts. E	0	0	5.00K
MIDDLESEX CO.	05/31/2002	Thunderstorm Wind	50 kts. E	0	0	2.00K
MIDDLESEX CO.	06/27/2002	Thunderstorm Wind	50 kts. E	0	0	5.00K
MIDDLESEX CO.	06/27/2002	Thunderstorm Wind	50 kts. E	0	0	5.00K
MIDDLESEX CO.	07/15/2002	Thunderstorm Wind	50 kts. E	0	0	2.00K
MIDDLESEX CO.	07/23/2002	Thunderstorm Wind	50 kts. E	0	0	5.00K
MIDDLESEX CO.	07/23/2002	Thunderstorm Wind	65 kts. E	0	0	35.00K
MIDDLESEX CO.	08/02/2002	Thunderstorm Wind	50 kts. E	0	0	2.00K
MIDDLESEX CO.	08/02/2002	Thunderstorm Wind	50 kts. E	0	0	2.00K
MIDDLESEX CO.	08/13/2003	Thunderstorm Wind	50 kts. EG	0	0	25.00K
MIDDLESEX CO.	08/22/2003	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	08/22/2003	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	08/22/2003	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	08/22/2003	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	07/08/2004	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	08/20/2004	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	08/20/2004	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	08/20/2004	Thunderstorm Wind	50 kts. EG	0	0	15.00K

LOCATION	BEGIN_DATE	EVENT_TYPE	MAGNITUDE	DEATHS	INJURIES	DAMAGE
MIDDLESEX CO.	08/20/2004	Thunderstorm Wind	50 kts. EG	0	0	75.00K
MIDDLESEX CO.	08/21/2004	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	06/29/2005	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	07/27/2005	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/27/2005	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	08/05/2005	Thunderstorm Wind	50 kts. EG	0	4	15.00K
MIDDLESEX CO.	08/05/2005	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	08/05/2005	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	08/14/2005	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	08/14/2005	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	08/14/2005	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	04/01/2006	Thunderstorm Wind	50 kts. EG	0	0	8.00K
MIDDLESEX CO.	05/21/2006	Thunderstorm Wind	61 kts. EG	0	0	75.00K
MIDDLESEX CO.	05/21/2006	Thunderstorm Wind	61 kts. EG	0	0	20.00K
MIDDLESEX CO.	06/23/2006	Thunderstorm Wind	50 kts. EG	0	0	30.00K
MIDDLESEX CO.	07/11/2006	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	07/11/2006	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	07/11/2006	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	07/21/2006	Thunderstorm Wind	50 kts. EG	0	0	35.00K
MIDDLESEX CO.	07/21/2006	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	07/21/2006	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	07/21/2006	Thunderstorm Wind	50 kts. EG	0	0	35.00K
MIDDLESEX CO.	07/28/2006	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	07/28/2006	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	07/28/2006	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	07/28/2006	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	08/02/2006	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	05/16/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	06/27/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/06/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/09/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/09/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/15/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/15/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/15/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/15/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/28/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/28/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/28/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/28/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/29/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K

LOCATION	BEGIN_DATE	EVENT_TYPE	MAGNITUDE	DEATHS	INJURIES	DAMAGE
MIDDLESEX CO.	08/17/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	08/17/2007	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	09/08/2007	Thunderstorm Wind	50 kts. EG	0	0	25.00K
MIDDLESEX CO.	05/27/2008	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	05/27/2008	Thunderstorm Wind	50 kts. EG	0	0	8.00K
MIDDLESEX CO.	05/27/2008	Thunderstorm Wind	50 kts. EG	0	0	0.50K
MIDDLESEX CO.	05/27/2008	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	05/27/2008	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	06/10/2008	Thunderstorm Wind	50 kts. EG	0	0	20.00K
MIDDLESEX CO.	06/10/2008	Thunderstorm Wind	50 kts. EG	0	0	13.00K
MIDDLESEX CO.	06/10/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	06/23/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	06/23/2008	Thunderstorm Wind	50 kts. EG	0	0	4.00K
MIDDLESEX CO.	06/24/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	06/24/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	06/24/2008	Thunderstorm Wind	50 kts. EG	0	1	0.00K
MIDDLESEX CO.	06/24/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	06/24/2008	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	06/24/2008	Thunderstorm Wind	50 kts. EG	0	0	3.00K
MIDDLESEX CO.	06/24/2008	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	06/27/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	06/27/2008	Thunderstorm Wind	50 kts. EG	0	0	3.00K
MIDDLESEX CO.	06/29/2008	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	06/29/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	06/29/2008	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	07/01/2008	Thunderstorm Wind	50 kts. EG	0	0	20.00K
MIDDLESEX CO.	07/01/2008	Thunderstorm Wind	55 kts. MG	0	0	0.00K
MIDDLESEX CO.	07/01/2008	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	07/01/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/01/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/02/2008	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	07/02/2008	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	07/02/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/02/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/03/2008	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	07/03/2008	Thunderstorm Wind	50 kts. EG	0	0	3.00K
MIDDLESEX CO.	07/03/2008	Thunderstorm Wind	50 kts. EG	0	0	3.00K
MIDDLESEX CO.	07/19/2008	Thunderstorm Wind	50 kts. EG	0	0	6.00K
MIDDLESEX CO.	07/19/2008	Thunderstorm Wind	50 kts. EG	0	0	8.00K
MIDDLESEX CO.	07/19/2008	Thunderstorm Wind	50 kts. EG	0	0	2.00K
MIDDLESEX CO.	07/20/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K

LOCATION	BEGIN_DATE	EVENT_TYPE	MAGNITUDE	DEATHS	INJURIES	DAMAGE
MIDDLESEX CO.	07/27/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	08/03/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	08/07/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	08/07/2008	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	09/09/2008	Thunderstorm Wind	50 kts. EG	0	0	8.00K
MIDDLESEX CO.	09/09/2008	Thunderstorm Wind	50 kts. EG	0	0	4.00K
MIDDLESEX CO.	05/09/2009	Thunderstorm Wind	50 kts. EG	0	0	2.00K
MIDDLESEX CO.	05/24/2009	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	07/07/2009	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	07/08/2009	Thunderstorm Wind	50 kts. EG	0	0	20.00K
MIDDLESEX CO.	07/26/2009	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	07/26/2009	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	07/31/2009	Thunderstorm Wind	50 kts. EG	0	0	30.00K
MIDDLESEX CO.	07/31/2009	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	07/31/2009	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	07/31/2009	Thunderstorm Wind	50 kts. EG	0	0	3.00K
MIDDLESEX CO.	07/31/2009	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	07/31/2009	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	05/04/2010	Thunderstorm Wind	50 kts. EG	0	0	30.00K
MIDDLESEX CO.	05/04/2010	Thunderstorm Wind	50 kts. EG	0	0	7.00K
MIDDLESEX CO.	06/01/2010	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	06/03/2010	Thunderstorm Wind	50 kts. EG	0	0	20.00K
MIDDLESEX CO.	06/03/2010	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	06/05/2010	Thunderstorm Wind	50 kts. EG	0	0	40.00K
MIDDLESEX CO.	06/06/2010	Thunderstorm Wind	50 kts. EG	0	1	25.00K
MIDDLESEX CO.	06/06/2010	Thunderstorm Wind	50 kts. EG	0	0	3.00K
MIDDLESEX CO.	06/06/2010	Thunderstorm Wind	50 kts. EG	0	0	20.00K
MIDDLESEX CO.	06/06/2010	Thunderstorm Wind	50 kts. EG	0	0	50.00K
MIDDLESEX CO.	06/06/2010	Thunderstorm Wind	50 kts. EG	0	0	30.00K
MIDDLESEX CO.	06/06/2010	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	06/06/2010	Thunderstorm Wind	50 kts. EG	0	0	100.00K
MIDDLESEX CO.	06/06/2010	Thunderstorm Wind	50 kts. EG	0	0	25.00K
MIDDLESEX CO.	06/06/2010	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	06/06/2010	Thunderstorm Wind	50 kts. EG	0	0	30.00K
MIDDLESEX CO.	06/06/2010	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	06/24/2010	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	06/24/2010	Thunderstorm Wind	50 kts. EG	0	0	2.00K
MIDDLESEX CO.	06/24/2010	Thunderstorm Wind	50 kts. EG	0	0	2.00K
MIDDLESEX CO.	06/24/2010	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	06/24/2010	Thunderstorm Wind	50 kts. EG	0	0	3.00K
MIDDLESEX CO.	06/24/2010	Thunderstorm Wind	50 kts. EG	0	0	30.00K

LOCATION	BEGIN_DATE	EVENT_TYPE	MAGNITUDE	DEATHS	INJURIES	DAMAGE
MIDDLESEX CO.	06/24/2010	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	06/24/2010	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	06/24/2010	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	06/24/2010	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	07/12/2010	Thunderstorm Wind	50 kts. EG	0	0	25.00K
MIDDLESEX CO.	07/12/2010	Thunderstorm Wind	50 kts. EG	0	0	50.00K
MIDDLESEX CO.	07/19/2010	Thunderstorm Wind	50 kts. EG	0	0	25.00K
MIDDLESEX CO.	06/01/2011	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	06/01/2011	Thunderstorm Wind	50 kts. EG	0	0	3.00K
MIDDLESEX CO.	06/09/2011	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	06/09/2011	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	08/02/2011	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	08/19/2011	Thunderstorm Wind	50 kts. EG	0	0	3.00K
MIDDLESEX CO.	08/19/2011	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	08/19/2011	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	08/19/2011	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	08/19/2011	Thunderstorm Wind	50 kts. EG	0	0	0.00K
MIDDLESEX CO.	08/19/2011	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	06/08/2012	Thunderstorm Wind	50 kts. EG	0	0	25.00K
MIDDLESEX CO.	06/23/2012	Thunderstorm Wind	45 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/04/2012	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	07/18/2012	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	07/18/2012	Thunderstorm Wind	70 kts. EG	0	0	350.00K
MIDDLESEX CO.	09/07/2012	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	09/08/2012	Thunderstorm Wind	40 kts. EG	0	0	3.00K
MIDDLESEX CO.	06/17/2013	Thunderstorm Wind	50 kts. EG	0	0	25.00K
MIDDLESEX CO.	06/17/2013	Thunderstorm Wind	50 kts. EG	0	0	20.00K
MIDDLESEX CO.	06/17/2013	Thunderstorm Wind	45 kts. EG	0	0	3.00K
MIDDLESEX CO.	06/18/2013	Thunderstorm Wind	45 kts. EG	0	0	10.00K
MIDDLESEX CO.	06/24/2013	Thunderstorm Wind	45 kts. EG	0	0	3.00K
MIDDLESEX CO.	07/23/2013	Thunderstorm Wind	50 kts. EG	0	0	20.00K
MIDDLESEX CO.	07/29/2013	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/29/2013	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/03/2014	Thunderstorm Wind	50 kts. EG	0	0	50.00K
MIDDLESEX CO.	07/03/2014	Thunderstorm Wind	50 kts. EG	0	0	75.00K
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	40 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	87 kts. EG	0	0	100.00K
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	50 kts. EG	0	0	5.00K

LOCATION	BEGIN_DATE	EVENT_TYPE	MAGNITUDE	DEATHS	INJURIES	DAMAGE
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	50 kts. EG	0	0	25.00K
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	50 kts. EG	0	0	25.00K
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/07/2014	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	07/15/2014	Thunderstorm Wind	50 kts. EG	0	0	25.00K
MIDDLESEX CO.	07/28/2014	Thunderstorm Wind	50 kts. EG	0	0	50.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	1	10.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	0	3.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	0	3.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	0	2.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	0	15.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	0	5.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	0	1.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	0	10.00K
MIDDLESEX CO.	09/06/2014	Thunderstorm Wind	50 kts. EG	0	0	10.00K
Totals				**0**	**10**	**2.719M**

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

Severe thunderstorms are a Town-wide hazard for Wilmington. The Town's vulnerability to severe thunderstorms is similar to that of Nor'easters. High winds can cause falling trees and power outages, as well as obstruction of key routes and emergency access. Heavy precipitation may also cause localized flooding, both riverine and urban drainage related.

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

Winter Storms

Winter storms, including heavy snow, blizzards, and ice storms, are the most common and most familiar of the region's hazards that affect large geographic areas. The majority of blizzards and ice storms in the region cause more inconvenience than they do serious

property damage, injuries, or deaths. However, periodically, a storm will occur which is a true disaster, and necessitates intense large-scale emergency response.

Heavy Snow and Blizzards

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 increases with temperatures below 20 degrees.

Winter storms are a combination hazard because they often involve wind, ice and heavy snow fall. The National Weather Service defines "heavy snow fall" as an event generating at least 4 inches of snowfall within a 12 hour period. Winter Storms are often associated with a Nor'easter event, a large counter-clockwise wind circulation around a low-pressure center often resulting in heavy snow, high winds, and rain.

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

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

Source: Massachusetts State Hazard Mitigation Plan, 2013

The most significant winter storm in recent history was the "Blizzard of 1978," which resulted in over 3 feet of snowfall and multiple day closures of roadways, businesses, and schools. In Wilmington blizzards and severe winter storms have occurred in the following years:

Table 11- Severe Winter Storm Records for Massachusetts

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
Severe Snow Storm	January 2011
Blizzard of 2013	February 2013
Blizzard of 2015	January 2015

Source: National Oceanic and Atmospheric Administration

The average annual snowfall for all of Wilmington is 48 - 72 inches (see Map 6 in Appendix B).

The Town of Wilmington does not keep local records of winter storms. Data for Middlesex County, which includes Wilmington, is the best available data to help understand previous occurrences and impacts of heavy snow events. According to the National Climate Data Center (NCDC) records, from 1995 to 2015, Middlesex County experienced 151 heavy snowfall events, resulting in no deaths, no injuries, and $4.415 million dollars in property damage. See Table 12 for heavy snow events and impacts in Middlesex County.

Table 12 - Heavy Snow events and Impacts in Middlesex County 1996 –2014

Date	Type	Deaths	Injuries	Property Damage
01/02/1996	Heavy Snow	0	0	0.00K
01/02/1996	Heavy Snow	0	0	0.00K
01/07/1996	Heavy Snow	0	0	1.400M
01/07/1996	Heavy Snow	0	0	1.500M
01/10/1996	Heavy Snow	0	0	0.00K
01/12/1996	Heavy Snow	0	0	0.00K
02/02/1996	Heavy Snow	0	0	0.00K
02/16/1996	Heavy Snow	0	0	0.00K

Date	Type	Deaths	Injuries	Property Damage
02/16/1996	Heavy Snow	0	0	0.00K
03/02/1996	Heavy Snow	0	0	0.00K
03/02/1996	Heavy Snow	0	0	0.00K
03/07/1996	Heavy Snow	0	0	0.00K
03/07/1996	Heavy Snow	0	0	0.00K
04/07/1996	Heavy Snow	0	0	0.00K
04/07/1996	Heavy Snow	0	0	0.00K
04/09/1996	Heavy Snow	0	0	0.00K
04/09/1996	Heavy Snow	0	0	0.00K
12/06/1996	Heavy Snow	0	0	0.00K
12/06/1996	Heavy Snow	0	0	0.00K
12/07/1996	Heavy Snow	0	0	1.360M
03/31/1997	Heavy Snow	0	0	0.00K
03/31/1997	Heavy Snow	0	0	0.00K
04/01/1997	Heavy Snow	0	0	0.00K
04/01/1997	Heavy Snow	0	0	0.00K
11/14/1997	Heavy Snow	0	0	0.00K
12/23/1997	Heavy Snow	0	0	0.00K
12/23/1997	Heavy Snow	0	0	0.00K
01/15/1998	Heavy Snow	0	0	0.00K
01/15/1998	Heavy Snow	0	0	0.00K
01/23/1998	Heavy Snow	0	0	0.00K
01/14/1999	Heavy Snow	0	0	0.00K
01/14/1999	Heavy Snow	0	0	0.00K
02/25/1999	Heavy Snow	0	0	0.00K
02/25/1999	Heavy Snow	0	0	0.00K
03/06/1999	Heavy Snow	0	0	0.00K
03/06/1999	Heavy Snow	0	0	0.00K
03/15/1999	Heavy Snow	0	0	0.00K
03/15/1999	Heavy Snow	0	0	0.00K
01/13/2000	Heavy Snow	0	0	0.00K
01/13/2000	Heavy Snow	0	0	0.00K

Date	Type	Deaths	Injuries	Property Damage
01/25/2000	Heavy Snow	0	0	0.00K
01/25/2000	Heavy Snow	0	0	0.00K
02/18/2000	Heavy Snow	0	0	0.00K
02/18/2000	Heavy Snow	0	0	0.00K
12/30/2000	Heavy Snow	0	0	0.00K
01/20/2001	Heavy Snow	0	0	0.00K
01/20/2001	Heavy Snow	0	0	0.00K
02/05/2001	Heavy Snow	0	0	0.00K
02/05/2001	Heavy Snow	0	0	0.00K
03/05/2001	Heavy Snow	0	0	0.00K
03/05/2001	Heavy Snow	0	0	0.00K
03/09/2001	Heavy Snow	0	0	0.00K
03/09/2001	Heavy Snow	0	0	0.00K
03/30/2001	Heavy Snow	0	0	0.00K
12/08/2001	Heavy Snow	0	0	0.00K
12/08/2001	Heavy Snow	0	0	0.00K
03/20/2002	Heavy Snow	0	0	0.00K
03/16/2004	Heavy Snow	0	0	0.00K
03/16/2004	Heavy Snow	0	0	0.00K
02/24/2005	Heavy Snow	0	0	0.00K
12/13/2007	Heavy Snow	0	0	0.00K
12/13/2007	Heavy Snow	0	0	0.00K
12/16/2007	Heavy Snow	0	0	0.00K
12/16/2007	Heavy Snow	0	0	0.00K
12/19/2007	Heavy Snow	0	0	0.00K
12/19/2007	Heavy Snow	0	0	0.00K
01/14/2008	Heavy Snow	0	0	28.00K
01/14/2008	Heavy Snow	0	0	20.00K
01/14/2008	Heavy Snow	0	0	20.00K
02/22/2008	Heavy Snow	0	0	0.00K
02/22/2008	Heavy Snow	0	0	0.00K
02/22/2008	Heavy Snow	0	0	0.00K

Date	Type	Deaths	Injuries	Property Damage
03/01/2008	Heavy Snow	0	0	0.00K
12/19/2008	Heavy Snow	0	0	0.00K
12/19/2008	Heavy Snow	0	0	0.00K
12/19/2008	Heavy Snow	0	0	0.00K
12/20/2008	Heavy Snow	0	0	0.00K
12/20/2008	Heavy Snow	0	0	8.00K
12/21/2008	Heavy Snow	0	0	0.00K
12/31/2008	Heavy Snow	0	0	0.00K
12/31/2008	Heavy Snow	0	0	0.00K
01/10/2009	Heavy Snow	0	0	0.00K
01/11/2009	Heavy Snow	0	0	0.00K
01/18/2009	Heavy Snow	0	0	0.00K
01/18/2009	Heavy Snow	0	0	0.00K
01/18/2009	Heavy Snow	0	0	0.00K
03/01/2009	Heavy Snow	0	0	0.00K
03/01/2009	Heavy Snow	0	0	0.00K
03/02/2009	Heavy Snow	0	0	0.00K
12/09/2009	Heavy Snow	0	0	15.00K
12/09/2009	Heavy Snow	0	0	0.50K
12/19/2009	Heavy Snow	0	0	0.00K
12/20/2009	Heavy Snow	0	0	0.00K
01/18/2010	Heavy Snow	0	0	0.00K
02/16/2010	Heavy Snow	0	0	0.00K
02/16/2010	Heavy Snow	0	0	0.00K
02/16/2010	Heavy Snow	0	0	15.00K
02/23/2010	Heavy Snow	0	0	8.00K
01/12/2011	Heavy Snow	0	0	0.00K
01/12/2011	Heavy Snow	0	0	0.00K
01/26/2011	Heavy Snow	0	0	0.00K
01/26/2011	Heavy Snow	0	0	0.00K
01/26/2011	Heavy Snow	0	0	0.00K
10/29/2011	Heavy Snow	0	0	0.00K

Date	Type	Deaths	Injuries	Property Damage
10/29/2011	Heavy Snow	0	0	30.00K
12/29/2012	Heavy Snow	0	0	0.00K
12/29/2012	Heavy Snow	0	0	0.00K
12/29/2012	Heavy Snow	0	0	0.00K
02/08/2013	Heavy Snow	0	0	0.00K
02/08/2013	Heavy Snow	0	0	0.00K
02/08/2013	Heavy Snow	0	0	0.00K
02/23/2013	Heavy Snow	0	0	0.00K
03/07/2013	Heavy Snow	0	0	0.00K
03/07/2013	Heavy Snow	0	0	0.00K
03/07/2013	Heavy Snow	0	0	0.00K
03/18/2013	Heavy Snow	0	0	0.00K
03/18/2013	Heavy Snow	0	0	0.00K
03/18/2013	Heavy Snow	0	0	0.00K
12/14/2013	Heavy Snow	0	0	0.00K
12/14/2013	Heavy Snow	0	0	0.00K
12/14/2013	Heavy Snow	0	0	0.00K
12/17/2013	Heavy Snow	0	0	0.00K
12/17/2013	Heavy Snow	0	0	0.00K
12/17/2013	Heavy Snow	0	0	0.00K
01/02/2014	Heavy Snow	0	0	0.00K
01/02/2014	Heavy Snow	0	0	0.00K
01/02/2014	Heavy Snow	0	0	0.00K
01/18/2014	Heavy Snow	0	0	0.00K
02/05/2014	Heavy Snow	0	0	0.00K
02/05/2014	Heavy Snow	0	0	0.00K
02/05/2014	Heavy Snow	0	0	0.00K
02/13/2014	Heavy Snow	0	0	0.00K
02/13/2014	Heavy Snow	0	0	0.00K
02/13/2014	Heavy Snow	0	0	0.00K
02/18/2014	Heavy Snow	0	0	0.00K
02/18/2014	Heavy Snow	0	0	0.00K

Date	Type	Deaths	Injuries	Property Damage
11/26/2014	Heavy Snow	0	0	10.00K
01/24/2015	Heavy Snow	0	0	0.00K
01/24/2015	Heavy Snow	0	0	0.00K
01/24/2015	Heavy Snow	0	0	0.00K
01/26/2015	Heavy Snow	0	0	0.00K
01/26/2015	Heavy Snow	0	0	0.00K
02/02/2015	Heavy Snow	0	0	0.00K
02/02/2015	Heavy Snow	0	0	0.00K
02/02/2015	Heavy Snow	0	0	0.00K
02/08/2015	Heavy Snow	0	0	0.00K
02/08/2015	Heavy Snow	0	0	0.00K
02/08/2015	Heavy Snow	0	0	0.00K
02/14/2015	Heavy Snow	0	0	0.00K
02/14/2015	Heavy Snow	0	0	0.00K
02/14/2015	Heavy Snow	0	0	0.00K
Total		0	0	4.415M

Blizzards are considered to be high frequency events based on past occurrences, as defined by the Massachusetts State Hazard Mitigation Plan, 2013. This hazard occurs more than once in five years, with a greater than 20 percent chance of occurring each year.

Ice Storms

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

Description	Diameter (inches)
Pea	0.25
Marble or Mothball	0.50
Penny or Dime	0.75
Nickel	0.88
Quarter	1.00
Half Dollar	1.25

Walnut or Ping Pong Ball	1.50
Golf ball	1.75
Hen's Egg	2.00
Tennis Ball	2.50
Baseball	2.75
Tea Cup	3.00
Grapefruit	4.00
Softball	4.50

While ice pellets and sleet are examples of these, the greatest hazard is created by freezing rain conditions, which is rain that freezes on contact with hard surfaces leading to a layer of ice on roads, walkways, trees, and other surfaces. The conditions created by freezing rain can make driving particularly dangerous and emergency response more difficult. The weight of ice on tree branches can also lead to falling branches damaging electric lines.

Town-specific data for previous ice storm occurrences are not collected by the Town of Wilmington. The best available local data is for Middlesex County through the National Climatic Data Center (see Table 13). Middlesex County, which includes the Town of Wilmington, experienced four ice storm events from 1995 –2015. No deaths or injuries were reported and the total reported property damage in the county was $6.155 million dollars.

Table 13- Middlesex County Ice Storm Events, 1995-2015

Location	Date	Type	Deaths	Injuries	Damage
Totals:			0	0	6.155M
WESTERN MIDDLESEX (ZONE)	01/09/1998	Ice Storm	0	0	5.00K
WESTERN MIDDLESEX (ZONE)	11/16/2002	Ice Storm	0	0	150.00K
NORTHWEST MIDDLESEX COUNTY (ZO...	12/11/2008	Ice Storm	0	0	3.000M
WESTERN MIDDLESEX (ZONE)	12/11/2008	Ice Storm	0	0	3.000M
Totals:			0	0	6.155M

Source: NOAA, National Climatic Data Center

Ice storms are considered to be medium frequency events based on past occurrences, as defined by the Massachusetts State Hazard Mitigation Plan, 2013. This hazard occurs once in 5 years to once in 50 years, with 2% to 20% chance of occurring each year.

The impacts of winter storms are often related to the weight of snow and ice, which can cause roof collapses and also causes tree limbs to fall which can in turn cause property damage and potential injuries.

Winter storms are a potential Town-wide hazard in Wilmington. The Town's vulnerability is primarily related to restrictions to travel on roadways, temporary road closures, school closures, and potential restrictions on emergency vehicle access. The Town works to clear roads and carries out general snow removal operations, and bans on-street parking during snow removal to ensure that streets can be plowed and public safety vehicle access is maximized. Transit operations may also be impacted, as they were in the 2015 blizzard which caused the closure of the MBTA system for one day and limited services on several transit lines for several weeks. Another winter storm vulnerability is power outages due to fallen trees and utility lines.

Winter storms are considered to be high frequency events based on past occurrences, as defined by the Massachusetts State Hazard Mitigation Plan, 2013. This hazard occurs more than once in years, with a greater than percent chance of occurring each year.

Geologic Hazards

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

Earthquakes

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

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

Richter Magnitudes	**Earthquake Effects**
Less than 3.5	Generally not felt, but recorded
3.5- 5.4	Often felt, but rarely causes damage

Richter Magnitudes	Earthquake Effects
Under 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas up to about 100 km. across where people live.
7.0- 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or greater	Great earthquake. Can cause serious damage in areas several hundred meters across.

Source: Nevada Seismological Library (NSL), 2005

According to the State Hazard Mitigation Plan, New England experiences an average of five earthquakes per year. From 1668 to 2007, 355 earthquakes were recorded in Massachusetts (NESEC). Most have originated from the La Malbaie fault in Quebec or from the Cape Anne fault located off the coast of Rockport. The region has experienced larger earthquakes, including a magnitude 5.0 earthquake in 1727 and a 6.0 earthquake that struck in 1755 off the coast of Cape Ann. More recently, a pair of damaging earthquakes occurred near Ossipee, NH in 1940, and a 4.0 earthquake centered in Hollis, Maine in October 2012 was felt in the Boston area. Historical records of some of the more significant earthquakes in the region are shown in Table 14.

Table 14- Historical Earthquakes in Massachusetts or Surrounding Area

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

Table 14- Historical Earthquakes in Massachusetts or Surrounding Area

Location	Date	Magnitude
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

One measure of earthquake risk is ground motion, which is measured as maximum peak horizontal acceleration, expressed as a percentage of gravity (1 g). The range of peak ground acceleration in Massachusetts is from 10g to 20g, with a 2% probability of exceedance in 50 years. Wilmington is in the middle part of the range for Massachusetts, at 14g to 16g, making it a relatively moderate area of earthquake risk within the state, although the state as a whole is considered to have a low risk of earthquakes compared to the rest of the country. There have been no recorded earthquake epicenters within Wilmington.

Although New England has not experienced a damaging earthquake since 1755, seismologists state that a serious earthquake occurrence is possible. There are five seismological faults in Massachusetts, but there is no discernible pattern of previous earthquakes along these fault lines. Earthquakes occur without warning and may be followed by aftershocks. Most older buildings and infrastructure were constructed without specific earthquake resistant design features.

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

Earthquakes are a potential Town-wide hazard in Wilmington. The Town has many older buildings that pre-date current building code which could be vulnerable in the event of a severe earthquake. Potential earthquake damages to Wilmington have been estimated using HAZUS-MH. Total building damages are estimated at $825 million for a 5.0 magnitude earthquake and $9.1 billion for a 7.0 magnitude earthquake. Other potential impacts are detailed in Table 22.

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

Landslides

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

Landslides can result from human activities that destabilize an area or can occur as a secondary impact from another natural hazard such as flooding. In addition to structural damage to buildings and the blockage of transportation corridors, landslides can lead to sedimentation of water bodies. Typically, a landslide occurs when the condition of a slope changes from stable to unstable. Natural precipitation such as heavy snow accumulation, torrential rain and run-off may saturate soil creating instability enough to contribute to a landslide. The lack of vegetation and root structure that stabilizes soil can destabilize hilly terrain.

There is no universally accepted measure of landslide extent but it has been represented as a measure of the destructiveness. The table below summarizes the estimated intensity for a range of landslides. For a given landslide volume, fast moving rock falls have the highest intensity while slow moving landslides have the lowest intensity.

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

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

The entire Town has been classified as having a low incidence risk for landslides, less than 1.5 % of the area is involved in land sliding. (Map 4, Appendix B) The Town does not have records of any damages caused by landslides in Wilmington. Because of this, no specific mitigation measures for landslides have been included in the plan update.

Should a landslide occur in the future, the type and degree of impacts would be highly localized, and the Town's vulnerabilities could include damage to structures, damage to transportation and other infrastructure, and localized road closures. Injuries and casualties, while possible, would be unlikely given the low extent and impact of landslides in Wilmington.

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

Fire Related Hazards

A brush fire is an uncontrolled fire occurring in a forested or grassland area. In the Boston Metro region these fires rarely grow to the size of a wildfire as seen more typically in the western U.S. As their name implies, these fires typically burn no more than the underbrush of a forested area. Wildfire season can begin in March and usually ends in late November. The majority of wildfires typically occur in April and May, when most vegetation is void of any appreciable moisture, making them highly flammable. Once "green-up" takes place in late May to early June, the fire danger usually is reduced somewhat.

These fires can present a hazard where there is the potential for them to spread into developed or inhabited areas, particularly residential areas where sufficient fuel materials might exist to allow the fire the spread into homes.

The Fire Department responds to approximately 75 brush fires annually. About 10% of these involve significant property damage but none have resulted in any deaths. Most brush fires are caused by careless disposal of cigarettes and by weather conditions such as lack of rainfall, winds and lightning. The higher risk areas are along the highway and in densely wooded areas.

The following areas of Town were identified as having the highest potential for brush fires based on past occurrences and their potential for the accumulation of dried vegetation growth. The numbers correspond to the numbers on Map 8, "Hazard Areas".

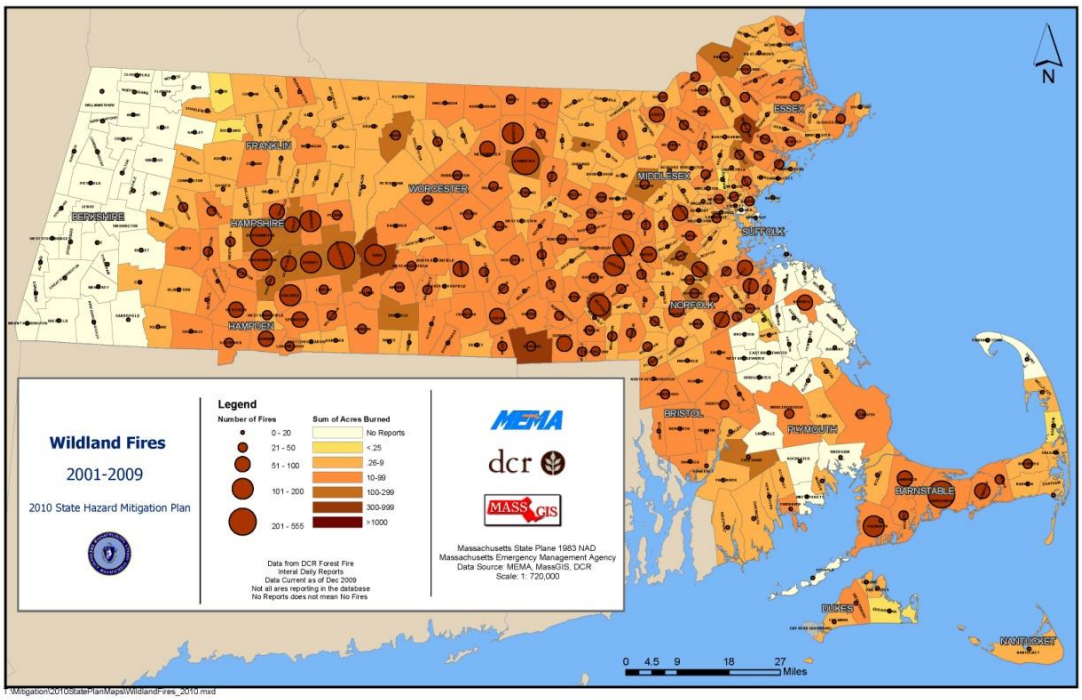
9. BMC Recycling Facility- Fire- (876 Boston Road,Tewksbury): Regional fire problem: compost fires with limited access for fire vehicles.

10. Wilmington Recycling Facility- Fire- Infrequent compost fires due to heat from composting; infrequent small brush fires caused by vandalism.

11. Wilmington Town Forest- Fire- No fires reported here since 2008. This area has road access and a new water tower was installed in 2011.

Wildfires in Massachusetts are measured by the number of fires and the sum of acres burned. The most recent data available for wildfires in Massachusetts, shown in Figure 2 below, indicates that the wildfire extent in Wilmington consists of 10-99 acres burned, with 51 -100 fires from 2001 to 2009.

Figure 2 Massachusetts Wildfires 2001-2009



Source: Massachusetts State Hazard Mitigation Plan

Potential vulnerabilities to wildfires include damage to structures and other improvements, and impacts on natural resources such as the Town Forest. Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations including children, the elderly, and those with respiratory and cardiovascular diseases.

Based on past occurrences and the Massachusetts Hazard Mitigation Plan 2013, brushfires are of High frequency, events that occur more frequently than once in 5 years (Greater than 20% per year)

Extreme Temperatures

Extreme temperatures occur when either high temperature or low temperatures relative to average local temperatures occur. These can occur for brief periods of time and be acute,

or they can occur over long periods of time when there is a prolonged period of excessively hot or cold weather.
Wilmington has four well-defined seasons. The seasons have several defining factors, with temperature one of the most significant. Extreme temperatures can be defined as those, which are far outside of the normal seasonal ranges for Massachusetts. The average temperatures for Massachusetts are: winter (Dec-Feb) Average = 31.8°F and summer (Jun-Aug) Average = 71°F. Extreme temperatures are a Town-wide hazard.

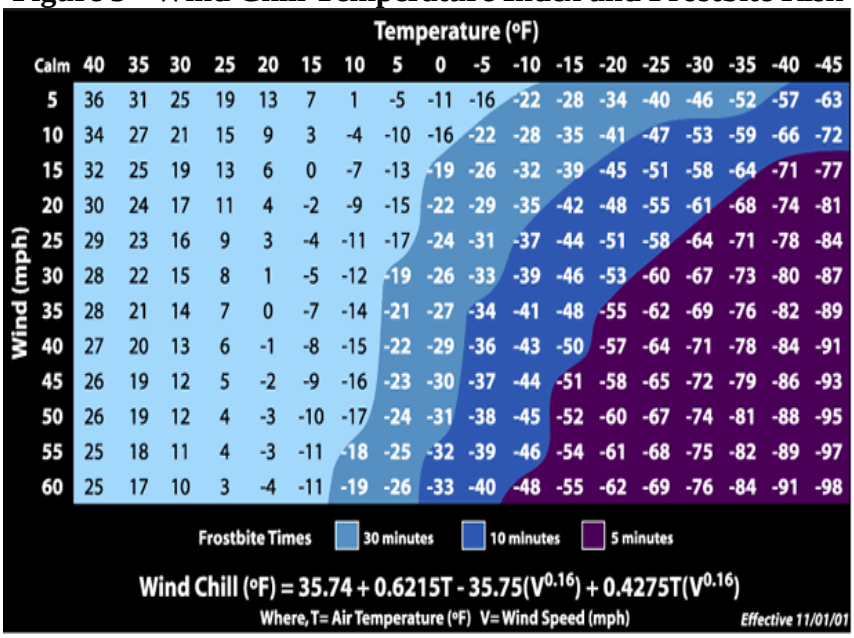
Extreme Cold

For extreme cold, temperature is typically measured using Wind Chill Temperature Index, which is provided by the National Weather Service (NWS). The latest version of the index was implemented in 2001 and it meant to show how cold conditions feel on unexposed skin. The index is provided in Figure 3 below.

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

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

Figure 3 - Wind Chill Temperature Index and Frostbite Risk



The Town of Wilmington does not collect data for previous occurrences of extreme cold. The best available local data are for Middlesex County, 1995- 2015, through the National

Climatic Data Center (NCDC). There are three extreme cold events on record which caused no deaths and no injuries, property damage (see Table 15).

Table 15 – Middlesex County Extreme Cold and Wind Chill Occurrences

Date	Location	Type	Deaths	Injuries	Property Damage
2/15/2015	Western Middlesex	Extreme Cold/wind Chill	0	0	0
2/16/2015	Northwest Middlesex	Extreme Cold/wind Chill	0	0	0
2/16/2015	Southeast Middlesex	Extreme Cold/wind Chill	0	0	0

Source: NOAA, National Climatic Data Center

Extreme Heat

While a heat wave for Massachusetts is defined as three or more consecutive days above 90°F, another measure used for identifying extreme heat events is through a Heat Advisory from the NWS. These advisories are issued when the heat index (Figure 4) is forecast to exceed 100 degree Fahrenheit (F) for 2 or more hours; an excessive heat advisory is issued if forecast predicts the temperature to rise above105 degree F.

Figure 4- Heat Index Chart

Relative Humidity (%) \ Temperature (°F)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Category	Heat Index	Health Hazards
Extreme Danger	130 °F – Higher	Heat Stroke or Sunstroke is likely with continued exposure.
Danger	105 °F – 129 °F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Extreme Caution	90 °F – 105 °F	Sunstroke, muscle cramps, and/or heat exhaustions possible with prolonged exposure and/or physical activity.
Caution	80 °F – 90 °F	Fatigue possible with prolonged exposure and/or physical activity.

Extreme heat poses a potentially greater risk to 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. Hot summer days can also worsen air pollution. With increased extreme heat, urban areas of the Northeast are likely to experience more days that fail to meet air quality standards.

The Town of Wilmington does not collect data on excessive heat occurrences. The best available local data are for Middlesex County, through the National Climatic Data Center. From 1999 - 2015, there has been a total of one excessive heat event, with no reported deaths, no injuries, and no property damage resulting from excessive heat (see Table 16).

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

Table 16 – Middlesex County Extreme Heat Occurrences 1999-2015

DATE	EVENT_TYPE	DEATHS	INJURIES	DAMAGE
7/6/2010	Excessive Heat	0	0	0

Source: NOAA, National Climatic Data Center

Drought

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

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

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

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

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

As dry conditions can have a range of different impacts, a number of drought indices are available to assess these various impacts. Massachusetts uses a multi-index system that takes advantage of several of these indices to determine the severity of a given drought or extended period of dry conditions. Drought level is determined monthly based on the number of indices which have reached a given drought level. Drought levels are declared on a regional basis for each of six regions in Massachusetts. County by county or watershed-specific determinations may also be made.

A determination of drought level is based on seven indices:

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

Determinations regarding the end of a drought or reduction of the drought level focus on two key drought indicators: precipitation and groundwater levels. These two factors have

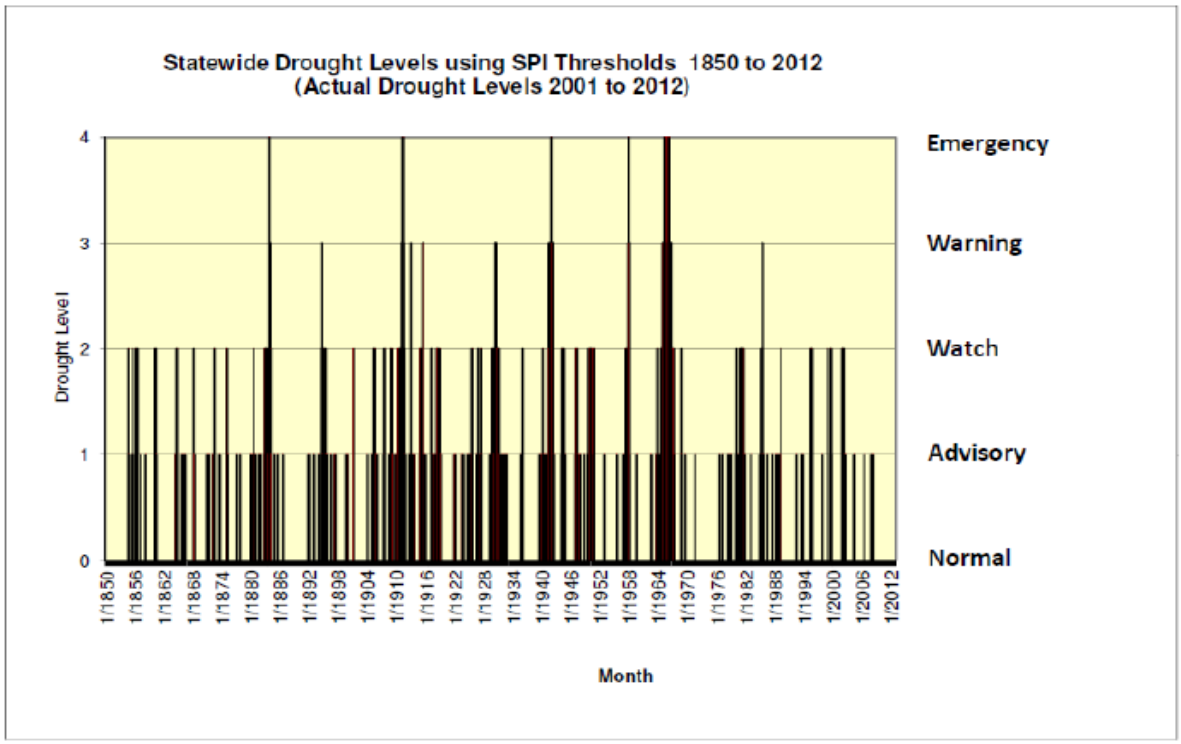
the greatest long-term impact on stream flow, water supply, reservoir levels, soil moisture and potential for forest fires.

Previous Occurrences

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

Figure 5 depicts the incidents of drought levels' occurrence in Massachusetts from 1850 to 2012 using the Standardized Precipitation Index (SPI) parameter alone. On a monthly basis, the state would have been in a Drought Watch to Emergency condition 11 percent of the time between 1850 and 2012. Table 17 summarizes the chronology of major droughts since the 1920's.

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



(Source: Mass. State Drought Management Plan 2013)

Drought Emergency

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

Drought Warning

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

Drought Watch

Drought Watches not associated with higher levels of drought generally have occurred in three to four years per decade between 1850 and 1950. In the 1980s, there was a lengthy drought Watch level of precipitation between 1980 and 1981, followed by a drought Warning in 1985. A frequency of drought Watches at a rate of three years per decade resumed in the 1990s (1995, 1998, 1999). In the 2000s, Drought Watches occurred in 2001 and 2002. The overall frequency of being in a drought Watch is 8 percent on a monthly basis over the 162-year period of record.

Table 17 - Chronology of major droughts in Massachusetts

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

Date	Area affected	Recurrence interval (years)	Remarks
1985-88	Housatonic River basin	25	Duration and severity unknown. Streamflow showed mixed trends elsewhere.

Probability of Future Occurrences

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

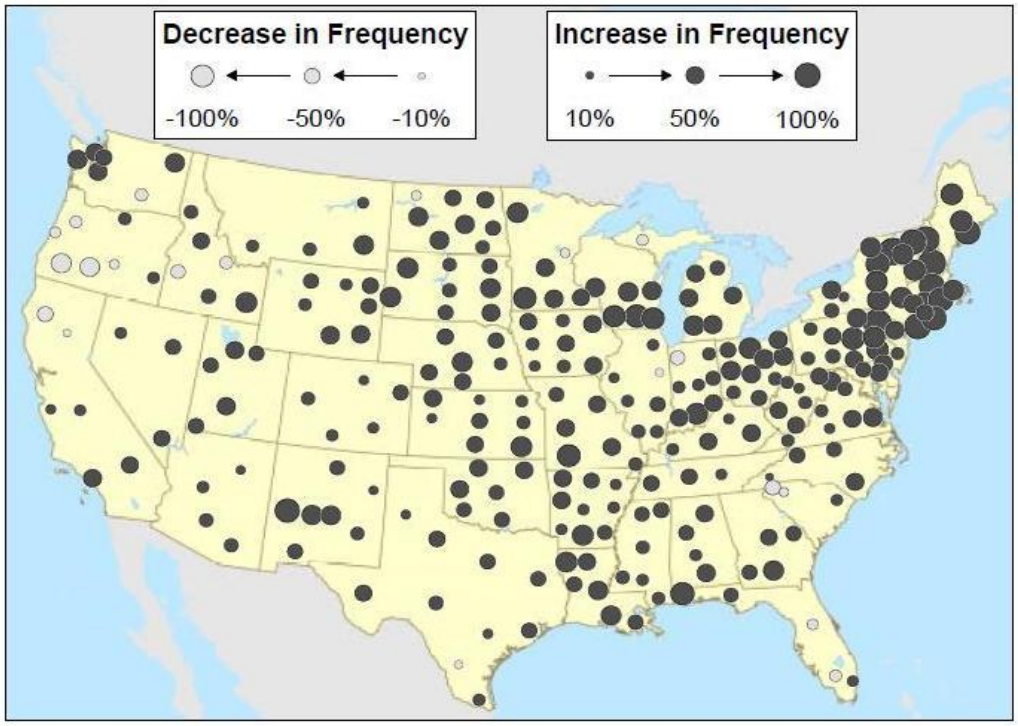
Impacts of Climate Change

Many of the natural hazards that Wilmington has historically experienced are likely to be exacerbated by climate change in future years. This is particularly true for flooding caused by extreme precipitation and extreme heat. These are described in more detail below.

Climate Change Impacts: Extreme Precipitation

Wilmington's average annual precipitation is 42 inches. While total annual precipitation has not changed significantly, according to the 2012 report *When It Rains It Pours – Global Warming and the Increase in Extreme Precipitation from 1948 to 2011* intense rainstorms and snowstorms have become more frequent and more severe over the last half century in the northeastern United States**.** Extreme downpours are now happening 30 percent more often nationwide than in 1948 (see Figure 6). In other words, large rain or snow storms that happened once every 12 months, on average, in the middle of the 20th century, now happen every nine months.

Figure 6- Changes in Frequency of Extreme Downpours, 1948 – 2011



Source: *When It Rains It Pours – Global Warming and the Increase in Extreme Precipitation*, Environment America Research and Policy Center, July 2012

Not only are these intense storm events more frequent, they are also more severe: the largest annual storms now produce 10 percent more precipitation, on average, than in 1948. In particular, the report finds that New England has experienced the greatest change with intense rain and snow storms occurring 85 percent more often than in 1948.

At the other extreme, changes in precipitation patterns and the projected future rising temperatures due to climate change (discussed below) will likely increase the frequency of short-term (one- to three-month) droughts and decrease stream flow during the summer.

Climate Change Impacts: Extreme Heat

Recent temperature trends suggest greater potential impacts to come due to climate change. In the report "Confronting Climate Change in the U.S. Northeast," (2007), the Union of Concerned Scientists presented temperature projections to 2099 based on two scenarios, one with lower carbon dioxide emissions, and the other with high emissions.

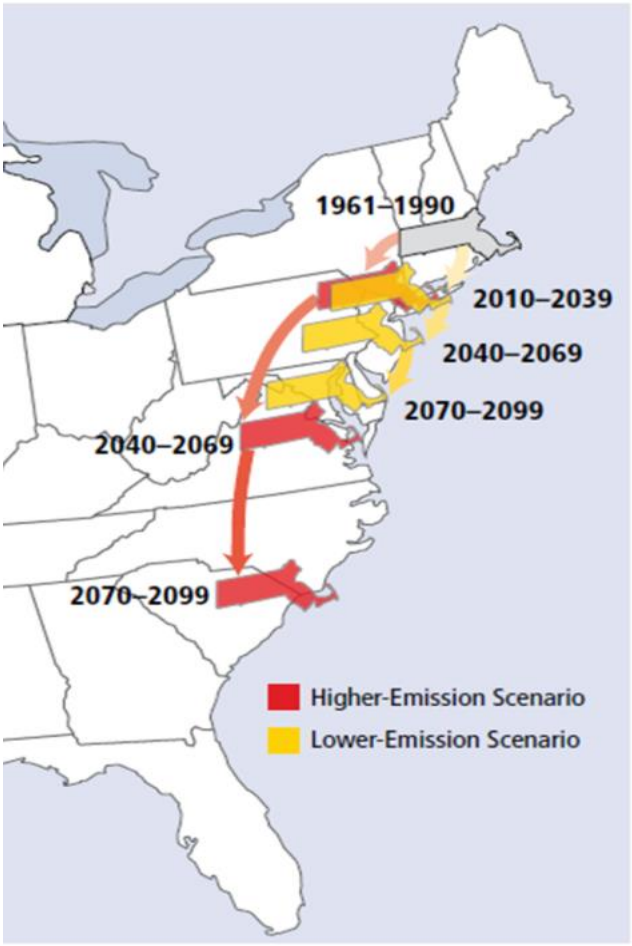


Figure 7 – Mass. Extreme Heat Scenarios

Between 1961 and 1990, Boston experienced an average of 11 days per year over 90°F. That could triple to 30 days per year by 2095 under the low emissions scenario, and increase to 60 days per year under the high emissions scenario. Days over 100°F could increase from the current average of one day per year to 6 days with low emissions or 24 days with high emissions By 2099, Massachusetts could have a climate similar to Maryland's under the low emissions scenario, and similar to the Carolinas' with high emissions (Figure 12). Furthermore, the number of days with poor air quality could quadruple in Boston by the end of the 21st century under higher emissions scenario, or increase by half under the lower emissions scenario. These extreme temperature trends could have significant impacts on public health, particularly for those individuals with asthma and other respiratory system conditions, which typically affect the young and the old more severely.

Source: Union of Concerned Scientists

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 18 shows the acreage and percentage of land in 20 categories. If the four residential categories are aggregated, residential uses make up 35.34% of the area of the Town (3879.56 acres). Commercial and industrial combined make up 10.96 % of the Town, or 1203.48 acres.

Table 18- 2005 Land Use

Land Use Type	Acres	Percent
Cropland	33.24	0.30%
Pasture	28.55	0.26%
Forest	3941.82	35.91%
Non Forested Wetland	725.36	6.61%
Mining	221.77	2.02%
Open Land	298.34	2.72%
Participation Recreation	60.26	0.55%
Spectator Recreation	5.31	0.05%
Water Recreation	2.92	0.03%
Multifamily Residential	23.18	0.21%
High Density Residential	0.00	0.00%
Medium Density Residential	2158.68	19.67%
Low Density Residential	1697.71	15.47%
Commercial	304.38	2.77%
Industrial	899.11	8.19%
Urban Open	142.50	1.30%
Transportation	279.21	2.54%
Waste Disposal	79.95	0.73%
Water	79.95	0.63%
Woody Perennial	5.61	0.05%
Totals	10976.86	100.00%

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

Economic Elements

Wilmington has a strong economic foundation. The Town has about as much employment as it does population, a rarity among Boston suburbs. Wilmington has joined the cities of Waltham, Woburn and Peabody and the Town of Burlington as a major

employment center in the Route I-95 area. Almost one-half of Wilmington's employment is in manufacturing, another unusual situation. More typically, suburban Towns have most employment in trade and services categories. Wilmington has pursued a policy of attracting industry by allowing the creation of modern industrial parks in several parts of Town, most notably those with excellent accessibility to Routes I-93 and I-95. Industrial development is concentrated in the General Industrial zones along I-93 in the northeast and southeast areas of Wilmington. There is also some industrial development north of Concord Street along the border with North Reading. Most of the industrial development, primarily planned industrial parks, is low density in character with modern one and two story buildings. (Wilmington Master Plan)

Historic, Cultural, and Natural Resource Areas

The first European settlers came to what is now Wilmington in 1665, during the early years of the Massachusetts Bay Colony. Although the area currently occupied by Wilmington was at that time part of other communities, the Town was formally incorporated in 1730. It continued to grow thereafter and was on the route of the Middlesex Canal and three railroad lines constructed during the nineteenth century. As a result, there are numerous historical resources in Wilmington. These include historic homes, structures (such as the Middlesex Canal), mill sites, and old farmsteads. These historic resources contribute to Town character and are important educational tools for teaching Wilmington students about local and American history. Wilmington's Historic District is centered on the Town Common. It also includes most of the properties along Middlesex Avenue from the Common north to past the First Congregational Church. (Wilmington Master Plan)

Wilmington's cultural resources include both the Council for the Arts and the Wilmington Arts Center. The Council for the Arts programs includes concerts at Town Hall, museum passes and library presentations while the Arts Center offers art classes, exhibits and the annual Winter Tree Festival.

The high percentage of wet soils creates a landscape dominated by wetlands. Now covering slightly less than 20% of the Town's total land area, Wilmington's streams, ponds, swamps, bogs, and other permanently or perennially wet lands are generally of moderate area (25-75 acres) and interspersed among higher formations. Several large open swamp areas occur, such as the remnants of the old Cedars of Lebanon and Ladderpole Swamps. The wetlands in the northwest along the Tewksbury line and west of Interstate 93 cover approximately 250 acres. Many smaller wetlands scattered throughout Town provide visual relief from urban development and serve as natural buffers for privacy, wildlife habitat, and – if left intact – working drainage systems to prevent flooding. The remaining green spaces serve as reminders of the Town's more rural past. Rounded hills and relatively broad lowlands characterize its topography. Elevations generally range between 80 and 120 feet above mean sea level, with higher terrain and steeper slopes to the north overlooking Foster's Pond near the Andover Town line, and to the southwest along the border with Burlington. The highest point is 255 feet,

site of the water tower in the Town Forest; the lowest elevation is 70 feet above mean sea level where the Ipswich River flows into Reading and North Reading just east of Interstate 93. (Wilmington Open Space and Recreation Plan)

Development Trends

Wilmington's original dispersed agricultural character has been replaced by more developed suburbia as transportation services have expanded and improved. This has resulted in increased population density. Although population growth has slowed, a buildout analysis performed in 2000 shows that current zoning would allow over 1200 new residential lots. Development at full buildout would significantly reduce land available for active and passive recreation while increasing the demand for such amenities as well as increase stormwater runoff, pervious surfaces and flooding. (Wilmington Open Space and Recreation Plan)

Development trends throughout the metropolitan region are tracked by MAPC's Development Database, which provides an inventory of new development over the last decade. The database tracks both completed developments and those currently under construction. The database includes 25 developments in the Town of Wilmington since 2008, of which 23 are completed and 2 were under construction or planned for beyond 2015.

The database also includes several attributes of the new development, including site acreage, housing units, and commercial space. The 25 developments in Wilmington include a total of 240 housing units, 892,365 square feet of commercial space, and are sited on a total of 324 acres (see Table 20).

In order to characterize any change in the Town's vulnerability associated with new developments, a GIS mapping analysis was conducted which overlaid the development sites with the FEMA Flood Insurance Rate Map. The analysis shows that two of the developments, Jacques Lane and North Wilmington Road Estates, are located within a flood zone.

Potential Future Development

MAPC consulted with Town planning staff to determine areas that may be developed in the future, based on the Town's comprehensive planning efforts and current trends and projects. These areas are described below. Two these sites are in a flood hazard zone, though one is located in an X zone with only a 0.2 % chance of flooding.

A. Sciarrapa Farms
This is vacant land with frontage on Andover Street.

B. Redevelopment project with new Target store anchoring a retail mall.

Table 19 **Relationship of Potential Development to Hazard Areas**			
Parcel	**Landslide risk**	**Flood Zone**	**Brush Fire**
A. Sciarrapa Farms	Low	No	No
B. Target	Low	No	No

Table 20- Summary of Wilmington Developments 2008-2015

DEVELOPMENTS COMPLETED 2008-2015	Acres	HOUSING UNITS	COMMERCIAL (SQ FEET)	PROJECT TYPE
Wilmington Crossing	7.55	0	71300	Retail Plaza
Charles River Laboratories	60.18	0	57786	Industrial
36 Middlesex Avenue	0	11	2272	Mixed-use / office
355 Middlesex Avenue	4.49	0	59170	Retail / Office / Restaurant
Progressive Gourmet	3.6	0	20200	Industrial
Wilmington Plaza	25.17	0	2000	Retail
200 Ballardvale Street	20.61	0	345000	Industrial
Leonard Estates / Leonard Lane	17.9	7	0	Residential
Heritage Pines / Lt. Buck Drive	10.96	7	0	
Eleanor Estates	11.8	12	0	12 Single-Family residential homes were constructed through subdivision control.
Jacques Lane Subdivision	5.54	16	0	
Sonic & Learning Express	2.65	0	12977	Restaurant & Educational Daycare Center
Metro at Wilmington Station	11.5	108	0	
Rotary Park Estates	2.88	22	1600	Mixed-Use / Office
Cushing Drive ANR	3.58	5	0	
Analog Devices, Inc.	10.6	0	70000	Industrial
Koch Membrane Systems, Inc.	28.69	0	83940	Industrial
Target Superstore	16.3	0	139000	Retail: At 210 Ballardvale Street, Wilmington, MA which is on the western edge of Ballardvale Street between the street and the highway. The property will have visibility from the highway, I-93. The land is just due north of a small abandoned street.
Proposed Retail Building	1.99	0	12000	

DEVELOPMENTS COMPLETED 2008-2015	Acres	HOUSING UNITS	COMMERCIAL (SQ FEET)	PROJECT TYPE
One Church Street	0.4	8	10800	Mixed-Use / Retail
SUBTOTAL	246.39	196	888045	
UNDER CONSTRUCTION/PLANNED				
McGrane Woods	11.6	7	0	Residential
McDonald Road Estates	64	26	0	Residential
Murray Hill Estates	23	36	0	Residential
13-15 Church Street	0.7	8	4320	Mixed Use / Office / Retail
Rhode Island Road Extension	1.39	3	0	Residential
Total	383.08	276	892,365	

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.). There are 96 facilities identified in Wilmington. These are listed in Table 21 and are shown on the maps in Appendix B.

Explanation of Columns in Table 21

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

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

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

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

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

Column 6: Snowfall. Areas designated "low" receive an annual average of 36.1 to 48.0 inches of snow. Areas designated "high" receive an annual average of 48.1 to 72 inches of snow, as shown on Map 6 in Appendix B.

Column 7.Brush Fires- Areas determined by Local Hazard Mitigation Team to be at risk for brush fires.

Table 21
Critical Facilities and Relationship to Hazard Areas

ID	NAME	TYPE	Landslides	FEMA\ Flood Zone	Locally Identified Area of Flooding	Average Annual Snow Fall-inches	Brush Fires
342-002	Sunbridge Nursing Home	Nursing Home	Low incidence	No	No	H 48.1 - 72.0	No
342-003	Woodbriar Nursing Home	Nursing Home	Low incidence	No	No	H 48.1 - 72.0	No
342-004	Wilmington High School	School	Low incidence	No	No	H 48.1 - 72.0	No
342-005	North School	School	Low incidence	No	No	H 48.1 - 72.0	No
342-006	Middle School	School	Low incidence	No	No	H 48.1 - 72.0	No
342-007	West School	School	Low incidence	X: 0.2% Annual Chance of Flooding	No	H 48.1 - 72.0	No
342-008	Wildwood Street School	School	Low incidence	No	No	H 48.1 - 72.0	No
342-009	Woburn Street School	School	Low incidence	No	No	H 48.1 - 72.0	No
342-010	Shawsheen Elementary School	School	Low incidence	No	No	H 48.1 - 72.0	No
342-011	Abundant Life Christian School	School	Low incidence	No	No	H 48.1 - 72.0	No
342-012	Boutwell School	School	Low incidence	No	No	H 48.1 - 72.0	No
342-013	Wilmington Fire	Fire Station	Low incidence	No	No	H 48.1 - 72.0	No
342-014	Wilmington Police	Police Station	Low incidence	No	No	H 48.1 - 72.0	No
342-015	Ristuccia Exposition Center	Place of Assembly	Low incidence	X: 0.2% Annual Chance of Flooding	No	H 48.1 - 72.0	No
342-016	Wilmington	Municipal	Low incidence	No	No	H 48.1 - 72.0	No

Table 21
Critical Facilities and Relationship to Hazard Areas

ID	NAME	TYPE	Landslides	FEMA\ Flood Zone	Locally Identified Area of Flooding	Average Annual Snow Fall-inches	Brush Fires
	Town Hall	Office					
342-017	Wilmington Department of Public Works	Municipal Office	Low incidence	No	No	H 48.1 - 72.0	No
342-018	Children's Corner Inc	School	Low incidence	No	No	H 48.1 - 72.0	No
342-019	Baptist Church	School	Low incidence	No	No	H 48.1 - 72.0	No
342-020	Brookside Day School	School	Low incidence	No	No	H 48.1 - 72.0	No
342-021	Gingerbread House Preschool	School	Low incidence	No	No	H 48.1 - 72.0	No
342-022	Mill Brook Country Day School	School	Low incidence	No	No	H 48.1 - 72.0	No
342-023	Stepping Stones Nursery School	School	Low incidence	X: 0.2% Annual Chance of Flooding	No	H 48.1 - 72.0	No
342-024	Wilmington Senior Center	Senior Center	Low incidence	No	No	H 48.1 - 72.0	No
342-025	Emergency Dispensing Site - Middle School	School	Low incidence	No	No	H 48.1 - 72.0	No
342-026	NeoResins Inc.	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-027	Barrows Wellfield	Wellfield	Low incidence	No	No	H 48.1 - 72.0	No
342-028	Butters Row	Well	Low incidence	No	No	H 48.1 - 72.0	No

Table 21
Critical Facilities and Relationship to Hazard Areas

ID	NAME	TYPE	Landslides	FEMA\ Flood Zone	Locally Identified Area of Flooding	Average Annual Snow Fall-inches	Brush Fires
	Well #1						
342-029	Nassau Avenue Water Storage Tank	Water Storage Tank	Low incidence	No	No	H 48.1 - 72.0	No
342-030	Wilmington MBTA Station	Transportation Facility	Low incidence	AE: 1% Annual Chance of Flooding; with BFE	No	H 48.1 - 72.0	No
342-031	North Wilmington MBTA Station	Transportation Facility	Low incidence	No	No	H 48.1 - 72.0	No
342-032	Public Buildings Office	Municipal Office	Low incidence	No	No	H 48.1 - 72.0	No
342-033	Winchester Hospital	Hospital	Low incidence	No	No	H 48.1 - 72.0	No
342-034	Mill Brook Country Day School, Inc.	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-035	Stepping Stones Nursery School	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-036	Brookside Nursery School	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-037	Children's Corner, Inc.	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-038	Textron Systems Children's Center	Child Care	Low incidence	No	No	H 48.1 - 72.0	No

Table 21
Critical Facilities and Relationship to Hazard Areas

ID	NAME	TYPE	Landslides	FEMA\ Flood Zone	Locally Identified Area of Flooding	Average Annual Snow Fall-inches	Brush Fires
342-039	Burke, Tracy A Day Care	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-040	The Wonder Years Learning Center, Inc.	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-041	Abundant Life Christian School	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-042	Brooks, Lee Ann Day Care	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-043	Caples, Jean M. Day Care	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-044	Cudia, Lina Day Care	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-045	Bellefontaine, Mary Ann Day Care	Child Care	Low incidence	X: 0.2% Annual Chance of Flooding	No	H 48.1 - 72.0	No
342-046	Kusa, Marilyn Day Care	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-047	Swartz, Pamela J. Day Care	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-048	Straccamoro, Paula M. Day Care	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-049	Misiph, Catherine E. Day Care	Child Care	Low incidence	No	No	H 48.1 - 72.0	No
342-050	Public Safety	Emergency	Low incidence	No	No	H 48.1 - 72.0	No

Table 21
Critical Facilities and Relationship to Hazard Areas

ID	NAME	TYPE	Landslides	FEMA\ Flood Zone	Locally Identified Area of Flooding	Average Annual Snow Fall-inches	Brush Fires
	Building (Police & Fire)	Operations Center					
342-051	Art Center	Emergency Operations Center	Low incidence	No	No	H 48.1 - 72.0	No
342-052	ACME Printing, LLC	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-053	Aggregate Industries N.E Region, Inc.	Hazardous Materials	Low incidence	AE: 1% Annual Chance of Flooding; with BFE	No	H 48.1 - 72.0	No
342-054	Ametek Aerospace & Defense	Hazardous Materials	Low incidence	A: 1% Annual Chance of Flooding; no BFE	No	H 48.1 - 72.0	No
342-055	Ahura Scientific Corporation	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-056	Analog Devices, Inc.	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-057	MKS Instruments, Inc.	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-059	Brown's Crossing Pump Station	Wellfield	Low incidence	AE: 1% Annual Chance of Flooding; with BFE	No	H 48.1 - 72.0	No
342-060	ChemGenes Corporation	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-061	Reading Municipal Light Sub Station	Power Substation	Low incidence	AE: 1% Annual Chance of Flooding; with BFE	Wildwood Street/Meadow Brook	H 48.1 - 72.0	No

Table 21
Critical Facilities and Relationship to Hazard Areas

ID	NAME	TYPE	Landslides	FEMA\ Flood Zone	Locally Identified Area of Flooding	Average Annual Snow Fall-inches	Brush Fires
342-063	EcoLab Inc.HM	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-064	E.H Sargent Water Treatment Plant	Water Treatment Facility	Low incidence	No	No	H 48.1 - 72.0	No
342-065	Energy Sciences, Inc.	Hazardous Materials	Low incidence	X: 0.2% Annual Chance of Flooding	No	H 48.1 - 72.0	No
342-066	Engelhard Surfaces Technologies	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-067	Rolling Frito-Lay Sales, L.P	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-068	Gibbs Oil Company, L.P	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-069	Lehigh Northeast Cement Co.	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-070	Progressive Gourmet Company, Inc.	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-071	Amerada Hess Express Gas Station	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-072	Hubbard-Hall, Inc.	Hazardous Materials	Low incidence	X: 0.2% Annual Chance of Flooding	No	H 48.1 - 72.0	No
342-073	Koch Membrane Systems, Inc.	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-074	Napa	Hazardous	Low incidence	No	No	H 48.1 - 72.0	No

Table 21
Critical Facilities and Relationship to Hazard Areas

ID	NAME	TYPE	Landslides	FEMA\ Flood Zone	Locally Identified Area of Flooding	Average Annual Snow Fall-inches	Brush Fires
	Distribution Center	Materials					
342-075	Shell Service Station	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-076	Shell Service Station	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-077	SourceOne Healthcare Technologies	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-078	AllCoat Technology, Inc.	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-079	Textron Systems Corporation	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-080	Verizon Wireless - Wilmington North Cell	Communication Tower	Low incidence	No	No	H 48.1 - 72.0	No
342-081	Verizon Wireless - Wilmington South Cell	Communication Tower	Low incidence	X: 0.2% Annual Chance of Flooding	No	H 48.1 - 72.0	No
342-082	Verizon - Wilmington Exchange	Telecommunications	Low incidence	No	No	H 48.1 - 72.0	No
342-083	Verizon - Wilmington Cell Tower	Communication Tower	Low incidence	No	No	H 48.1 - 72.0	No
342-084	NOVEON	Hazardous	Low incidence	No	No	H 48.1 - 72.0	No

Table 21
Critical Facilities and Relationship to Hazard Areas

ID	NAME	TYPE	Landslides	FEMA\ Flood Zone	Locally Identified Area of Flooding	Average Annual Snow Fall-inches	Brush Fires
		Materials					
342-085	Wilmington Cold Storage, Inc.	Hazardous Materials	Low incidence	X: 0.2% Annual Chance of Flooding	No	H 48.1 - 72.0	No
342-041	Cell Tower	Communication Tower	Low incidence	No	No	H 48.1 - 72.0	No
342-087	Xexon Corporation	Hazardous Materials	Low incidence	No	No	H 48.1 - 72.0	No
342-088	Research Drive Water Storage Tank	Water Storage Tank	Low incidence	No	No	H 48.1 - 72.0	Wilmington Town Forest
342-089	Shawsheen River Estates Pump Station	Sewer Pumping Station	Low incidence	No	No	H 48.1 - 72.0	No
342-090	Salem Street Sewer Pump Station	Sewer Pumping Station	Low incidence	No	No	H 48.1 - 72.0	No
342-091	Town Park Septage Station	Sewer Pumping Station	Low incidence	AE: 1% Annual Chance of Flooding; with BFE	No	H 48.1 - 72.0	No
342-092	Pilcher Drive Sewer Pump Station	Sewer Pumping Station	Low incidence	X: 0.2% Annual Chance of Flooding	No	H 48.1 - 72.0	No
342-093	Industrial Way Sewer Pump Station	Sewer Pumping Station	Low incidence	No	No	H 48.1 - 72.0	No
342-094	Adelaide Street Sewer Pump Station	Sewer Pumping Station	Low incidence	No	No	H 48.1 - 72.0	No
342-095	Hillside Way	Water Storage	Low incidence	No	No	H 48.1 - 72.0	No

Table 21
Critical Facilities and Relationship to Hazard Areas

ID	NAME	TYPE	Landslides	FEMA\ Flood Zone	Locally Identified Area of Flooding	Average Annual Snow Fall-inches	Brush Fires
	Water Storage Tank	Tank					
342-096	Water Booster Station	Water Booster Station	Low incidence	No	No	H 48.1 - 72.0	No
342-097	Salem Street Well	Well	Low incidence	AE: Regulatory Floodway	No	H 48.1 - 72.0	No

Vulnerability Assessment

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

Introduction to HAZUS-MH

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

> "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 Wilmington, 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 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.

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 1% and .0.2% 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 22 - Estimated Damages from Hurricanes

	100 Year	500 Year
Building Characteristics		
Estimated total number of buildings	7,568	
Estimated total building replacement value (2010$)	$3,478	
Millions of dollars		
Building Damages		
# of buildings sustaining minor damage	149	1,020
# of buildings sustaining moderate damage	8	134
# of buildings sustaining severe damage	0	6
# of buildings destroyed	0	2
Population Needs		
# of households displaced	0	22
# of people seeking public shelter	0	4
Debris		
Building debris generated (tons)	5,257	15,994
Tree debris generated (tons)	2,298	6339
# of truckloads to clear building debris	21	122
Value of Damages (Thousands of dollars)		
Total property damage (buildings and content)	$16,013.63	$57,070.28
Total losses due to business interruption	$411.09	$3,162.52

Estimated Damages from Earthquakes

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

Table-23
Estimated Damages from Earthquakes

	Magnitude 5.0	**Magnitude 7.0**
Building Characteristics		
Estimated total number of buildings	7,568	
Estimated total building replacement value (2010 $) Millions of dollars	$3,478	
Building Damages		
# of buildings sustaining slight damage	2,139	114
# of buildings sustaining moderate damage	929	1,160
# of buildings sustaining extensive damage	175	2,123
# of buildings completely damaged	29	4,165
Population Needs		
# of households displaced	93	4,376
# of people seeking public shelter	48	2,299
Debris		
Building debris generated (million tons)	0.07	0.92
# of truckloads to clear debris (@ 25 tons/truck)	2,920	36,720
Value of Damages (Millions of dollars)		
Total property damage	$363.64	$3,543.44
Total losses due to business interruption	$40.21	$356.42

Estimated Damages from Flooding

Although HAZUS-MH was used to estimate damages from hurricanes and tornadoes, MAPC did not use HAZUS-MH to estimate flood damages in Wilmington. The riverine module is not a reliable indicator of flooding in suburban areas such as Wilmington, where drainage systems contribute to flooding even when structures are not within a mapped flood zone In lieu of using HAZUS, MAPC developed a methodology to provide an approximation of flood damages in areas of the Town where structures have been affected in the past.

We estimated the acreage in these three areas as 222.88 acres. Wilmington is 10,976.86 acres, so the 222.88 acres of impacted areas comprise 2.03 % of Wilmington's land area. The number of structures in each flood area was estimated by assuming that if 2.03 % of the land area is affected by flooding, then 2.03 % of the total buildings are also affected. According to HAZUS there are 7,568 structures in Wilmington, which HAZUS estimates have an average replacement value of $459,567 per structure. Then, as suggested in the FEMA publication, "State and Local Mitigation Planning How-to Guides" (Page 4-13), we calculated a low estimate (assuming 10% of the building is damaged) and a high estimate (assuming up to 50% of the building is damaged). The results, as shown in Table 24, indicate a range of damages from $347.8 million to $1,739 million due to flooding.

Table 24 - Estimated Damages from Flooding

Flood Hazard Areas with Known Damages in Past	Wildwood Street/Meadow Brook Concord Brook/Lubbers Brook Route 62/Salem Street/Martins Brook Lubbers Brook Main Street Butter's Row Burt Road North Street
Estimated Area of Hazard Areas	222.88 acres
Total Wilmington Land Area	10,976.86 acres
Hazard Area as % of Total Land Area	2.03 %
Total Structures in Wilmington (HAZUS)	7,568
Estimated # of Structures in Hazard Area (2.03 % of total)	15
Estimated Replacement Value of All Structures (HAZUS) Millions of dollars	$ 3,478

Replacement Value Per Building	$459,567
Low Estimate of Potential Damages (10% Damage	$ 689,350
High Estimate of Potential Damages (50% Damage)	$ 3,446,752

V. HAZARD MITIGATION GOALS

The Wilmington Local Hazard Mitigation Planning Team reviewed and discussed the goals from the 2008 Hazard Mitigation Plan for the Town of Wilmington. The Team modified their 2008 goals to reflect a more inclusive and streamlined approach for this plan update. All of the goals are considered critical for the Town and they are not listed in order of importance.

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

2. Build and enhance local mitigation capabilities to ensure individual safety, reduce damage to public and private property and ensure continuity of emergency services.

3. Increase cooperation and coordination among private entities, Town officials and Boards, State agencies and Federal agencies.

4. Increase awareness of the benefits of hazard mitigation through outreach and education.

VI. EXISTING MITIGATION MEASURES

The existing protections in the Town of Wilmington are a combination of zoning, land use, and environmental regulations, infrastructure maintenance and drainage infrastructure improvement projects. Infrastructure maintenance generally addresses localized drainage clogging problems, while large scale capacity problems may require pipe replacement or invert elevation modifications. These more expensive projects are subject to the capital budget process and lack of funding is one of the biggest obstacles to completion of some of these.

The Town's existing mitigation measures are listed by hazard type here and are summarized in Table 25 below.

Flooding – Existing Town-wide mitigation

Wilmington employs a number of practices to help minimize potential flooding and impacts from flooding, and to maintain existing drainage infrastructure. Existing Town-wide mitigation measures include the following:

National Flood Insurance Program (NFIP) – Wilmington participates in the NFIP with 75 policies in force as of the May 31, 2015. FEMA maintains a database on flood insurance policies and claims. This database can be found on the FEMA website at https://www.fema.gov/policy-claim-statistics-flood-insurance/policy-claim-statistics-flood-insurance/policy-claim-13

The following information is provided for the Town of Wilmington:

Flood insurance policies in force (as of May 31, 2015)	75
Coverage amount of flood insurance policies	$20,697,400
Premiums paid	$90,385
Total losses (all losses submitted regardless of the status)	36
Closed losses (Losses that have been paid)	25
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	11
Total payments (Total amount paid on losses)	$168,744.13

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.

Massachusetts State Building Code – The Massachusetts State Building Code contains many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing, and snow loads. The Town has adopted the state building code.

Street sweeping – The Town does most of its street sweeping in-house but hires a contractor in the spring to supplement the Towns' efforts. The Town has two vacuum sweepers which are

ten years old and will eventually need to be replaced. Every street is swept once in the spring and other problem areas throughout the Town are swept several times a year.

Catch basin cleaning – The Town has an older Vac-All and a catch basin cleaning truck. Every basin is cleaned every other year and all the work is done in-house.

Plans and Studies: The Town has undertaken numerous studies related to drainage issues including:

- Final Report: Planning for Growth in the Upper Ipswich River Watershed, June 2002.
- Assessment of Habitat Fish Communities and Streamflow Requirements for Habitat Protection, Ipswich River, MA 1998-99 from USGS 2001.
- A Precipitation-Runoff Model for Analysis of the Effects of Water Withdrawals on Streamflow, Ipswich River Basin, MA from USGS 2000
- Flow Impairment Report on the Headwaters of the Ipswich River from Headwaters Stream Team (2000).

The Wilmington Zoning Bylaw

Section 21 establishes zoning districts, including a Flood Plain Conservancy District. The Wilmington Flood Insurance Rate Map (FIRM) dated June 4, 2010 is referenced.

Section 3.7.1 lists prohibited uses, including mobile homes. Section 6.2 is the flood plain district.

Section 6.2.1 lists the seven purposes of the flood plain district regulations

Section 6.2.2 relates to the flood plain district boundaries, base flood elevation and floodway data. The district boundaries include all special flood hazard areas designated on the Wilmington Flood Insurance Rate Map (FIRM) issued by FEMA and dated June 4, 2010 as Zone A, AE, AH, AO, A99 and V. These areas constitute the regulatory flood plain and the regulatory floodway.

Section 6.2.2.2 states that in Zone A, where no regulatory floodway has been designated, the best available Federal, State, local or other floodway data shall be used to prevent encroachments in floodways. Base flood elevation data is required for subdivision proposals or other developments greater than 50 lots or 5 acres, whichever is less, within Zone A.

Section 6.2.3 states that any new construction including filling or excavation is prohibited within the limits of the floodway as designated on the FIRM map.

Permitted uses are those permitted in the underlying district provided that such use does not involve any alteration or development of the land that would alter the natural flood storage volume of the site.

Section 6.2.5 states that the Board of Appeals may authorize by Special Permit any use permitted in the underlying district, including grading, filling and excavating provided that the Board of Appeals finds:

At least 100 percent of the flood storage volume of the site (as it existed on June 15, 1982) shall be maintained.

For residential structures, the elevation of the lowest floor level shall be at or above the base flood and for non-residential structures, the elevation of the lowest floor shall be at or above the base flood or flood-proofed to above the base flood.

The elevation of the lowest point of any new driveway shall be at or above the base flood and all new construction, including utilities, is anchored to prevent flotation and designed to avoid impairment during the base flood.

All development, including structural and non-structural activities, whether permitted by right or by special permit, must be in compliance with Chapter 131, Section 40 of MGL, the Flood Resistant Construction section of the Massachusetts Building Code, DEP Wetlands Protection Regulation, Inland and Coastal Wetlands Restrictions (DEP), minimum requirements for subsurface disposal of sanitary sewage.

Section 6.4.4. pertains to site design standards. It states that design and construction shall minimize, to the extent possible encroachment within any wetland or flood plain and should maximize the maintenance of existing rates of runoff from the site and preservation of the existing flood storage capacity of the site.

Section 6.4.4.2 (a) states that all non-residential parking spaces, loading and driveways shall be graded, paved and drained in accordance with construction specifications reviewed and approved by the Town Engineer. In addition, no stormwater runoff in excess of rates existing prior to new construction shall be discharged onto a public way or into a public drainage system unless there is, in the determination of the Town Engineer, sufficient capacity to handle the additional runoff.

Section 6.5 Site Plan Review states that all site plans must should the flood plain and all wetlands and all facilities for drainage. The reviewing boards and departments must submit comments regarding the protection of adjoining premises against detrimental uses by provision for surface water drainage.

Section 8 lays out the requirements for a Conservation Subdivision Design proposal. The plan must show all wetlands and floodplains. Wetlands, riverfront areas, and floodplains are to be included in the identification of primary conservation areas. A certified Professional Engineer must prepare a narrative description of proposed systems for stormwater drainage and its likely impacts on-site and to any abutting parcels of land.

Section 8.10.2.7 regulates drainage and stormwater management in Conservation Subdivision Design developments. The regulations state that developers shall seek to reduce the amount of impervious surface and to recharge to groundwater as much as possible. Development shall not increase the peak rate of discharge for the 2, 10, and 100 year storms.

Section 9.9 Stormwater Management for 55 and Over Developments-The development shall meet the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Policies regardless of whether it is subject to the Wetlands Protection Act.

Stormwater Management Bylaw and Regulations- Wilmington adopted a Stormwater Management Bylaw in 2009 and Regulations in 2010, which applies to any activity which alters or disturbs more than 20,000 square feet of land. A simple stormwater permit is required for site plan review or for any activity disturbing less than 20,000 square feet, with some exemptions.

Public Education on Stormwater-The Town DPW maintains a web page on stormwater management and nonpoint source pollution prevention at: http://www.wilmingtonma.gov/Pages/WilmingtonMA_PublicWorks/Stormwater

Open Space and Recreation Plan – The Town's 2015 Open Space and Recreation Plan identifies the Town's open space areas, as well as properties that could be acquired for open space, which serve a number of different purposes including mitigation of flooding and storm damage. Goal Three of the plan is "To protect the Town's natural resources and open space areas that support water protection, flood management and essential

wildlife habitat and ecosystems." Objective One is to "work with land owners and other interested parties to protect privately owned properties identified for protecting water resources" through the increased use of Conservation Subdivision style subdivisions and conservation restrictions. Objective Three encourages the creation of waterway greenways to promote wildlife habitat and improve water quality.

Flooding – Existing Site Specific Mitigation

2008 Plan Flooding Areas of Concern mitigation measure

Shawsheen River: The bridge was replaced but at the same elevation, so some of the same issues of flooding and backup remain due to the low elevation above sea level. The one house that had been impacted in 2008 has since been removed. Billerica, where the bridge is located, is installing new drainage and overflows at the bridge in 2015. This site no longer impacts Wilmington.

Lubber's Brook: mitigated when bridge in Site 1 replaced. Flooding no longer occurring.

Canal Street: The culvert impacting flooding at this site was replaced in 2006 and the site no longer floods.

Burlington Avenue/Main Street/Sweetheart Plastics: After cleaning the drainage culverts in 2009, this site has not experienced flooded conditions since.

Saw Mill Brook: four new drainage lines installed in 2008. No flooding issues since then.

Lawrence Street : drainage for this area was installed by the Town in 2013 and flooding no longer occurs.

Brown's Crossing water pump station: The station was renovated in 2009-10 with water tight doors, a floodwall and a sump pump constructed.

Burlington Avenue: Town replaced older culvert that had been causing problems with four new culverts in 2010 and the site is no longer flooding.

Dams

There are no dams in Wilmington. However, if the Mill Pond Dam on the Burlington Reservoir burst, the water would flow into Wilmington. The Mill Pond Dam was last inspected in July of 2014 and found to be in satisfactory condition. (*Mill Pond Dam and Dikes Phase I Inspection/Evaluation*: Haley and Aldrich, July 2014)

The 2014 Emergency Action Plan for the Mill Pond Dam includes notification of the Wilmington Fire Department in the event of an emergency. The purpose of the Emergency Action Plan (EAP) is to safeguard the lives and reduce property damage of

Burlington, Woburn and Wilmington, Massachusetts downstream of the Mill Pond Dam, along Maple Meadow Brook in the event of a breach or impending breach of the dam. The EAP is also employed during periods of unusually high water events that are not expected to result in a dam failure. (*Emergency Action Plan, Mill Pond Dam, Burlington, MA:* Haley and Aldrich, January, 2014)

Once that notification has been made, the Town of Wilmington is responsible for notifying residents. Any necessary evacuations are also the responsibility of the Town of Wilmington. The plan includes a "Resident Evacuation/Notification Table which lists 17 residences on Main Street, 6 on Butters Row, 6 on Factory Street, one business on Eames Street and 27 residences on Chestnut Street.

DCR dam safety regulations –In 2002 the Massachusetts legislature enacted revisions of the Dam Safety Statute, MGL Chapter 253 §§ 44-50, which significantly changes the responsibilities of dam owners to register, inspect and maintain dams in good operating condition. Amendments to Dam Safety Regulations 302 CMR 10.00-10.16 became effective November 4, 2005 and are reflective of the statutory changes. MGL Chapter 253 and 302 CMR 10.00 requires Emergency Action Plans be prepared, maintained and updated by dam owners, for High Hazard Potential dams and certain Significant Hazard Potential dams.

Existing Wind Hazard Mitigation Measures

Tree-trimming program – The Town has a three person crew with a brush grinder and a bucket truck. The crew does preventative maintenance and clean-up after storms.

Vegetation management plan- The Town of Wilmington has developed a five year Vegetation Management Plan (VMP) to ensure compliance with Rights of Way (ROW) management regulations 333CMR11 for the control of hazardous, detrimental, nuisance, and invasive vegetation in order to promote safe travel. The 5 Year VMP was approved in December of 2013 for years 2014 –2018.

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.

Existing Winter Hazard Mitigation Measures

Roadway treatments – Town uses salt that is wetted down at it leaves the truck with magnesium chloride.). Salters were equipped in 2014/2015 with variable speed controls, improving salt efficiency and conservation.

Snow disposal – Because there is no dense downtown, there are very few areas where the Town needs to haul snow away. There are certain bad intersections where the Town will remove snow banks. The snow is then disposed of at the yard waste recycling facility or the DPW yard.

Catch basin Cleaning: The Wilmington DPW clears snow from clogged catch basins to prevent flooding.

Massachusetts State Building Code: The Town enforces the Massachusetts State Building Code, which contains regulations regarding snow loads on building roofs. The Town has adopted the state building code.

Existing Brush Fire Hazard Mitigation Measures

Permits required for outdoor burning - The Town does allow outdoor burning but a permit is required. In order to obtain a permit, a property owner must call the fire station to discuss the date, time and location of the burning and the materials to be burned.

Subdivision review - The Fire Department is involved in reviewing subdivision plans from conceptual design through occupancy to ensure that there is adequate access for fire trucks and an adequate water supply.

Existing Geologic Hazard Mitigation Measures

Massachusetts State Building Code – The State Building Code, updated in 2010, 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.

Existing Multihazard Mitigation

Capital Improvement Plan (CIP) allocates funding over a 5 year period, including for storm drain, wastewater improvements, fire protection and winter storm mitigation. Projects that address natural hazard mitigation are listed below. Some of the projects in the CIP for drainage infrastructure and flood prevention originated from the comprehensive water and drainage study the Town completed in 2009.

Butters Row Culvert Repair Project (Engineering and Construction) Flooding
$ 200,000- 2016

Mass Ave Drainage Improvement Project Infrastructure $55,000-2016- Flooding

Heavy Duty Tow-Behind Tree Chipper Equipment $55,000-2017- High Winds

Heavy Duty Dump Truck w/plow and sander - $165,000- 2019-Winter Storms

Heavy Duty Dump Truck w/plow and sander Vehicle $170,000-2020-Winter Storms

North Wilmington Fire Substation Construction Building $7,000,000-2020- Fire/Brush Fire Prevention

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, tornadoes, 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. The Town of Wilmington's current CEMP was updated in 2014.

Emergency Management Team (EMT)

Wilmington is a member of Region 4A Medical Reserve Corps (MRC). It was formed to promote public health and safety across the region in three key areas:

1. Public Health Emergencies – events that threaten public health, such as a disease outbreak or toxic chemical release.

2. Mass Casualty Incidents – disasters that cause injury or threats to large numbers of people. These can include a building collapse, fire, storm, flood, or other event that displaces groups of residents that must be moved to emergency shelters.
3. Community Service Activities – opportunities to foster the well-being of local residents; such as health fairs, blood pressure clinics, or training programs.

The Town maintains a web page on the MRC at http://www.region4a-mrc.org/

Natural Hazards Public Education- The Board of Health maintains a link to the Ready website (http://www.ready.gov/) that offers education and tips on how to prepare for natural hazard emergencies such as earthquakes, fires, floods, hurricanes, winter storms, and extreme temperatures.

Table 25- Summary Existing Hazard Mitigation Measures

Hazard	Area	Mitigation Measure	Update/comments
Flooding	Town-wide	Participation in the National Flood Insurance Program (NFIP)	Effective / 75 policies in force
		Massachusetts Building Code	Effective
		Floodplain Conservancy District	Updated /Effective
		Stormwater Management Bylaw and Regulations	Effective
		Street sweeping	Effective
		Catch basin cleaning	
		Zoning: Site Plan Review, Conservation Subdivision Design, Stormwater Management in Over 55 developments,	Effective
		Stormwater Management Bylaw and Regulations	Effective
		Town cleans & inspects catch basins every other year.	Effective
		Public Education on Stormwater	Effective
		2015 Open Space and Recreation Plan	Effective
		Existing Site Specific Flooding Mitigation	Effective
Dams		Mill Pond Dam Inspection and EAP	Updated/Effective
		DCR dam safety regulations	Effective
		DCR Dam Safety Regulations	Effective
		Emergency Action Plan for Burlington Reservoir Dam	Implementation of EAP: Up to date
Wind	Town-wide	Town tree-pruning management	Effective
		Vegetation management plan for rights of way	Effective
		State Building Code addresses wind standards	Effective for new construction

Table 25- Summary Existing Hazard Mitigation Measures

Hazard	Area	Mitigation Measure	Update/comments
Winter-Related	Town-wide	Regular snow removal operations and roadway treatments	Effective
		Catch basin cleaning to maintain drainage	Effective
		State Building Code addresses snow load standards	Effective for new construction
Fire	Town-wide	Outdoor burning permits	Effective
Fire	Town-wide	Subdivision review	Effective
Geologic	Town-wide	State Building Code addresses earthquake standards	Effective for new construction / Town has many older buildings
Multi hazard	Town-wide	Capital Improvement Plan (CIP)	Effective/Up to date
Multi hazard	Town-wide	Comprehensive Emergency Management Plan (CEMP)	Effective/Up to date
Multi hazard	Town-wide	Emergency Management Team (EMT)	Effective
Multi-hazard	Town-wide	Natural Hazards Public Education	Effective
		2001 Master Plan	Add Climate Adaptation to next plan update

Local Capacity for Implementation

The Town of Wilmington has recognized several existing mitigation measures that require implementation or improvements, and has the capacity within its local boards and departments to address these. The Wilmington Department of Public Works will address the needs for catch basin cleaning, repairs and upgrades to drainage infrastructure. The Town's Planning Board will address the updates to the Master Plan and implementation of the Zoning Ordinance, Floodplain District, and Subdivision Rules and Regulations. The Conservation Commission will oversee implementation of the Wetlands Bylaw and the Open Space Plan. The Department of Public Works together with the Planning Board and Conservation Commission will coordinate implementation and enforcement of the Stormwater Bylaw

VII. MITIGATION MEASURES FROM THE 2008 PLAN

Implementation Status of the Previous Plan

At a meeting of the Wilmington Hazard Mitigation Planning Committee, Town staff reviewed the mitigation measures identified in the 2008 Wilmington Hazard Mitigation Plan 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 this Hazard Mitigation Plan 2015 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 26 summarizes the status of mitigation measures, and mitigation projects completed are described in more detail below.

Table 26- Mitigation Measures from the 2008 Plan

Mitigation Measure	Priority	Lead Implementation	Current Status	Include in 2015 Plan/Priority
Renovated the water pump station buildings at Brown's Crossing, including new water tight doors and sump pumps.	High	DPW	Complete	No
Drainage improvements at Concord Street and Lubbers Brook.	High	DPW	Not completed: This is a very low lying area where a larger culvert won't improve drainage significantly. The road is usually passable when floods occur.	No

Mitigation Measure	Priority	Lead Implementation	Current Status	Include in 2015 Plan/Priority
Support the N. Reading HMGP application for the Martins Pond Flood Improvement project.	High	DPW in North Reading and Wilmington	Complete	Yes
Enact storm water regulations that require more infiltration rather than just designing to meet the peak flow.	High	Conservation/Planning/ MAPC	Complete: Stormwater bylaw adopted in 2009 and regulations in 2010	No
Educate residents within the inundation area of the Mill Pond Dam about notification and evacuation procedures	High	Wilmington Fire Department	Not Complete: Inspection and EAP up to date but education needs to be done	Yes: High
Mitigate flooding on Wildwood Street.	Medium	DPW	Not completed; floods 1-2X per year	No: Less than 5 homes are impacted during floods and fire access is not impeded.
Drainage improvements on Glen Road at Lubbers Brook.	High	DPW	Not Completed: Last flooded in 2006 and only one house impacted.	No
Encourage property owners at Burlington Avenue/Main Street/Sweetheart Plastics to improve storm water management.	Medium	Private property owners and the MBTA.	Completed: culverts cleaned	No

Mitigation Measure	Priority	Lead Implementation	Current Status	Include in 2015 Plan/Priority
Additional drainage improvements at Saw Mill Brook.	Medium	DPW	Completed: new drainage lines installed	No
Negotiate easements to allow the Town to replace three culverts under Lawrence Street	Medium	DPW	Completed in 2013	No
Purchase a new brush truck	Medium	Fire Department	Not completed	No: Fire Department addressed by adding skid pump to existing truck
Expand the curbside compost collection program	Low	Conservation Commission	Completed	No
Expand erosion control regulations to include projects outside of the jurisdiction of the Wetlands Protection Act	Low	Conservation Commission	Complete: new stormwater bylaw and regulations	No

Wilmington has made considerable progress on implementing mitigation measures identified in the 2008 Hazard Mitigation Plan. The most significant project, the renovation of the Brown's Crossing water pumping station has been completed. The Town completed a comprehensive drainage study in 2009 and has incorporated drainage system upgrades into a comprehensive and ongoing capital improvement planning and implementation process. The Town also adopted a stormwater bylaw and regulations, worked with Burlington to help ensure that the Mill Pond Dam inspection and EAP were brought up to date and enacted, expanded its curbside composting program, and added stormwater and natural hazard citizen education web pages to the Town's website.

Overall, one mitigation measure from the 2008 plan will be continued in the plan update. The Town will work to educate residents within the inundation area of the Mill Pond Dam about notification and evacuation procedures, which remains a high priority for 2015.

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.

The challenges the Town faces in implementing these measures are primarily due to limited funding and available staff time. This plan should help the Town prioritize the best use of its limited resources for enhanced mitigation of natural hazards.

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 hazards through long-term strategies. These long-term strategies include planning, policy changes, education programs, infrastructure projects and other activities. FEMA currently has three mitigation grant programs: the Hazards Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation program (PDM), and the Flood Mitigation Assistance (FMA) program. The three links below provide additional information on these programs.

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

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

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

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. There is a third level of mitigation which is regional; involving a state, regional or federal agency or an issue that involves three or more municipalities.

Regional Partners

In the densely developed communities of the study area, mitigating natural hazards, particularly flooding, is more than a local issue. The drainage systems that serve these communities are a complex system of storm drains, 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 Wilmington, the Department of Conservation and Recreation (DCR), the Massachusetts Water Resources Authority (MWRA), Massachusetts Highway Department (MHD) and the Massachusetts Bay Transportation Authority (MBTA). The planning, construction, operations and maintenance of these structures are integral to the flood hazard mitigation efforts of communities. These agencies must be considered the communities regional partners in hazard mitigation. These agencies also operate under the same constraints as communities do including budgetary and staffing constraints and numerous competing priorities. In the sections that follow, the plan includes recommendations for activities to be undertaken by these other agencies. Implementation of these recommendations will require that all parties work together to develop solutions.

Inter-Community Considerations

Mill Pond Dam Reservoir -There are no dams in Wilmington. However, if the Mill Pond Dam on the Burlington Reservoir burst, the water would flow into Wilmington. The 2014 Emergency Action Plan for the Mill Pond Dam includes notification of the Wilmington Fire Department in the event of an emergency. Once that notification has been made, the Town of Wilmington is responsible for notifying residents. Any necessary evacuations are also the responsibility of the Town of Wilmington. The plan includes a "Resident Evacuation/Notification Table which lists 17 residences on Main Street, 6 on Butters Row, 6 on Factory Street, one business on Eames Street and 27 residences on Chestnut Street.

Route 62 Bridge- North Reading and Wilmington signed a memo of understanding in 2010 to mitigate the flooding that occurs at this site due largely to an undersized culvert that backs up during heavy precipitations events, heavily impacting the Martin's Pond neighborhood in North Reading. The project will be carried forward into the 2015 plan update.

Shawsheen River Bridge in Wilmington/Billerica: The center line of the river is the Town Line. This Bridge has been replaced since 2008 but at the same elevation above sea level as the previous bridge. Flooding occurs when water backs up from the bridge during heavy precipitation events, though the bridge is designed to be overtopped by water during extreme flooding events.

Main Street– There is a culvert under State Route 38 (Main Street) which is owned by the Massachusetts Highway Department. The culvert was poorly designed and inadequate drainage has caused a number of sinkholes to develop in the parking lot of a commercial property in this area. The Town believes that these sinkholes are indicative of an impending problem. If this drainage system deteriorates, it will back up Mill Brook. The state has not taken any steps to correct the problem and the Town does not have jurisdiction. This is a high priority area for the Town. No action has been taken on this since the 2008 plan and it will be carried forward to the 2015 update.

BMC Recycling Facility, Boston Road, Tewksbury- This regional compost recycling facility experiences infrequent fires caused by the heat produced by composting. It has limited access for fire fighting vehicles.

Process for Setting Priorities for Mitigation Measures

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

Priority setting was based on local knowledge of the hazard areas, including impacts of hazard events, the extent of the area impacted, and the relation of a given mitigation measure to the City's goals. In addition, the local Hazard Mitigation Planning Team also took into consideration factors such as the number of homes and businesses affected, whether or not road closures occurred and what impact closures had on delivery of emergency services and the local economy, anticipated project costs, whether any environmental constraints existed, and whether the Town would be able to justify the costs relative to the anticipated benefits.

Table 27 below demonstrates the prioritization of the Town's potential hazard mitigation measures. For each mitigation measure, the geographic extent of the potential benefiting area is identified as is an estimate of the overall benefit and cost of the measures. The benefits, costs, and overall priority were evaluated in terms of:

Estimated Benefits

High	Action will result in a significant reduction of hazard risk to people and/or property from a hazard event
Medium	Action will likely result in a moderate reduction of hazard risk to people and/or property from a hazard event
Low	Action will result in a low reduction of hazard risk to people and/or property from a hazard event

Estimated Costs

High	Estimated costs greater than $100,000
Medium	Estimated costs between $10,000 to $100,000
Low	Estimated costs less than $10,000 and/or staff time

Priority

High	Action very likely to have political and public support and necessary maintenance can occur following the project, and the costs seem reasonable considering likely benefits from the measure
Medium	Action may have political and public support and necessary maintenance has potential to occur following the project
Low	Not clear if action has political and public support and not certain that necessary maintenance can occur following the project

Table 27- Mitigation Measure Prioritization

Mitigation Action	Geographic Coverage	Estimated Benefit	Estimated Cost	Priority
Flood Hazard Mitigation				
1. Massachusetts Avenue drainage improvement project	Mass. Ave.	High	High	High
2. Route 62 Bridge culvert replacement	Regional with North Reading	High	High	High
Wind Mitigation Measures				
3. Complete 2015 tree inventory and risk assessment.	Town-wide	High	Low	Medium
4. Acquire heavy-duty tow behind tree chipper	Town-wide	High	Medium	Medium
Brushfire Mitigation				
5. Construct North Wilmington Fire Substation	Town-wide	High	High	High
Winter Storm Hazard Mitigation				
6. Evaluate public buildings for ability to withstand snow loads; retrofit if needed to greatest degree feasible.	Town-Wide	Medium	Low	Low
7. Acquire two heavy duty dump trucks with plow and sander	Town-Wide	High	High	High
Earthquake Mitigation				
10. Determine which buildings may be most vulnerable to earthquake damage and conduct a structural assessment if needed.	Town-Wide	Medium	Low	Low
11. Assess the vulnerability of roadways and utilities in high liquefaction susceptibility areas	Localized	Low	Low	Low

Table 27- Mitigation Measure Prioritization

Mitigation Action	Geographic Coverage	Estimated Benefit	Estimated Cost	Priority
Dam Mitigation				
12. Update the Emergency Action Plan for the Burlington Reservoir Dam spillway area every two years	Burlington Reservoir spillway area	Medium	Medium	Medium
Extreme Temperature Mitigation				
13. Site Design to increase tree plantings near buildings, increase the percentage of trees used in parking areas, and along public ways.	Town-Wide	Medium	Medium	Medium
14. Promote Green Building and Cool Roof designs	Town-Wide	Medium	Low	Medium
15. Assess placement of cooling centers at schools, senior center and emergency shelters.	Town-wide	Medium		High
Drought Mitigation				
16. Promote drought tolerant landscaping and site design measures	Town-Wide	Medium	Low	Medium
Climate Resilience/Adaptation				
17. Incorporate climate resilience/adaptation components into the next Comprehensive Plan	Town-Wide	High	Medium	High

Potential Mitigation Measures

The potential mitigation measures are provided in this section and summarized in Table 28.

Flooding, Drainage Infrastructure, and Dams

Wilmington completed a comprehensive water and drainage plan in 2009. The Town has since adopted a regular five year Capital Improvements Program which has been used to address infrastructure needs including those for drainage, fire and winter storms.

Route 62 Bridge culvert replacement- Being negotiated with the Town of North Reading; has been placed on the MA Transportation Bond Bill project list. There was an attempt to secure HMGP funding for this project but the project did not receive funding.

Update the Emergency Action Plan for the Burlington Reservoir Dam spillway area every two years- An update of the EAP was completed in 2014.

Wind Hazards

In 2015 the DPW received grant funding to begin a Town wide tree inventory and risk assessment. Bartlett Tree Experts was hired and the GIS based inventory is focusing on the more heavily traveled routes first. The town has also applied for an Urban Forest Challenge Grant funding through the DCR to expand the inventory.

Acquire heavy-duty tow behind tree chipper- Both of these are contained within the Town's 5 year CIP.

Fire Hazards

Construct North Wilmington Fire Substation-Contained within the Town's 5 year CIP.

Winter Hazards

Evaluate public buildings for ability to withstand snow loads; retrofit if needed to greatest degree feasible.

Acquire two heavy duty dump trucks with plow and sander. This is contained within the Town's 5 year CIP.

Earthquakes

Earthquake building assessment—Determine which buildings may be most vulnerable to earthquake damage and conduct a structural assessment if needed.

Earthquake infrastructure assessment— Assess the vulnerability of roadways and utilities in high liquefaction susceptibility areas.

Extreme Temperatures

Site Design guidelines to increase tree plantings near buildings, increase the percentage of trees used in parking areas, and along public ways.

Promote guidelines for Green Building and Cool Roof designs.

Assess placement of cooling centers at schools, senior center and emergency shelters.

Drought

Promote guidelines for drought tolerant landscaping and site design measures.

Climate Change

Incorporate climate resilience/adaptation components into the Town's next Comprehensive Plan. The Comprehensive Plan was last updated in 2001.

Introduction to Potential Mitigation Measures Table (Table 28)

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

Priority – As described above and summarized in Table 28, the designation of high, medium, or low priority was done considering potential benefits and estimated project costs, as well as other factors in the STAPLEE analysis.

Implementation Responsibility – The designation of implementation responsibility was done 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 team 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/stream bank 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.

Abbreviations Used in Table 28

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

ACOE = Army Corps of Engineers.
DHS/EOPS = Department of Homeland Security/Emergency Operations
DEP (SRF) = Department of Environmental Protection (State Revolving Fund)
USDA = United States Department of Agriculture
Mass DOT = Massachusetts Department of Transportation
DCR = MA Department of Conservation and Recreation
CIP= Capital Improvement Program
HMPT=Hazard Mitigation Planning Team

Table 28 – Potential Mitigation Measures

Mitigation Measure	Priority	Lead Implementation	Time Frame	Estimated Cost	Potential Funding Sources
FLOODING					
1. Massachusetts Avenue drainage improvement project	High	Public Works	Short Term 2015- 2016	Medium $55,000	CIP 2015- 2019
2. Route 62 Bridge culvert replacement	High	Public Works	Long Term 2015-2020	High TBD	MA DOT, North Reading operating budget , Wilmington operating budget, MA Transportation Bond, HMGP
3. Lubber's Brook flooding mitigation	High	Public Works	Long Term 2015-2020	High TBD	Army Corps, DCR, Wilmington, Boston (State, Town, & City funding secured; Federal funding not yet available)
4. Update the Emergency Action Plan for the Burlington Reservoir Dam spillway area every two years	High	Public Works	Long Term 2015-2020	Medium $25,000	DCR grant
WIND RELATED HAZARDS					
5. Complete 2015 tree inventory and risk assessment.	Medium	DPW	Long Term 2015-2020	Low Staff time	DCR grant
6. Acquire heavy-duty tow behind tree chipper	High	Public Works	Medium Term 2015-2017	Medium $55,000	CIP
BRUSHFIRES					
7. Construct North Wilmington Fire Substation	High	Fire	Long Term Construct by 2020	High $7,000,000	CIP

Table 28 – Potential Mitigation Measures

Mitigation Measure	Priority	Lead Implementation	Time Frame	Estimated Cost	Potential Funding Sources
WINTER STORMS					
8. Evaluate public buildings for ability to withstand snow loads; retrofit if needed to greatest degree feasible.	Low	Building/HMPT	Long Term TBD	Low	Staff time / Town general operating budget
9.Acquire two heavy duty dump trucks with plow and sander	High	Public Works	Long Term 2019-2020	High $335,000	CIP
EARTHQUAKES					
10. Determine which buildings may be most vulnerable to earthquake damage and conduct a structural assessment if needed.	Low	Building/HMPT	Long Term TBD	Low	Staff time / Town general operating budget
11. Assess the vulnerability of roadways and utilities in high liquefaction susceptibility areas	Low	Public Works/HMPT	Long Term TBD	Low	Staff time / Town general operating budget
EXTREME TEMPERATURES					
12. Site Design to increase tree plantings near buildings, increase the percentage of trees used in parking areas, and along public ways.	Medium	Planning / Conservation	Long Term 2015-2020	Low	Staff time / Town general operating budget
13. Promote Green Building and Cool Roof designs	High	Building/Planning	Long Term 2015-2020	Low	Staff time / Town general operating budget

Table 28 – Potential Mitigation Measures

Mitigation Measure	Priority	Lead Implementation	Time Frame	Estimated Cost	Potential Funding Sources
14. Assess placement of cooling centers at schools, senior center and emergency shelters.	High	Fire/HMPT	Short Term 2015-2016	Low	Staff time / Town general operating budget
DROUGHT					
15. Promote drought tolerant landscaping and site design measures	Medium	Planning / Conservation	Long Term 2015-2020	Low	Staff time / Town general operating budget
CLIMATE RESILIENCE / ADAPTATION					
16. Incorporate climate resilience/adaptation components into the next Comprehensive Plan	High	HMPT/Planning/ Conservation/ Public Works/ Public Health	Long Term 2015-2020	Medium	Town general operating funds / Staff time

IX. PLAN ADOPTION AND MAINTENANCE

Plan Adoption

The Wilmington Hazard Mitigation Plan 2015 Update was adopted by the Board of Selectmen on [ADD DATE]. See Appendix D for documentation. The plan was approved by FEMA on [ADD DATE] for a five-year period that will expire on [ADD DATE].

Plan Maintenance

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

MAPC worked with the Wilmington Hazard Mitigation Planning Team to prepare this plan. After approval of the plan by FEMA, this group will meet on a regular basis, at least annually, to function as the Hazard Mitigation Implementation Team, with the Commissioner of Public Works designated as the coordinator. Additional members could be added to the local implementation team from businesses, non-profits and institutions. The Town will encourage public participation during the next 5-year planning cycle. As updates and a review of the plan are conducted by the Hazard Mitigation Implementation Team, these will be placed on the Town's web site, and any meetings of the Hazard Mitigation Implementation Team will be publicly noticed in accordance with Town and state open meeting laws.

Implementation and Evaluation Schedule

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

This information will be used to prepare a report or addendum to the local hazard mitigation plan in order to evaluate its effectiveness in meeting the plan's goals and identify areas that need to be updated in the next plan. The Hazard Mitigation Implementation Team, coordinated by the Commissioner of Public Works, will have primary responsibility for tracking progress and updating the plan.

Begin to Prepare for the next Plan Update -- Given the lead time needed to secure funding and conduct the planning process, the Hazard Mitigation Implementation Team

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

Prepare and Adopt an Updated Local Hazard Mitigation Plan – 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. Once the resources have been secured to update the plan, 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 Wilmington Hazard Mitigation Plan Update will be forwarded to MEMA and DCR for review and to FEMA for approval.

Integration of the Plans with Other Planning Initiatives

Upon approval of the Wilmington Hazard Mitigation Plan 2015 Update by FEMA, the Local Hazard Mitigation 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 Department
- Emergency Management
- Police Department
- Public Works Department
- Engineering
- Planning and Community Development
- Conservation Commission
- Parks and Recreation
- Public 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.

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

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X. LIST OF REFERENCES

Wilmington Capital Improvement Program, FY 2015 – 2019

Wilmington Comprehensive Emergency Management Plan, 2014

Wilmington Master Plan, 2001

Wilmington Comprehensive Water Resource Management Plan, 2009

Open Space and Recreation Plan for the Town of Wilmington,
Wilmington Conservation Commission, 2015

Wilmington By-Laws

Wilmington Zoning By-Law

Wilmington Subdivision Regulations

Environment America Research and Policy Center, *When It Rains It Pours – Global Warming and the Increase in Extreme Precipitation*, July 2012

FEMA, Flood Insurance Rate Maps for Middlesex County, MA, 2012

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

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

MA Geographic Information System, *McConnell Land Use Statistics*, 2005

MA Office of Dam Safety, Inventory of Massachusetts Dams

Metropolitan Area Planning Council, Geographic Information Systems Lab

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

Northeast States Emergency Consortium, website http://www.nesec.org/

NOAA, National Climatic Data Center, website

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

USGS, National Water Information Center, website

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APPENDIX A

HAZARD MITIGATION PLANNING TEAM MEETING AGENDAS

Meeting Agenda
Local Natural Hazard Mitigation Plan
Town of Wilmington, Room 9
June 12, 2014, 10:00 – 11:30 AM

---

1) Welcome and Introductions

2) Overview Presentation on Hazard Mitigation Planning

- Questions and discussion

3) Review of Project Scope (See attached summary)

1. Planning Process and Community Participation
2. Hazard Identification, Critical Facilities, and Vulnerability Analysis
3. Assessment of Existing Mitigation Measures
4. hazard Mitigation Strategies
5. Local Hazard Mitigation Plan Maintenance
6. Local hazard Mitigation Plan Adoption and Approval

4) Local Team Meeting #1 (Information Gathering) – Fall 2014

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

5) Local Team Meeting #2 (Analysis and Review) – Spring 2015

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

6) Local Team Meeting #3 (Recommendations and Draft Plan) – Mid-2015

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

7) Next Steps/Adjourn

Meeting Agenda
Local Natural Hazard Mitigation Plan
Town of Wilmington, Room 9
September 29, 2014, 10:00 AM – 12:00 PM

Local Team Meeting #1 (Information Gathering)

a) Hazard Mitigation Planning Map Series and Digitized Ortho Photo Map
b) Review 2008 mitigation actions
c) Identify Critical Facilities
d) Identify local hazards:
   i) Flood Hazard Areas
   ii) Fire Hazard Areas (brushfires/wildfires)
   iii) Dams
   iv) Ice jams
   v) Thunderstorms
   vi) Drought
   vii) Extreme Temps
   viii) Tornadoes
   ix) High winds
   x) Snow and Blizzards
   xi) Ice storms
   xii) Earthquakes
   xiii) Landslides
   xiv) Future Potential Development Areas

e) Review Plan Goals and Objectives- see over

f) Discuss Public Involvement and Outreach
   i) Identify local stakeholders
   ii) Schedule first public meeting
g) Identify draft priority projects and funding for update

Project Overview - MAPC received a grant to prepare natural hazards *Pre-Disaster Mitigation Plan* for the communities of Burlington, Dover, Hanover, Holliston, Wilmington, Marlborough and Wilmington. MAPC is working with the seven 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.

This FEMA planning program is separate from new or ongoing homeland security initiatives, and is focused solely on addressing natural hazards, although some of the data collected for this plan may be useful for other aspects of emergency planning as well.

2008 Wilmington 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 residents, the business community, major institutions and non- profits to work with the Town to develop review and implement the hazard mitigation plan.

6. Work with surrounding communities, state, regional and federal agencies to ensure regional cooperation and solutions for hazards affecting multiple communities.

7. Ensure that future development meets federal, state and local standards for preventing and reducing the impacts of natural hazards.

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

Recommended to align with State 2013 Plan and FEMA Guidelines

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

2. Build and enhance local mitigation capabilities to ensure individual safety, reduce damage to public and private property and ensure continuity of emergency services.

3. Increase cooperation and coordination among private entities, Town officials and Boards, State agencies and Federal agencies.

4. Increase awareness of the benefits of hazard mitigation through outreach and education.

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 map series consists of eight maps as described below. The maps in this appendix are necessarily reduced scale versions for general reference. Full sized higher resolution PDF's of the maps can be downloaded from: https://www.dropbox.com/sh/w0zqp7niu7b35f8/AAAOL9X_5wTVvYaBYZ_fsvaia?dl=0

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

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

Map 2: 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. The map also depicts current land use.

Map 3: Flood Zones – The map of flood zones used the FEMA NFIP Flood Zones as depicted on the FIRMs (Federal Insurance Rate Maps) for Middlesex County as its source. This map is not intended for use in determining whether or not a specific property is located within a FEMA NFIP flood zone. The currently adopted FIRMS for Wilmington are kept by the Town. 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 repetitive loss areas.

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

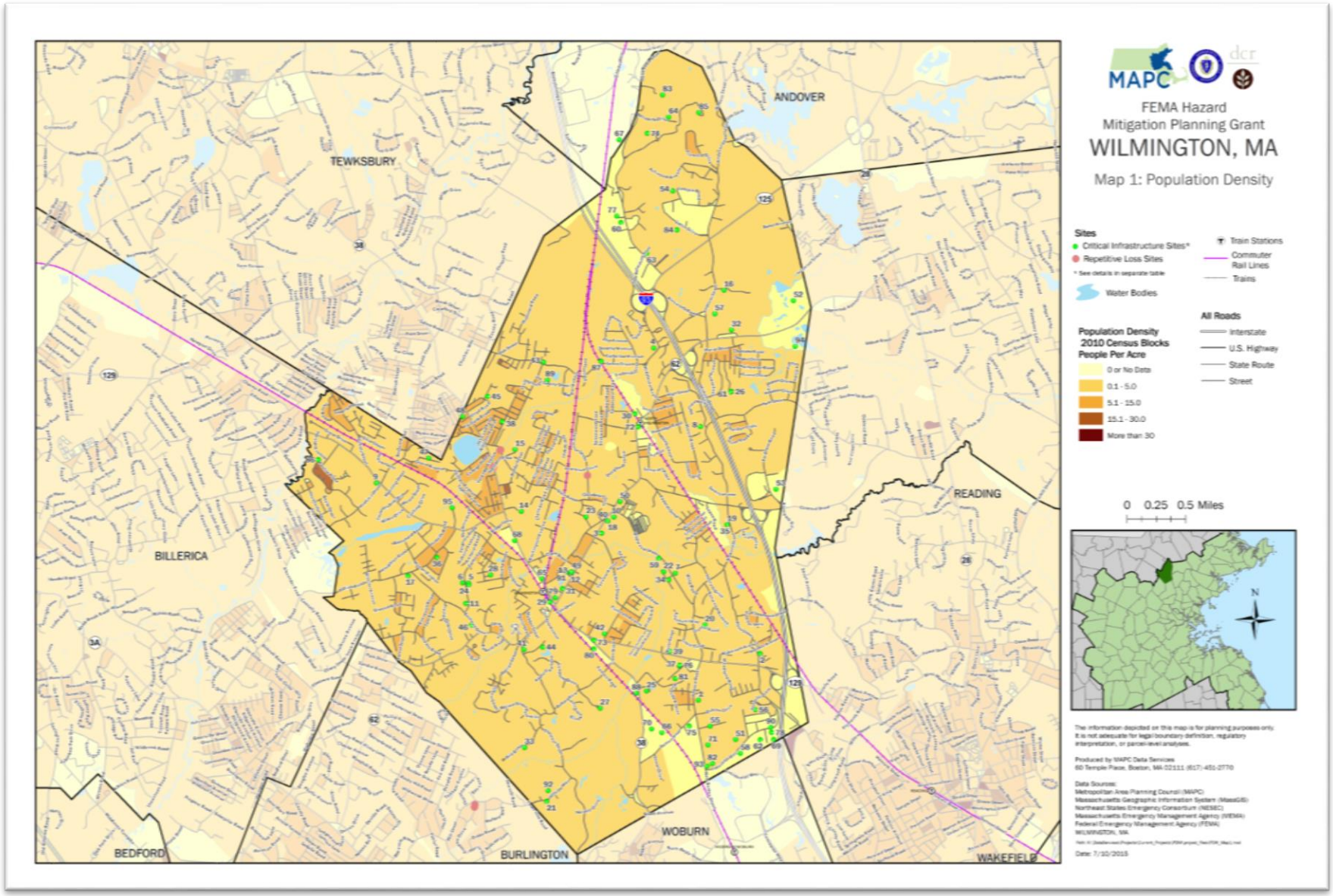
The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to http://pubs.usgs.gov/pp/p1183/pp1183.html.

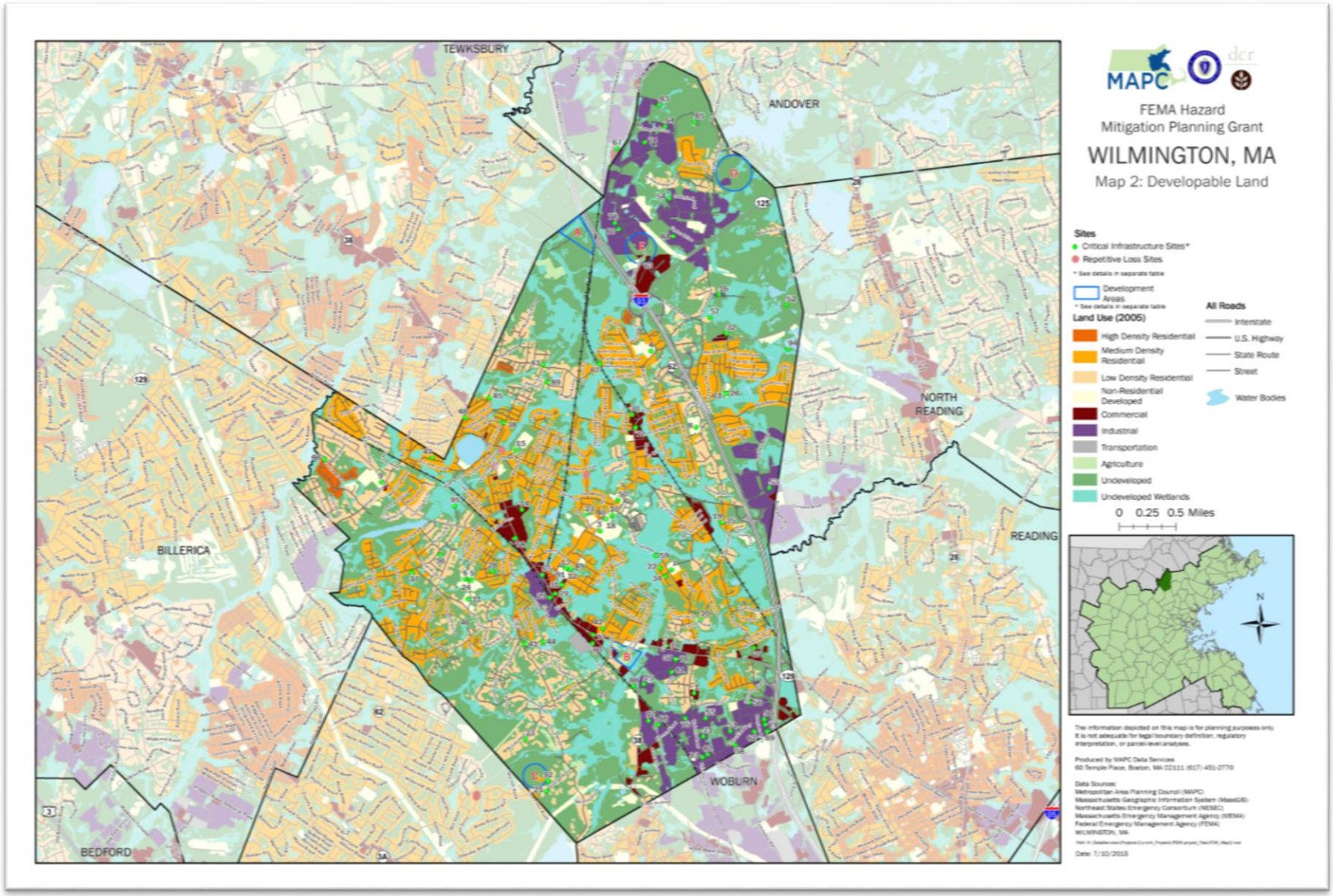
Map 5: Hurricanes and Tornadoes – This map shows a number of different items. The map includes the storm tracks for both hurricanes and tropical storms, if any occurred in this community. This information must be viewed in context. A storm track only shows where the eye of the storm passed through. In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

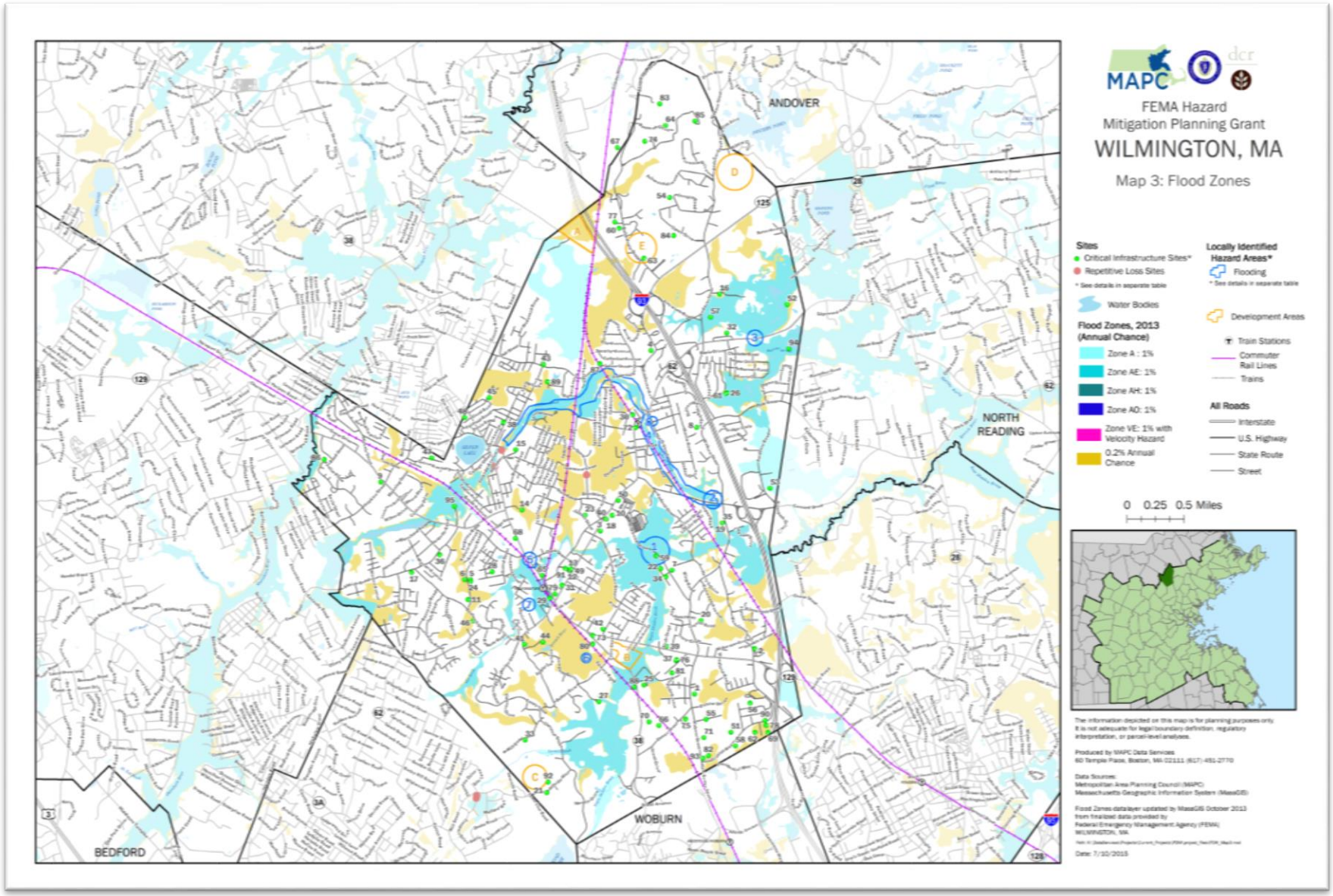
Map 6: Average Snowfall - - This map shows the average snowfall. It also shows storm tracks for nor'easters, if any storms tracked through the community.

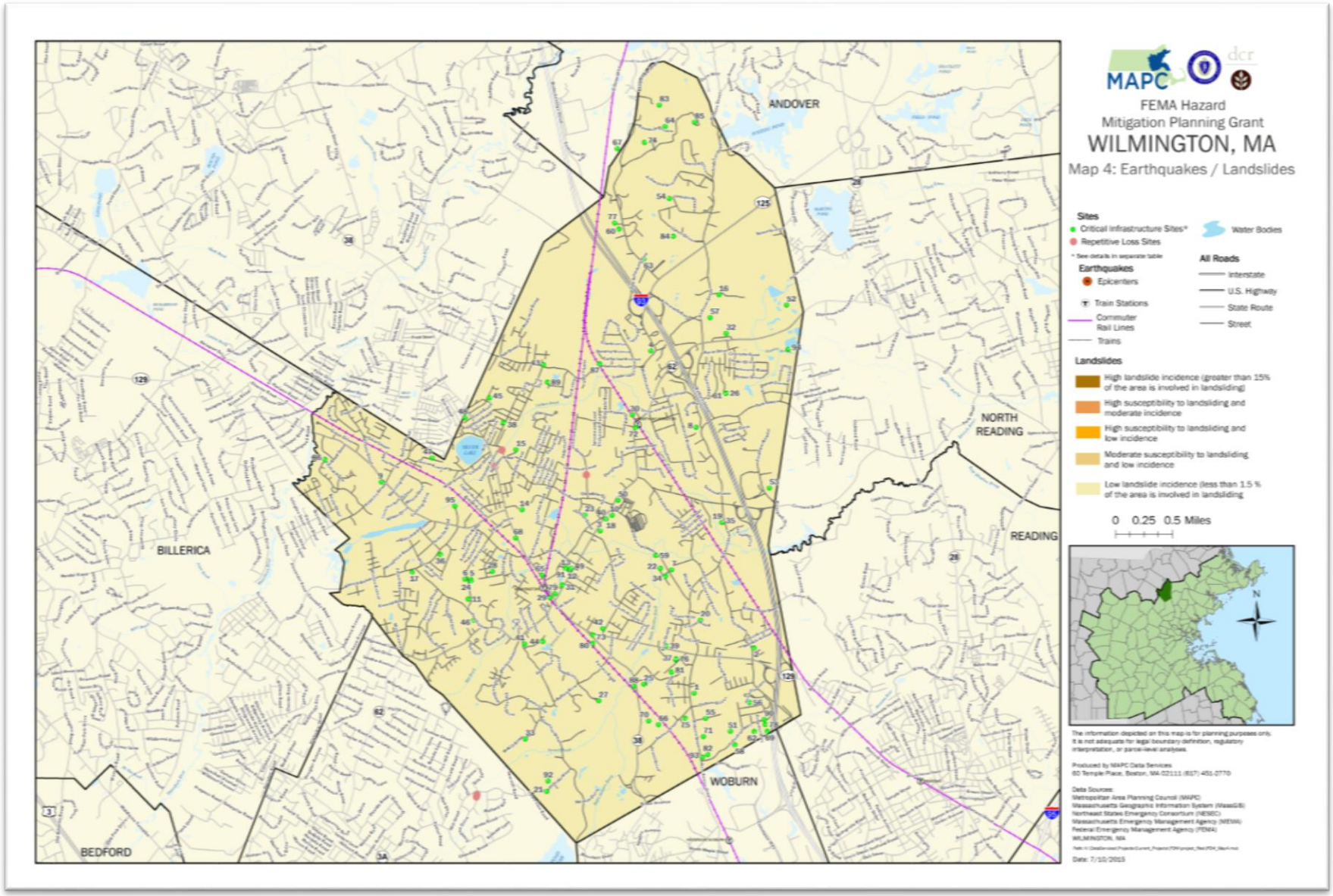
Map 7: Composite Natural Hazards - This map shows four categories of composite natural hazards for areas of existing development. The hazards included in this map are 100 year wind speeds of 110 mph or higher, low and moderate landslide risk, FEMA Q3 flood zones (100 year and 500 year) and hurricane 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.


MAPC
dcr
FEMA Hazard
Mitigation Planning Grant
WILMINGTON, MA
Map 1: Population Density
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Water Bodies
Train Stations
Commuter Rail Lines
Trains
All Roads
Interstate
U.S. Highway
State Route
Street
Population Density
2010 Census Blocks
People Per Acre
0 or No Data
0.1 - 5.0
5.1 - 15.0
15.1 - 30.0
More than 30
0 0.25 0.5 Miles
N
ANDOVER
TEWKSBURY
BILLERICA
READING
BEDFORD
BURLINGTON
WOBURN
WAKEFIELD


TEWKSBURY
ANDOVER
NORTH READING
READING
BILLERICA
WOBURN
BEDFORD
MAPC
dcr
FEMA Hazard Mitigation Planning Grant
WILMINGTON, MA
Map 2: Developable Land
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Development Areas
* See details in separate table
Land Use (2005)
High Density Residential
Medium Density Residential
Low Density Residential
Non-Residential Developed
Commercial
Industrial
Transportation
Agriculture
Undeveloped
Undeveloped Wetlands
All Roads
Interstate
U.S. Highway
State Route
Street
Water Bodies
0 0.25 0.5 Miles
N
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.
Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
WILMINGTON, MA
Date: 7/10/2015


ANDOVER
NORTH READING
WOBURN
BEDFORD
MAPC
dcr
FEMA Hazard
Mitigation Planning Grant
WILMINGTON, MA
Map 3: Flood Zones
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Water Bodies
Flood Zones, 2013
(Annual Chance)
Zone A : 1%
Zone AE: 1%
Zone AH: 1%
Zone AO: 1%
Zone VE: 1% with Velocity Hazard
0.2% Annual Chance
Locally Identified Hazard Areas*
Flooding
* See details in separate table
Development Areas
Train Stations
Commuter Rail Lines
Trains
All Roads
Interstate
U.S. Highway
State Route
Street
0 0.25 0.5 Miles
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)
Flood Zones dataset updated by MassGIS October 2013
from finalized data provided by
Federal Emergency Management Agency (FEMA)
WILMINGTON, MA
Date: 7/10/2015


MAPC
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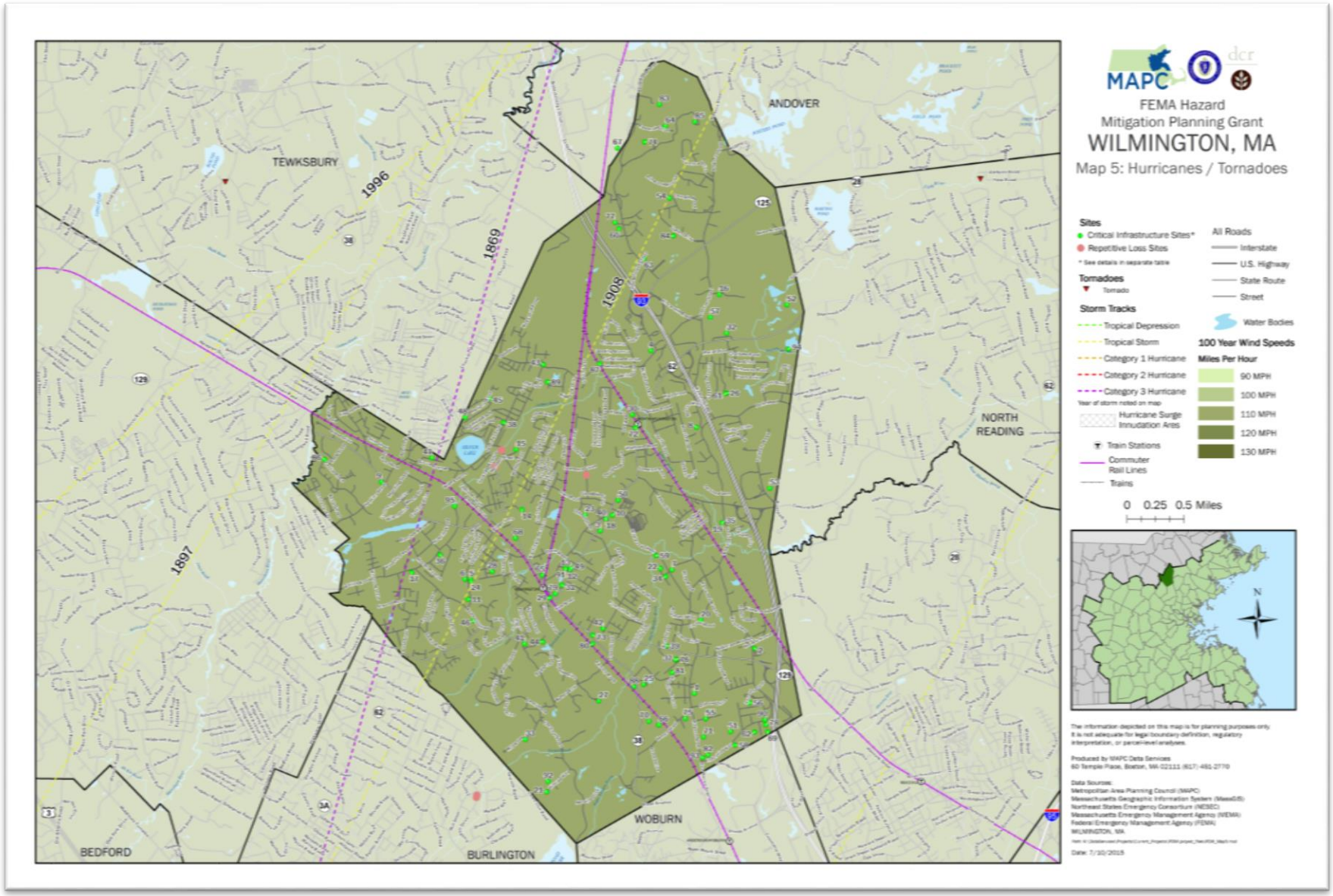
FEMA Hazard
Mitigation Planning Grant
WILMINGTON, MA
Map 4: Earthquakes / Landslides
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Earthquakes
Epicenters
Train Stations
Commuter Rail Lines
Trains
Water Bodies
All Roads
Interstate
U.S. Highway
State Route
Street
Landslides
High landslide incidence (greater than 15% of the area is involved in landsliding)
High susceptibility to landsliding and moderate incidence
High susceptibility to landsliding and low incidence
Moderate susceptibility to landsliding and low incidence
Low landslide incidence (less than 1.5 % of the area is involved in landsliding
0 0.25 0.5 Miles
ANDOVER
NORTH READING
READING
BILLERICA
WOBURN
BEDFORD
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis.
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)
WILMINGTON, MA
Date: 7/10/2015


MAPC
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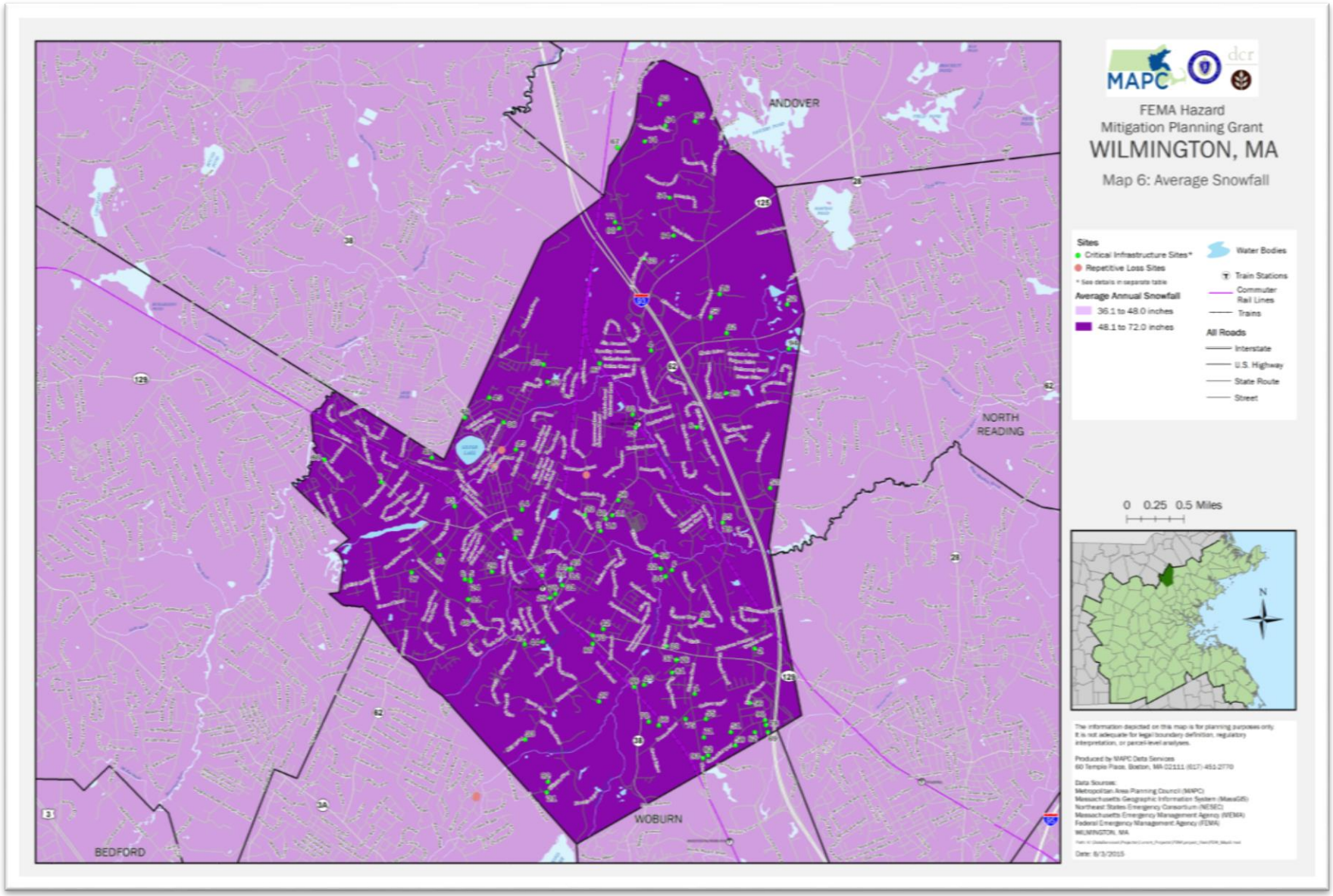
FEMA Hazard
Mitigation Planning Grant
WILMINGTON, MA
Map 5: Hurricanes / Tornadoes
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Tornadoes
Tornado
Storm Tracks
Tropical Depression
Tropical Storm
Category 1 Hurricane
Category 2 Hurricane
Category 3 Hurricane
Year of storm noted on map
Hurricane Surge Innudation Area
Train Stations
Commuter Rail Lines
Trains
All Roads
Interstate
U.S. Highway
State Route
Street
Water Bodies
100 Year Wind Speeds
Miles Per Hour
90 MPH
100 MPH
110 MPH
120 MPH
130 MPH
0 0.25 0.5 Miles
N
TEWKSBURY
ANDOVER
NORTH READING
WOBURN
BURLINGTON
BEDFORD
1996
1869
1908
1897


MAPC
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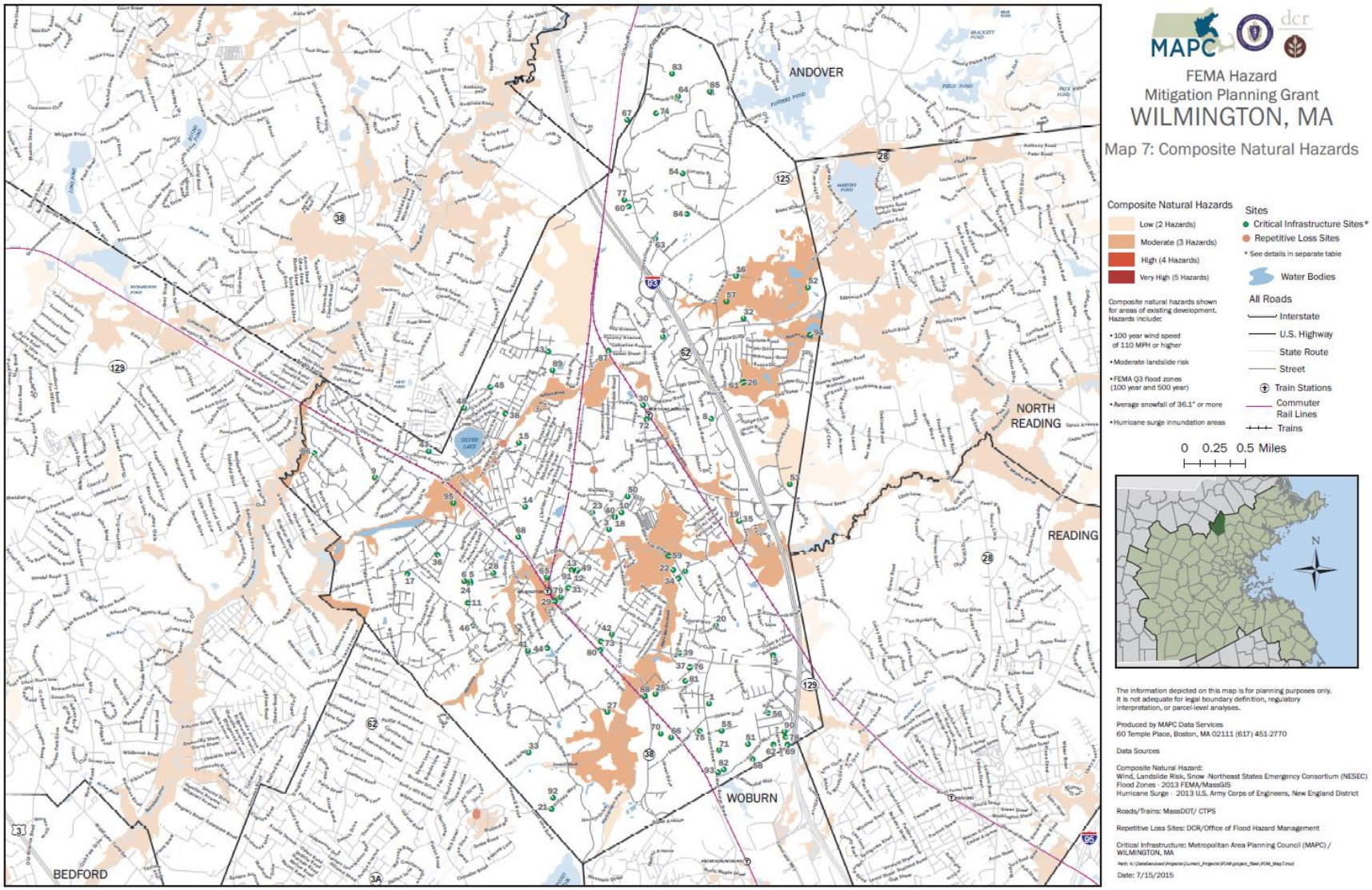
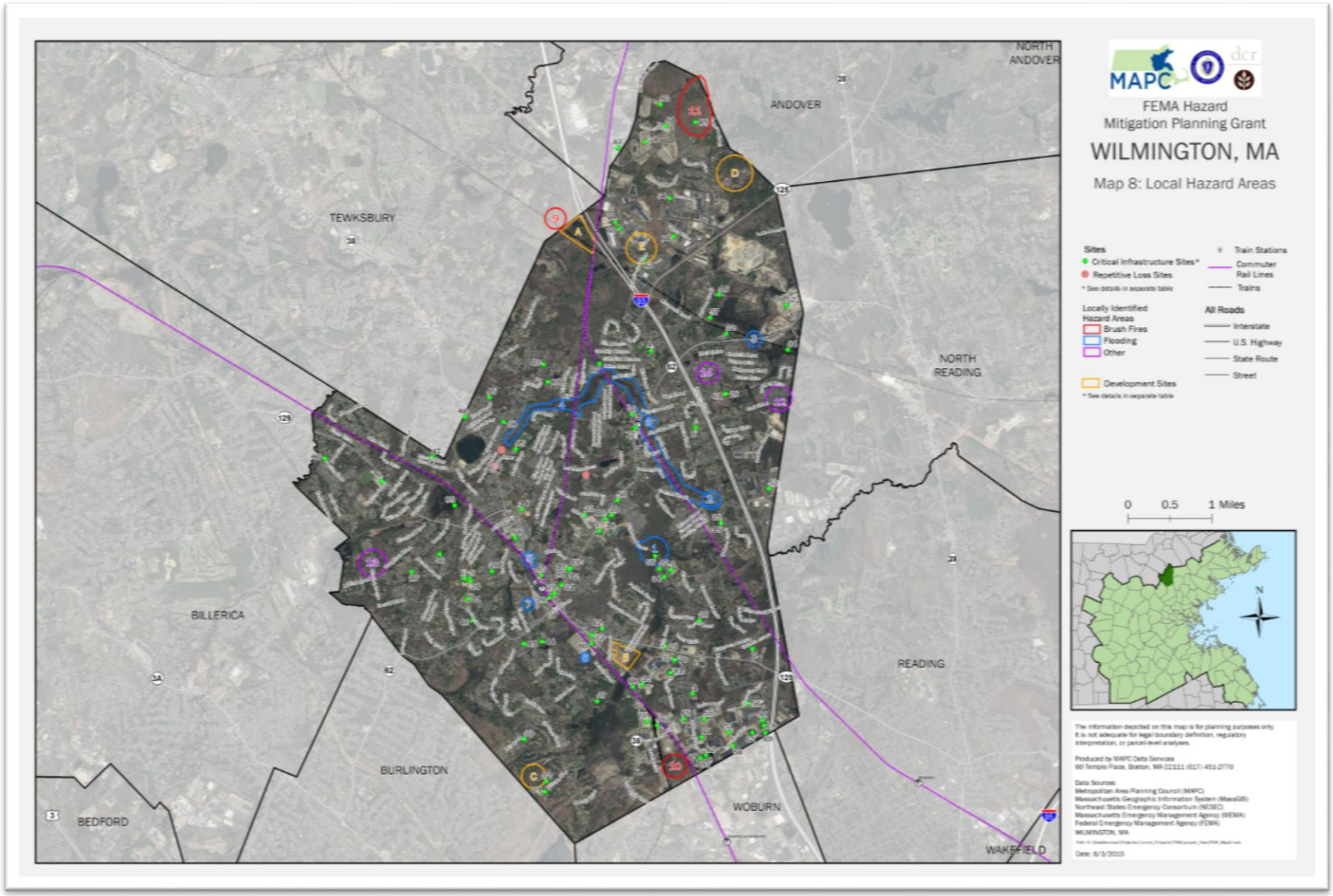
FEMA Hazard
Mitigation Planning Grant
WILMINGTON, MA
Map 6: Average Snowfall
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Average Annual Snowfall
36.1 to 48.0 inches
48.1 to 72.0 inches
Water Bodies
Train Stations
Commuter Rail Lines
Trains
All Roads
Interstate
U.S. Highway
State Route
Street
0 0.25 0.5 Miles
N
ANDOVER
NORTH READING
WOBURN
BEDFORD
Produced by MAPC Data Services
Date: 8/3/2015


ANDOVER
NORTH READING
READING
WOBURN
BEDFORD
MAPC
dcr
FEMA Hazard Mitigation Planning Grant
WILMINGTON, MA
Map 7: Composite Natural Hazards
Composite Natural Hazards
Low (2 Hazards)
Moderate (3 Hazards)
High (4 Hazards)
Very High (5 Hazards)
Composite natural hazards shown for areas of existing development. Hazards include:
• 100 year wind speed of 110 MPH or higher
• Moderate landslide risk
• FEMA Q3 flood zones (100 year and 500 year)
• Average snowfall of 36.1" or more
• Hurricane surge innundation areas
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Water Bodies
All Roads
Interstate
U.S. Highway
State Route
Street
Train Stations
Commuter Rail Lines
Trains
0 0.25 0.5 Miles
N
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
Composite Natural Hazard:
Wind, Landslide Risk, Snow -Northeast States Emergency Consortium (NESEC)
Flood Zones - 2013 FEMA/MassGIS
Hurricane Surge - 2013 U.S. Army Corps of Engineers, New England District
Roads/Trains: MassDOT/ CTPS
Repetitive Loss Sites: DCR/Office of Flood Hazard Management
Critical Infrastructure: Metropolitan Area Planning Council (MAPC) / WILMINGTON, MA
Path: K:\DataServices\Projects\Current_Projects\FEMA\project_files\FEM_Map7.mxd
Date: 7/15/2015


NORTH ANDOVER
ANDOVER
TEWKSBURY
NORTH READING
READING
BILLERICA
BURLINGTON
WOBURN
WAKEFIELD
BEDFORD
MAPC
dcr
FEMA Hazard Mitigation Planning Grant
WILMINGTON, MA
Map 8: Local Hazard Areas
Sites
Critical Infrastructure Sites*
Repetitive Loss Sites
* See details in separate table
Train Stations
Commuter Rail Lines
Trains
Locally Identified Hazard Areas
Brush Fires
Flooding
Other
Development Sites
* See details in separate table
All Roads
Interstate
U.S. Highway
State Route
Street
0 0.5 1 Miles
N
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.
Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
WILMINGTON, MA
Date: 8/3/2015

APPENDIX C
DOCUMENTATION OF PUBLIC PARTICIPATION

Amanda Linehan, Communications Manager, Metropolitan Area Planning Council
617-933-0705, alinehan@mapc.org

CALENDAR LISTING / MEDIA ADVISORY

WILMINGTON'S NATURAL HAZARDS PLAN UPDATE IS FOCUS OF MAY 5 PUBLIC MEETING

Meeting to present an overview of the update of Wilmington's Natural Hazards Mitigation Plan and solicit public comments

Who: Wilmington residents, business owners, representatives of non-profit organizations and institutions, and others who are interested in preventing and reducing damage from natural hazards.

What: The Wilmington Emergency Management Team (EMT) will hold a public meeting to present an overview of the pending update of the Town of Wilmington's Natural Hazards Mitigation Plan. The Metropolitan Area Planning Council (MAPC) is assisting the Town on the plan update, and a representative of MAPC will present an overview of the plan update.

The Town of Wilmington adopted its first Hazard Mitigation Plan in 2008, which was approved by the Federal Emergency Management Agency (FEMA). The plan identifies natural hazards affecting Wilmington such as floods, hurricanes, winter storms, and earthquakes, as well as actions that the Town can take to reduce the impacts of these hazards. FEMA requires that plans be updated regularly, so MAPC is assisting the Town prepare a 2015 updated plan.

When: May 5, 2014, 7 PM

Where: Wilmington Town Hall, 121 Glen Road, Room 9

MAPC is the regional planning agency for 101 communities in the metropolitan Boston area, promoting smart growth and regional collaboration. More information about MAPC is available at www.mapc.org.

##

Amanda Linehan, Communications Manager, Metropolitan Area Planning Council
617-933-0705, alinehan@mapc.org

CALENDAR LISTING / MEDIA ADVISORY

WILMINGTON'S DRAFT HAZARD MITIGATION PLAN TO BE PRESENTED AT AUGUST 4 PUBLIC MEETING

Meeting to present the 2015 update of Wilmington's Hazard Mitigation Plan and solicit public comments

Who: Wilmington residents, business owners, representatives of non-profit organizations and institutions, and others who are interested in preventing and reducing damage from natural hazards.

What: The Wilmington Emergency Management Team (EMT) will hold a public meeting to present an overview of the draft Wilmington Hazard Mitigation Plan Update 2015. The Metropolitan Area Planning Council (MAPC) is assisting the Town on the plan update, and a representative of MAPC will present an overview of the plan update.

The Town of Wilmington adopted its first Hazard Mitigation Plan in 2008, which was approved by the Federal Emergency Management Agency (FEMA). The plan identifies natural hazards affecting Wilmington such as floods, hurricanes, winter storms, and earthquakes, as well as actions that the Town can take to reduce the impacts of these hazards. FEMA requires that plans be updated regularly, so MAPC is assisting the Town prepare a 2015 updated plan.

When: Tuesday, August 4, 2015, 7 PM

Where: Wilmington Town Hall, 12 Glen Road, Room 9

MAPC is the regional planning agency for 101 communities in the metropolitan Boston area, promoting smart growth and regional collaboration. More information about MAPC is available at www.mapc.org.

##

WILMINGTON HAZARD MITIGATION PLAN – NEIGHBORING COMMUNITIES OF WILMINGTON, MA
Notification / Email Sent on April 24 and July 10, 2015

Andover
Paul Materazzo – planning@andoverma.gov

Billerica
Anthon Fields - afields@Town.billerica.ma.us

Burlington
Kristen Kassner- kkassner@burlington.org

North Reading
Danielle McKnight – dmcknight@northreadingma.gov

Reading
Jessie Wilson - jwilson@ci.reading.ma.us

Tewksbury
Steve Sadwick – ssadwick@tewksbury-ma.gov

Woburn
Tina Cassidy - tcassidy@cityofwoburn.com

Additional Organizations:
Wilmington Chamber of Commerce

Wilmington Conservation Commission

Wilmington Department Directors – DPW, PUBLIC BUILDINGS, FIRE, POLICE, TOWN CLERK, RECREATION AND BOARD OF HEALTH.

Wilmington Town Crier

HAZARD MITIGATION PLAN PUBLIC MEETING

Natural hazards can have serious impacts on the Town of Wilmington and its residents


The Wilmington Hazard Mitigation Plan is being updated to help the town reducing its vulnerability to the impacts of natural hazard events such as flooding, hurricanes and winter storms.

Join the Town for a presentation and discussion about the update to the Wilmington Hazard Mitigation Plan at a Public meeting:

Date: Tuesday, May 5, 2015

Time: 7 PM

Location: Town Hall, 121 Glen Road, Room 9

For more information, please contact Sam Cleaves via phone at (617) 933-0748 or email scleaves@mapc.org

MAPC
METROPOLITAN AREA PLANNING COUNCIL

HAZARD MITIGATION PLAN PUBLIC MEETING

Natural hazards can have serious impacts on the Town of Wilmington and its residents



The Wilmington Hazard Mitigation Plan is being updated to help the town reducing its vulnerability to the impacts of natural hazard events such as flooding, hurricanes and winter storms.

Join the Town for a presentation and discussion about the update to the Wilmington Hazard Mitigation Plan at a Public meeting:

Date: Tuesday, August 4, 2015

Time: 7 PM

Location: Town Hall, 121 Glen Road, Room 9

For more information, please contact Sam Cleaves via phone at (617) 933-0748 or email scleaves@mapc.org

MAPC
METROPOLITAN AREA PLANNING COUNCIL

TOWN OF WILMINGTON, MASSACHUSETTS

PLANNING & CONSERVATION (978)658-8238
DEPARTMENT (978)658-3311
FAX (978)658-3334

PLANNING BOARD

May 5, 2015

ROOM 9

7:00 p.m.

1. **Minutes**:

   Correspondence:
   Planning Director's Report:

2. **Form A**

3. **Matters of Appointment**

   7:00 p.m. – 7:30 p.m. Hazard Mitigation Plan Workshop
   Sam Cleaves, MAPC

   7:30 p.m. – 7:45 p.m. Continued Public Hearing - Site Plan Review #15-01 and
   Stormwater Management Permit #15-01
   203 Lowell Street - Map 48 Parcel 73
   HDO, LLC, Applicant
   Site Plan Review Action Deadline - May 29, 2015

SMP Action Deadline - May 29, 2015

7:45 p.m. – 8:15 p.m. Continued Public Hearing - Site Plan Review #14-04 and
Stormwater Management Permit #14-06
90 Eames Street - Map 38 Parcels 3A & 3B
Tresca Brothers Sand & Gravel, Applicant
Site Plan Review Action Deadline - May 29, 2015
SMP Action Deadline - May 29, 2015

8:15 p.m. – 8:45 p.m. Continued Public Hearing - Site Plan Review #15-04
45 Industrial Way - Map 46 Parcel 110
45 Industrial Way LLC, Applicant
Site Plan Review Action Deadline - May 29, 2015

8:45 p.m. – 9:15 p.m. Continued Public Hearing Special Permit #15-01
50 Hopkins Street - Map 11 Parcel 40
Robert K. Ahern for RKACO LLC, Applicant
Special Permit Action Deadline - July 6, 2015

4. **Board of Appeals**

5. **Old Business**

6. **New Business**

Decision for Site Plan Review #15-06 - Amendment to 269 Main Street
Map 43 Parcels 4C - Michael Coffman for Wilmington Main Realty LP, Applicant

Decision for Site Plan Review #15-05 and Multi-Family Special Permit #15-01
13-15 Church Street - Map 41 Parcels 108 & 109
Northeastern Development Corp., Applicant

Adjourn

Next meeting: June 2, 2015

RECEIVED
TOWN CLERK

2015 JUL 31 PM 3:40

TOWN OF WILMINGTON, MASSACHUSETTS

TOWN OF WILMINGTON, MA

PLANNING & CONSERVATION
DEPARTMENT

(978)658-8238
(978)658-3311
FAX (978)658-3334

PLANNING BOARD
AUGUST 4, 2015
ROOM 9
7:00 p.m.

1. **Minutes**:

   Correspondence:
   Planning Director's Report:

2. **Form A**

3. **Matters of Appointment**

7:00 p.m. - 7:30 p.m.	Draft Hazard Mitigation Plan Sam Cleaves, MAPC
7:30 p.m. – 7:45 p.m.	Continued Public Hearing - Site Plan Review #15-01 and Stormwater Management Permit #15-01 203 Lowell Street - Map 48 Parcel 73 HDO, LLC, Applicant **Site Plan Review Action Deadline - August 7, 2015** **SMP Action Deadline - August 7, 2015**
7:45 p.m. – 8:15 p.m. **REQUEST TO CONTINUE**	Continued Public Hearing - Site Plan Review #15-02 and Stormwater Management Permit #15-02 319A Andover Street - Map R1 Parcel 118 G & D Realty Trust, Applicant **Site Plan Review Action Deadline - August 31, 2015** **SMP Action Deadline - August 31, 2015**
8:15 p.m. – 8:30 p.m. **REQUEST TO CONTINUE**	Continued Public Hearing - Site Plan Review #15-09 & Stormwater Management Permit #15-04 269 Ballardvale Street - Map R2 Parcel 27A William & Anne Saurman, Applicant **Site Plan Review Action Deadline - August 15, 2015** **SMP Action Deadline - August 15, 2015**

TOWN OF WILMINGTON HAZARD MITIGATION PLAN
2015 UPDATE

Smart Growth & Regional Collaboration

What is the Hazard Mitigation Plan Update?
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. The Town of Wilmington adopted a hazard mitigation plan in 2008 and FEMA regulations require that the plan be updated every five years.

Why is this plan important?
The Federal Disaster Mitigation Act of 2000 requires that a city or town have an approved hazard mitigation plan in order to qualify for federal funding from the following grant programs:

- Pre-Disaster Mitigation Competitive (PDM-C)
- Hazard Mitigation Grant Program (HMGP)
- Flood Mitigation Assistance (FMA)

Additionally, the plan provides a municipality the opportunity to review potential vulnerabilities to natural hazards and develop measures that can reduce or mitigate these vulnerabilities and be included in the local planning process.

What goes into a hazard mitigation plan?
A hazard mitigation plan assesses the municipality's risks and vulnerabilities to natural hazard events such as flooding, hurricanes, winter storms, and earthquakes. MAPC uses statewide data and information directly from the community to make this assessment.

The plan includes a set of goals related to the overall goal of hazard mitigation planning, an assessment of existing mitigation measures, and a set of new mitigation measures that will serve to advance the plan goals. The plan update will also look at implementation progress that has been made on mitigation measures from the previous plan.

What is the Local Hazard Mitigation Committee?
The Local Hazard Mitigation Committee includes and coordinates with representatives from a number of different Town departments including Public Works, Engineering, Health, Community Development, Emergency Management and Fire. This committee provides the local on-the-ground knowledge necessary to write this plan including information on local hazard areas and current mitigation measures. This committee also identifies and prioritizes mitigation measures to be included in the plan.

How can the public become involved in the Hazard Mitigation planning process?
Public participation is very important to the hazard mitigation planning process. FEMA requires a minimum of two public meetings. As a first draft of the plan is developed, the Town will provide an online link where the plan can be viewed and comments may be provided by the public.

60 Temple Place, Boston, MA 02111 • 617-451-2770 • Fax 617-482-7185 • www.mapc.org

Jay Ash, *President* • Michelle Ciccolo, *Vice-President* • Marilyn Contreas, *Secretary* • Grace S. Shepard, *Treasurer* • Marc Draisen, *Executive Director*

APPENDIX D
DOCUMENTATION OF PLAN ADOPTION

<TOWN LETTERHEAD>

CERTIFICATE OF ADOPTION
BOARD OF SELECTMEN
TOWN OF WILMINGTON, MASSACHUSETTS

A RESOLUTION ADOPTING THE
TOWN OF WILMINGTON HAZARD MITIGATION PLAN 2015 UPDATE

WHEREAS, the Town of Wilmington established a Committee to prepare the *Town of Wilmington Hazard Mitigation Plan 2015 Update*; and

WHEREAS, the *Town of Wilmington Hazard Mitigation Plan 2015 Update* contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Wilmington, and

WHEREAS, duly-noticed public meetings were held by the EMERGENCY MANAGEMENT TEAM on March 27, 2014, and June 9, 2015

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

NOW, THEREFORE BE IT RESOLVED that the Town of Wilmington BOARD OF SELECTMEN adopts the *Town of Wilmington Hazard Mitigation Plan 2015 Update*, in accordance with M.G.L. 40 §4 or the charter and bylaws of the Town of Wilmington.

ADOPTED AND SIGNED this Date. _____

Name(s)

Title(s)

Signature(s)

ATTEST