



DRAFT
January 7, 2019

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ACKNOWLEDGEMENTS & CREDITS

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

MAPC Officers

President, Keith Bergman, Town of Littleton
Vice President, Erin Wortman, Town of Stoneham
Secretary, Sandra Hackman, Town of Bedford
Treasurer, Taber Keally, Town of Milton
Executive Director, Marc Draisen, MAPC

Credits

Project Manager: Martin Pillsbury
Mapping/GIS Services: Caitlin Spence,

Massachusetts Emergency Management Agency

Director: Kurt Schwartz

Department of Conservation and Recreation

Commissioner: Leo Roy

Watertown Local Hazard Mitigation Planning Team

Robert Quinn	Fire Department
Gerald Mee	Public Works Department
Matthew Shuman	Public Works Department
Steven Magoon	Community Development and Planning

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SECTION 1: 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 Watertown Local Hazard Mitigation Planning Team, composed of staff from a number of different Town Departments. This team met on March 6, 2018, August 10, 2018, and December 18, 2018 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 Local Hazard Mitigation Planning Team held two public meetings, the first hosted by the Joint Committees on Public Works and Public Safety on December 4, 2018 and the second hosted by the Town Council on January 8 2019, and the draft plan update was posted on the Town's website for public review. Key town stakeholders and neighboring communities were notified of the public meeting and invited to review the draft plan and submit comments.

RISK ASSESSMENT

The Watertown Hazard Mitigation Plan assesses the potential impacts to the Town from flooding, high winds, winter storms, brush fire, geologic hazards, extreme temperatures, and drought. These are shown in the map series in Appendix B.

The Watertown Local Hazard Mitigation Planning Team identified 82 Critical Facilities. These are also shown on the map series and listed in Table 29, identifying which facilities are located within the mapped hazard zones.

A HAZUS-MH analysis provided estimates of property damages from Hurricanes of 100-year and 500-year frequency (\$24.8 million to \$112.5 million) as well as earthquakes of magnitudes 5 and 7 (\$891 million to \$5.0 billion) and flood damage ranging from (\$45.6 million to \$69.1 million).

HAZARD MITIGATION GOALS

The Watertown Local Multiple Hazard Community Planning Team reviewed and discussed the set of goals for the Town of Watertown. The Team endorsed the eight goals included in the previous plan, and added an additional goal relating to climate change. The following goals were endorsed by the team for the Watertown Hazard Mitigation Plan 2018 Update:

1. Prevent and reduce the loss of life, injury, public health impacts and property damages resulting from all major natural hazards.
2. Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.
3. Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.
4. Prevent and reduce the damage to public infrastructure resulting from all hazards.
5. Encourage the business community, major institutions and non-profits to work with the Town 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.
9. Consider the impacts of climate change and incorporate climate sustainability and resiliency into hazard mitigation and other Town plans and policies.

HAZARD MITIGATION STRATEGY

The Watertown Local Hazard Mitigation Planning Team identified a number of mitigation measures that would serve to reduce the Town's vulnerability to natural hazard events. Overall, the hazard mitigation strategy recognizes that mitigating hazards for Watertown 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, and 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 & UPDATE PROCESS

The process for developing Watertown's Hazard Mitigation Plan 2019 Update is summarized in Table 1.

Table 1: Plan Review and Update Process

Section	Reviews and Updates
Section 3: 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 Watertown Board of Selectmen. The plan was also available on the Town's website for public commentbbb.
Section 4: 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.
Section 5: Goals	The Hazard Mitigation Goals were reviewed and endorsed by the Watertown Local Hazard Mitigation Planning Team.
Section 6: Existing Mitigation Measures	The list of existing mitigation measures was updated to reflect current mitigation activities in the town.
Sections 7 and 8: Hazard Mitigation Strategy	Mitigation measures from the 2012 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 2019 Plan Update or modify or delete them. The Plan Update's hazard mitigation strategy reflects both new measures and measures carried forward from the 2012 plan. The Local Hazard Mitigation Team prioritized all of these measures based on current conditions.
Section 9: 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 in Table 34, Watertown made progress implementing mitigation measures identified in the 2012 Hazard Mitigation Plan. The town completed several mitigation measures include. Adoption of a Stormwater Ordinance, installation of a fixed generator in Town Hall, initiation of a test program to assist homeowners with installing pumps, increased capacity for sediment removal in drainage facilities, acquisition of hand-held GPS units and upgrade of GIS equipment.

Several projects that were not completed will be continued into this plan update. These include installing backup generators in several schools, implementing the Rutland Street project for pump installations, increasing capacity for tree maintenance, coordinating dam management with state agencies, and upgrading the emergency communications system for inter-operability between Fire, Police, and Public Works. .

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 2012 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 Watertown Hazard Mitigation Implementation Team, as described in Section 9 Plan Adoption and Maintenance.

SECTION 2: 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 Watertown to update its local Hazard Mitigation Plan, which was first adopted in 2012.

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 Watertown 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)

Disaster Name (Date of Event)	Type of Assistance	Declared Areas
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
	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 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 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

Disaster Name (Date of Event)	Type of Assistance	Declared Areas
May Rainstorm/ Flood May 12-23, 2006	Hazard Mitigation Grant Program	Statewide
April Nor'easter April 15-27, 2007	Hazard Mitigation Grant Program	Statewide
Flooding March, 2010	FEMA Public Assistance FEMA Individuals and Households Program SBA Loan	Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Statewide
Tropical Storm Irene August 27-28, 2011	FEMA Public Assistance	Statewide
Hurricane Sandy October 27-30, 2012	FEMA Public Assistance	Statewide
Severe snowstorm and Flooding February 8-9, 2013	FEMA Public Assistance; Hazard Mitigation Grant Program	Statewide
Blizzard of 2015 January 26-28, 2015	FEMA Public Assistance; Hazard Mitigation Grant Program	Statewide
Winter Storm Riley and Flooding March 3-6, 2018	Hazard Mitigation Grant Program	Statewide

Source: Database provided by MEMA

FEMA FUNDED MITIGATION PROJECTS

The Town of Watertown has not received funding from FEMA for mitigation projects, but MAPC received funding to prepare the Town's first Hazard Mitigation Plan and the Town received a grant for this 2018 plan update. These grants are summarized in Table 3 below.

Table 3: FEMA-Funded Mitigation Plans

Grant	Grantee/ Project Title	Scope of Work	Total Cost	Federal Funding	Local Funding
PDMC 07-01	MAPC/ Hazard Mitigation Planning	Development of first hazard mitigation plan (17 municipalities including Watertown)	\$217,000	\$162,000	\$54,000
PDM16- Wat	Watertown/ Hazard Mitigation Planning	Update of first hazard mitigation plan	\$20,000	\$15,000	\$5,000

Source: MEMA Grants Database

COMMUNITY PROFILE

Founded in 1630, Watertown was the first inland settlement in Massachusetts and initially encompassed the present communities of Weston, Waltham and large sections of Lincoln, Belmont, and Cambridge, thus becoming one of the largest American settlements of its time. Settled by Englishmen who had set sail on the Arbella, and were led by Sir Richard Saltonstall, Watertown quickly grew to be an important center for trade, commerce, and industry. Over the years this community has played an important role in Massachusetts history, once serving as the temporary seat of government during the Revolutionary War.

Located along the banks of the Charles River, today Watertown is a dense community on the immediate outskirts of Boston. With only 4.1 square miles and a population of 35,756 people, This diverse suburb provides its residents with a close-knit community and prime access to economic, medical, and education centers in the Boston metropolitan area.

Today Watertown is rich in ethnic diversity and culture, boasts a high level of citizen involvement and many amenities such as shopping malls, swimming pools, country and tennis clubs, skating rinks, eleven fine parks, and public transportation providing easy access to Boston and surrounding communities.

(Narrative supplied by the community and taken from the Community Profile on the website maintained by the Department of Housing and Community Development and the Watertown Open Space and Recreation Plan)

The Town is governed by a nine-member Town Council with a Town Manager acting as the Town's Chief Administrative Officer. The town maintains a website at <http://www.ci.watertown.ma.us/>.

According to the US Census 2017 American Community Survey, the population was 35,756 people and there were 16,046 housing units.

Table 4: Watertown Characteristics

Population = 35,756,

- 6.7% are under age 5
- 15.7% are under age 18
- 15.4% are over age 65
- 10% have a disability
- 28.9% speak English-less than very well

Number of Housing Units = 16,046

- 50% are renter-occupied housing units
- 42.6% of housing units were built before 1940

Sources: US Census, 2017 American Community Survey

Important characteristics of Watertown to keep in mind include:

- Watertown serves as a regional hub that draws people from nearby communities due to the retail services and restaurants, particularly in Watertown Square and the former Arsenal site.

- Watertown's location on the Charles River provides important open space, some of which is owned by the Massachusetts Department of Conservation and Recreation, which serves as a regional resource.
- Watertown is continuously growing and continues to face development, both residential and commercial.
- Watertown on the Massachusetts Water Resources Authority for both drinking water and wastewater services, providing the town with reliable infrastructure services.

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SECTION 3: PLANNING PROCESS & 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 a 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, 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’s 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.

Figure 1: Six-Step Planning Process



1. **Map the Hazards** – MAPC relies on data from a number of different federal, state, and local sources in order to map the areas with the potential to experience natural hazards. This mapping represents a multi-hazard assessment of the municipality and is used as a set of base maps for the remainder of the planning process. A particularly important source of information is the knowledge drawn from local municipal staff on where natural hazard impacts have occurred. These maps can be found in Appendix B.
2. **Assess the Risks & Potential Damages** – Working with local staff, critical facilities, infrastructure, vulnerable populations, and other features are mapped and contrasted with the hazard data from the first step to identify those that might represent particular vulnerabilities to these hazards. Land use data and development trends are also incorporated into this analysis. In addition, MAPC develops estimates of the potential impacts of certain hazard events on the community. MAPC drew on the following resources to complete the plan:
 - Town of Watertown, Zoning Ordinance
 - Town of Watertown, Stormwater Ordinance
 - Town of Watertown, Wetlands Ordinance
 - Town of Watertown Open Space and Recreation Plan, 2015
 - FEMA, Local Mitigation Plan Review Guide, October 2011
 - FEMA, Flood Insurance Rate Maps for Middlesex County, MA, 2010
 - Massachusetts State Hazard Mitigation Plan
 - Metropolitan Area Planning Council, GIS Lab, Regional Plans and Data.
 - New England Seismic Network, Boston College Weston Observatory
 - NOAA National Center for Environmental Information
 - Northeast States Emergency Consortium
 - USGS, National Water Information System
 - US Census, 2010 and American Community Survey, 2017
3. **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.
4. **Develop Mitigation Strategies** – MAPC works with the local municipal staff to identify new mitigation measures, utilizing information gathered from the hazard identification, vulnerability assessments, and the community's existing mitigation efforts to determine where additional work is necessary to reduce the potential damages from hazard events. Additional information on the development of hazard mitigation strategies can be found in Section 7.
5. **Plan Approval & Adoption** – Once a final draft of the plan is complete it is sent to MEMA for the state level review and, following that, to FEMA for approval. Typically, once FEMA has approved the plan the agency issues a conditional approval (Approval Pending Adoption), with the condition being adoption of the plan by the municipality. More information on plan adoption can be found in Section 9 and documentation of plan adoption can be found in Appendix D.
6. **Implement & Update the Plan** – Implementation is the final and most important part of any planning process. Hazard Mitigation Plans must also be updated on a five year basis making

preparation for the next plan update an important on-going activity. Section 9 includes more detailed information on plan implementation.

2012 PLAN IMPLEMENTATION & MAINTENANCE

The 2012 Town of Watertown Hazard Mitigation Plan contained a risk assessment of identified hazards for the town and mitigation measures to address the risk and vulnerability from these hazards. Since approval of the plan by FEMA and local adoption, progress has been made on implementation of the measures. The Town has advanced a number of projects, including adoption of a stormwater ordinance, stormwater drainage projects, purchase of mobile generators, and upgraded GIS.

THE LOCAL MULTIPLE HAZARD COMMUNITY PLANNING TEAM

MAPC worked with the local community representatives to organize a Local Hazard Mitigation Planning Team for Watertown. MAPC briefed the local representatives as to the desired composition of that team as well as the need for public participation in the local planning process.

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 are listed in Table 5 below.

Table 5: Watertown Local Hazard Mitigation Team

Robert Quinn	Fire Department
Gerald Mee	Public Works Department
Matthew Shuman	Public Works Department
Steven Magoon	Community Development and Planning

The Watertown Planning Board and the Watertown Conservation Commission are the primary entities responsible for regulating development in town. Feedback from the Planning Board and the Conservation Commission was assured through the participation of the Director of Community Development and Planning, which includes staff to both the Planning Board and Conservation Commission. In addition, MAPC, the State-designated regional planning authority for Watertown, works with all agencies that regulate development in the region, including the listed municipal entities and state agencies, such as the MassDOT (MassHighway and MBTA), the Department of Conservation and Recreation (open space and dams), and the Massachusetts Water Resources Authority (water supply and wastewater).

The Local Hazard Mitigation Planning Team met on the following dates: March 6, 2018, August 10, 2018; and December 18, 2018. The purpose of the meetings was to introduce the Hazard Mitigation planning program, review and update hazard mitigation goals, and to gather information on local hazard mitigation issues and sites or areas related to these. Later meetings focused on verifying information gathered by MAPC staff and discussion of existing mitigation practices, the status of mitigation measures identified in the 2012 hazard mitigation plan, and potential new or revised mitigation measures. The agendas for these meetings are included in Appendix A.

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 Watertown hazard mitigation planning process during a meeting of the Joint Committees on Public Works and Public Safety on December 3, 2018 held in at Watertown Town Hall. The draft plan update was presented at a Town Council meeting on January 8, 2019 at Watertown Town Hall. Both meetings were publicized in accordance with the Massachusetts Public Meeting Law (see public meeting notices in Appendix C). Both meetings were broadcast on Watertown Local Access Cable Television.

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:

- Armenian Museum of America
- Athena Health
- Historical Society of Watertown
- Oakley Country Club
- Perkins School for the Blind
- Rotary Club of Watertown
- Watertown Community Foundation
- Watertown Early Childhood Services
- Watertown Free Public Library
- Watertown Health Center
- Watertown Mall Merchants
- Town of Belmont
- City of Waltham
- City of Cambridge
- City of Boston
- City of h

The draft Watertown Hazard Mitigation Plan 2019 Update was posted on the Town’s website for the second public meeting. Members of the public could access the draft document and submit comments or questions to the Town.

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

PLANNING TIMELINE

March 3, 2018	Meeting of the Watertown Local Hazard Mitigation Planning Team
August 10, 2018	Meeting of the Watertown Local Hazard Mitigation Planning Team
December 4, 2018	First Public Meeting with Joint Committees on Public Works and Public Safety
December 18, 2018	Meeting of the Watertown Local Hazard Mitigation Planning Team
January 8, 2019	Second Public Meeting with Watertown Town Council
TBD	Draft Plan Update submitted to MEMA

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SECTION 4: RISK ASSESSMENT

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

In order to update Watertown'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.

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 6 below summarizes the hazard risks for Watertown. 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 Watertown using the definitions for hazard frequency and severity listed below. Based on this, the Town set an overall priority for each hazard.

Table 6: Hazard Risks Summary

Hazard	Frequency		Severity	
	Massachusetts	Watertown	Massachusetts	Watertown
Flooding	High	Medium	Serious to extensive	Serious
Dam failures	Low	Low	Extensive	Extensive
Coastal Hazards	High	N/A	Serious	N/A
Tsunami	Very Low	N/A	Extensive	N/A
Hurricane/Tropical Storm	Medium	Medium	Serious	Serious
Tornadoes	Medium	Low	Serious	Minor
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
Winter Ice Jams	Low	N/A	Serious	N/A
Earthquakes	Very Low	Very Low	Serious	Serious
Landslides	Low	Low	Minor	Minor
Brush fires	Medium	Low	Minor	Minor
Major Urban Fires	Low	N/A	Minor	N/A
Extreme Temperatures	Medium	Medium	Minor	Minor
Drought	Low	Low	Minor	Minor

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

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.

It should be noted that several of the hazards listed in the Massachusetts State Hazard Mitigation plan are not applicable to the Town of Watertown. Due to its inland location away from the coast, coastal hazards including Tsunamis and Storm Surge are not applicable to Watertown. Due to the low incidence of wildfires in proximity to developed areas in Watertown, Major Urban Fires are also not applicable to this town. In addition, ice jams are not a hazard for the town. The US Army Corps Ice Jam Database shows no record of ice jams in Watertown.

FLOOD-RELATED HAZARDS

Flooding was the most prevalent serious natural hazard identified by local officials in Watertown. 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 sixty years. Significant flood events that have impacted Watertown include:

- August 1954
- March 1968
- January 1979
- April 1987
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007
- March 2010

Local data for previous flooding occurrences are not collected by the Town of Watertown. The best available local data is for Middlesex County through the National Environmental Information Center (see Table 7). Middlesex County, which includes the Town of Watertown, experienced 60 flood events from 1996 –2017. No deaths or injuries were reported and the total reported property damage in the county was \$41.9 million dollars. Of that total, \$35.2 million is attributed to the two major events of March 2010.

Table 7: Middlesex County Flood Events, 1996 to 2018

Date	Deaths	Injuries	Property Damage
1/29/1996	0	0	0
4/17/1996	0	0	0
9/18/1996	0	0	0
10/21/1996	0	0	0
10/22/1996	0	0	0
3/10/1998	0	0	0
3/11/1998	0	0	0
5/12/1998	0	0	0
6/14/1998	0	0	0
6/15/1998	0	0	0
6/17/1998	0	0	0
4/22/2000	0	0	0
4/23/2000	0	0	0
3/22/2001	0	0	0
3/23/2001	0	0	0
3/31/2001	0	0	0
4/1/2001	0	0	0
4/2/2004	0	0	0
4/15/2004	0	0	0
3/29/2005	0	0	0
10/15/2005	0	0	100,000
10/15/2005	0	0	100,000
10/15/2005	0	0	125,000
5/13/2006	0	0	5,000,000
7/11/2006	0	0	2,000
10/28/2006	0	0	5,000
4/16/2007	0	0	25,000
2/13/2008	0	0	0
5/27/2008	0	0	3,000
6/24/2008	0	0	10,000
6/29/2008	0	0	5,000
8/10/2008	0	0	15,000

Date	Deaths	Injuries	Property Damage
8/10/2008	0	0	40,000
9/6/2008	0	0	15,000
12/12/2008	0	0	20,000
3/14/2010	0	0	26,430,000
3/29/2010	0	0	8,810,000
4/1/2010	0	0	0
8/28/2011	0	0	5,000
10/14/2011	0	0	0
6/8/2012	0	0	0
6/23/2012	0	0	15,000
7/18/2012	0	0	5,000
10/29/2012	0	0	0
6/7/2013	0	0	0
7/1/2013	0	0	0
7/23/2013	0	0	0
9/1/2013	0	0	10,000
3/30/2014	0	0	35,000
7/27/2014	0	0	0
8/31/2014	0	0	0
10/22/2014	0	0	20,000
10/23/2014	0	0	0
12/9/2014	0	0	5,000
12/9/2014	0	0	30,000
5/31/2015	0	0	0
8/4/2015	0	0	0
8/15/2015	0	0	50,000
8/15/2015	0	0	75,000
9/30/2015	0	0	0
4/6/2017	0	0	0
6/27/2017	0	0	1,000
7/12/2017	0	0	1,000,000
7/18/17	0	0	0
8/2/2017	0	0	5,000
10/25/17	0	0	0
10/30/2017	0	0	0
1/12/2018	0	0	0
1/13/2018	0	0	0

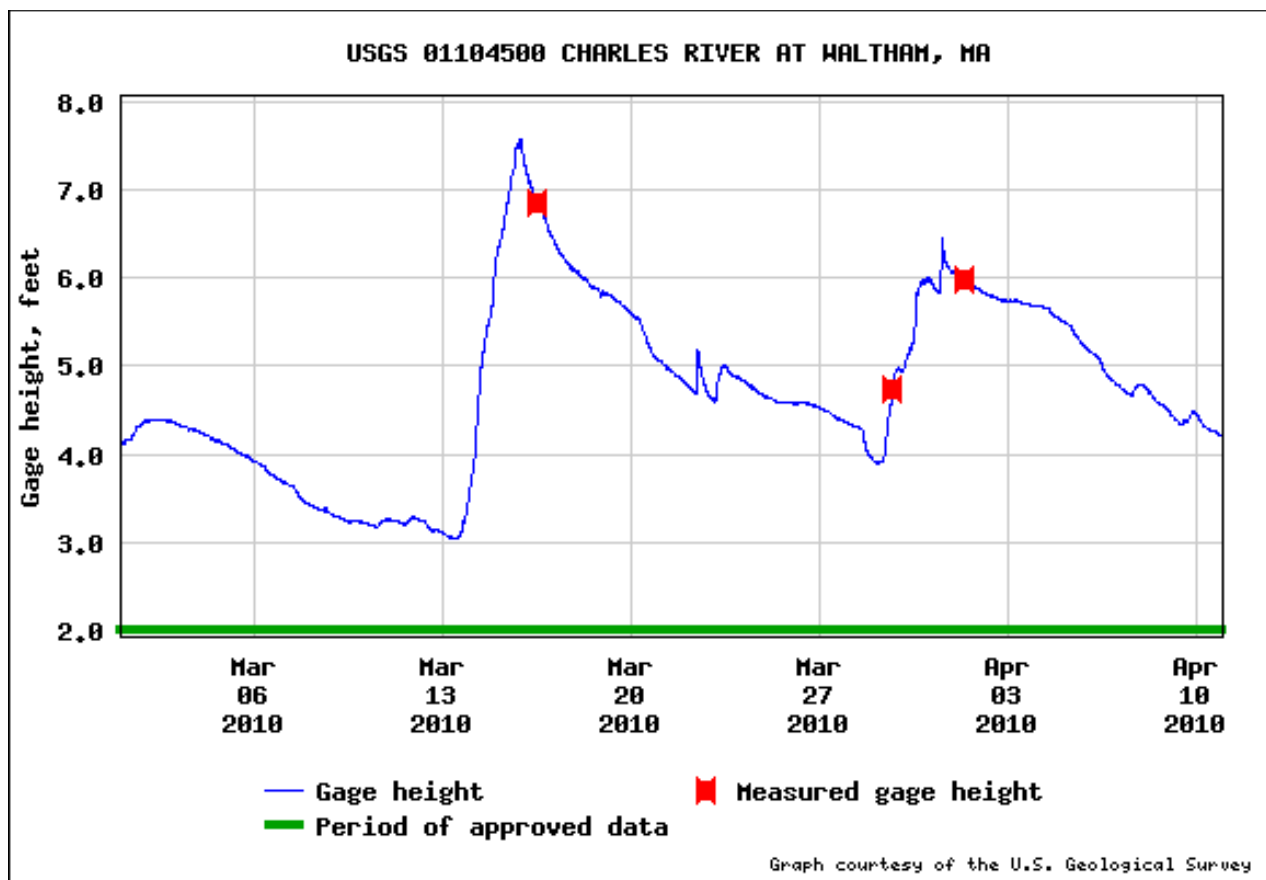
Date	Deaths	Injuries	Property Damage
4/16/2018	0	0	0
6/25/2018	0	0	15,000

Source: NOAA, National Environmental Information Center

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 Charles River in nearby Waltham. The USGS gage height, shown in Figure 2, reached 7.5 feet on March 16, 2010 and over 6 feet on March 31, 2010. Average gage height in April is about 4 feet.

Figure 2 USGS Flow Gage Data for Charles River, March 2010



Source: United States Geological Survey

OVERVIEW OF TOWN-WIDE FLOODING

The Charles River is the predominant source of potential flood waters in Watertown. Flood zones line the riverbanks, though they are generally constricted to the area immediately adjacent to the waterway. Most actual flooding occurs upstream of the Watertown Dam. Groundwater sourced flooding of basements is also relatively common across many different parts of the Town.

Information on flood hazard areas was taken from two sources. The first was the National Flood Insurance Rate Maps. The FIRM flood zones are shown on Map 3 in Appendix B. The second was the Watertown Hazard Mitigation Team. The locally identified areas of flooding described below were identified by Town staff as areas where flooding occurs outside of the FIRM flood zones.

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. Most of the FIRM flood zones in Watertown are located along the Charles River.

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.

Zone X (0.2% annual chance): Zone X500 is the flood insurance rate zone that corresponds 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.

LOCALLY IDENTIFIED AREAS OF FLOODING

In addition to the FIRM flood zones, information on other areas subject to flooding was provided by the Watertown Local Hazard Mitigation Team. These “Locally Identified Areas of Flooding” are shown in Table 8. 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 in Table 8 correspond to the numbers on Map 8, “Local Hazard Areas.”

Table 8: Locally Identified Areas of Flooding

Map ID	Name	Description
1	Charles River	During severe storms flooding can occur directly along the shore on this stretch of the Charles River, above the dam.
2	Cunniff Elementary School	Basement flooding from groundwater.
3	Watertown High School	Basement flooding from groundwater.
4	New Police Headquarters	Basement flooding from groundwater.
7	Rutland Street	Basement flooding of homes from groundwater.
8	Arlington Street and Keith Street	Flooding was caused after a series of three storms

REPETITIVE LOSS STRUCTURES

There are no repetitive loss structures in Watertown. As defined by the Community Rating System (CRS) of the National Flood Insurance Program (NFIP), a repetitive loss property is any property which the NFIP has paid two or more flood claims of \$1,000 or more in any given 10-year period since 1978. For more information on repetitive losses see <http://www.fema.gov/business/nfip/replps.shtm>.

Potential flooding damages to Watertown have been estimated using HAZUS-MH. Total losses are estimated at \$45.6 million for a 100-year flood event and \$69.1 million for a 500-year flood event. Other potential impacts are detailed in Table 32.

Based on the record of previous occurrences flooding events in Watertown are a medium frequency event as defined by the Massachusetts State Hazard Mitigation Plan. This hazard may occur from once in 5 years to once in 50 years (2% to 20% per year) in Watertown.

DAMS AND DAM FAILURE

Dam failure can arise from two types of situations. Dams can fail because of structural problems independent of any storm event. Dam failure can follow an earthquake by causing structural damage. Dams can fail structurally because of flooding arising from a storm or they can overflow due to flooding.

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. An issue for dams in Massachusetts is that many were built in the 19th century without the benefits of modern engineering or construction oversight.

Dam failure is a highly infrequent occurrence but a severe incident could result in loss of lives and significant property damage. According to the Association of State Dam Safety Officials, three dams have failed in Massachusetts since 1984, one of which resulted in a death. There has not been a dam failure incident in Watertown.

According to data provided by the Massachusetts Department of Conservation and Recreation (DCR) and the town, there is one dam located in Watertown, the Watertown Dam on the Charles River, owned by the MA Department of Conservation and Recreation (see Figure 3). The Town coordinates with DCR at this dam and others up and downstream on the Charles River to maintain an appropriate level of flow during storm events to manage flooding to the extent possible.

In addition to the Watertown Dam, there are also several upstream dams on tributaries of the Charles that could have an impact on Watertown should they fail. These include two dams owned by the City of Cambridge Water Department in Weston and Waltham, the Norumbega Reservoir Dams, Schenck's Pond Dam, and Weston Reservoir Dam in Weston, operated by the Massachusetts Water Resources Authority.

The Watertown Dam and upstream dams are summarized in Table 9 according to river or stream, ownership, and hazard potential. DCR defines dam hazard potential classifications as follows:

DCR Dam Hazard Classification

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 highway(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)

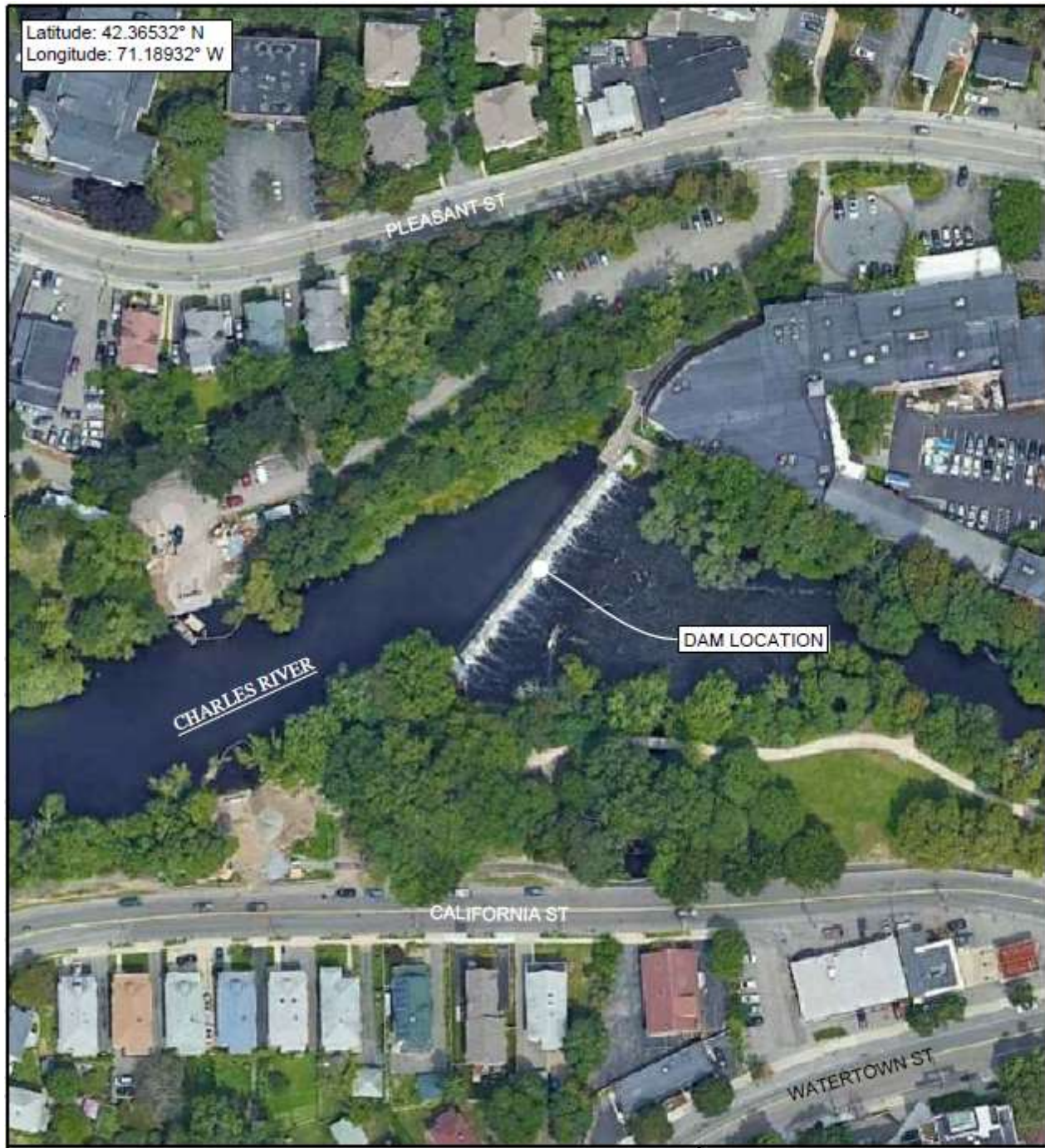
Low: Dams located where failure or mis-operation may cause minimal property damage to others. Loss of life is not expected.

Table 9 Inventory of Dams in and Upstream of Watertown

Dam Name	River/Stream	Owner/Operator	Owner Type	Hazard Potential Classification
Cambridge Reservoir	Hobbs Brook	City of Cambridge	Municipal	Significant Hazard
Norumbega Dam#1	Seaverns Brook	DCR/MWRA	State	High Hazard
Norumbega Dam#2	Seaverns Brook	DCR/MWRA	State	Significant Hazard
Norumbega Dam#3	Seaverns Brook	DCR/MWRA	State	Significant Hazard
Norumbega Dam#4	Seaverns Brook	DCR/MWRA	State	High Hazard
Norumbega East Dike	Seaverns Brook	DCR/MWRA	State	High Hazard
Schencks Pond Dam	Seaverns Brook	DCR/MWRA	State	High Hazard
Stony Brook Reservoir	Stony Brook	City of Cambridge	Municipal	High Hazard
Watertown Dam	Charles River	DCR	State	Significant Hazard
Weston Reservoir	Pine Brook	DCR/MWRA	State	High Hazard

There are no records of dam failures in Watertown or upstream communities. Based on the record of previous occurrences, dam failure in Watertown is a low frequency event as defined by the Massachusetts State Hazard Mitigation Plan. This hazard may occur less frequently than once in 50 years to once in 100 years (1% to 2% per year).

Figure 3 Aerial View of the Watertown Dam



Source: Watertown Dam Emergency Action Plan

WIND-RELATED HAZARDS

Wind-related hazards include hurricanes, tropical storms, and tornadoes, as well as high winds during nor'easters and thunderstorms. Information on wind related hazards can be found on Map 5 in Appendix B. The hazard mapping indicates that the 100-year wind speed in Watertown is 110 miles per hour. No tornadoes have been recorded in Watertown.

Downed trees and limbs can be a problem due to weather conditions such as strong wind or heavy snow and ice. Tree limbs can down power and communication lines and impact major roadways. The combination of wind and snow caused significant power line damage during the 2018 Nor'easter.

HURRICANES AND TROPICAL STORMS

A hurricane is a violent wind and rainstorm with wind speeds of 74 to 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 land. Given its location not too distant from the coast, the Town of Watertown's entire area is vulnerable to hurricanes, which 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.

No hurricanes have tracked directly through Watertown. However, as shown in Map 5 in Appendix B, a tropical storm tracked just west of Watertown through Waltham in 1861, and another tracked just east of Watertown through Brighton in 1944. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. The town also experiences the impacts of the wind and rain of hurricanes and tropical storms regardless of whether the storm track passed through the town.

Table 10: Hurricane Records for Massachusetts, 1938 to 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 Earl	September 4, 2010
Tropical Storm Irene	August 28, 2011
Hurricane Sandy	October 29-30, 2012

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)	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 Watertown. Potential hurricane damages to Watertown have been estimated using HAZUS-MH. Total damages are estimated at \$24.8 million for a 100-Year hurricane and \$112.5 million for a 500-Year hurricane. Other potential impacts such as debris generation and sheltering needs are detailed in Table 30.

Based on records of previous occurrences, hurricanes in Watertown are a medium frequency event as defined by the 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 1, 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 in Table 11 below:

Table 11: Enhanced Fujita Scale

Fujita Scale			Derived		Operational EF Scale	
F Number	Fastest $\frac{1}{4}$ mile (mph)	3-second gust (mph)	EF Number	3-second gust (mph)	EF Number	3-second gust (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. 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 four deaths in June of 2011. The Revere tornado touched down in Chelsea and moved north into Revere's business district along Broadway, ending near the intersection of Routes 1 and 60. The path was two miles long and $\frac{3}{8}$ mile wide, with wind speeds up to 120 miles per hour. Approximately 65 homes had substantial damages and 13 homes and businesses were rendered uninhabitable.

There have been no recorded tornadoes in the Town of Watertown. Since 1955 there have been 18 tornadoes in surrounding Middlesex County recorded by the Tornado History Project. Two of these were F3 tornadoes, and four were F2. These 18 tornadoes resulted in a total of one fatality and six injuries and \$38.8 million in damages, as summarized in Table 12.

Table 12: Tornado Records for Middlesex County

Date	Fujita	Fatalities	Injuries	Width	Length	Damage
10/24/1955	1	0	0	10	0.1	\$500-\$5000
6/19/1957	1	0	0	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-\$500K
9/27/1985	1	0	0	40	0.1	\$50-\$500K
8/7/1986	1	0	0	73	4	\$50K-\$500K
8/22/2016	1	0	0	400	.85	\$10K

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 Watertown, tornado impacts are relatively localized compared to severe storms and hurricanes. Damages from any tornado in Watertown would greatly depend on the track of the tornado. The greatest economic damage would likely result from a tornado striking the town's commercial districts, including Watertown Square and Arsenal Street.

Based on the record of previous occurrences since 1956, Tornado events in Watertown are a low frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur from once in 50 years to once in 100 years (1% to 2% 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 rain or snow, depending on temperatures. Previous occurrences of nor'easters include the following, which are listed in the Massachusetts State Hazard Mitigation Plan, or have occurred since:

Table 13: Nor'easter Events for Massachusetts, 1978 to 2015

Nor'easter Event	Date
Blizzard of 1978	February 1978
Severe Coastal Storm ("Perfect Storm")	October 1991
Great Nor'easter of 1992	December 1992
Blizzard/Nor'easter	January 2005
Coastal Storm/Nor'easter	October 2005
Severe Storms, Inland & Coastal Flooding/Nor'easter	April 2007
Winter Storm/Nor'easter	January 2011
Severe Storm/Nor'easter	October 2011
Blizzard of 2013	February 2013
Blizzard of 2015	January 2015
March 2015 Nor'easters	March 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, January 2015 were large nor'easters that caused significant snowfall amounts. March 2015 saw four nor'easters which brought significant snowfall to Watertown.

Watertown is vulnerable to both the wind and precipitation that accompany nor'easters. High winds can cause damage to structures, fallen trees, and downed power lines leading to power outages. Intense rainfall can overwhelm drainage systems causing localized flooding of rivers and streams as well as urban stormwater ponding and localized flooding. Fallen tree limbs as well as heavy snow accumulation and intense rainfall can impede local transportation corridors, and block access for emergency vehicles.

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

Based on the record of previous occurrences, nor'easters in Watertown 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. A thunderstorm typically features lightning, strong winds, 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 best available data on previous occurrences of thunderstorms in Watertown is for Middlesex County through the National Environmental Information Center ('). Between the years 2006 and 2017 NEIC records show 72 thunderstorm events in Middlesex County (Table 14). These storms resulted in a total of \$1,631,000 in property damages. There were no injuries or deaths reported.

Table 14: Middlesex County Thunderstorm Events, 2006 to 2018

Date	Type	Magnitude	Deaths	Injuries	Damage
4/1/2006	Thunderstorm Wind	50	0	0	8000
5/21/2006	Thunderstorm Wind	61	0	0	95000
6/23/2006	Thunderstorm Wind	50	0	0	30000
7/11/2006	Thunderstorm Wind	50	0	0	10000
7/21/2006	Thunderstorm Wind	50	0	0	35000
7/28/2006	Thunderstorm Wind	50	0	0	15000
8/2/2006	Thunderstorm Wind	50	0	0	15000
5/16/2007	Thunderstorm Wind	50	0	0	0
6/27/2007	Thunderstorm Wind	50	0	0	0
7/6/2007	Thunderstorm Wind	50	0	0	0
7/9/2007	Thunderstorm Wind	50	0	0	0
7/15/2007	Thunderstorm Wind	50	0	0	0
7/28/2007	Thunderstorm Wind	50	0	0	0
7/29/2007	Thunderstorm Wind	50	0	0	0
8/17/2007	Thunderstorm Wind	50	0	0	0
9/8/2007	Thunderstorm Wind	50	0	0	25000

Date	Type	Magnitude	Deaths	Injuries	Damage
5/27/2008	Thunderstorm Wind	50	0	0	8000
6/10/2008	Thunderstorm Wind	50	0	0	20000
6/23/2008	Thunderstorm Wind	50	0	0	5000
6/24/2008	Thunderstorm Wind	50	0	0	5000
6/27/2008	Thunderstorm Wind	50	0	0	5000
6/29/2008	Thunderstorm Wind	50	0	0	10000
7/1/2008	Thunderstorm Wind	50	0	0	20000
7/2/2008	Thunderstorm Wind	50	0	0	5000
7/3/2008	Thunderstorm Wind	50	0	0	15000
7/19/2008	Thunderstorm Wind	50	0	0	8000
7/20/2008	Thunderstorm Wind	50	0	0	5000
7/27/2008	Thunderstorm Wind	50	0	0	5000
8/3/2008	Thunderstorm Wind	50	0	0	5000
8/7/2008	Thunderstorm Wind	50	0	0	5000
9/9/2008	Thunderstorm Wind	50	0	0	8000
5/9/2009	Thunderstorm Wind	50	0	0	2000
5/24/2009	Thunderstorm Wind	50	0	0	15000
7/7/2009	Thunderstorm Wind	50	0	0	1000
7/8/2009	Thunderstorm Wind	50	0	0	20000
7/26/2009	Thunderstorm Wind	50	0	0	15000
7/31/2009	Thunderstorm Wind	50	0	0	30000
5/4/2010	Thunderstorm Wind	50	0	0	30000
6/1/2010	Thunderstorm Wind	50	0	0	5000
6/3/2010	Thunderstorm Wind	50	0	0	20000
6/5/2010	Thunderstorm Wind	50	0	0	40000
6/6/2010	Thunderstorm Wind	50	0	0	100000
6/24/2010	Thunderstorm Wind	50	0	0	30000
7/12/2010	Thunderstorm Wind	50	0	0	50000
7/19/2010	Thunderstorm Wind	50	0	0	25000
6/1/2011	Thunderstorm Wind	50	0	0	5000
6/9/2011	Thunderstorm Wind	50	0	0	15000
8/2/2011	Thunderstorm Wind	50	0	0	1000
8/19/2011	Thunderstorm Wind	50	0	0	15000
6/8/2012	Thunderstorm Wind	50	0	0	25000
6/23/2012	Thunderstorm Wind	45	0	0	5000
7/4/2012	Thunderstorm Wind	50	0	0	10000
7/18/2012	Thunderstorm Wind	70	0	0	350000
9/7/2012	Thunderstorm Wind	50	0	0	10000
9/8/2012	Thunderstorm Wind	40	0	0	3000
6/17/2013	Thunderstorm Wind	50	0	0	25000
6/18/2013	Thunderstorm Wind	45	0	0	10000
6/24/2013	Thunderstorm Wind	45	0	0	3000
7/23/2013	Thunderstorm Wind	50	0	0	20000
7/29/2013	Thunderstorm Wind	50	0	0	5000

Date	Type	Magnitude	Deaths	Injuries	Damage
7/3/2014	Thunderstorm Wind	50	0	0	75000
7/7/2014	Thunderstorm Wind	87	0	0	100000
7/15/2014	Thunderstorm Wind	50	0	0	25000
7/28/2014	Thunderstorm Wind	50	0	0	50000
9/6/2014	Thunderstorm Wind	50	0	0	15000
5/28/2015	Thunderstorm Wind	45	0	0	5000
8/4/2015	Thunderstorm Wind	50	0	0	40000
8/15/2015	Thunderstorm Wind	50	0	0	25000
2/25/2016	Thunderstorm Wind	50	0	0	30000
3/17/2016	Thunderstorm Wind	45	0	0	5000
7/22/2016	Thunderstorm Wind	50	0	0	14,000
7/23/2016	Thunderstorm Wind	50	0	0	0
8/22/2016	Thunderstorm Wind	50	0	0	0
9/11/2016	Thunderstorm Wind	50	0	0	10,000
5/18/2017	Thunderstorm Wind	50	0	0	0
6/13/2017	Thunderstorm Wind	52	0	0	0
6/23/2017	Thunderstorm Wind	52	0	0	1,000
6/27/2017	Thunderstorm Wind	50	0	0	0
7/12/2017	Thunderstorm Wind	50	0	0	0
8/2/2017	Thunderstorm Wind	50	0	0	0
9/6/2017	Thunderstorm Wind	50	0	0	0
5/15/2018	Thunderstorm Wind	40	0	0	0
6/18/2018	Thunderstorm Wind	50	0	0	0
6/25/2018	Thunderstorm Wind	43	0	0	0

*Magnitude refers to maximum wind speed

Source: NOAA, National Environmental Information Center

Severe thunderstorms are a town-wide hazard for Watertown. 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 Watertown 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. 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. This in turn can cause property damage and potential injuries. Power outages may also result from fallen trees and utility lines.

Winter storms are a potential town-wide hazard in Watertown. The average annual snowfall Watertown is 48-72 inches (see Map 6 in Appendix B). A number of public safety issues can arise during snow storms. Impassible streets are a challenge for emergency vehicles and affect residents and employers. Snow-covered sidewalks force people to walk in streets, which are already less safe due to snow, slush, puddles, and ice. Large piles of snow can also block sight lines for drivers, particularly at intersections. Not all residents are able to clear their properties, especially the elderly. Refreezing of melting snow can cause dangerous roadway conditions. In addition, transit operations may 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.

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 which reduces visibility to or below $\frac{1}{4}$ mile. These conditions must be the predominant condition over a three hour period. Extremely cold temperatures are often associated with blizzard conditions, but are not a formal part of the definition. The hazard related to the combination of snow, wind, and low visibility significantly increases when temperatures drop 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 four 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 in Table 15 below:

Table 15: NESIS Categories

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+	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 three feet of snowfall and multiple day closures of roadways, businesses, and schools. In Watertown, blizzards and severe winter storms have occurred in the following years, shown in Table 16:

Table 16: Severe Winter Storm Records for Massachusetts

Severe Winter Storm Event	Date
Blizzard of 1978	February 1978
Blizzard	March 1993
Blizzard	January 1996
Severe Snow Storm	March 2001
Severe Snow Storm	December 2003
Severe Snow Storm	January 2004
Severe Snow Storm	January 2005
Severe Snow Storm	April 2007
Severe Snow Storm	December 2010
Severe Snow Storm	January 2011
Blizzard of 2013	February 2013
Blizzard of 2015	January 2015
Severe Snow Storm	March 2018

Source: National Oceanic and Atmospheric Administration

The Town of Watertown does not keep local records of winter storms. Data for Middlesex County, which includes Watertown, is the best available data to help understand previous occurrences and impacts of heavy snow events. According to National Climate Data Center (NEIC) records, from 1996 to 2016, Middlesex County experienced 75 heavy snowfall events, resulting in no injuries or deaths, and \$229,000 in property damage. See Table 17 for and heavy snow events and impacts in Middlesex County.

Table 17: Heavy Snow Events and Impacts in Middlesex County, 2000 to 2018

Date	Type	Deaths	Injuries	Property Damage
1/13/2000	Heavy Snow	0	0	0
1/25/2000	Heavy Snow	0	0	0
2/18/2000	Heavy Snow	0	0	0
12/30/2000	Heavy Snow	0	0	0
1/20/2001	Heavy Snow	0	0	0
2/5/2001	Heavy Snow	0	0	0
3/5/2001	Heavy Snow	0	0	0
3/9/2001	Heavy Snow	0	0	0
3/30/2001	Heavy Snow	0	0	0
12/8/2001	Heavy Snow	0	0	0
3/20/2002	Heavy Snow	0	0	0
3/16/2004	Heavy Snow	0	0	0
2/24/2005	Heavy Snow	0	0	0
12/13/2007	Heavy Snow	0	0	0
12/16/2007	Heavy Snow	0	0	0
12/19/2007	Heavy Snow	0	0	0
1/14/2008	Heavy Snow	0	0	28000
1/14/2008	Heavy Snow	0	0	20000

1/14/2008	Heavy Snow	0	0	20000
2/22/2008	Heavy Snow	0	0	0
3/1/2008	Heavy Snow	0	0	0
12/19/2008	Heavy Snow	0	0	0
12/20/2008	Heavy Snow	0	0	8000
12/21/2008	Heavy Snow	0	0	0
12/31/2008	Heavy Snow	0	0	0
1/10/2009	Heavy Snow	0	0	0
1/11/2009	Heavy Snow	0	0	0
1/18/2009	Heavy Snow	0	0	0
3/1/2009	Heavy Snow	0	0	0
3/2/2009	Heavy Snow	0	0	0
12/9/2009	Heavy Snow	0	0	15000
12/9/2009	Heavy Snow	0	0	500
12/19/2009	Heavy Snow	0	0	0
12/20/2009	Heavy Snow	0	0	0
1/18/2010	Heavy Snow	0	0	0
2/16/2010	Heavy Snow	0	0	15000
2/23/2010	Heavy Snow	0	0	8000
1/12/2011	Heavy Snow	0	0	0
1/26/2011	Heavy Snow	0	0	0
10/29/2011	Heavy Snow	0	0	30000
12/29/2012	Heavy Snow	0	0	0
2/8/2013	Heavy Snow	0	0	0
2/8/2013	Heavy Snow	0	0	0
2/23/2013	Heavy Snow	0	0	0
3/7/2013	Heavy Snow	0	0	0
3/18/2013	Heavy Snow	0	0	0
12/14/2013	Heavy Snow	0	0	0
12/17/2013	Heavy Snow	0	0	0
1/2/2014	Heavy Snow	0	0	0
1/18/2014	Heavy Snow	0	0	0
2/5/2014	Heavy Snow	0	0	0
2/13/2014	Heavy Snow	0	0	0
2/18/2014	Heavy Snow	0	0	0
11/26/2014	Heavy Snow	0	0	10000
1/24/2015	Heavy Snow	0	0	0
1/26/2015	Heavy Snow	0	0	0
2/2/2015	Heavy Snow	0	0	0
2/8/2015	Heavy Snow	0	0	0
2/14/2015	Heavy Snow	0	0	0
2/5/2016	Heavy Snow	0	0	70000
2/5/2016	Heavy Snow	0	0	5000
3/21/2016	Heavy Snow	0	0	0
4/4/2016	Heavy Snow	0	0	0
12/29/2016	Heavy Snow	0	0	0
3/14/2017	Heavy Snow	0	0	0

Source: NOAA, National Environmental Information Center

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% 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, shown in Table 18.

Table 18: Hail Size Comparisons

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 Watertown. The best available local data is for Middlesex County through the National Environmental Information Center. Middlesex County, which includes the Town of Watertown, experienced 46 events from 2000 to 2017 (see Table 19).

Table 19: Middlesex County Hail Events, 2000-2018

Date	Event	Magnitude	Deaths	Injuries	Damage
7/18/2000	Hail	1	0	0	0
6/20/2001	Hail	1.75	0	0	0
7/12/2001	Hail	1.5	0	0	0
5/27/2002	Hail	0.75	0	0	0
6/2/2002	Hail	0.75	0	0	0
8/13/2003	Hail	0.75	0	0	0
7/2/2004	Hail	0.75	0	0	0
8/20/2004	Hail	0.88	0	0	75,000
5/21/2006	Hail	0.75	0	0	0

7/11/2006	Hail	1	0	0	0
7/28/2006	Hail	0.75	0	0	0
6/5/2007	Hail	1.25	0	0	0
6/22/2007	Hail	0.75	0	0	0
7/9/2007	Hail	1	0	0	0
7/28/2007	Hail	0.88	0	0	0
6/23/2008	Hail	0.75	0	0	0
6/24/2008	Hail	0.75	0	0	0
7/1/2008	Hail	0.88	0	0	0
7/2/2008	Hail	0.75	0	0	0
8/3/2008	Hail	0.75	0	0	0
8/7/2008	Hail	1	0	0	0
8/10/2008	Hail	0.75	0	0	0
5/24/2009	Hail	1	0	0	0
6/27/2009	Hail	0.88	0	0	0
7/7/2009	Hail	0.75	0	0	0
7/8/2009	Hail	1.75	0	0	0
5/4/2010	Hail	0.75	0	0	0
5/7/2011	Hail	0.75	0	0	0
6/1/2011	Hail	0.75	0	0	0
8/2/2011	Hail	0.75	0	0	0
8/19/2011	Hail	0.75	0	0	0
3/13/2012	Hail	1.25	0	0	0
3/14/2012	Hail	1	0	0	0
6/23/2012	Hail	0.75	0	0	0
7/18/2012	Hail	1	0	0	0
10/30/2012	Hail	1	0	0	0
6/17/2013	Hail	0.75	0	0	0
5/25/2014	Hail	0.75	0	0	0
7/3/2014	Hail	1	0	0	0
8/7/2014	Hail	0.75	0	0	0
9/6/2014	Hail	0.88	0	0	0
8/4/2015	Hail	1	0	0	0
8/15/2015	Hail	0.75	0	0	0
7/23/2016	Hail	.75	0	0	0
6/27/2017	Hail	1.00	0	0	0
8/2/2017	Hail	.75	0	0	0

*Magnitude refers to diameter of hail stones in inches

Source: NOAA, National Environmental Information Center

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

GEOLOGIC HAZARDS

Geologic hazards include earthquakes, landslides, sinkholes, subsidence, and unstable soils such as fill, peat, and clay. Town officials did not identify any problems with areas of geologic instability, such as sinkholes or subsidence. Although new construction under the most recent building codes generally will be built to seismic standards, there are still many structures in town which pre-date the most recent building code. Information on geologic hazards in Watertown 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 known as the Richter scale to express the seismic energy released by each earthquake. The typical effects of earthquakes in various ranges are summarized in Table 20 below:

Table 20: Richter Scale and Effects

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

Source: Nevada Seismological Library (NSL), 2005

According to the State Hazard Mitigation Plan, New England experiences an average of five earthquakes per year. From 1668 to 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 in the distant past, including a magnitude 5.0 earthquake in 1727 and a 6.0 earthquake that struck in 1755 off the coast of Cape Anne. More recently, a pair of damaging earthquakes occurred near Ossipee, NH in 1940. A 4.0 earthquake centered in Hollis, Maine in October 2012 was felt in the Boston area. Historic records of some of the more significant earthquakes in the region are shown in Table 21.

Table 21: 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

Location	Date	Magnitude
MA - Cape Ann	12/9/1729	NA
MA - Cape Ann	2/20/1730	NA
MA - Cape Ann	3/9/1730	NA
MA - Boston	6/24/1741	NA
MA - Cape Ann	6/14/1744	4.7
MA - Salem	7/1/1744	NA
MA - Off Cape Ann	11/18/1755	6
MA - Off Cape Cod	11/23/1755	NA
MA - Boston	3/12/1761	4.6
MA - Off Cape Cod	2/2/1766	NA
MA - Offshore	1/2/1785	5.4
MA - Wareham/Taunton	12/25/1800	NA
MA - Woburn	10/5/1817	4.3
MA - Marblehead	8/25/1846	4.3
MA - Brewster	8/8/1847	4.2
MA - Boxford	5/12/1880	NA
MA - Newbury	11/7/1907	NA
MA - Wareham	4/25/1924	NA
MA - Cape Ann	1/7/1925	4
MA - Nantucket	10/25/1965	NA
MA - Boston	12/27/74	2.3
VA - Mineral	8/23/11	5.8
MA - Nantucket	4/12/12	4.5
ME - Hollis	10/17/12	4.0

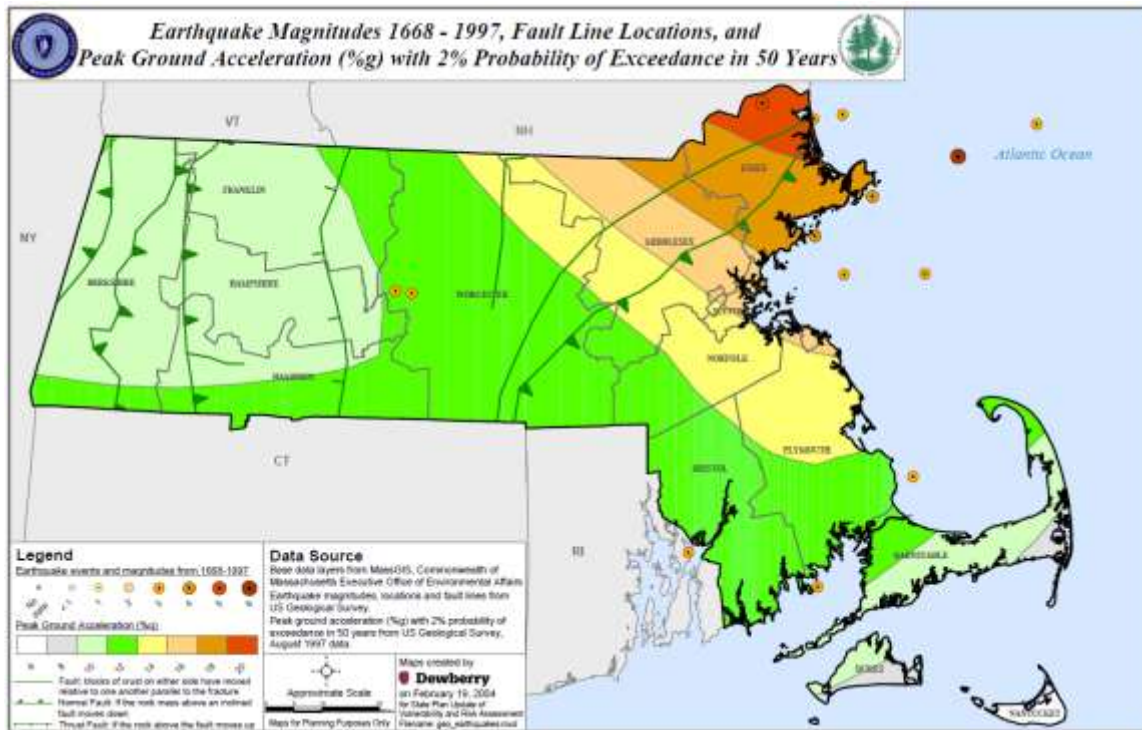
Source: City of Boston, Hazard Identification and Risk Assessment

One measure of earthquake risk is ground motion, which is measured as maximum peak horizontal acceleration, expressed as a percentage of gravity (%g). The range of peak ground acceleration in Massachusetts is from 10 %g to 20 %g, with a 2% probability of exceedance in 50 years (see Figure 4).

Watertown is in the middle part of the range for Massachusetts, at 14 %g to 16 %g, 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 has been one earthquake with an epicenter in Watertown. See Map 4 in Appendix B.

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. The majority of older buildings and infrastructure were constructed without specific earthquake resistant design features.

Figure 4: State of Massachusetts Earthquake Probability Map



Source: Massachusetts State Hazard Mitigation Plan

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.

Much of the development in town pre-dates the current building code and could be vulnerable in the event of a severe earthquake. Potential earthquake damages to Watertown have been estimated using HAZUS-MH. Total building damages are estimated at \$891 million for a 5.0 magnitude earthquake and \$5 billion for a 7.0 magnitude earthquake. Other potential impacts such as debris generation and sheltering needs are detailed in Table 31.

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% chance per year. Earthquakes are a potential town-wide hazard in Watertown.

LANDSLIDES

According to the U.S. Geological Survey, “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; earthquake created stresses that make weak slopes fail; excess weight from accumulation of rain or snow; and stockpiling of rock or ore from waste piles or 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. A lack of vegetation and root structure that normally stabilize 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. Table 22 below summarizes the estimated intensity for a range of landslides. Fast moving rock falls have the highest intensity while slow moving landslides have the lowest intensity.

Table 22: Landslide Volume and Velocity

Estimate Volume (m ³)	Expected Landslide Velocity		
	Fast moving (rock fall)	Rapid moving (debris flow)	Slow moving (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

Watertown has been classified as having a low risk for landslides (see Map 4, Appendix B). Local officials did not identify any significant issues related to landslides.

Should a landslide occur in the future, the type and degree of impacts would be highly localized. 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 Watertown. Based on past occurrences and the Massachusetts Hazard Mitigation Plan, landslides are low frequency events that can occur once in 50 to 100 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, brush fires typically burn no more than the underbrush of a forested area. There are three different classes of wildfires:

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

Wildfire season can begin in March and usually ends in late November. The majority of wildfires typically occur in April and May, when 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.

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

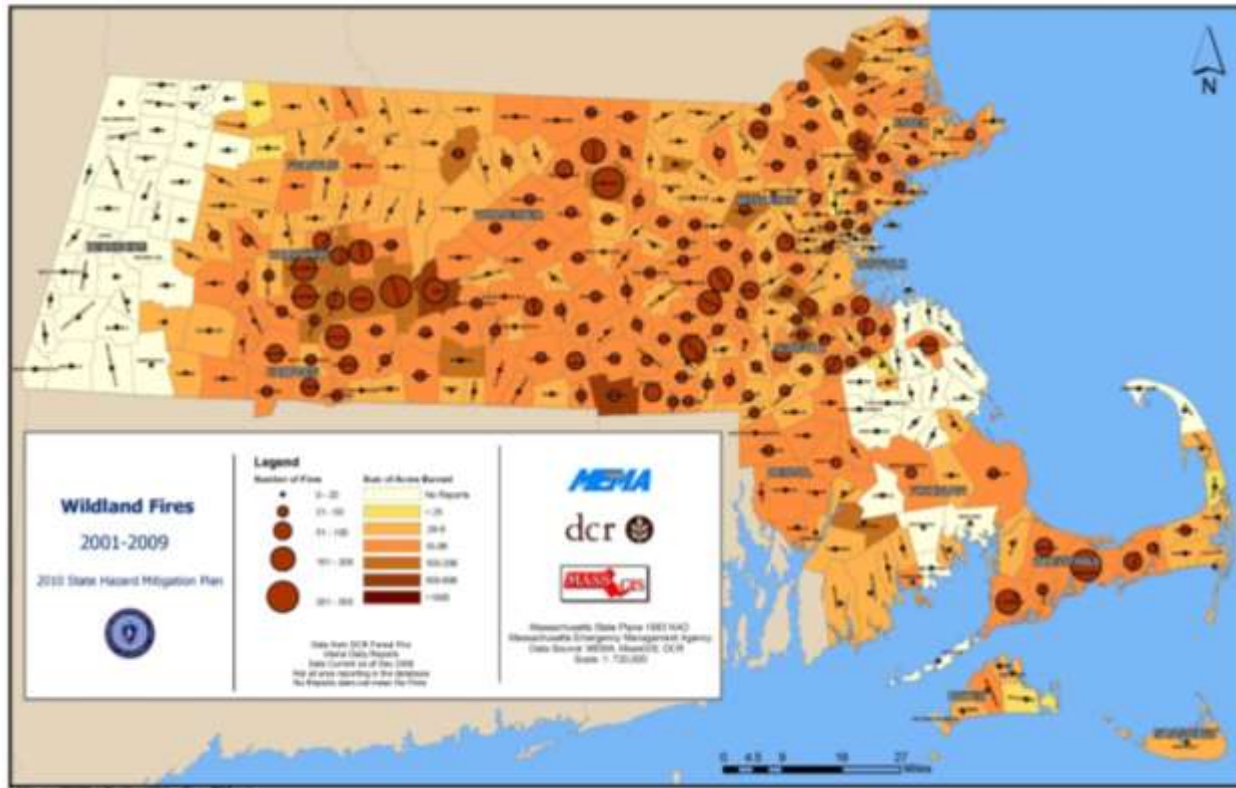
These fires can present a hazard where there is the potential for them to spread into developed or inhabited areas, particularly residential areas where sufficient fuel materials might exist to allow the fire the spread into homes. Protecting structures from fire poses special problems, and can stretch firefighting resources to the limit. If heavy rains follow a fire, other natural disasters can occur, including landslides, mudflows, and floods. If the wild fire destroys the ground cover, then erosion becomes one of several potential problems.

Potential Brushfire Hazard Areas

According to local officials, brush fires in Watertown are not a significant issue. The town sees several brush fires annually, but these fires have not caused significant property damage or injuries. The Town identified only three small areas of potential brush fires, Whitney Hill, the wooded area off of Greenough Boulevard, and the Bike Path along Arsenal Street and Pleasant Street. These are shown on Map 8 in Appendix B as sites number 5, 6, and 9 respectively.

Wildfires in Massachusetts are measured by the number of fires and acres burned. The most recent data available for wildfires in Massachusetts, shown in Figure 5h, indicates that the wildfire extent in Watertown consists of 0.25 to 9 to 26 acres burned, with zero to 20 recordable fires from 2001 to 2009.

Figure 5: Massachusetts Wildfires, 2001 to 2009



Source: Massachusetts State Hazard Mitigation Plan

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

EXTREME TEMPERATURES

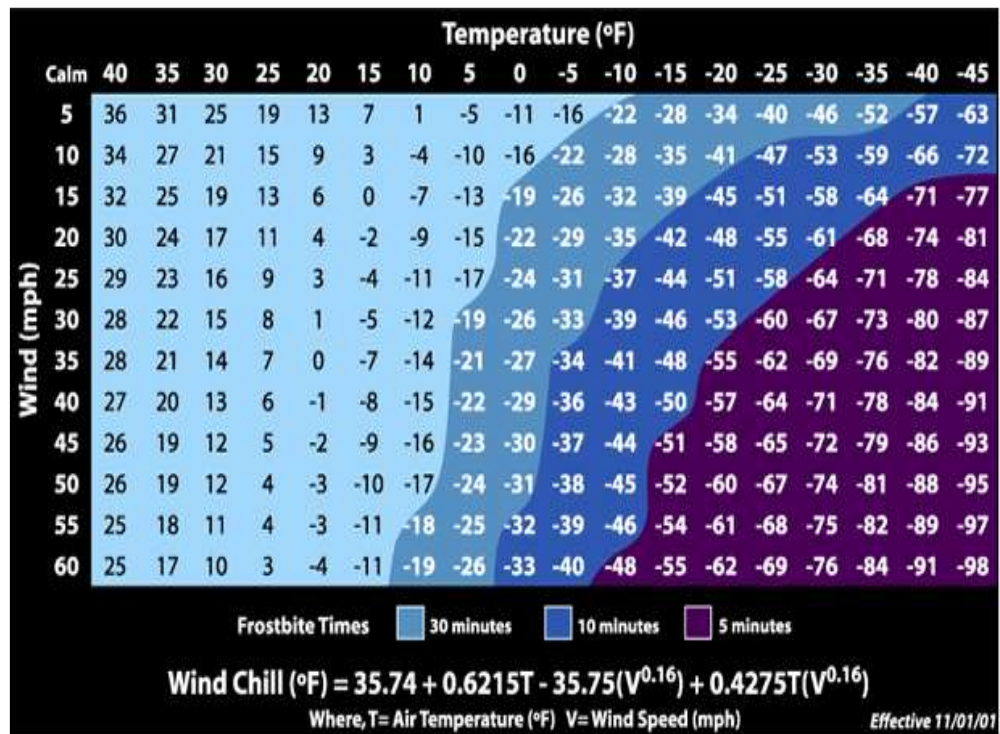
Extreme temperatures occur when either high temperature or low temperatures relative to average local temperatures occur. These can occur for brief periods of time and be acute, or they can occur over long periods of time where there is a long stretch of excessively hot or cold weather.

Watertown 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 that are far outside of the normal seasonal ranges for Massachusetts. The average temperature for winter (December to February) in Massachusetts is 31.8°F. The average temperature for summer (June to August) is 71°F. Extreme temperatures are a town-wide hazard.

EXTREME COLD

For extreme cold, temperature is typically measured using the Wind Chill Temperature Index, which is provided by the National Weather Service (NWS). The latest version of the index was implemented in 2001 and is meant to show how cold conditions feel on unexposed skin and can lead to frostbite. The index is provided in Figure 6.

Figure 6: Wind Chill Temperature Index and Frostbit Risk



Source: National Weather Service

Extreme cold is a dangerous situation that can result in health emergencies for susceptible people, such as those without shelter, those who are stranded, or those who live in homes that are poorly insulated or without heat. The elderly and people with disabilities are often most vulnerable. In Watertown, 15.4 percent of the population are over 65 and 10 percent of the population has a disability

The Town of Watertown does not collect data for previous occurrences of extreme cold. The best available local data are for Middlesex County, through the National Environmental Information Center (NEIC). There are three extreme cold events on record since 2000 for the county, which caused no deaths, no injuries, or property damage (Table 23).

Table 23: Middlesex County Extreme Cold and Wind Chill Occurrences

Date	Deaths	Injuries	Damage
2/15/2015	0	0	0
2/16/2015	0	0	0
2/14/2016	0	0	0

Source: NOAA, National Environmental Information Center

EXTREME HEAT

A heat wave in 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 (see Figure 7) is forecasted to exceed 100°F for two or more hours; an excessive heat advisory is issued if the forecast predicts the temperature to rise above 105°F.

Figure 7: Heat Index Chart

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

Extreme heat poses a potentially greater risk to the elderly, children, and people with certain medical conditions, such as heart disease. In Watertown children under 5 years old make up 6.7 percent of the population, and 15.4 percent are over 65 years old. 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 Watertown does not collect data on excessive heat occurrences. The best available local data are for Middlesex County, through the National Environmental Information Center. Since 200, there has been one excessive heat day, which did not result in injury, death, or property damage (see Table 24).

Table 24: Middlesex County Extreme Heat Occurrences

Date	Deaths	Injuries	Damage (\$)
7/6/2010	0	0	0
Total	0	0	0

Source: NOAA, National Environmental Information Center

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

DROUGHT

Drought is a temporary irregularity in precipitation and differs from aridity since the latter is restricted to low rainfall regions and is a permanent feature of climate. Drought is a period characterized by long

durations of below normal precipitation. Drought conditions occur in virtually all climatic zones, yet its characteristics vary significantly from one region to another since it is relative to the normal precipitation in that region. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life.

In Massachusetts, droughts are caused by the prevalence of dry northern continental air and a decrease in coastal- and tropical-cyclone activity. During the 1960s, a cool drought occurred because dry air from the north caused lower temperatures in the springs and summers of 1962 through 1965. 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 record drought in Massachusetts modern history.

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

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. Watertown is located in the Northeast region. Drought is a potential town-wide hazard in Watertown.

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.

The drought levels begin with a normal situation where data are routinely collected and distributed, move to heightened vigilance with increased data collection during an advisory, and 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 become 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 the 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.

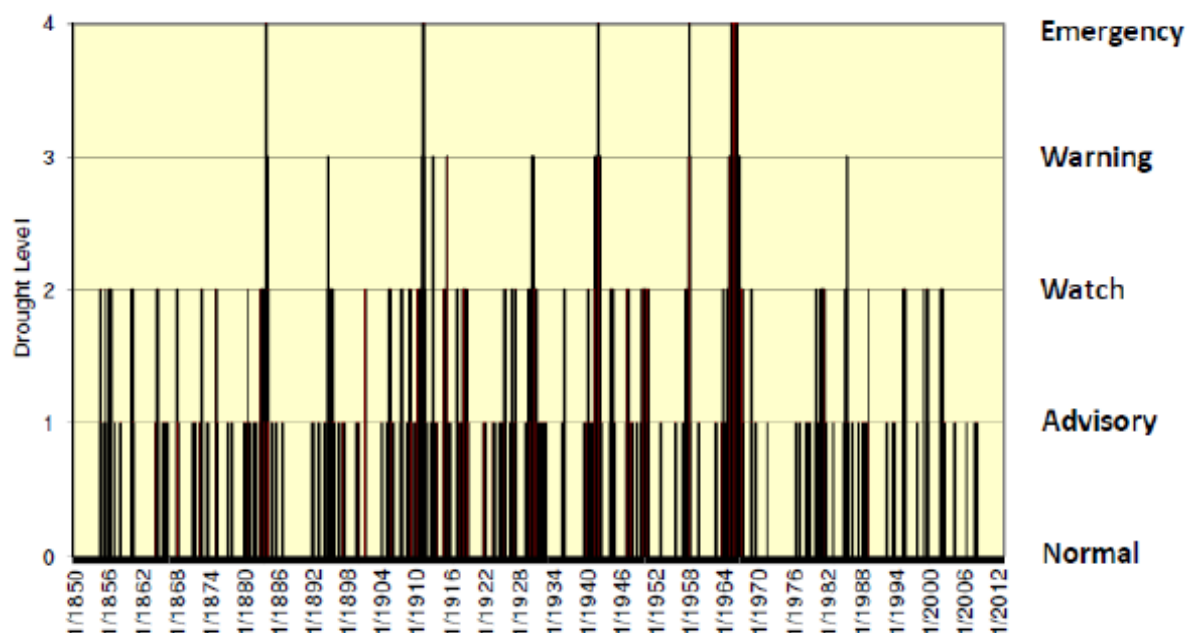
3. Keetch Byram Drought Index (KBDI) is designed for fire-potential assessment.
4. Precipitation Index is a comparison of measured precipitation amounts to historic normal precipitation.
5. The Groundwater Level Index is based on the number of consecutive month's groundwater levels below normal (lowest 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.

Watertown 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 the six regions in the state. Regional composite precipitation values are based on monthly values from six stations, and three stations in the smaller regions (Cape and Islands and West regions).

Figure 8 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% of the time between 1850 and 2012. Table 25 summarizes the chronology of major droughts since the 1920s.

Figure 8: Statewide Drought Levels using SPI Thresholds, 1850 to 2012



Source: Massachusetts State Drought Management Plan 2013

Table 25: Chronology of Major Droughts in Massachusetts

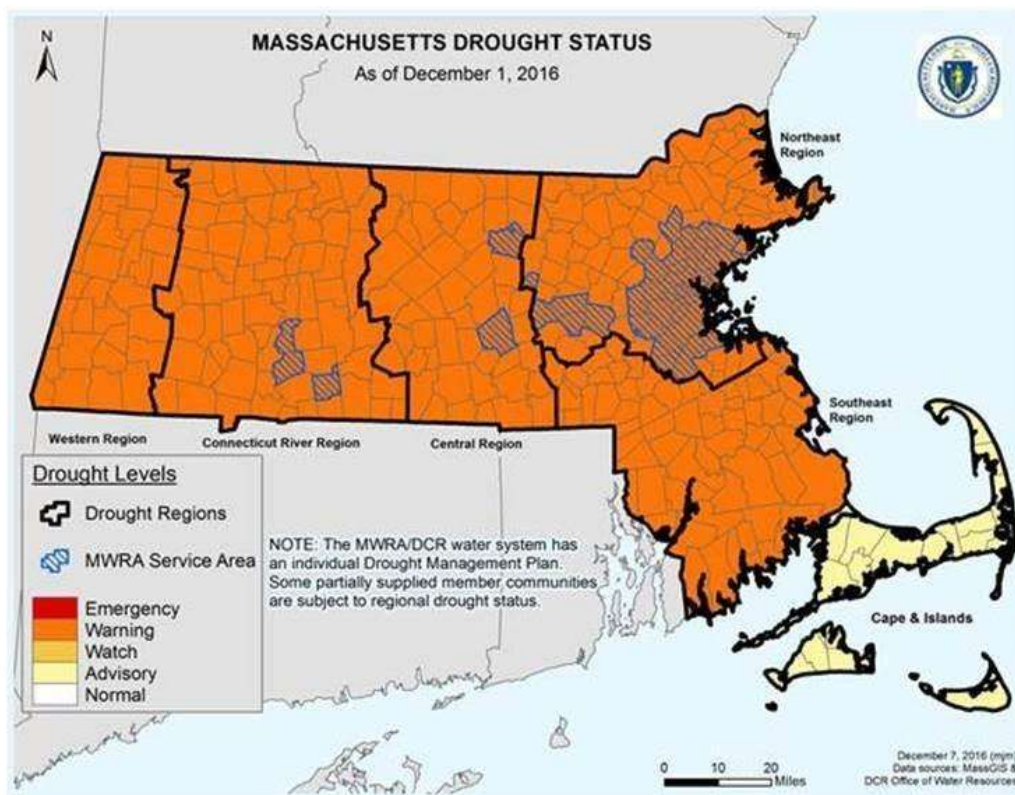
Date	Area Affected	Recurrence Interval (years)	Remarks
1929 to 1932	Statewide	10 to >50	Water-supply sources altered in 13 communities. Multistate.
		15 to >50	More severe in eastern and extreme western Massachusetts. Multistate.
1957 to 1959	Statewide	5 to 25	Record low water levels in observation wells, northeastern Massachusetts.
1961 to 1969	Statewide	35 to >50	Water-supply shortages common. Record drought. Multistate.
1980 to 1983	Statewide	10 to 30	Most severe in Ipswich and Taunton River basins; minimal effect in Nashua River basin. Multistate.
1958 to 1988	Housatonic River Basin	25	Duration and severity unknown. Streamflow showed mixed trends elsewhere.
2016-2017	Statewide	N/A	Drought declaration began in June 2016 with a Drought Watch which was upgraded to a Drought Warning in August 2016. The Central and Northeast regions were the most severely affected.

Drought emergencies have been reached infrequently, with five events occurring in the period between 1850 and 2012: 1883, 1911, 1941, 1957, and 1965 to 1966. The drought period between 1965 and 1966 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 1% chance of being in a drought emergency.

Drought warning levels not associated with drought emergencies have occurred five times, in 1894, 1915, 1930, 1985, and 2016. As of July 2016, a Drought Warning had been declared for the Northeast region, which includes the Town of Watertown. November 2016 marked the eighth consecutive month of below average rainfall, and Drought Warnings were extended to the entire state except the Cape and Islands (see Figure 9).. Conditions returned to normal by April 2017. On a monthly basis over the 162-year period of record, there is a 2% chance of being in a drought warning.

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, and 1999). In the 2000s, drought watches occurred in 2001 and 2002. The overall frequency of being in a drought watch is 8% on a monthly basis over the 162-year period of record.

Figure 9: Massachusetts Drought Status, December 2016



Source: MA Department of Conservation and Recreation, Office of Water Resources

Under a severe long term drought the Town of Watertown could be vulnerable to restrictions on water supply. Potential damages of a severe drought could include losses of landscaped areas if outdoor watering is restricted and potential loss of business revenues if water supplies were severely restricted for a prolonged period. As this hazard has never occurred to such a severe degree in Watertown, there are no data or estimates of potential damages, but under a severe long term drought scenario it would be reasonable to expect a range of potential damages from several hundred thousand to several millions of dollars. Another potential vulnerability of droughts could be increased risk of wildfires.

However, given the resilience of the MWRA water system due to its very large amount of storage in the Quabbin and Wachusett Reservoirs (4 billion gallons, which is equivalent to five years of water demand), severe impacts on the Town are unlikely. For example, even during the multi-year drought of record in the 1960s, there were no severe limitations of supply from the regional water system.

The state has experienced emergency droughts five times between 1850 and 2012. Even though 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 Watertown 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

Watertown'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 10). 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.

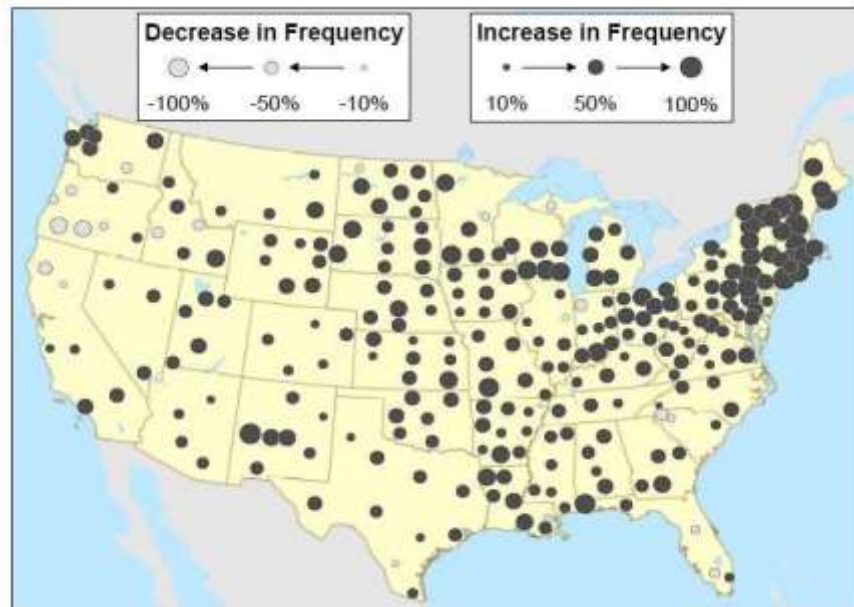
Not only are these intense storm events more frequent, they are also more severe: the largest annual storms now produce 10 percent more precipitation, on average, than in 1948. In particular, the report finds that New England has experienced the greatest change with intense rain and snow storms occurring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

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.

Climate Change Impacts: Extreme Heat

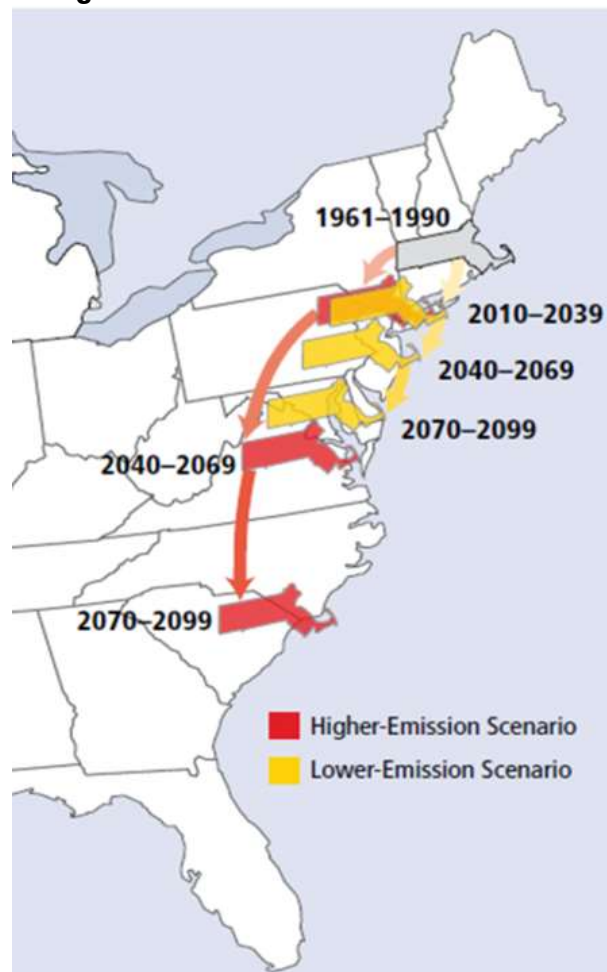
Between 1961 and 1990, Boston experienced an average of 11 days per year over 90°F. That could triple to 30 days per year by 2095 under the low emissions scenario, and increase to 60 days per year under the high emissions scenario. Days over 100°F could increase from the current average of one day per 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 (see Figure 11). 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.

Figure 10 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

Figure 11 Mass. Extreme Heat Scenarios



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. Change has certainly occurred in Watertown since then, but this data still provides the most detailed description of Land Use available. Table 26 shows the acreage and percentage of land use in 17 categories. If the two residential categories are aggregated, residential uses make up 51.5% of the area of the town (1,360 acres). Commercial and industrial combined make up 21.7% of the town, or 572 acres. Recreation (parks, playing fields) and golf courses comprise another 7% , or 184 acres, and several categories of open space combined (forest, forested wetlands, wetlands, crop land, urban public, urban open, and water) make up 11.4% of the town, or 301 acres.

Table 26: Town of Watertown, MA 2005 Land Use

Land Use	Acres	% of Town
Crop Land (1)	21.3516	0.81%
Forest (3)	61.3060	2.32%
Wetland (4)	6.4152	0.24%
Participation Recreation (7)	100.8173	3.82%
Multi-Family Residential (10)	857.1564	32.48%
High Density Residential (11)	502.7954	19.05%
Salt Water Wetland (14)	0.0000	0.00%
Commercial (15)	408.7280	15.49%
Industrial (16)	163.9892	6.21%
Urban Open (17)	2.4282	0.09%
Transportation (18)	11.5978	0.44%
Water (20)	78.5200	2.98%
Golf Course (26)	83.6821	3.17%
Marina (29)	5.6353	0.21%
Urban Public (31)	126.5023	4.79%
Cemetery (34)	203.2636	7.70%
Forested Wetland (37)	4.6617	0.18%
TOTAL ACRES	2638.8501	100.00%

For more information on how the land use statistics were developed and the definitions of the categories, please go to <https://docs.digital.mass.gov/dataset/massgis-data-land-use-2005>.

Economic Elements

Much of the Town's economic activity is concentrated on Arsenal Street, in Watertown Square, and along a few other commercial corridors. The Arsenal Mall, a 225,000 square foot redevelopment, opened in 1983. The remainder of the historic Watertown Arsenal buildings were converted to civilian uses in 1995, and is now a commercial and office complex known as the Arsenal on the Charles. There are several

redevelopment projects moving through the permitting process along the Arsenal Street corridor that can transform the area. Two formerly industrial areas, Pleasant Street and Coolidge Hill, have evolved over time. Pleasant Street now has a mix of industrial, wholesale, office, research and development, and multifamily housing developments along its corridor. Coolidge Hill is primarily a residential and neighborhood retail area, with some manufacturing still located there.

The median household income in Watertown was \$74,081 in 2010. This represents a 24% increase from \$59,764 in 2000, after being adjusted for inflation. Watertown's median household income is 14.8% above the state median income. About 7.5% of families were considered below the poverty line.

Watertown has a labor force of about 20,125. In 2010, Watertown had 1,103 industries. Of these, the largest employment sectors included "Professional and Business Services" (22.1%) and "Trade, Transportation and Utilities" (18.5%). These two sectors comprised 40.6% of the employment in the Town. Other proportionately large employment sectors include "Education and Health Services" (15.9%), "Financial Activities" (10.5%), and "Information" (10.2%). Manufacturing, at one point one of the highest, has continually decreased over the years and in 2010 was only the 7th highest employment sector (5.4%). (Narrative from the *Watertown Open Space and Recreation Plan 2015*).

NATURAL, CULTURAL, AND HISTORIC RESOURCE AREAS

Founded in 1630, Watertown has been described as the "mother town" as it was one of America's earliest colonial settlements and served as an entry into the heartland of America for early settlers. These early arrivals to the "New World" were welcomed by Native Americans of the Pequotsette Tribe, who had a long-established tribal network strategically situated to access the natural bounties of the Charles River. Early colonial accounts of the area describe the abundance of bass, salmon, and herring making their way to and from the sea for spawning.

During the past 300 years, the Charles River along its length changed from a bountiful aquatic habitat to a polluted waterway, damaged by former use as an open sewer for industrial and human wastes. It was reborn as a "water parkway" in the late 1890's only to decline in the mid-20th century and then be rediscovered as a regional recreational asset. The river has begun to rebound with aquatic life, improved water quality, and a significant return of recreational activities. Additionally, the Department of Conservation and Recreation (DCR) continues to make improvements to the Charles River Reservation land that enhances open space and recreational opportunities for Watertown's residents and visitors.

Watertown's open space system is closely linked to the larger regional system of open space and natural areas of its neighboring communities. The Charles River links Watertown ecologically and recreationally with Cambridge and Boston to the east and with up-stream communities such as Waltham, Newton, Weston, Wellesley, Needham and beyond. Watertown's open space network is particularly closely connected with Cambridge where the two communities share another significant regional landmark, the Mt. Auburn Cemetery as a semi-public open space. Approximately 164 acres of the 175-acre Mt. Auburn Cemetery are in Watertown, making it the largest contiguous open space in Watertown. Narrative from the *Watertown Open Space and Recreation Plan 2015*).

DEVELOPMENT TRENDS

MAPC's MassBuilds database includes 29 new developments in Watertown since 2008. As the town is built out, most of these projects are on redevelopment sites. As redevelopment occurs it is subject to the latest building code requirements and zoning regulations pertaining to floodplains, wind, and earthquakes. The database (Table 27) includes attributes of the new development, including housing units and commercial space. The 29 new developments in Watertown include a total of 2,142 housing units and more than 1 million square feet of commercial space.

Table 27: Summary of Watertown Developments, 2008-2017

Name	Status	Year	Housing Units	Commercial Square Feet	Flood Zone
175 N. Beacon St.-Perkins School	Completed	2011		55000	No
480 Arsenal (Linx)	Construction	2017		185595	No
Archstone Apartments	Completed	2001	134		No
Arsenal Yards	Planning	2019	503	380000	No
Arsenal on the Charles		2018		263000	No
32 Church St	Panning	2018	5		No
590 Main Street	Completed	2010	14		No
Watertown Mews	Completed	2008	179		No
24-26 Arsenal Street	Completed	2011	14		No
Bell Tower Place	Completed	2009	9		No
First Baptist	Completed	2009	14		No
Nally Estates	Completed	2010	18		No
Towards Independent Living	Completed	2011		7800	No
Grousebeck Center-Perkins School	Completed	2011		15200	No
Charlesbank Residences	Completed	2012	44		No
Riverbend	Completed	2013	135		AE: 1% Annual Chance; with BFE
Part of Riverbend	Completed	2013	35		X: 0.2% Annual Chance of Flooding
Repton	Completed	2013	206		No
Bell Watertown	Completed	2013	155		No
9 Winter Street	Completed	2011	3		No
River Park Lofts	Completed	2015	65	10394	No
192 Pleasant St	Completed	2014	7		AE: 1% Annual Chance; with BFE
The Gables	Completed	2015	296	6777	No
33 Mt Auburn	Planning	2019	24	2115	No
Union Market	Construction	2016	282	10600	No
Central Rock Gym	Completed	2012			No
65 Grove Street (Old Ionics Bldg.)	Construction	2017		1493	No
CVS Pharmacy	Construction	2017		14000	No
Marriott Hotel	Completed	2016		105652	No
TOTAL			2,142	1,065,426	

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 30 developments are partially within an AE zone, 0.1% chance of flooding (100-year), and one of them is also partially within an X zone, 0.2% Annual Chance of flooding (500 Year). Typically these are portions of a site that are not built out, and at a minimum comply with the Town's Floodplain regulations.

With respect to other hazard categories, there is no geographic variation across the Town of Watertown. All developments are within the zone of low incidence for landslides and the zone of 48 to 72 inches average annual snowfall. The entire town is in the zone of 100-year wind maximum speed of 110 miles per hour. Overall, Watertown's new development does not significantly increase the town's vulnerability to natural hazards.

POTENTIAL FUTURE DEVELOPMENT

MAPC consulted with the Local Hazard Mitigation Planning Team to determine areas that may be developed in the future, based on the Town's comprehensive planning efforts and current trends and projects. The Town identified 18 potential new development sites, which are listed in Table 28 and shown on Map 8 in Appendix B.

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 four of the sixteen sites are partially located in flood zones, typically a portion of the site that is not built on.

With respect to landslide risk, all of the development sites are located in the area designated as "Low Incidence" for landslides. As mentioned above, other hazards such as wind speed and snowfall rates do not vary across the Town of Watertown. None of the potential development sites coincide with hazard areas identified by the local team. (See hazard maps in Appendix C). Overall, Watertown's potential future development would not significantly increasing the town's vulnerability.

Table 28: Relationship of Potential Development to Hazard Areas

Map ID	Potential Future Project	Flood Zones
A	Hartz Mason	78.34% in AE: 1% Annual Chance of Flooding, with BFE , and 16.0% in X: 0.2% Annual Chance of Flooding
B	Boston Scientific	55.45% in AE: 1% Annual Chance of Flooding, with BFE , and 16.92% in X: 0.2% Annual Chance of Flooding
C	Repton Phase II	
D	Port Oil / Mount Auburn St	
E	Perkins School	
E	Perkins School	
F	Gore Property	

G	140 Pleasant St	4.6% in X: 0.2% Annual Chance of Flooding
H	Ionics	
I	Greenhouse	
J	Athena Campus	
K	Arsenal Yards	
L	330 Pleasant	29.48% in AE: 1% Annual Chance of Flooding, with BFE , and 65.89% in X: 0.2% Annual Chance of Flooding
M	385 Pleasant St.	
N	Marriott Inn Hotel	
O	100 N. Beacon	
P	Elan, Arsenal St. and Irving St.	
Q	Howard Bacon	

CRITICAL FACILITIES & INFRASTRUCTURE IN HAZARD AREAS

Critical facilities and 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 82 facilities identified in Watertown. These are listed in Table 29 and are shown on the maps in Appendix B.

Explanation of Columns in Table 29

- **Column 1: ID #:** The first column in Table 29 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: FEMA Flood Zone:** The fourth column addresses the risk of flooding. A “No” entry in this column means that the site is not within any of the mapped risk zones on the Flood Insurance Rate Maps (FIRM maps). If there is an entry in this column, it indicates the type of flood zone. as follows:
Zone AE (1% annual chance) - Zones AE is the flood insurance rate zone 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.
Zone X: Areas of 0.2% annual chance of flood.
Floodway: The channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.
- **Column 5: Locally-Identified Area of Flooding:** The fifth column indicates the risk of flooding in local hazard areas. A “No” entry in this column means that the site is not within any of the mapped flood hazard zones. If there is an entry in this column, it indicates the local hazard area.

Table 29: Critical Facilities and Relationship to Hazard Areas

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area
1	Watertown Town Hall	Municipal	No	No
2	Watertown Health Department	Municipal	No	No
3	Watertown Police Department	Police Station	No	No
4	EOC-Secondary Fire HQ	Emergency Operations Center	No	No
5	Fire Department #2	Fire Station	No	No
6	Fire Department HQ	Fire Station	No	No
7	Fire Department #3	Fire Station	No	No
8	Harvard Vanguard Medical Facility Associates	Medical Facility	No	No
9	Caritas Medical Facility Group at Watertown	Medical Facility	No	No
10	St. Elizabeth's Caritas Clinic	Medical Facility	No	No
11	Dr. Richard J. Kerbel	Medical Facility	No	No
12	Dr. Aida M. Yavshayan	Medical Facility	No	No
13	Milestones Child Care & Preschool	Child Care	No	No
14	Bright Horizons on the Charles	Child Care	No	No
15	Caterpillars to Butterflies	Child Care	No	No
16	First Path Day Care Center	Child Care	No	No
17	Four Seasons Preschool	Child Care	No	No
18	Watertown Integrated Pre-School	Child Care	No	No
19	Russell Cooperative Preschool	Child Care	No	No
20	St. Stephens Armenian Preschool	Child Care	No	No
21	Stepping Stones Child Care Center, Inc.	Child Care	No	No
22	Storyville Preschool	Child Care	No	No
23	Watertown Cooperative Nursery School	Child Care	No	No
24	Watertown Creative Start	Child Care	No	No
25	Watertown Dam	Dam	AE: 1% Annual Chance	No
26	Watertown High School	School	No	Yes
27	James Russell Lowell Elementary School	School	No	No
28	Cunniff Elementary School	School	No	Yes
29	Hosmer Elementary School	School	No	No
30	Jewish Community Day School	School	No	No
31	Perkins School for the Blind	School	No	No
32	Atrium School	School	No	No
33	St Stephen's Armenian School	School	No	No

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area
34	Beacon High School	School	No	No
35	Watertown Middle School	School	No	No
36	James Russell Lowell School - EDS	Emergency Distribution Site	No	No
37	St Stephen's Armenian Cultural Center	Church	No	No
38	Brigham House	Assisted Living	No	No
39	Commander's Mansion - Secondary EDS	Emergency Distribution Site	No	No
40	John A Ryan Arena	Place of Assembly	No	No
41	Watertown Senior Center	Senior Center	No	No
42	Watertown Boys and Girls Club	Place of Assembly	No	No
43	Watertown School Department Offices	Municipal	No	No
44	Verizon Switching Station	Communication Tower	No	No
45	Police-Fire Main Repeaters	Communication Tower	No	No
46	U.S. Post Office	Post Office	No	No
47	U.S. Post Office	Post Office	No	No
48	U.S. Post Office	Post Office	No	No
49	Marshall Home	Assisted Living	No	No
50	NStar Power Station	Power Substation	No	No
51	NStar Power Station	Power Substation	No	No
52	MBTA Power Station	Power Substation	No	No
53	MWRA Water Meter #40	MWRA	No	No
54	Saint John's Methodist Church	Church	No	No
55	MWRA Meter #2	MWRA	No	No
56	MWRA Water Meter #103	MWRA	No	No
57	MWRA Water Meter #92	MWRA	No	No
58	MWRA Water Isolation Valve	MWRA	No	No
59	Watertown Free Public Library	Municipal	No	No
60	Arsenal Apartment Elder Housing	Elder Housing	No	No
61	Watertown Elder Housing	Elder Housing	No	No
62	McSherry Gardens	Elder Housing	No	No
63	100 Warren Street Elder Housing	Elder Housing	No	No
64	Emergency Water Connection Belmont	Water Connection	No	No
65	Emergency Water Connection Belmont	Water Connection	No	No
66	Emergency Water Connection Newton	Water Connection	No	No
67	Emergency Water Connection Waltham	Water Connection	No	No
68	Emergency Water Connection Waltham	Water Connection	No	No

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area
69	Emergency Water Connection Waltham	Water Connection	No	No
70	Emergency Water Connection Waltham	Water Connection	No	No
71	Clinic - Partners Urgent Care	Medical Facility	No	No
72	Watertown Health Center	Nursing Home	No	No
73	Coolidge Hill Radio Antenna	Communications	No	No
74	Coolidge School Apartments	Senior Housing	No	No
75	MBTA Transit Hub	Transportation	No	No
76	Residence	Residences	No	No
77	AFC Urgent Clinic	Medical Facility	No	No
78	Circle of Boston Nursery School	Daycare	No	No
79	Strawberry Childcare	Daycare	No	No
80	First Step Child Care Center	Daycare	No	No
81	Open Wings Child Care Center	Daycare	No	No
82	Early Steps Watertown Pre-school	Daycare	No	No

With respect to the location of Critical Facilities in hazard zones, only one site, the Watertown Dam, is located within a FEMA Flood zone, AE, 1% Annual Chance of flooding. This would be expected as by definition any dam is located within the floodplain of a river or stream.

Two of the sites, Watertown High School and Cunniff Elementary School, were identified by the Town as areas of local concern for flooding due to basement flooding from high groundwater (see Table 8).

All the Towns Critical Facilities are located within an area designated as “low incidence” for landslides, and average annual snowfall of 48 to 72 inches. All are also within the area of 100-year wind speeds of 110 miles per hour, as these hazards are the same across the entire town.

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 through the HAZUS-MH software.

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 Watertown, 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 30: Estimated Damages from Hurricanes

	100-Year	500-Year
Building Characteristics		
Estimated total number of buildings	9,836	
Estimated total building replacement value (2014 \$)	\$4,852,000,000	
Building Damages		
# of buildings sustaining minor damage	321	1,667
# of buildings sustaining moderate damage	39	360
# of buildings sustaining severe damage	2	27
# of buildings destroyed	0	6
Population Needs		
# of households displaced	1	63
# of people seeking public shelter	0	6
Debris		
Building debris generated (tons)	2,719	11,747
Tree debris generated (tons)	1,136	3,231
# of truckloads of building debris (@25 tons/truck)	109	470
Value of Damages		
Property damage (buildings and content)	\$23,315,020	\$101,801,000
Losses due to business interruption	\$1,456,000	\$10,725,000
Total Losses	\$24,771,020	\$112,526,000

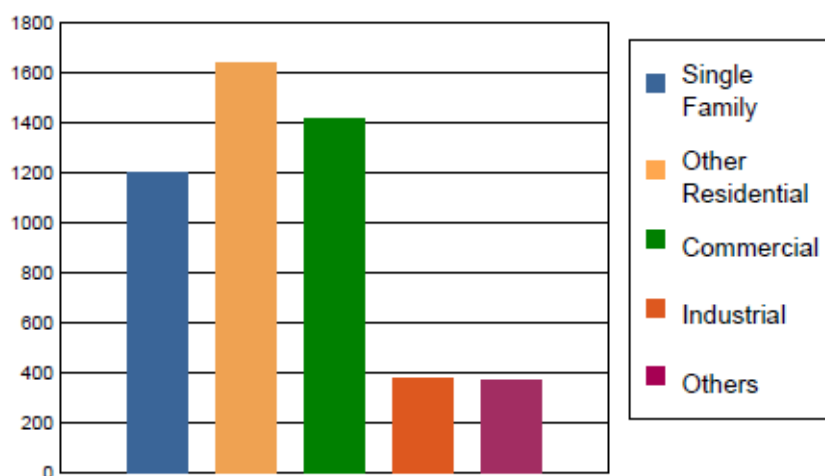
ESTIMATED DAMAGES FROM EARTHQUAKES

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 31: Estimated Damages from Earthquakes

	Magnitude 5.0	Magnitude 7.0
Building Characteristics		
Estimated total number of buildings		9,836
Estimated total building replacement value (2014 \$)		\$4,852,000,000
Building Damages		
# of buildings sustaining slight damage	2,752	470
# of buildings sustaining moderate damage	1,781	2,051
# of buildings sustaining extensive damage	640	2,348
# of buildings completely damaged	184	4,410
Population Needs		
# of households displaced	1,137	9,876
# of people seeking public shelter	505	2,324
Debris		
Building debris generated (tons)	175,000	1,167,000
# of truckloads to clear debris (@ 25 tons/truck)	7,000	46,680
Value of Damages		
Property damage	\$770,490,000	\$4,363,566,300
Losses due to business interruption	\$120,548,400	\$629,104,500
Total Losses	\$891,038,400	\$4,992,670,800

Figure 12 Watertown Magnitude 7 Earthquake Losses by Occupancy Type



Source: HAZUS for Watertown, MA, 500-Year Riverine Flood Scenario

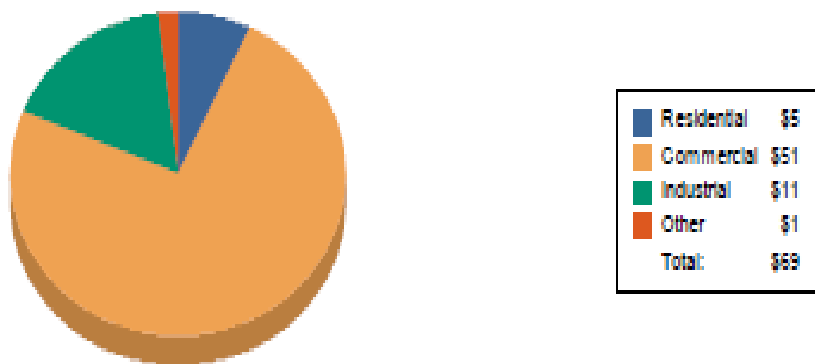
ESTIMATED DAMAGES FROM FLOODING

The HAZUS flooding module allows users model the potential damages caused by a 100-year flood event and a 500-year flood event.

Table 32: Estimated Damages from Flooding

	100-Year Flood	500-Year Flood
Building Characteristics		
Estimated total number of buildings	9,836	
Estimated total building replacement value (2014 \$)	\$4,853,000,000	
Building Damages		
# of buildings sustaining moderate damage	2	5
# of buildings sustaining extensive damage	0	1
# of buildings substantially damaged	0	0
Population Needs		
# of households displaced	84	162
# of people seeking public shelter	4	6
Value of Damages		
Total property damage	\$24,690,000	\$37,240,000
Total losses due to business interruption	\$20,960,000	\$31,900,000
Total Losses	\$45,650,000	\$69,140,000

Figure 13: Watertown 500-Year Flood Losses by Occupancy Type



Source: HAZUS for Watertown, MA, 500-Year Riverine Flood Scenario

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SECTION 5: HAZARD MITIGATION GOALS

The Watertown Local Hazard Mitigation Team reviewed and discussed the of hazard mitigation goals for the Town of Watertown. The following nine goals were endorsed by the team for this Watertown Hazard Mitigation Plan 2019 Update:

1. Prevent and reduce the loss of life, injury, public health impacts and property damages resulting from all major natural hazards.
2. Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.
3. Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.
4. Prevent and reduce the damage to public infrastructure resulting from all hazards.
5. Encourage the business community, major institutions and non-profits to work with the Town 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.
9. Consider the impacts of climate change and incorporate climate sustainability and resiliency into hazard mitigation and other Town plans and policies.

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SECTION 6: EXISTING MITIGATION MEASURES

The existing protections in the Town of Watertown 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.

The Town's existing mitigation measures, which were in place prior to the original 2012 Plan, are listed by hazard type here and are summarized in Table 33 below. Many upgrades to existing measures are noted in the following sections.

EXISTING TOWN-WIDE MITIGATION FOR FLOOD-RELATED HAZARDS

Watertown 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:

Participation in the National Flood Insurance Program (NFIP) – Watertown participates in the NFIP with 91 policies in force as of the September 30, 2018. 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>

The following information is provided for the Town of Watertown:

Flood insurance policies in force (September 30, 2018)	91
Coverage amount of flood insurance policies	\$25,440,100
Premiums paid	\$51,569
Total losses (all losses submitted regardless of the status)	18
Closed losses (losses that have been paid)	13
Open losses (losses that have not been paid in full)	0
CWOP losses (losses that have been closed without payment)	5
Total payments (total amount paid on losses)	\$788,689.62

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.

Street sweeping – Every street gets swept at least four times a year with the Town completing on average 16 curb miles a week.

Catch basin cleaning – The town has approximately 3200 catch basins that are cleaned every year on average. This service is contracted out by the town.

Roadway treatments – The Town uses liquid calcium salt additive.

Drainage infrastructure maintenance - The town requires a maintenance agreement in perpetuity on private drainage facilities. To the extent possible, the Town requires all storm water to be handled on site rather than directed into the municipal storm drain system.

Zoning Regulations – Zoning is intended to protect the public health and safety through the regulation of land use. The Watertown Zoning Ordinance includes a Floodplain District (Section 5.06). The purposes of this district are to:

1. To provide that lands in the Town of Watertown subject to seasonal or periodic flooding as described hereinafter shall not be used for residence or other purposes in such manner as to endanger the health or safety of the occupants thereof.
2. To protect, preserve and maintain the water table and water recharge areas within the Town so as to preserve the present and potential water supplies for the public health and safety of the residents of the Town of Watertown.
3. To assure the continuation of the natural flow pattern of the water courses within the Town of Watertown in order to provide adequate and safe floodwater storage capacity to protect persons and property against the hazards of flood inundation.

The Floodplain District is an overlay district, defined by the 100-year floodplain as designated by FEMA. Within the District, by-right uses are limited to conservation, outdoor recreation, wildlife preservation, existing structures, and certain retail uses in the RD – Limited Redevelopment District which meet criteria established within the Floodplain District and have been issued a final Order of Conditions under the Massachusetts Wetlands Protection Act. An existing structure may be expanded and other uses, as allowed in the underlying zoning district, may be allowed by Special Permit, providing that it can be demonstrated that the proposed construction will not be detrimental to the public health, safety, or welfare, and the project meets the requirements of all applicable state and local regulations including those of the Massachusetts State Building Code pertaining to buildings within the floodplain.

Stormwater Ordinance – A storm water ordinance is has been adopted to help the Town comply with the MS4 Stormwater Permit issued by EPA. The Ordinance requires stormwater retention up to the 100-year storm for new development

Wetlands Ordinance - The Town of Watertown Wetlands Ordinance (Chapter XV) protects water resources, wetlands, and their adjoining land areas by controlling activities that might have a significant or cumulative impact on the recognized values of these resource areas, including their ability to serve as a flood control and storm damage prevention feature. Any activity that might fill or otherwise alter these resource areas requires a permit from the Watertown Conservation Commission. The adjoining land area under the protection of this by-law includes land within 150 feet of a pond or wetland and land within 200 feet of a river or stream as well as any land within a designated floodplain.

Watertown Open Space and Recreation Plan (OSRP) - Watertown's OSRP was updated in 2015 and identifies a number of open space parcels in identified hazard areas including floodplains and brush fire areas. For many of these parcels the plan recommends developing use and management plans, including lands along the Charles River and Whitney Hill. These management plans should include consideration of hazard issues such as flooding and brush fires.

EXISTING DAM MITIGATION MEASURES

DCR dam safety regulations – The state has enacted dam safety regulations mandating inspections and emergency action plans. All new dams are subject to state permitting.

Watertown Dam: An Emergency Action Plan (EAP) was completed in July 2018 by the MA Department of Conservation and Recreation (DCR), which owns and operates this dam on the Charles River near Watertown Square. The plan includes emergency notification procedures, a general response flowchart, an impact summary and mapping, and sections on preparedness, emergency detection, evaluation, and classification. A section on general responsibilities describes the roles of DCR, MEMA, the State Police, and the local police and fire departments.

In addition, Emergency Action Plans have been completed for several upstream dams outside of Watertown that could have an impact on the town if they failed. These include

- *Cambridge Reservoir Dam and Stony Brook Reservoir Dam*, located in Waltham and Weston, owned and operated by the City of Cambridge Water Department. These reservoirs on tributaries of the Charles River are the principal sources of public water supply for the city of Cambridge.
- *Norumbega and Schenck's Pond Dams* in Weston, both owned and operated by the Massachusetts Water Resources Authority as part of the MWRA regional water distribution system.
- *Weston Reservoir Dam*, also owned by the MWRA as part of the regional water distribution system.

In March 2018 the Watertown Fire Department attended Emergency Action Plan training for Weston Reservoir Dam and Norumbega Reservoir Dams/Schenck's Pond Dam in Weston MA. This training was conducted by Christine E. Suhonen, P.E. from GZA and administered by the MWRA.

EXISTING TOWN-WIDE MITIGATION FOR WIND-RELATED HAZARDS

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

Tree-trimming program – The Town conducts its own tree maintenance and also uses its own equipment to trim and remove trees as needed and grind stumps.

EXISTING TOWN-WIDE MITIGATION FOR WINTER-RELATED HAZARDS

Snow disposal –The town conducts general snow removal operations with its own equipment. There is a park on grove street that is used a snow disposal site as necessary.

EXISTING TOWN-WIDE MITIGATION FOR FIRE-RELATED HAZARDS

Outdoor Burning Prohibited – Outdoor burning is prohibited in Watertown.

Development Review – The Fire Department is a member of the site plan review committee.

EXISTING TOWN-WIDE MITIGATION FOR GEOLOGIC HAZARDS

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

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

EXISTING MULTI-HAZARD MITIGATION MEASURES

Comprehensive Emergency Management Plan (CEMP) – Every community in Massachusetts is required to have a Comprehensive Emergency Management Plan. These plans address mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies. These plans contain important information regarding flooding, hurricanes, 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.

Communications Equipment – The Town has access to three Incident Command Units, mobile communications centers available to the town through the MA State Police, the MA Dept. of Fire Services, and MEMA. Improvements to the communications system are being pursued by the Town (see Section 8).

Emergency Power Generators – Emergency generators are located at the Town Hall, Main Library, Police Department, Fire Department, Public Works Facility, and Watertown High School. The town is planning to install additional generators in schools (See Section 8).

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

COMPILATION OF EXISTING MITIGATION

Table 33 summarizes the existing natural hazard mitigation measures already in place in Watertown.

Table 33: Existing Natural Hazard Mitigation Measures in Watertown

Type of Existing Mitigation Measures	Area Covered	Effectiveness/ Enforcement	Improvements/ Changes Needed
MULTIPLE HAZARDS			
Comprehensive Emergency Management Plan (CEMP)	Town-wide.	Emphasis is on emergency response.	Currently up to date. Needs to be periodically update
Communications Equipment	Town-wide.	Improvements are being implemented by the town.	The Town is pursuing upgrades for integrated communications among Police, Fire, and Public Works
Massachusetts State Building Code	Town-wide.	Most effective for new construction.	None.
Participation in the Regional Emergency Planning Committee (disbanded since the previous plan)	Town-wide.	A forum for cooperation on natural and manmade disasters.	The Battle Road Emergency Planning Comm. disbanded. The Town is considering other options for this.
Emergency Power Generators	Town-wide.	Improvements are being implemented by the town.	The Town is pursuing generators for schools
FLOOD HAZARDS			
Participation in the National Flood Insurance Program (NFIP). The Town actively enforces the floodplain regulations.	Areas identified on the FIRM maps.	There are 91 policies in force. FIRM map date 2010 (not updated since 2012 plan)	Encourage all eligible homeowners to obtain insurance.
Street sweeping	Town-wide.	Effective.	MS4 Permit may require changes
Catch basin cleaning	Town-wide.	Effective.	MS4 Permit may require changes
Roadway treatments	Town roads.	Effective.	None.
Drainage infrastructure maintenance	Town-wide.	Effective	Ongoing maintenance needed
Zoning – Floodplain District	Town-wide.	Effective.	None

Stormwater Ordinance	Town-wide.	Effective	MS4 Permit may require changes
Wetlands Protection Ordinance	Wetland Resource Areas	Effective	None
Watertown OSRP	Town-wide	Effective	The OSRP was updated in 2015
DAM HAZARDS			
DCR dam safety regulations and permitting	State-wide.	Somewhat effective	Improvements to the statewide system for dam inspections.
Emergency Action Plans (EAP) have been prepared for the Watertown Dam, Cambridge Reservoir and Stony Brook Dams, Weston Dam, and the Norumbega and Schenck's Pond Dams	Charles River floodplain areas	Effective	Plans were recently completed and are up to date
Watertown Fire Dept attended EAP training for Weston Reservoir Dam and Norumbega Reservoir Dams/Schenck's Pond Dams	Charles River floodplain areas	Effective	None; continue to participate in any future dam trainings
WIND HAZARDS			
Comprehensive Emergency Management Plan (CEMP)	Town-wide.	Effective primarily for emergency response.	CEMP is up to date
The Massachusetts State Building Code	Town-wide.	Effective for most situations except severe storms	None.
Tree trimming program	Town-wide.	Improvements are being implemented by the town.	More capacity for tree trimming needed
WINTER HAZARDS			
Regular salting and sanding of the roads and local plowing.	Town-wide	Effective	None
BRUSH FIRE HAZARDS			
Outdoor burning prohibited.	Town-wide.	Effective.	None.
Development Review	Town-wide.	Effective.	None.
GEOLOGIC HAZARDS			
The Massachusetts State Building Code	Town-wide.	Effective for most situations.	None.

MITIGATION CAPABILITIES AND LOCAL CAPACITY FOR IMPLEMENTATION

Under the Massachusetts system of “Home Rule,” the Town of Watertown is authorized to adopt and from time to time amend a number of local bylaws and regulations that support the town’s capabilities to mitigate natural hazards. These include the Zoning Ordinance, Stormwater Ordinance, Subdivision and Site Plan Review Regulations, Wetlands Ordinance, Health Regulations, Public Works regulations, and local enforcement of the State Building Code. Local Ordinances may be amended by the Town Council to improve the town’s capabilities, and changes to most regulations simply require a public hearing and a vote of the authorized board or commission. The Town of Watertown has recognized several existing mitigation measures that require implementation or improvements, and has the capacity based on these Home Rule powers within its local boards and departments to address these.

Several Town departments including Public Works and Community Development and Planning will address planned infrastructure projects. The Department of Public Works will collaborate with state agencies (DCR, MWRA) on dam management issues. Finally, efforts to improve emergency communications will be a collaborative effort among the Fire Department, Police Department, and Public Works Department.

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SECTION 7: STATUS OF MITIGATION MEASURES FROM THE 2012 PLAN

IMPLEMENTATION PROGRESS ON THE PREVIOUS PLAN

At a meeting of the Watertown Hazard Mitigation Planning Committee, Town staff reviewed the mitigation measures identified in the 2012 Watertown 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 2019 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 34 summarizes the status of the mitigation measures.

Table 34: 2019 Status of Mitigation Measures from the 2012 Plan

	Mitigation Measure	Priority	2019 Status Completed / In Progress / Not Completed	Include in 2018 Plan Update? Priority?
High Priority				
A) Charles River	Maintain coordination with operators of dams upstream and downstream of Watertown	High	Partially complete: Emergency Action Plans (EAP) have been completed for Watertown Dam in 2018, for the upstream Norumbega and Schenck's Pond Dams in Weston in 2018, and the upstream Stony Brook and Hobbs Brook Dams in Waltham and Weston in 2013 In March 2018 Watertown Fire Dept. staff attended Emergency Action Plan training for the Norumbega Reservoir Dam/ Schenck's Pond Dam and Weston Reservoir Dam in Weston	Yes-High
B) Flooding,	Continue revising storm	High	Completed: Stormwater	No

	Mitigation Measure	Priority	2019 Status Completed / In Progress / Not Completed	Include in 2018 Plan Update? Priority?
Drainage Infrastructure and Dams	water program.		Ordinance was adopted by the Town; requires retention of stormwater up to the 100-year storm.	
C) Earthquakes	Purchase mobile, long- running generators and/or install fixed, multi-fuel generators in designated emergency shelters	High	Completed	No
D) Brush Fire – Whitney Hill	Build fire access road and create brush fire prevention program.	High	Not Completed	No
E) Brush Fire	Purchase a Brush truck.	High	Not Completed	No
F) Multi-hazard	Purchase hand-held GPS units and mobile radio communications equipment	High	Partially completed: The Town acquired GPS units; they are currently working on a communications upgrade to change radio frequencies for a uniform single system that will serve Police, Fire, and Public Works	Yes-High
G) Multi-hazard: power outage	Upgrade all generators as needed.	High	Partially completed: The Town upgraded 2 generators.	Yes-High
H) Multi-hazard: power outage	Install fixed, multi-fuel generators at Town Hall.	High	Completed	No
I) FIRM mapping and bylaws	Maintain updated town Flood Information Rate Maps (FIRM) maps information and town ordinance.	High	Partially Completed: Town staff attended a Charles Watershed Risk Map workshop sponsored by FEMA in July 2018	Yes-High
Medium Priority				
J) Charles River	Program to fund and provide technical assistance for flood protection.	Medium	Not completed	No

	Mitigation Measure	Priority	2019 Status Completed / In Progress / Not Completed	Include in 2018 Plan Update? Priority?
K) Cunniff Elementary School	Upgrade pumps and improve site drainage.	Medium	Not completed: To be incorporated into the Town's School Building Program	Yes-Medium
L) Watertown High School	Upgrade pumps and improve site drainage.	Medium	Not completed: To be incorporated into the Town's School Building Program	Yes-Medium
M) Rutland Street	Program to fund and assist homeowners with pumps.	Medium	Partially completed: Homeowners have more pumping capacity.	Yes-Medium
N) Flooding, Drainage Infrastructure and Dams	Dedicate more resources for more frequent maintenance of town-owned drainage facilities, such as more frequent removal of sediment.	Medium	Completed	No
O) Flooding, Drainage Infrastructure and Dams	Study feasibility of creating stormwater utility	Medium	Not completed	Yes-Medium
P) Flooding, Drainage Infrastructure and Dams	Develop greater emergency flood preparation and emergency response capacity.	Medium	Partially completed:	Yes-Medium
Q) High Winds and Hurricanes	Increase contract labor for tree maintenance program.	Medium	Partially completed: The Town has established a Tree Warden Supervisor under the Dept. of Public Works	Yes-Medium
R) Earthquakes	Investigate options to make all public buildings earthquake resistant.	Medium	Not completed	Yes-Low
S) Multi-hazard	Purchase a digital/hard copy map plotter to enable large map creation from town GIS files	High	Completed	No

As indicated in Table 34, the Town completed several mitigation measures include. Adoption of a Stormwater Ordinance, installation of a fixed generator in Town Hall, initiation of a test program to assist homeowners with installing pumps, increased capacity for sediment removal in drainage facilities, acquisition of hand-held GPS units and upgrade of GIS equipment.

Several projects that were not completed will be continued into this plan update. These include installing backup generators in several schools, implementing the Rutland Street project for pump installations, increasing capacity for tree maintenance, coordinating dam management with state agencies, and upgrading the emergency communications system for inter-operability between Fire, Police, and Public Works. .

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.

Overall, eleven mitigation measures from the 2012 plan will be continued in this 2019 plan update. Most will retain the same priority in this 2019 update. Three measures that were not completed will not be carried forward into current plan, including the purchase of a brush fire truck, which is not deemed necessary due to the low frequency of brush fires in the Town.

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.

SECTION 8: 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.

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

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

<https://www.fema.gov/flood-mitigation-assistance-grant-program>

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

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

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

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 and require cooperation between two or more municipalities. There is a third level of mitigation which is regional and may involve a state, regional or federal agency, or three or more municipalities.

REGIONAL PARTNERS

In many communities, mitigating natural hazards, particularly flooding, is more than a local issue. The drainage systems that serve these communities are complex systems of storm drains, roadway drainage structures, pump stations, dams, and other facilities owned and operated by a wide array of agencies including the Town, Massachusetts Department of Transportation (MassDOT) the Massachusetts Water Resources Authority (MWRA), and the Department of Conservation and Recreation (DCR). The planning, construction, operation and maintenance of these structures are integral to the flood hazard mitigation efforts of towns. These agencies must be considered the town's regional partners in hazard mitigation. These agencies also operate under the same constraints as communities do including budgetary and staffing constraints and they must make decisions about numerous competing priorities. In the sections that follow, the plan includes recommendations for activities where cooperation with these other agencies may be necessary. Implementation of these recommendations will require that all parties work together to develop solutions. Rail (MBTA).

REGIONAL AND INTERCOMMUNITY FACILITIES WITHIN WATERTOWN

Major facilities owned, operated and maintained by state or regional entities include:

- Watertown Dam (DCR)
- Cambridge Reservoir and Stony Brook Dams (Cambridge Water Department)
- Weston Dam, Norumbega Dam, and Schenck's Pond Dams (MWRA)
- State Route 20 (Main Street)
- MBTA Bus Lines
- MWRA water distribution mains and wastewater collectors

NEW DEVELOPMENT AND INFRASTRUCTURE

As part of the process of developing recommendations for new mitigation measures for this plan update, the Town considered the issues related to new development, redevelopment, and infrastructure needs in order limit future risks. Taking into consideration the Zoning and Stormwater Ordinances, priorities for the future include bylaw updates for stormwater management, upgrading intraoperative communications, installation of key generators, and coordination of dam management with state agencies.

PROCESS FOR SETTING PRIORITIES FOR MITIGATION MEASURES

The last step in developing the Town's mitigation strategy is to assign a level of priority to each mitigation measure so as to guide the focus of the Town's limited resources towards those actions with the greatest potential benefit. At this stage in the process, the Local Hazard Mitigation 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 Town'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 35 below demonstrates the prioritization of the Town's recommended 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 35: Prioritization of Mitigation Measures

Mitigation Action	Geographic Coverage	Estimated Benefit	Estimated Cost	Priority
DAMS				
1. Maintain coordination with operators of Watertown Dam and dams upstream of Watertown in Waltham and Weston	Charles River floodplains	High	Low	High
FLOODING				
2. Continue developing storm water program to comply with the MS4 permit	Town-wide	High	Medium	High
3. Maintain updated Flood Information Rate Maps maps information and town ordinance.	Town-wide	High	Low	High
4. Upgrade pumps and improve site drainage.	Cunniff Elementary School	Medium	Medium	Medium
5. Upgrade pumps and improve site drainage.	Watertown High School	Medium	Medium	Medium
6. Test Program to fund and assist homeowners with pumps.	Rutland Street	Medium	Medium	Medium
7. Study feasibility of creating stormwater utility	Town-wide	Medium	Medium	Medium
WIND				
8. Increase contract labor for tree maintenance program	Town-wide	Medium	Medium	Medium
MULTI-HAZARD				
9. Upgrade communications to a uniform single system that will serve Police, Fire, and Public Works, including interconnections conduit. The Town is having a study done by Cyber-Comm, and awaiting a decision by the FCC regarding radio frequency availability.	Town-wide	High	High	High
10. Upgrade all fixed generators as needed. The Fire Dept, Police and DPW all have generators. The town hall recently added one. The schools are being rebuilt with generators added through the capital budget process.	Town-wide	High	High	High
GEOLOGIC HAZARDS				
11. Identify public buildings that may be vulnerable to earthquakes and investigate options to make them more resistant to earthquakes	Town-wide	Low	Low	Low

Mitigation Action	Geographic Coverage	Estimated Benefit	Estimated Cost	Priority
BRUSH FIRE HAZARDS				
12. Evaluate the status of fire access roads and maintain or upgrade if needed	Town-wide	Low	Low	Low
13. Provide public information about brushfire hazards and preventive measures for property owners.	Town-wide	Low	Low	Low
WINTER STORMS				
14. Identify public buildings that may be vulnerable to damage from snow loads and conduct a structural assessment if needed	Town-wide	Low	Low	Low
DROUGHT HAZARDS				
15. Adopt guidelines for new development to promote drought tolerant landscaping and site design measures	Town-wide	Medium	Low	Medium
EXTREME TEMPERATURES				
16. Conduct a public awareness program on the risks of extreme temperatures and resources available to residents	Town-wide	Medium	Low	Medium
17. Adopt Site Design regulations to increase shade tree plantings near buildings, increase trees used in parking areas and along public ways.	Town-wide	h	Low	Medium

RECOMMENDED MITIGATION MEASURES

INTRODUCTION TO RECOMMENDED MITIGATION MEASURES TABLE 36

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 35, the designation of high, medium, or low priority was done considering potential benefits, areas affected, and estimated project costs.

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.

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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/streambank protection, flood damage reduction, flood plain management services and planning services.

Massachusetts Emergency Management Agency (MEMA) – The grants page <https://www.mass.gov/hazard-mitigation-assistance-grant-programs> describes the various Hazard Mitigation Assistance Program.h

Table 36: Recommended Hazard Mitigation Measures

Hazard Category/ Location	Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Dams						
1. Charles River Dams	Maintain coordination with operators of Watertown Dam and dams upstream of Watertown in Waltham and Weston	High	Dept. of Public Works, with DCR, MWRA, and City of Cambridge	2019-2023	Staff Time	Watertown General Fund
Flooding						
2. Town-wide Drainage Infrastructure	Continue developing storm water program to comply with the MS4 permit	High	Dept. of Public Works	2019-2023	Staff time and Consultants 100,000/year	Enterprise Fund and Sewer Fund
3. FIRM mapping and bylaws	Maintain updated town Flood Information Rate Maps (FIRM) maps information and town ordinance.	High	Planning Dept.	2019-2023	Staff time	Watertown General Fund
4. Cunniff Elementary School	Upgrade pumps and improve site drainage.	Medium	School Dept./Public Works Dept.	2019-2023	TBD	School Building Fund / FEMA
5. Watertown High School	Upgrade pumps and improve site drainage.	Medium	School Dept./Public Works Dept.	2019-2023	TBD	School Building Fund / FEMA
6. Rutland Street	Test Program to fund and assist homeowners with pumps.	Medium	Dept. of Public Works	2019-2023	\$70,000	Watertown General Fund Mitigation Fund

Hazard Category/ Location	Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
7. Town-wide Drainage Infrastructure	Evaluate the feasibility of creating stormwater utility	Medium	Dept. of Public Works / Stormwater Advisory Committee	2020- 2023	\$50-100,000 and Staff Time	Watertown General Fund; Sewer Fund
Wind Hazards						
8. Town-wide wind hazards	Increase contract labor for tree maintenance program.	Medium	Dept. of Public Works /Tree Warden	2019- 2023	\$50,000	Watertown General Fund
Multi-Hazards						
9. Town-wide Multi- hazard: integrated communications	Upgrade communications to a uniform single system that will serve Police, Fire, and Public Works, including interconnections conduit. The Town is having a study done by Cyber-Comm, and awaiting a decision by the FCC regarding radio frequency availability.	High	Fire Dept./ Police Dept./ Dept. of Public Works	2019- 2023	\$2.2 million	Watertown General Fund / FEMA
10. Town-wide Municipal Facilities: Multi-hazard--power outage	Upgrade all fixed generators as needed. The Fire Dept, Police and DPW all have generators. The town hall recently added one. The schools are being rebuilt with generators added through the capital budget process.	High	Fire Dept./ Police Dept./ Dept. of Public Works	2019- 2023	\$150,000	Watertown General Fund / FEMA

Hazard Category/ Location	Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Geologic Hazards						
11. Town-wide: Public Buildings-Earthquake hazards	Identify public buildings that may be vulnerable to earthquakes and investigate options to make them more resistant to earthquakes	Low	Planning Dept. / Emergency Management	2020-2023	Staff time	Watertown General Fund
Wildfire Hazards						
12. Town-wide: Brush Fire hazards	Evaluate the status of fire access roads and maintain or upgrade if needed	Low	Fire Department	2020-2023	Staff time	Watertown General Fund
13. Town-wide: Brush Fire hazards	Provide public information about brushfire hazards and preventive measures for property owners.	Low	Fire Department	2020-2023	Staff time	Watertown General Fund
Winter Hazards						
14. Town-wide Public Buildings: Snow loads	Identify public buildings that may be vulnerable to damage from snow loads and conduct a structural assessment if needed	Low	Dept. of Public Works/ Planning Dept.	2020-2023	Staff time	Watertown General Fund
Drought Hazards						
15. Town-wide: drought	Adopt guidelines for new development to promote drought tolerant landscaping and site design measures	Medium	Community Development and Planning Dept. Conservation Commission, Planning Board, ZBA	2020-2023	Staff time	Watertown General Fund

Hazard Category/ Location	Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Extreme Temperatures						
16. Town-wide: Extreme heat and cold	Conduct a public awareness program on the risks of extreme temperatures and resources available to residents	Medium	Health Department/.. Emergency Management.	2020-2023	Staff time; cost for developing & distributing education materials	Watertown General Fund
17. Town-wide: Extreme heat and cold	Adopt Site Design regulations to increase shade tree plantings near buildings, increase trees used in parking areas and along public ways.	Medium	Community Development and Planning Dept. Planning Board, ZBA	2020-2023	Staff Time	Watertown General Fund

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SECTION 9: PLAN ADOPTION & MAINTENANCE

PLAN ADOPTION

The Watertown Hazard Mitigation Plan 2019 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 many 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 of the plan. 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 Watertown Hazard Mitigation Planning Team to prepare this plan. After approval of the plan by FEMA, this group will meet to function as the Hazard Mitigation Implementation Team, with the Fire Chief 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 Town Engineer, will have primary responsibility for tracking progress, evaluating, and updating the plan.

Begin to Prepare for the next Plan Update – FEMA's approval of this plan is valid for five years, by which time an updated plan must be approved by FEMA in order to maintain the town's approved plan status and its eligibility for FEMA mitigation grants. 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. This will help the Town avoid a lapse in its approved plan status and grant eligibility when the current plan expires.

The Hazard Mitigation Implementation Team will use the information from the Mid-Term progress review to identify the needs and priorities for the plan update and seek funding for the plan update process. Potential sources of funding may include FEMA Pre-Disaster Mitigation grants and the Hazard Mitigation

Grant Program. Both grant programs can pay for 75% of a planning project, with a 25% local cost share required.

Prepare and Adopt an Updated Local Hazard Mitigation Plan – Once 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 Watertown 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 Watertown Hazard Mitigation Plan 2019 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
- Community Development and Planning
- Conservation Commission
- Parks and Recreation
- Board of Health
- Building

Other groups that will be coordinated with include large institutions, Water District, Chamber of Commerce, land conservation organizations and watershed groups. The plans will also be posted on a community's website with the caveat that a 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 Open Space and Recreation Plan, Comprehensive Emergency Management Plan, and Capital Investment Program.

SECTION 10: LIST OF REFERENCES

- City of Cambridge, Emergency Action Plan, Cambridge Reservoir Dam and Stony Brook Dam, 2013
- 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, 2010
- FEMA, HAZUS, <https://www.fema.gov/hazus>
- FEMA, Local Mitigation Plan Review Guide; October 1, 2011
- FEMA, Flood Insurance Rate Maps for Middlesex County, MA, 2013
- MA Department of Conservation and Recreation, *Emergency Action Plan, Watertown Dam*, 2018
- MA Department of Conservation and Recreation, Office of Water Resources
- 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*
- MA Water Resources Authority, *Emergency Action Plan, Norumbega and Schenck's Pond Dams*, 2018
- MA Water Resources Authority, *Emergency Action Plan, Weston Reservoir Dam*
- 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 Centers for Environmental Information, website
- Town of Watertown, Open Space and Recreation Plan 2015
- Town of Watertown, Stormwater Ordinance
- Town of Watertown,
- Town of Watertown, Wetlands Ordinance
- Town of Watertown, Zoning Ordinance
- Union of Concerned Scientists, *Confronting Climate Change in the U.S. Northeast*, 2007

U.S. Army Corps of Engineers, Ice Engineering Group, Ice Jam Database

U. S. Census, 2010, and American Community Survey, 2017

USGS, National Water Information Center, website

APPENDIX A: MEETING AGENDAS

Watertown Hazard Mitigation Plan LOCAL HAZARD MITIGATION TEAM Meeting #1

Tuesday, March 6, 10:30 AM

Watertown Fire Department, 99 Main Street

AGENDA

1. Review Project Scope of Work and Schedule
2. Update Critical Facilities Inventory and Mapping
3. Identify/update local hazards:
 - a) Flood Hazard Areas
 - b) Fire Hazard Areas (brushfires/wildfires)
 - c) Dams
 - d) Other hazards
4. Identify/Update New and Potential Development Sites
5. Discuss Public Involvement and Outreach
 - Identify local stakeholders
 - Schedule first public meeting

Watertown Hazard Mitigation Plan

LOCAL HAZARD MITIGATION TEAM

Meeting #2

Friday, August 10, 10:00 AM

Watertown Fire Department, 99 Main Street

AGENDA

1. Review and Update Hazard Mitigation Goals

2. Update Existing Mitigation Measures

- a. Identify any updates/changes to existing mitigation
- b. Status of mitigation / any needed changes

3. Review status of Recommended Mitigation Measures from the 2012 Plan:

- e) Mitigation that was completed
- f) Mitigation partially completed
- g) Mitigation not completed
- h) Identify mitigation measures to retain in 2018 Plan Update

4. Prepare for First Public Meeting (September)

- Schedule first public meeting
- Identify list of local stakeholders & contact into

Watertown Hazard Mitigation Plan

LOCAL HAZARD MITIGATION TEAM

Meeting #3

Tuesday, December 18, 10:00 AM
Watertown Public Works Department

AGENDA

1. Finalize Recommended Mitigation Measures for the 2019 Plan:
2. Prepare for Second Public Meeting
 - Scheduled for January 8, 2019 with the Town Council
 - Identify list of local stakeholders & contact into

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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.nesec.org/>. 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 the MAPC File Transfer Protocol (FTP) website at:

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

- 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 (2010) 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 Watertown 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

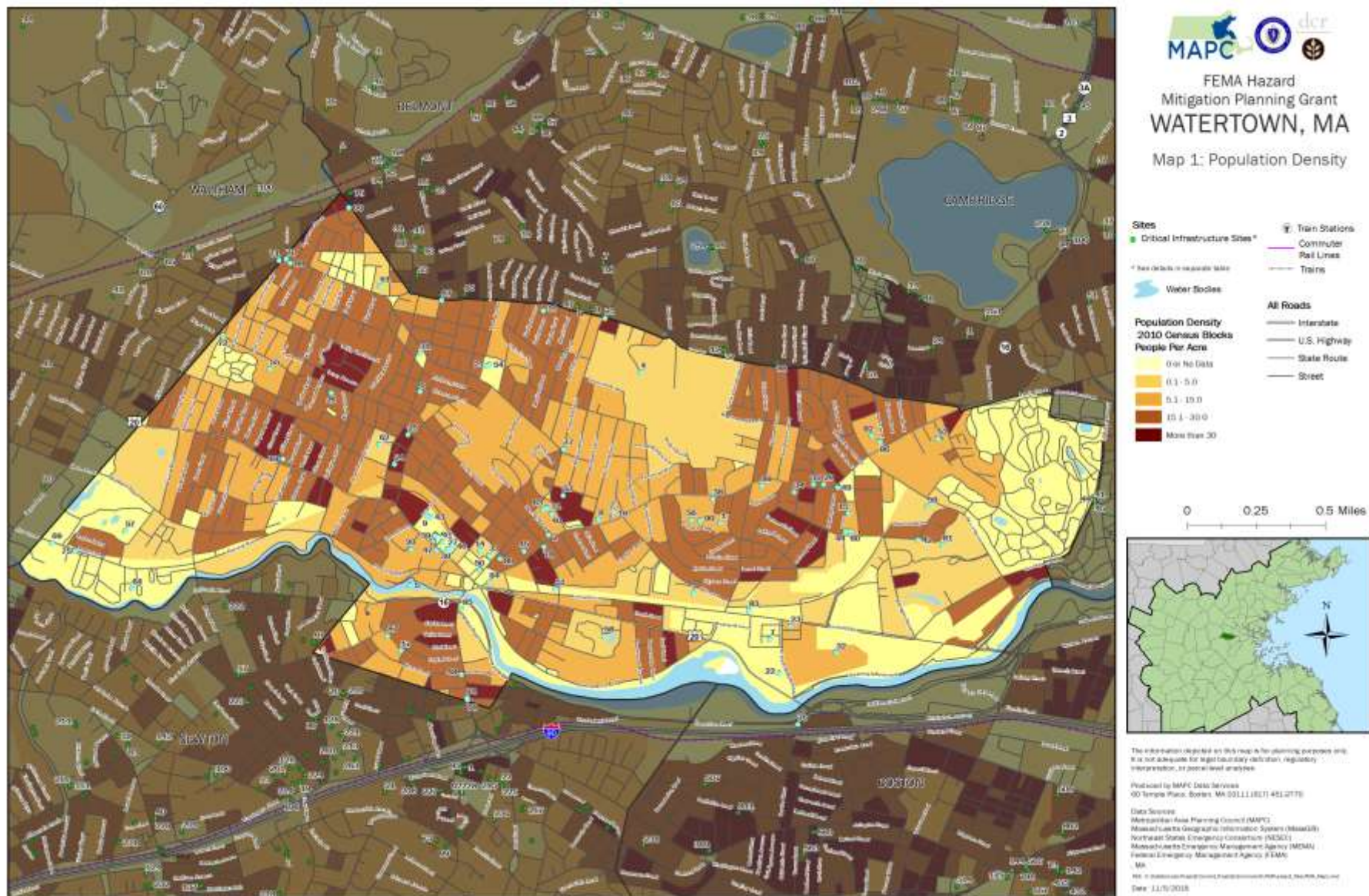
mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to <http://pubs.usgs.gov/pp/p1183/pp1183.html>.

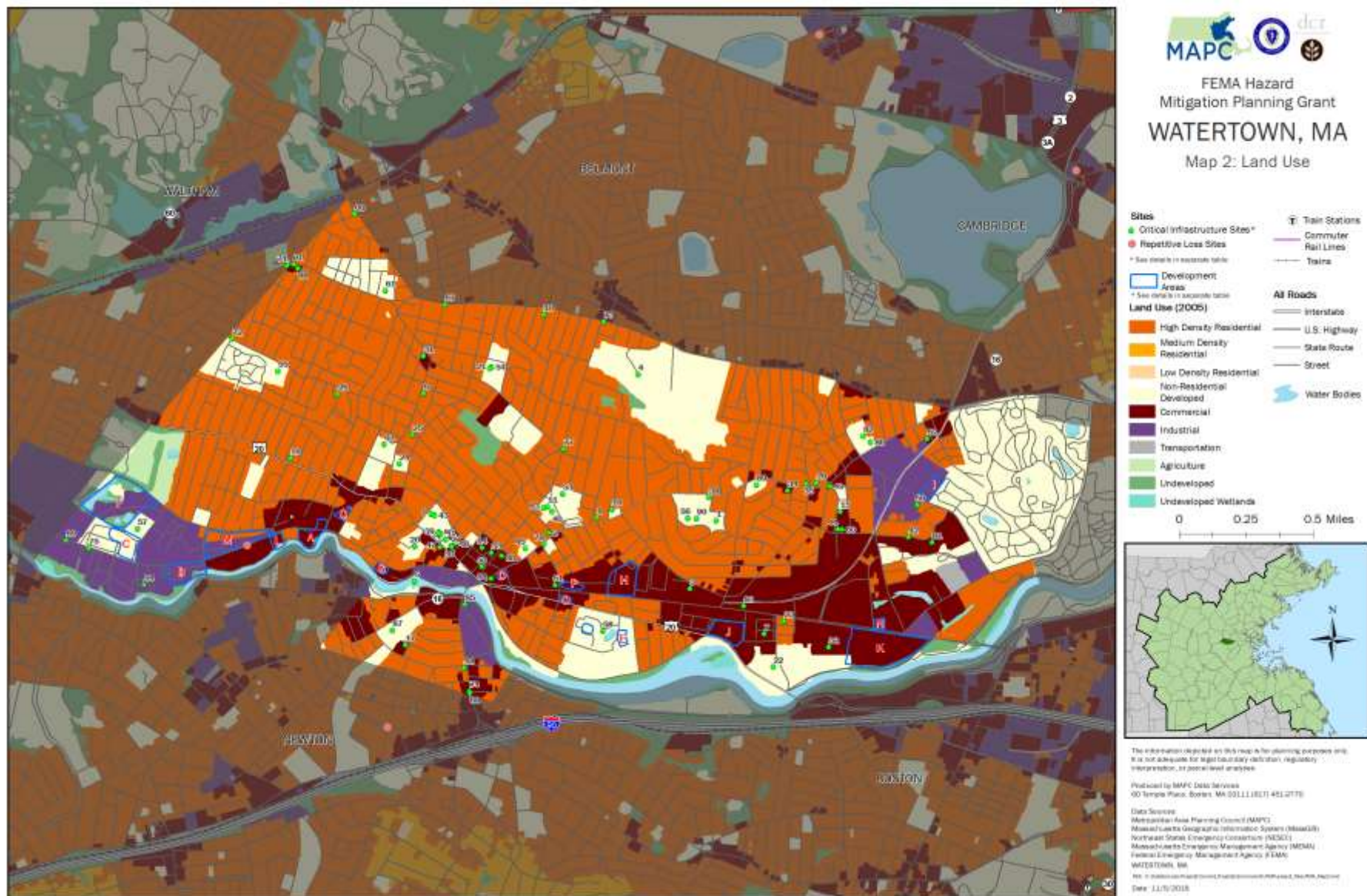
Map 5: Hurricanes and Tornadoes – This map shows a number of different items. The map includes the storm tracks for both hurricanes and tropical storms, if any occurred in this community. This information must be viewed in context. A storm track only shows where the eye of the storm passed through. In 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.

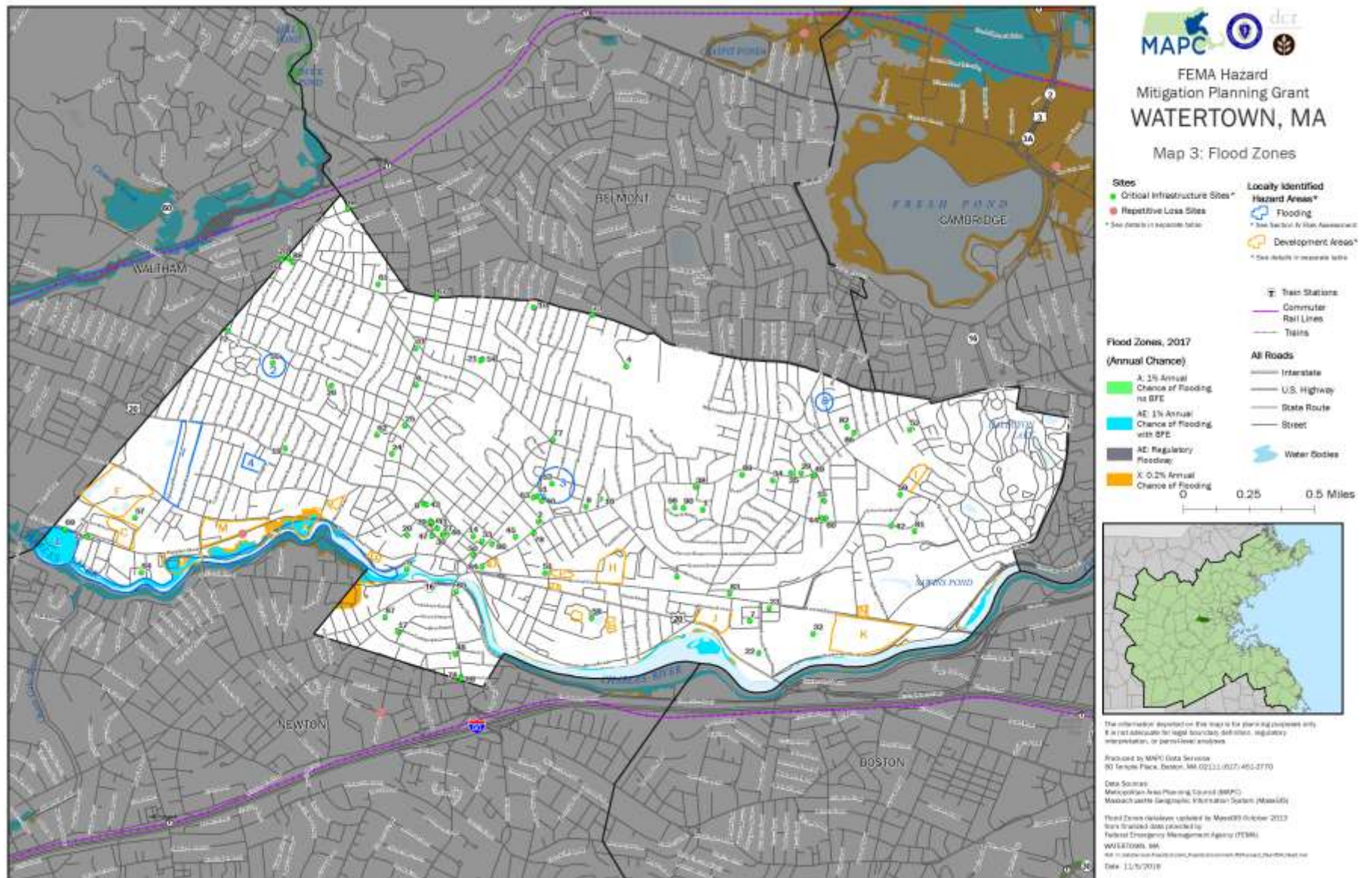
Map 6: Average Snowfall - This map shows the average snowfall. It also shows storm tracks for nor'easters, if any storms tracked through the community.

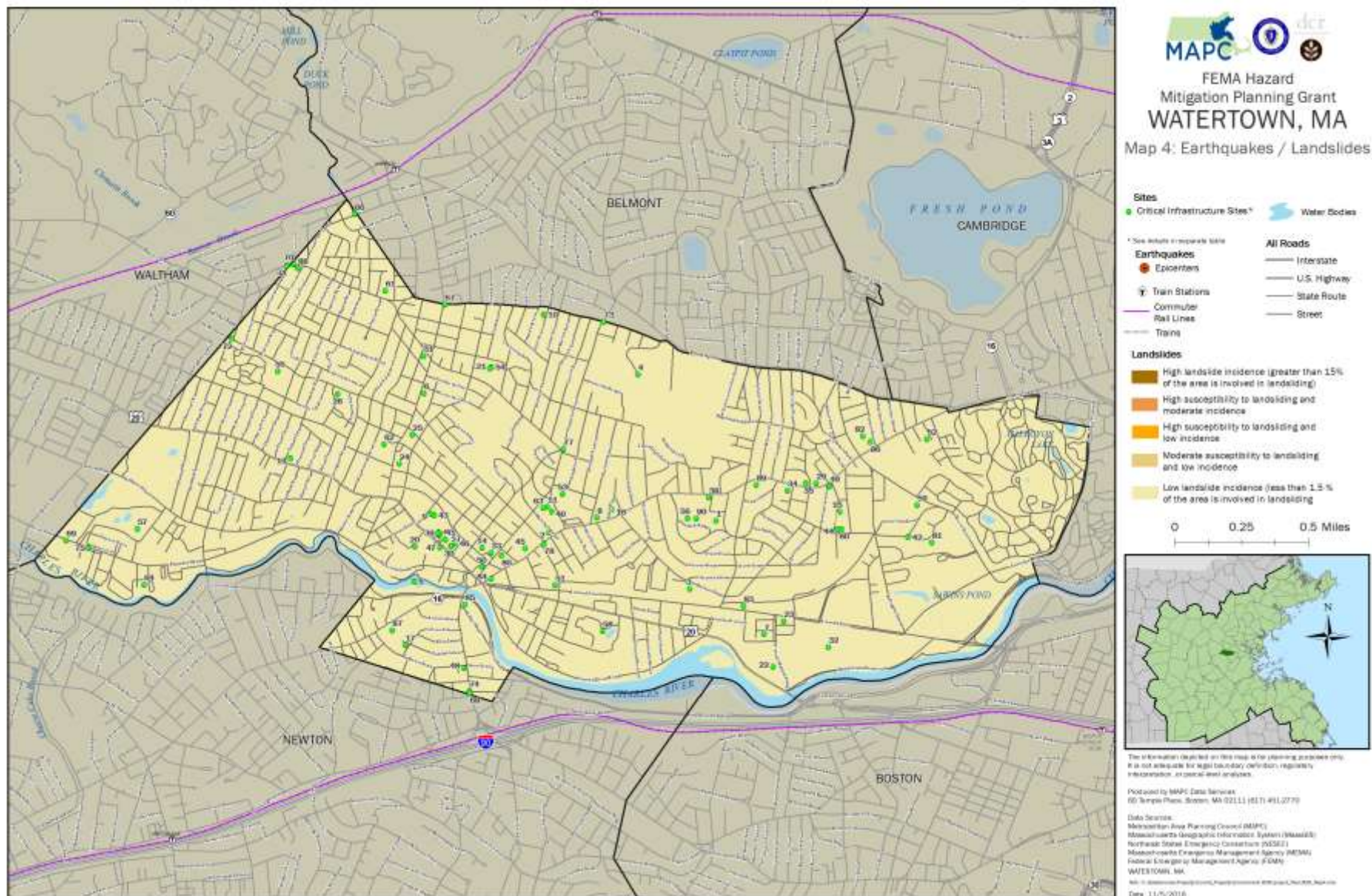
Map 7: Composite Natural Hazards - This map shows four categories of composite natural hazards for areas of existing development. The hazards included in this map are 100 year wind speeds of 110 mph or higher, low and moderate landslide risk, FEMA Q3 flood zones (100 year and 500 year) and hurricane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

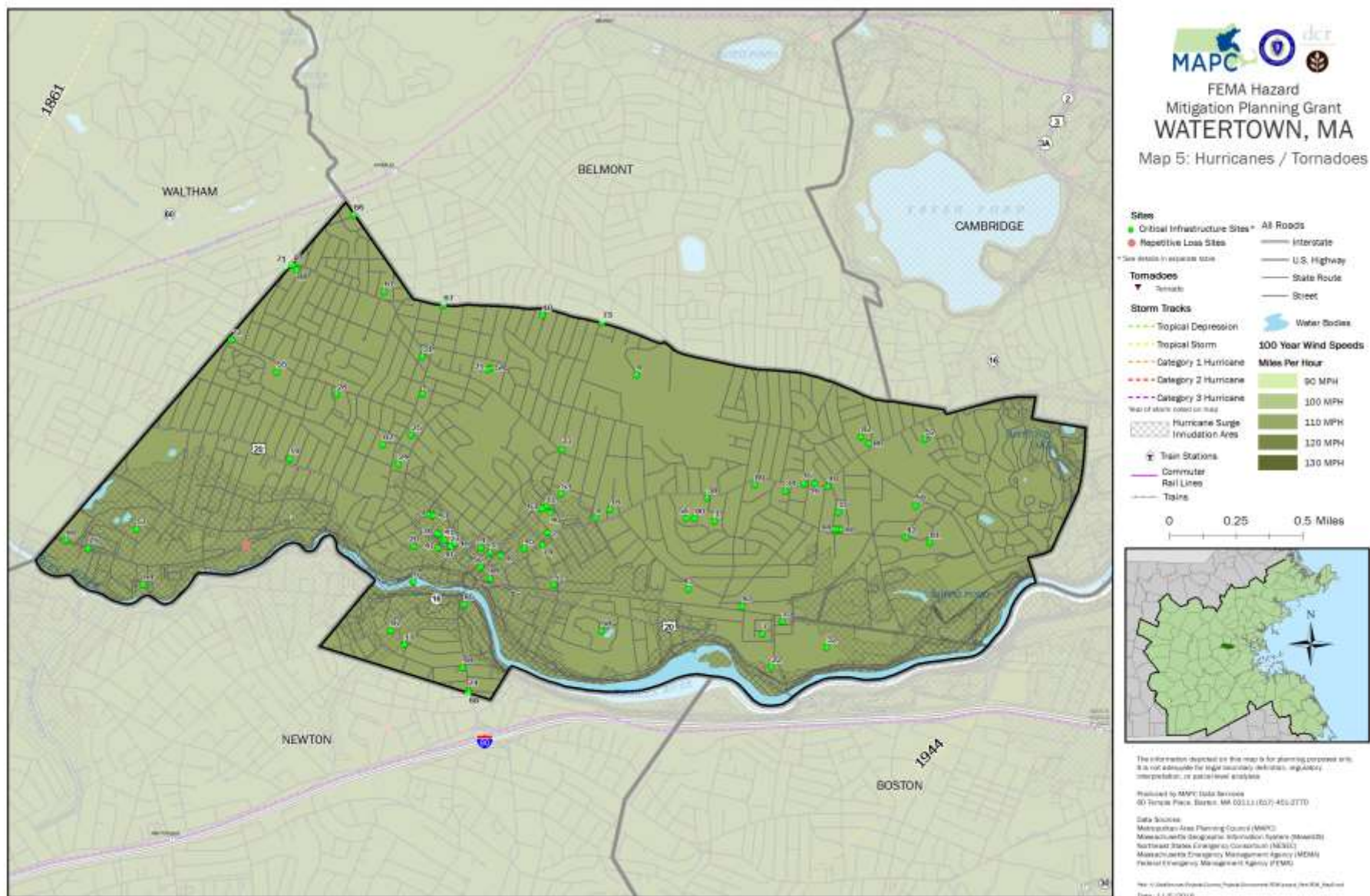
Map 8: Hazard Areas – For each community, locally identified hazard areas are overlaid on an aerial photograph dated April, 2008. The critical infrastructure sites are also shown. The source of the aerial photograph is Mass GIS.

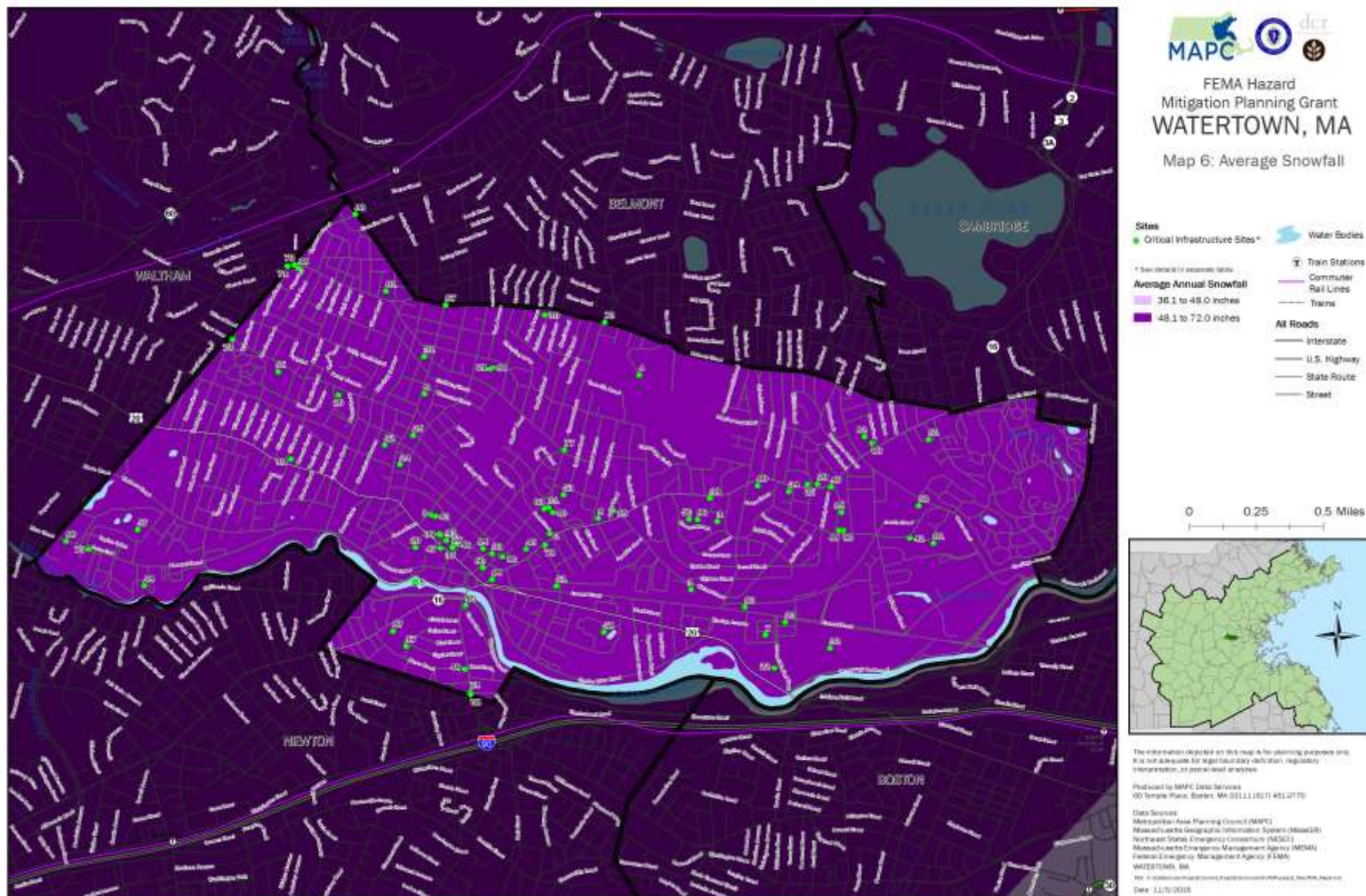














MAPC **der**

FEMA Hazard Mitigation Planning Grant
WATERTOWN, MA
 Map 8: Local Hazard Areas

Sites

- Critical Infrastructure Sites*
- Repetitive Loss Sites

* See Section 4.1.1 for more details.

Locally Identified Hazard Areas

- Shrub Fires
- Flooding
- Historic

* See Section 4.1.1 for more details.

Development Sites

* See Section 4.1.1 for more details.

All Roads

- Interstate
- U.S. Highway
- State Route
- Street

Train Stations

- Commuter Rail Lines
- Train Stations

0 0.5 1 Miles

The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or other-level analysis.

Prepared by MAPC Data Services
 60 Temple Place, Boston, MA 02111 (617) 451-2710

Data Sources

- Metropolitan Area Planning Council (MAPC)
- Metropolitan Geographic Information System (MetGIS)
- Massachusetts Emergency Management Agency (MEMA)
- Massachusetts Emergency Management Agency (MEMA)
- Federal Emergency Management Agency (FEMA)
- Prologix, Inc.
- Watertown, MA

Map 8: Local Hazard Areas
 Date: 11/15/2018

APPENDIX C: PUBLIC MEETINGS

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

CALENDAR LISTING / MEDIA ADVISORY

WATERTOWN'S HAZARD MITIGATION PLAN TO BE DISCUSSED AT DECEMBER 4 PUBLIC MEETING

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

What: At a meeting of the Joint Public Works and Public Safety Committees on Tuesday, December 4 at 7:00 PM, a presentation will be made by the Metropolitan Area Planning Council (MAPC), which is assisting the Town with the preparation of its Hazard Mitigation Plan.

The Town of Watertown is preparing a Hazard Mitigation plan that will document natural hazards that affect the Town, such as floods, hurricanes, winter storms, and earthquakes, as well as actions that the Town can take to reduce its vulnerability to these hazards.

When: Tuesday, December 4, 2018, 7:00 PM

Where: Joint Meeting of the Public Works and Public Safety Committees
Richard E. Mastrangelo Council Chamber
Watertown Administration Building
149 Main Street, Watertown, MA

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.

##

Hazard Mitigation Plan Public Meeting

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



The Town of Watertown is preparing a Hazard Mitigation Plan to help the town reduce its vulnerability to natural hazard events such as flooding, hurricanes, and winter storms. Please join the Town for a public presentation about the Hazard Mitigation Plan at a joint meeting of the Public Works and Public Safety Committees:

Date: Tuesday December 4, 2018
Time: 7:00 pm
Location: Richard E. Mastrangelo Council Chamber
Watertown Administration Building
149 Main Street, Watertown, MA

For more information, please contact
Martin Pillsbury at mpillsbury@mapc.org



CALENDAR LISTING / MEDIA ADVISORY

WATERTOWN'S HAZARD MITIGATION PLAN TO BE PRESENTED AT JANUARY 8 PUBLIC MEETING

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

What: At a meeting of the Watertown Town Council on Tuesday, January 8, 2019 at 7:00 PM, a presentation will be made by the Metropolitan Area Planning Council (MAPC), which is assisting the Town with the preparation of its updated Hazard Mitigation Plan.

The Town of Watertown has prepared an updated Hazard Mitigation plan that documents natural hazards that affect the Town, such as floods, hurricanes, winter storms, and earthquakes, as well as actions that the Town can take to reduce its vulnerability to these hazards.

When: Tuesday, January 8, 2018, 7:00 PM

Where: Meeting of the Town Council
Richard E. Mastrangelo Council Chamber
Watertown Administration Building
149 Main Street, Watertown, MA

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##

Hazard Mitigation Plan

Public Meeting

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



The Town of Watertown is preparing a Hazard Mitigation Plan to help the town reduce its vulnerability to natural hazard events such as flooding, hurricanes, and winter storms. Please join the Town for a public presentation of the Draft Hazard Mitigation Plan at a meeting of the Town Council. Questions and comments from the public are welcome at the meeting or afterwards until January 18, 2019.

Date: Tuesday, January 8, 2019

Time: 7:00 pm

Location: Richard E. Mastrangelo Council Chamber
Watertown Administration Building
149 Main Street, Watertown, MA

For more information, please contact
Martin Pillsbury at mpillsbury@mapc.org



Watertown Public Meeting Notification

Dear Town of Watertown stakeholder:

The Watertown Hazard Mitigation Plan is being updated to help the town reduce its vulnerability to natural hazard events such as flooding, hurricanes and winter storms. Natural hazards can have serious impacts on the Town of Watertown and its residents and businesses. The Metropolitan Area Planning Council (MAPC) is assisting the Town in the preparation of the updated plan.

Please join the Town for a presentation on the Draft Watertown Hazard Mitigation Plan Update at a public meeting on the following date and location:

Tuesday, January 8 at 7:00 PM
Watertown Town Council Meeting
Richard E. Mastrangelo Council Chamber
Watertown Administration Building
149 Main Street, Watertown, MA

Please feel free to forward the attached flyer to residents, business owners and anyone who may be interested in preventing and reducing damage from natural hazards in Watertown.

Best regards,
Martin Pillsbury

Martin Pillsbury | Director of Environmental Planning
Metropolitan Area Planning Council
60 Temple Place | Boston, MA 02111
617.933.0747 | mpillsbury@mapc.org | www.mapc.org



Watertown Public Meeting Notification
City/Town Clerks
Belmont, Boston, Cambridge, Newton, and Waltham

Dear City Clerk,

The Town of Watertown is preparing its updated *Hazard Mitigation Plan* to reduce the town's vulnerability to natural hazard events such as flooding, hurricanes, and winter storms. The plan will identify a set of hazard mitigation measures, including structural improvements, regulatory changes, and outreach efforts related to mitigating natural hazards in the town.

As part of the planning process, Watertown's neighboring communities are being notified of a public meeting on the draft plan to be hosted by the Watertown Town Council:

Tuesday, January 8, 2019 at 7:00 PM
Richard E. Mastrangelo Council Chamber
Watertown Administration Building
149 Main Street, Watertown, MA

A flyer announcing the meeting is attached. Please post this as a public meeting. If you have any questions about this please feel free to contact me.

Best regards,

Martin Pillsbury

Martin Pillsbury

Director of Environmental Planning
Metropolitan Area Planning Council
60 Temple Place
Boston, MA 02111
617.933.0747
mpillsbury@mapc.org

APPENDIX D: PLAN ADOPTION

**CERTIFICATE OF ADOPTION
TOWN COUNCIL
TOWN OF WATERTOWN, MASSACHUSETTS**

**A RESOLUTION ADOPTING THE
TOWN OF WATERTOWN HAZARD MITIGATION PLAN 2019 UPDATE**

WHEREAS, the Town of Watertown established a Committee to prepare the *Town of Watertown Hazard Mitigation Plan 2019 Update*; and

WHEREAS, the *Town of Watertown Hazard Mitigation Plan 2019 Update* contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Watertown, and

WHEREAS, duly-noticed public meetings were held by the Joint Committees on Public Safety and Public Health on December 4, 2018 and the Watertown Town Council on January 8, 2019

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

NOW, THEREFORE BE IT RESOLVED that the Town of Watertown TOWN COUNCIL adopts the *Town of Watertown Hazard Mitigation Plan 2019 Update*, in accordance with M.G.L. 40 §4 or the charter and ordinances of the Town of Watertown.

ADOPTED AND SIGNED this Date. _____

Name(s)

Title(s)

Signature(s)

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APPENDIX E: PLAN APPROVAL

To be added after the plan is approved by FEMA

