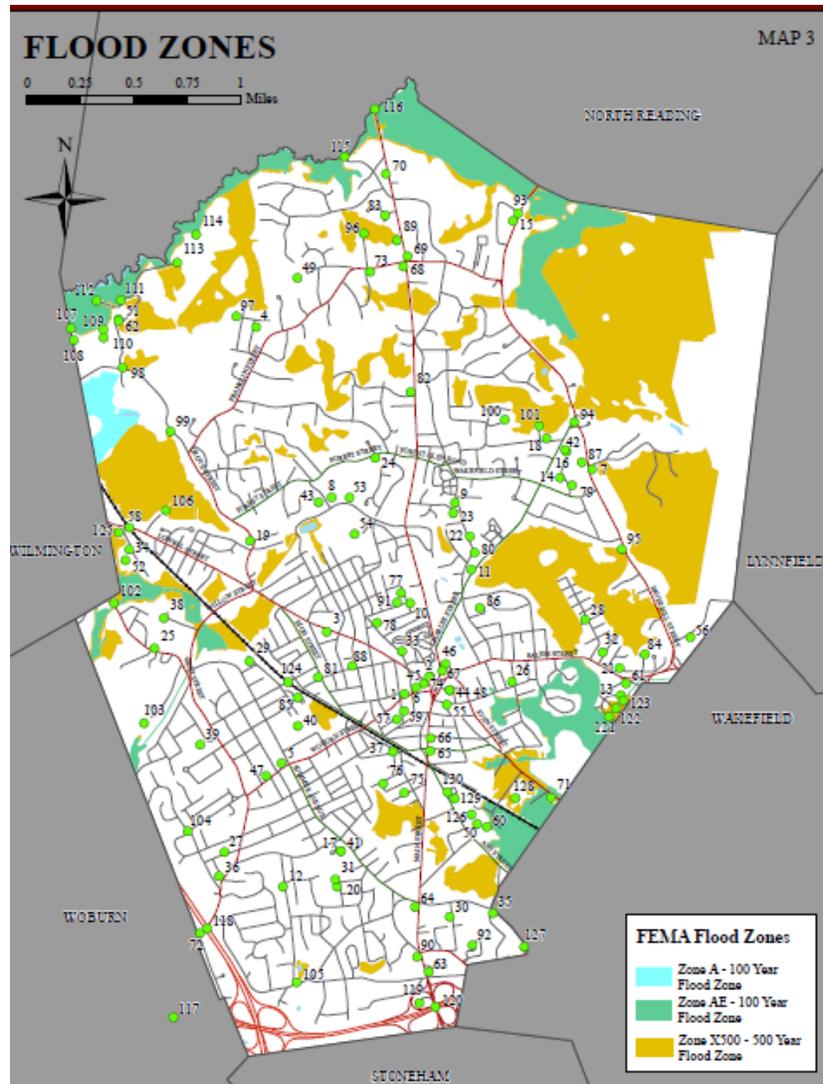


TOWN OF READING HAZARD MITIGATION PLAN



Final Plan
Adopted July 13, 2010

READING HAZARD MITIGATION PLAN

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ACKNOWLEDGEMENTS AND CREDITS

This plan was prepared for the Town of Reading 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: Jay Ash
Vice President: Michelle Ciccolo
Secretary: Marilyn Contreas
Treasurer: Grace S. Shepard

Executive Director: Marc. D. Draisen

Credits

Project Manager: Martin Pillsbury
Lead Project Planner: Joan Blaustein
Mapping/GIS Services: Allan Bishop, Tarin Comer and David dosReis

Massachusetts Emergency Management Agency

Director: Don Boyce

Department of Conservation and Recreation

Commissioner: Rick Sullivan

Town of Reading Engineering Department

Town Engineer: George Zambouras

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I. 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. This planning requirement does not affect disaster assistance funding.

Massachusetts has taken a regional approach and has encouraged the regional planning agencies to apply for grants to prepare plans for groups of their member communities. The Metropolitan Area Planning Council (MAPC) received a grant from the Federal Emergency Management Agency (FEMA) under the Pre-Disaster Mitigation (PDM) Program, to assist the Town of Reading and 22 other communities develop their local Hazard Mitigation Plans. The local Hazard Mitigation Plans produced under this grant are designed to meet the requirements of the Disaster Mitigation Act for each community.

What is Hazard Mitigation?

Natural hazard mitigation planning is the process of figuring out how to 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.

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II. COMMUNITY PROFILE

Overview

The Town of Reading is a medium size community which lies at a transportation hub. With Interstate Route 93 along its western boundary and Interstate 95 along its southern and southeastern boundaries, not only Boston but the seashore, retail shopping malls and employment centers are easily accessible. This accessibility plus the New England character of the town make Reading an ideal residential area. First settled in 1639, the town was incorporated in 1644. Under the guidance of a citizen volunteer committee, Reading is looking forward to celebrating its 350th anniversary in 1994. This committee is only one of many volunteer boards, committees and commissions that assist an elected board of selectmen and a representative town meeting in governing the town. The town manager is responsible for day-to-day operations of the local government.

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

The Town is governed by a Board of Selectmen and a Town Manager. The town operates under the representative town meeting format. The 2000 population was 23,708 people and there were 8,823 housing units.

The town maintains a website at <http://www.ci.reading.ma.us/>

Existing Land Use

The most recent land use statistics available from the state are based on aerial photography done in 1999. Table 1 shows the acreage and percentage of land in 21 categories. If the four residential categories are aggregated, residential uses make up 46 % of the area of the town. The next highest percentage is forest at 36% of the total land area.

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Table 1
1999 Land Use in Reading

Land Use Type	Acres	%
Cropland	6.37	0.10
Pasture	22.90	0.36
Forest	2,314.45	36.26
Non-forested wetlands	275.8	4.32
Mining	6.17	0.10
Open land	101.65	1.59
Participatory recreation	174.33	2.73
Spectator recreation	0.00	0.00
Water recreation	1.24	0.02
Multi-family residential	53.76	0.84
High density residential (less than ¼ acre lots)	0.00	0.00
Medium density residential (¼ - ½ acre lots)	2,430.43	38.08
Low density residential (larger than ½ acre lot)	451.88	7.08
Salt water wetlands	0.00	0.00
Commercial	174.97	2.74
Industrial	76.19	1.19
Urban open	148.55	2.33
Transportation	128.34	2.01
Waste disposal	3.72	0.06
Water	0.00	0.00
Woody perennials	11.41	0.18
Total	6,382.16	

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

Potential Future Land Uses

MAPC consulted with town staff to determine areas that were likely to be developed in the future. These areas are shown on Map 2, “Potential Development” and are described below. The letters in parentheses refer to the letters on Map 2.

Stop and Shop (A) – This is a redevelopment project that is taking place in an old building. It is currently under construction. The old building was demolished and a new one built. It has been occupied for several months. The old parking lot used to flood because the detention pond was too small and the catch basins surcharged. They have installed large underground detention systems for the new parking lot. They also filled a small floodplain and provided a compensatory area.

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New Restaurants (B) – This lot has been subdivided into three parcels. The office building will remain. The second building will remain. A Longhorn Steakhouse and a Bertucci's are under construction on the third parcel. On the second lot, another building was demolished and a new parking lot with an on-site infiltration system was installed. This building is now occupied by Hallmark Health. The restaurants also have new on-site infiltration.

Archstone (C) - This project has already been constructed. It is 204 rental units with a clubhouse and pool. It was developed under Chapter 40B.

Johnson Woods (D) – So far, 166 condo units have been approved and about half have been constructed under the PRD zoning. The project includes some affordable units and a full stormwater management system. There is additional land for which plans have not been received. Abutting land in Woburn between the town boundary and I-93 is under construction and partly occupied with over 400 units, mostly rental apartments, but one condo building. Access is only from West Street at the Reading/Wilmington line, and Reading has an understanding with Woburn about emergency response. In the future, it may be connected to the Johnson Woods roads.

80-100 Main Street (Atlantic Tambone) (E) – This is an approved redevelopment project. Three existing buildings would be torn down and consolidated into one new one. A restaurant will probably be the anchor for the development. The development will include an on-site stormwater management system including a detention basin to alleviate flooding of abutting residential lots on Haystack and Milepost Roads.

Addison – Wesley (F) – The Department of Housing and Community Development is reviewing a pending application for a Smart Growth District. The Community Planning and Development Commission is holding a public hearing on the proposed zoning changes for town houses, apartments, and an office building. Zoning changes will then be considered December 10 at a Special Town Meeting. The final design must meet DEP' Stormwater Management Policy.

Kylie Drive (G) – This is an eight lot subdivision. No buildings have been constructed yet but the new road has been constructed. Lot releases are pending. The development includes stormwater management systems that meet DEPs policy.

Benjamin Lane (H) – This will be a four lot subdivision. Trees have been cleared from the property. The utilities and roadways are under construction. The development includes stormwater management systems that meet DEPs policy.

Peter Sanborn Place Assisted Living (I) – This facility will be expanding. Plans have not yet been submitted for review. The project will be built under Chapter 40B.

Maplewood Village (J) – This project consists of 36 new condos on Salem Street (Route 129) next to the Registry of Motor Vehicles, opposite Libby Avenue. This project has been completed and is occupied. It was developed under Chapter 40B as a Local

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Initiative Project. The development includes stormwater management systems that meet DEP policy. The developers filled a floodplain and provided compensatory storage.

Pleasant Street (K) – The Housing Authority is applying for permits for a 4 unit building next to the Senior Center at #49 Pleasant Street. This building will share a parking lot and will include drainage improvements.

Sailor Tom subdivision (L) – This is a 3 lot subdivision at 175 Franklin Street abutting the west side of the Home Goods lot. The project includes stormwater management systems that meet DEP policy. The project is under a limit for impervious cover as per the Aquifer Protection District.

Camp Curtis Guild (M) – The National Guard recently decommissioned two firing ranges and is constructing a large vehicle maintenance facility. Most of the work is in Lynnfield but access and utilities are in Reading.

I-93/I-95 Interchange (N) – Mass Highway just filed an ENF for reconstruction of the interchange. This is the busiest interchange in the state and has a high accident rate including trucks with hazardous cargo. The proposed designs will have significant wetlands impact and will require significant stormwater management improvements.

8 Walkers Brook Drive (O) – The town recently received a proposal to demolish an existing gas station and build a bank. The fuel tanks have already been removed. The site is close to Walkers Brook and will require a wetlands permit and stormwater management system.

88 and 98 Walkers Brook (P) – This is a redevelopment project that is in the permit review process. The site will be used for an auto dealership and service center. One of the two buildings will be demolished and the parking lot will be completely reconstructed. Part of the site is the former town landfill and will need to be capped per DEP regulations. There have been several hazardous waste releases that were identified and cleaned up. The development will provide drainage system improvements but cannot fully meet the DEP policy standards due to a high water table, landfill materials, the fact that it abuts Mass Highway land and other constraints.

281,287 and 306 Main Street (Q) – These are all commercial sites where the previous uses have been abandoned. All have significant hazardous waste contamination and are in the middle of 21E analysis and cleanup processes. These sites are likely to be redeveloped for commercial uses after cleanup. All of the sites abut Walkers Brook and have wetlands so they will be subject to permits for the cleanup and for future redevelopment. These sites are within the low area on Main Street that has been identified as flood hazard area #5.

Meadow Brook Golf Club (R) – This golf course is located at the north end of Grove Street. There are currently no plans to change the use of this area and the club has recently installed new irrigation systems, updated the pool house, and made other

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improvements. However, this is the largest tract of remaining open land in Reading, is very close to the town wells, includes endangered species habitat, and has much upland with good development potential. A significant part of the land is also in the floodplain west of Grove Street and the Ipswich River floodplain north of the golf course.

40R District (S) – The town has voted to establish a 40R zoning district in this location.

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III. PUBLIC PARTICIPATION

Public participation occurred at two levels; the Metro Boston North/West Multiple Hazard Community Planning Team (regional committee) and the Reading Multiple Hazard Community Planning Team (local committee). In addition, the town held one meeting open to the general public to present the plan and hear citizen input.

Reading's Participation in the Regional Committee

On July 7, 2006, a letter was sent notifying the communities of the first meeting of the Metro Boston North/West Regional Committee and requesting that the Chief Elected Official designate two municipal employees and/or officials to represent the community. The following individual was appointed to represent Reading on the regional committee:

George Zambouras Town Engineer

The Metro Boston North/West Regional Committee met on the following dates:

July 26, 2006
March 28, 2007
November 1, 2007
June 26, 2008

The Local Multiple Hazard Community Planning Team

In addition to the regional committee meetings, MAPC worked with the local community representatives to organize a local committee for Reading. MAPC briefed the local representatives as to the desired composition of that team as well as the need for representation from the business community and citizens at large.

The Local Committee Meetings

On November 7, 2007 MAPC conducted the first meeting of the Reading Multi-Hazard Mitigation Planning Team. The meeting was organized by Carol Kowalski, Planning Director. The purpose of this meeting was to review existing and potential mitigation measures, evaluate and prioritize those measures and develop hazard mitigation goals. Table 2 lists the attendees at each meeting of the team. The agendas for these meetings are included in Appendix A. Other local meetings are noted in Table 3.

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Table 2
Attendance at the Reading Local Committee Meetings

Name	Representing
<i>November 7, 2007</i>	
Fran Fink	Conservation Commission
James Cormier	Police Department
Greg Burns	Fire Department
Carol Kowalski	Planning
George Zambouras	Town Engineer
Larry Ramdin	Health Department
Ted McIntire	DPW Director
Peter I. Heckenbleikner	Town Manager

Table 3
Other Local Meetings

Date	Participants	Purpose
9/28/06	George Zambouras, Paul Jackson	Data collection
3/20/07	George Zambouras, Fran Fink	Data collection
7/26/07	Carol Kowalski	Project briefing
12/6/07	Fran Fink	Review the ortho
3/31/08	Fran Fink, Carol Kowalski, George Zambouras	Review the ortho and discuss potential mitigation measures.

The Public Meeting - The plan was introduced to the public at a meeting of the Board of Selectmen on August 5, 2008. The meeting was held in the Reading Town Hall. The meeting was publicized as a regular Selectmen’s meeting in the local newspaper and posted in Town Hall. There were several members of the public in attendance during the portion of the meeting at which the plan was discussed but there were no questions or issues raised. Copies of an outline of the presentation were left for any members of the public who wished to take one. Following the meeting, the draft plan was posted on the Town’s website and a press release was issued to inform residents of a 30 day review period (from August 5 – September 5) to comment on the plan. A copy of the press release is included in Appendix D. Following the public meeting, on September 3, the Town Engineer received an e-mail from a resident of Glenmere Circle informing the town of flooding issues on his property.

Table 4
Attendance at the August 5, 2008 Public Meeting

Representing	Name
Board of Selectmen	Ben Tafoya, Vice Chairman James Bonazoli, Secretary Camille Anthone
Town Manager	Peter I. Heckenbleikner

IV. OVERVIEW OF HAZARDS AND VULNERABILITY

Overview of Hazards and Impacts

The Massachusetts Hazard Mitigation Plan 2007 (state plan) provides an in-depth overview of natural hazards in Massachusetts. The state plan indicates that Massachusetts is subject to the following natural hazards (listed in order of frequency); floods, heavy rainstorms, nor’easters, coastal erosion, hurricanes, tornadoes, urban and wildfires, drought and earthquakes. These risks were reviewed with the Local Committee at its first meeting. No additional hazards were identified and local officials concurred that flooding was the primary hazard facing the town.

Table 5 summarizes the federally declared disasters and emergencies since 1991 in the region.

**Table 5
Disaster and Emergency Declarations for Middlesex County**

ID Number	Type	Date
1701	Severe Storms and Inland and Coastal Flooding	April 2007
1642	Severe storms, flooding	May 2006
1614	Severe storms, flooding	October 2005
3252	Hurricane (Katrina)	August 2005
3201	Snow	January 2005
1512	Flooding	April 2004
3191	Snowstorm	December 2003
3175	Snowstorm	February 2003
3165	Blizzard	March 2001
1364	Severe storms, flooding	March 2001
1224	Heavy rain, flooding	June 1998
1142	Severe storms, flooding	October 1996
1090	Blizzard	January 1996
3103	Blizzard	March 1993
920	Severe Coastal Storm	October 1991
914	Hurricane (Bob)	August 1991

Sources: www.fema.gov and *State Hazard Mitigation Plan*, MEMA and DCR, October 2007.

Table 6 summarizes the hazard risks for Reading by hazard type. This evaluation takes into account the frequency of the hazard, historical records and variations in land use. This analysis uses the same vulnerability assessment methodology used in the Commonwealth of Massachusetts State Hazard Mitigation Plan, October 2007.

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Table 6 Hazard Risks		
Hazard	Frequency	Severity
Flooding	High	Serious
Winter storms	High	Serious
Hurricanes	Medium	Serious e
Earthquakes	Low	Catastrophic
Tornadoes	Low	Extensive
Landslides	Low	Minor
Brush fires	Low	Minor
Dam failures	NA	NA

Definitions used in the Commonwealth of Massachusetts State Hazard Mitigation Plan

Frequency

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

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

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

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

Severity

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

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

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

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

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Flood Hazards

Flooding was the most prevalent natural hazard identified by the State Hazard Mitigation Plan as well as local officials in Reading. Flooding can occur during hurricanes, nor'easters, severe rainstorms and thunderstorms.

Regionally Significant Storms

There have been a number of major rain storms that have resulted in significant flooding in northeastern Massachusetts over the last fifty years. Significant storms include:

- August 1954
- March 1968
- January 1979
- April 1987
- October 1991 (“The Perfect Storm”)
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007

Wind-related hazards

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

Between 1858 and 2000, Massachusetts has experienced approximately 32 tropical storms, nine Category 1 hurricanes, five Category 2 hurricanes and one Category 3 hurricane. This equates to a frequency of once every six years. There was a tropical storm that tracked through Reading in 1861. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. However, the town does experience the impacts of the wind and rain of hurricanes and tropical storms regardless of whether the storm track passed through the town. The hazard mapping indicates that the 100 year wind speed is 110 miles per hour. There have been no tornadoes recorded within the Town limits.

Winter Storms

In Massachusetts, northeast coastal storms known as nor'easters occur 1-2 times per year. Winter storms are a combination hazard because they often involve wind and high snow fall. The average annual snowfall for the town is 48.1 – 72.0 inches.

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Fire Related Hazards

The Reading Fire Department responds to approximately 26 brush fires annually. None of these have been major in terms of property damage and none have resulted in any deaths. Most brush fires are accidentally caused.

Geologic Hazards

Most town officials admitted that earthquakes were the hazard for which their community was least prepared. Although new construction under the most recent building codes generally will be built to seismic standards, there are still many structures which pre-date the most recent building code.

Regional Overview

According to the State Hazard Mitigation Plan, New England experiences an average of five earthquakes per year. From 1627 to 1989, 316 earthquakes were recorded in Massachusetts. Most have originated from the La Malbaie fault in Quebec or from the Cape Anne fault located off the coast of Rockport. The region has experienced larger earthquakes, of magnitude 6.0 to 6.5 in 1727 and 1755. Other notable earthquakes occurred here in 1638 and 1663. (Tufts). There have been no recorded earthquake epicenters within Reading although there is one just over the border in Stoneham.

Earthquake Impacts – 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.

Landslides

The entire town has been classified as having a low risk for landslides. There have been no recorded landslides in Reading.

Critical Infrastructure in Hazard Areas

Critical infrastructure includes facilities that are important for disaster response and evacuation (such as emergency operations centers, fire stations, hospitals, etc.) and facilities where additional assistance might be needed during an emergency (such as nursing homes, elderly housing, day care centers, etc.). It also includes facilities that might pose a particular danger during a natural disaster such as a sewage treatment plant

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or chemical facility. These facilities are listed in Table 7 and are shown on all of the maps in Appendix B.

The purpose of mapping the natural hazards and critical infrastructure is to present an overview of hazards in the community and how they relate to critical infrastructure.

Flooding – There are seven critical facilities sites that fall within a locally identified area of flooding. The majority of these (5) are within the Track Road area. There are also seven sites that fall within mapped FEMA flood zones.

Landslides - The entire town is considered to have a low risk for landslides and therefore, all critical infrastructures sites fall within this hazard category.

Earthquakes – All areas of the town have a low risk for earthquakes.

Explanation of Columns in Table 7.

Column 1: ID #: The first column in Table 6 is an ID number which appears on the maps that are part of this plan. See Appendix B.

Column 2: Site 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: Site Type: The third column indicates what type of site it is.

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

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

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

Column 7: Average annual snowfall: The snowfall mapping indicates that there are two bands of snowfall in southeastern Massachusetts. An entry of “high” indicates an annual average of 48.1 – 72 inches of snow. An entry of “low” indicates a range of 36-48 inches.

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Table 7
Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Within Locally Identified Area of Flooding	Within FEMA Flood Zone
1	Reading Baptist Day School	Daycare	No	No
2	Christian Cooperative Preschool	Daycare	No	No
3	Humpty Dumpty School	Daycare	No	No
4	Sandra Lane Nursery School	Daycare	No	No
5	Sawyer Nursery School	Daycare	No	No
6	Reading Extended-Day Activities Program	Daycare	No	No
7	Little Treasure School House	Daycare	No	No
8	Burbank YMCA Preschool Program	Daycare	No	No
9	Perry, Linda	Daycare	No	No
10	Van Horn, Susan L.	Daycare	No	No
11	Becker, Mary Ellen	Daycare	No	No
12	Blake, Gayle K.	Daycare	No	No
13	Bouchard, Jeanne F.	Daycare	Track Road at Line Road	No
14	Gingras, Linda H.	Daycare	No	No
15	Melanson, Barbara	Daycare	No	No
16	Reading Extended Day at Killam School	Daycare	No	No
17	Reading Extended Day at Joshua Eaton	Daycare	No	No
18	Kariger, Diane L.	Daycare	No	No
19	Tinney, Suzann M.	Daycare	No	No
20	Callahan, Louise M.	Daycare	No	No
21	Tucker, Susan	Daycare	No	No
22	Driscoll, Catherine H.	Daycare	No	No
23	Miller, Joan	Daycare	No	No
24	Zaccardo, Patricia	Daycare	No	No

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Table 7
Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Within Locally Identified Area of Flooding	Within FEMA Flood Zone
25	Thayer, Debra	Daycare	No	No
26	Gard-Bruce, Anna P.	Daycare	No	No
27	Pustorino, Concetta	Daycare	No	No
28	Brown, Krystal Gayle	Daycare	No	No
29	Melanson, Patricia	Daycare	No	No
30	Evangelista, Alison	Daycare	No	No
31	Reynolds, Dawn	Daycare	No	No
32	Lievenbruck, Nadine	Daycare	No	No
33	McWeeney, Kathryn	Daycare	No	No
34	Bartalini, Rockell M.	Daycare	No	No
35	Whelan, Katherine M.	Daycare	No	No
36	Giuliotti, Virginia	Daycare	No	No
37	Doucette, Shirley	Daycare	No	No
38	Austin Preparatory School	School	No	No
39	Alice M Barrows	School	No	No
40	Walter S Parker Middle	School	No	No
41	Joshua Eaton	School	No	No
42	J Warren Killam School	School	No	No
43	Birch Meadow Elementary School	School	No	No
44	Reading Police Department	EOC	No	No
45	Reading Town Hall	Town Hall	No	No
46	Reading Fire Department	Fire	No	No
47	Reading Fire Department	Fire	No	No
48	Reading Police Department	Police	No	No

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Table 7
Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Within Locally Identified Area of Flooding	Within FEMA Flood Zone
49	Wood End Elementary School	School	No	No
50	DPW Garage	DPW Garage	No	No
51	Louanis Water Treatment Plant	Water Treatment Plant	Water Treatment Plant	No
52	Reading Municipal Light substation	Power Substation	No	No
53	Arthur W Coolidge Middle School	School	No	No
54	Reading Memorial High School	School	No	No
55	Reading Senior Center	Senior Center	No	No
56	Camp Curtis Guild, MA	Hazardous Materials Site	No	ANI
57	Hodson Oil	Hazardous Materials Site	No	No
58	Mass Highway Dept Facility	Hazardous Materials Site	No	No
59	New England Tel & Tel Company	Hazardous Materials Site	No	No
60	DPW Garage	Hazardous Materials Site	No	No
61	Cumberland Farms (Mobil gas station)	Hazardous Materials Site	Track Road at Line Road	No
62	Louanis Water Treatment Plant	Hazardous Materials Site	Water Treatment Plant	No
63	Cumberland/Exxon (gas station)	Hazardous Materials Site	No	No
64	Main St Petroleum, LLC (Mobil)	Hazardous Materials Site	No	No
65	Reading Petroleum (gas station)	Hazardous Materials Site	No	No
66	Reading Car Care Center (gas station)	Hazardous Materials Site	No	No
67	Reading Square Shell (Gas Station)	Hazardous Materials Site	No	No
68	Reading Service Inc. Mobil on the Run	Hazardous Materials Site	No	No
69	Main Street Sunoco	Hazardous Materials Site	No	No
70	East Coast Gas	Hazardous Materials Site	No	No
71	Motiva Enterprises (Texaco gas station)	Hazardous Materials Site	No	X500
72	West Street Mobil (Gas Station)	Hazardous Materials Site	No	No

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Table 7
Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Within Locally Identified Area of Flooding	Within FEMA Flood Zone
73	Amico, Tonya Marie	Daycare	No	No
74	Clock Tower Kids	Daycare	No	No
75	Coffill, Patricia	Daycare	No	No
76	Cunningham, Dawn	Daycare	No	No
77	Dillaway, Ann A.	Daycare	No	No
78	Ellington, Holly	Daycare	No	No
79	Gaunci, Anne Marie	Daycare	No	No
80	Malcolm, Loretta	Daycare	No	No
81	Yang, Yi Fang	Daycare	No	No
82	Nichols, Kristina	Daycare	No	No
83	Cedar Glen	Elderly Housing	No	No
84	Peter Sanborn Place	Elderly Housing	No	No
85	Reading Housing Authority	Elderly Housing	No	No
86	Longwood Place	Elderly Housing	No	No
87	Sawtelle Family Hospice House	Nursing Home	No	No
88	Daniels House Nursing Home	Nursing Home	No	No
89	Wingate at Reading	Nursing Home	No	X500
90	EKS 2 Corporation Shell Station	Hazardous Materials Site	No	No
91	Auburn Street Water Tank	Water Tank	No	No
92	Bear Hill Stand Pipe	Water Tank	No	No
93	Batchelder Road Sewer Pumping Station	Sewer Pump Station	No	No
94	Charles Street Pumping Station	Sewer Pump Station	No	No
95	Haverill Sewer Pumping Station	Sewer Pump Station	No	X500
96	Collins Avenue Pumping Station	Sewer Pump Station	No	No

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Table 7
Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Within Locally Identified Area of Flooding	Within FEMA Flood Zone
97	Joseph Way Pumping Station	Sewer Pump Station	No	No
98	Strout Avenue Sewer Pumping Station	Sewer Pump Station	No	No
99	Grove Street Sewer Pumping Station	Sewer Pump Station	No	No
100	Brewer Lane Sewer pumping Station	Sewer Pump Station	No	No
101	Small Lane Sewer Pumping Station	Sewer Pump Station	No	No
102	West Street Sewer Pumping Station	Sewer Pump Station	No	No
103	Longwood Road Sewer Pumping Station	Sewer Pump Station	No	No
104	Lothrop Road Water Booster Station	Water Booster Station	No	No
105	Sturgis Park Sewer Pumping Station	Sewer Pump Station	No	No
106	Revey Well	PWS	No	No
107	Reading Well # 13	PWS	No	No
108	Reading Well # 15	PWS	No	No
109	Reading Well # 2	PWS	No	No
110	Reading Well # 3	PWS	No	No
111	Reading B-Line Well	PWS	No	No
112	Reading 66-8 Well	PWS	No	No
113	Reading Town Forest Well	PWS	No	No
114	Reading Well # 82-20	PWS	No	No
118	I 93 over West Street Bridge	Bridge	No	No
119	Apache Pass Mass Highway DPW Facility	DPW	No	No
120	I95 over Rte 28 Bridge	Bridge	No	No
121	Track Road Bridge #1	Bridge	Track Road at Line Road	AE
122	Track Road Bridge #2	Bridge	Track Road at Line Road	AE
123	Track Road Bridge #3	Bridge	Track Road at Line Road	AE

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Table 7
Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Within Locally Identified Area of Flooding	Within FEMA Flood Zone
124	Mineral Street Bridge	Bridge	No	No
125	129 RailRoad Bridge	Bridge	No	No
126	Reading Internal Medicine Offices MWRA Summer Avenue Sewer Pumping	Medical	No	No
127	Station	Sewer Pump Station	No	No
128	Hallmark Health Building	Medical	No	No
129	Reading Municipal Light Department	Municipal	No	No
130	RCTV Inc Studio	Broadcast	No	No

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HAZUS –MH Results

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 nine communities that are a part of this study, it does not capture all relevant information. In fact, the HAZUS training manual notes that the default data is “subject to a great deal of uncertainty.”

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

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HAZUS-MH Results for Hurricanes

According to the State Hazard Mitigation Plan, between 1858 and 2000, there were 15 hurricanes. 60% were Category 1, 33% were Category 2 and 7% were Category 3. For the purposes of this plan, a Category 2 and a Category 4 storm was chosen to illustrate damages. The reason is to present more of a “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 8
Estimated Damages from Hurricanes**

	Category 2	Category 4 ¹
Building Characteristics		
Estimated total number of buildings	7,178	7,178
Estimated total building replacement value (Year 2002 \$) (Millions of Dollars)	\$1,593	\$1,593
Building Damages		
# of buildings sustaining minor damage	1,601	331
# of buildings sustaining moderate damage	337	1,092
# of buildings sustaining severe damage	25	1,942
# of buildings destroyed	20	3,777
Population Needs		
# of households displaced	64	7,407
# of people seeking public shelter	13	1,463
Debris		
Building debris generated (tons)	5,788	193,839
Tree debris generated (tons)	58,523	95,474
# of truckloads to clear building debris	234	7,778
Value of Damages (Thousands of dollars)		
Total property damage	\$39,907.35	\$1,686,234.13
Total losses due to business interruption	\$4,342.54	\$195,653.77
¹ No Category 4 or 5 hurricanes have been recorded in New England. However, a Category 4 hurricane was included to help the communities understand the impacts of a hurricane beyond what has historically occurred in New England.		

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HAZUS-MH Results for Earthquakes

The HAZUS earthquake module allows users to define a number of different types of earthquakes and to input a number of different parameters. The module is more useful where there is a great deal of data available on earthquakes. In New England, defining the parameters of a potential earthquake is much more difficult because there is little historical data. The earthquake module does offer the user the opportunity to select a number of historical earthquakes that occurred in Massachusetts. For the purposes of this plan two earthquakes were selected: a 1963 earthquake with a magnitude of 5.0 and an earthquake with a magnitude of 7.0.

**Table 9
Estimated Damages from Earthquakes**

	Magnitude 5.0	Magnitude 7.0
Building Characteristics		
Estimated total number of buildings	7,178	7,178
Estimated total building replacement value (Year 2002 \$)(Millions of dollars)	\$1,593	\$1,593
Building Damages		
# of buildings sustaining slight damage	48	2,429
# of buildings sustaining moderate damage	7	1,364
# of buildings sustaining extensive damage	1	308
# of buildings completely damaged	0	71
Population Needs		
# of households displaced	0	336
# of people seeking public shelter	0	68
Debris		
Building debris generated (tons)	NA	NA
# of truckloads to clear building debris	NA	NA
Value of Damages (Millions of dollars)		
Total property damage	\$3.18	\$163.51
Total losses due to business interruption	\$0.08	\$18.09

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Vulnerability Assessment for Flooding

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

Reading is 9.97 square miles or 6,382 acres. Approximately 163 acres have been identified by local officials as areas of flooding. This amounts to 2.5% of the land area in Reading. The number of structures in each flood area was estimated by applying the percentage of the total land area to the number of structures (7,178) in Reading; the same number of structures used by HAZUS for the hurricane and earthquake calculations. HAZUS uses a value of \$221,789 per structure for the building replacement value. This was used to calculate the total building replacement value in each of the flood areas. The calculations were done for a low estimate of 10% building damages and a high estimate of 50% as suggested in the FEMA September 2002 publication, "State and Local Mitigation Planning how-to guides". (Page 4-13). The range of estimates for flood damages is \$8,294,909 - \$41,474,543. These calculations are not based on location within the floodplain or a particular type of storm (i.e. 100 year flood).

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**Table 10
Estimated Damages from Flooding**

ID	Flood Hazard Area	Approximate Area in cres	% of Total Land Area	Approximate # of Structures	Replacement Value	Low Estimate of Damages	High Estimate of Damages
1	Sunnyside and Fairview	2.36	0.04	3	\$665,367	\$66,537	\$332,684
2	New Crossing@ DPW Garage	7.12	0.11	8	\$1,774,312	\$177,431	\$887,156
3	Track Road at Line Road	16.31	0.26	19	\$4,213,991	\$421,399	\$2,106,996
4	South Main Street	17.12	0.27	20	\$4,435,780	\$443,578	\$2,217,890
5	Brook and Ash Streets	4.62	0.07	6	\$1,330,734	\$133,073	\$665,367
6	Morgan Park	9.94	0.16	12	\$2,661,468	\$266,147	\$1,330,734
7	150 West St, Keith-Glenmere-Garrett Area	33.94	0.53	39	\$8,649,771	\$864,977	\$4,324,886
8	Lowell Street at Intervale	1.54	0.02	2	\$443,578	\$44,358	\$221,789
9	Willow Street/Austin Prep	1.94	0.03	3	\$665,367	\$66,537	\$332,684
10	Main Street	30.04	0.47	34	\$7,540,826	\$754,083	\$3,770,413
11	Milepost at Haystack	12.32	0.19	14	\$3,105,046	\$310,505	\$1,552,523
12	Pine Ridge/Cherry Hill	3.37	0.05	4	\$887,156	\$88,716	\$443,578
13	Haverhill Street at the Town Line	3.83	0.06	5	\$1,108,945	\$110,895	\$554,473
14	Water Treatment Plant	8.59	0.13	10	\$2,217,890	\$221,789	\$1,108,945
15	Hopkins Street	2.97	0.05	4	\$887,156	\$88,716	\$443,578
16	Hunt Park	6.92	0.11	8	\$1,774,312	\$177,431	\$887,156
	TOTAL	162.93	2.55	183	\$40,587,387	\$4,058,739	\$20,293,694
						\$8,294,909	\$41,474,543

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Future Development in Hazard Areas – As indicated in Table 11, some potential development and redevelopment sites are partially within flood zones.

Table 11
Relationship of Potential Development Parcels to Hazard Areas

Parcel	Landslide risk	Flood zone
Stop & Shop	Low	92% within flood zone
New restaurants	Low	51% within flood zone
Archstone	Low	Not within flood zone
Johnson Woods	Low	Not within flood zone
Tambonis	Low	Not within flood zone
Addison Wesley	Low	Not within flood zone
Kiley Drive	Low	Not within flood zone
Benjamin Lane	Low	Not within flood zone
Peter Sanborn Place	Low	8% within flood zone
Maplewood Village	Low	45% within flood zone
Pleasant Street	Low	Not within flood zone
Sailor Tom	Low	Not within flood zone
Camp Curtis Guild	Low	Not within flood zone
I-93/I95 Interchange	Low	Not within flood zone
8 Walkers Brook Drive	Low	72% within flood zone
88-98 Walkers Brook Drive	Low	9% within flood zone
281-287 & 306 Main Street	Low	100% within flood zone
Meadow Brook Golf Club	Low	41% within flood zone
40R	Low	Not within flood zone

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V. HAZARDS AND EXISTING MITIGATION MEASURES

Flood-Related Hazards

Overview of Drainage Issues

Reading is divided by topography into three watersheds. Tributary streams that arise in these watersheds flow to the Aberjona, the Saugus and the Ipswich Rivers. The streams are associated with large swamps and marshes that play a significant role in flood storage and control. Flooding from the Ipswich River and its major tributary, Bare Meadow Brook, does not affect many structures because the Town has preserved most of the floodplains as open space. Because most of the development in Reading has been constructed above the floodplains, Reading does not have many serious flooding problems. However, there are areas where flooding occurs during major storms, causing damage to buildings and roadways. Some of the flooding problems may be exacerbated by historical filling of floodplains and routing of streams through culverts in older parts of town. Subdivisions, commercial development, and other large projects permitted in the last 25 years generally includes stormwater management systems designed to detain runoff and thus control downstream flooding. Flood hazard areas tend to be small in scale and clustered in the southern part of town.

Conservation Commission Issues

According to the conservation agent, the town's wetlands regulations are adequate to protect wetlands and no further regulations are needed at this time. The most recent amendments to the regulations were passed by Town Meeting in 2001. The long term maintenance of stormwater management systems is a concern because the storage capacity of these systems decreases when they are not maintained.

On privately owned wetlands, the most common types of violations tend to be filling, brush and trash dumping, poor erosion controls during construction, paving without permits, hazardous materials releases and cutting trees without permits. On publicly owned lands the violations are primarily brush dumping and the use of all terrain vehicles. The conservation department has no staff or budget for maintenance.

There are two potential mitigation measures that should be considered for stormwater management. These are to retrofit neighborhoods with underground storage and to encourage or mandate rooftop infiltration.

Areas of Flooding

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 discussions with local officials. The locally identified areas of flooding described below were identified by town staff as areas where flooding

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occurs. These areas do not necessarily coincide with the flood zones from the FIRM maps. They may be areas that flood due to inadequate drainage systems or other local conditions rather than location within a flood zone. The numbers correspond to the numbers on Map 8, "Hazard Areas". The numbers do not reflect priority order.

Saugus River Watershed Flood Hazard Areas

Walkers Brook and its associated tributaries in southern Reading are the headwaters of the Saugus River in Wakefield. Flooding of property and roadways occur at numerous locations within the watershed and is caused by a combination of system capacity inadequacies and localized capacity deficiencies. A large portion of the basin lies in the moderately dense older portion of the town which affords little or no available land for storage or retention of flood waters. As planned improvements within Reading may impact communities downstream, the mitigation of flood damage to roadways and properties within the watershed is a true urban challenge making resolution of flooding in this watershed the town's highest priority.

The town has recently appropriated \$200,000 to perform a hydraulic and hydrological study of the watershed. The study will provide recommendations to alleviate flooding and to provide an extensive stormwater management plan for the basin.

The individual flood hazard areas are as follows:

Sunnyside and Fairview (#1) - There are six homes where severe flooding occurs within the properties and within Sunnyside Avenue. This flooding is due to system surcharges and capacity deficiencies of the drainage system. This neighborhood is in the middle third of one of the primary tributaries of the drainage basin.

New Crossing at the DPW Garage (#2) –Flooding in this area affects New Crossing Road, the primary access to the DPW facility, the Fraen Corporation manufacturing facility and the adjacent office building and is therefore a high priority for the town. Both Walkers Brook and a tributary stream join downstream of the area causing flooding of New Crossing Road, adjacent to the Lowell Branch commuter rail and the Fraen site. Flooding has also occurred from the tributary stream over the southern end of the industrial park off Ash Street to the northeast of New Crossing Road. Newer development in this area has incorporated detention basins and infiltration systems but is inadequate in providing relief to the area.

Track Road at Line Road (#3) – This area is within the lower reaches of the watershed and experiences backyard and basement flooding along several private properties. The stream banks are steep and unstable which results in excessive erosion during periods of high stream flows. Two of the bridges within this neighborhood have been condemned due to structural deficiencies. Failure to modify the channel to effectively accept high flows and control erosion could result in the failure of the only remaining bridge due to scouring, with loss of access for this area.

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South Main Street (#4) – Flooding in this area occurs along Main Street (Route 28), an adjacent apartment building and several businesses. Flooding occurs for a variety of reasons including undersized drains and culverts, excess impervious cover, lack of an area for detention and infiltration systems, accumulations of sediments and debris in stream channels and culverts that block flows. This is a high priority area because of the flooding of Route 28, a major arterial roadway.

Brook and Ash Streets (#5) – There are 3-4 houses that flood due to elevated levels of sediment within the adjacent wetland and drainage channel attributed to years of sediment accumulation from untreated roadway discharges.

Morgan Park(#6) – Flooding occurs upstream and downstream along the drainage channel and wetlands adjacent to the Parker Middle School and affects homes on the northerly side of Woburn Street, easterly side of Temple Street and in Morgan Park. The town is planning to dredge the drainage channel this year to remove over 70 years of sedimentation. However, the dredging will provide no flood relief during moderate to severe storm events due to the downstream capacity deficiencies.

Aberjona River Watershed Flood Hazard Areas

This is the second highest priority area for the town. The town has allocated \$75,000 to fund a study of drainage and flooding problems in this watershed. The town will be issuing an RFP in the spring of 2008.

150 West Street, Winslow Street, Keith-Glenmere-Garrett area (#7) – There are several houses that experience flooding because a majority of the neighborhood is in a low lying area. There is an undersized drainage channel and conduit system that runs along the rear lots and continues under Howard Street and Keith Road, and then northwesterly around Glenmere to Garrett and Munroe. The flooding is influenced by the undersized culvert and drainage channel and is compounded as the area is low lying, with wetlands and a high water table.

Lowell Street at Intervale (#8) – There is one house and one business that experience backyard flooding.

Willow Street/Austin Prep (#9) – Flooding occurs on Willow Street, within rear yards of several homes along the easterly side of Willow Street and within low-lying portions of the Austin Prep School campus. The flooding is due to capacity deficiencies along the north branch of the Aberjona River.

Main Street, Ridge Road, Waverly Road, Whittier Road, Tennyson Road and Birch Meadow Drive (#10) – The Church of the Nazarene and more than a dozen homes experience property and basement flooding associated with streams and wetlands in this area.

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Milepost and Haystack (#11) – There are approximately five homes that experience property and occasional basement flooding. Recent re-development along Main Street, tributary to this area, is required to install detention facilities that will only provide minor improvements to the affected area.

Pine Ridge/Cherry Hill (#12) - Flooding occurs in two areas, affecting approximately six houses. The flooding is caused by an undersized culvert system.

Ipswich River Watershed

Haverhill Street at the town line (#13) - This section of Haverhill Street is closed by floods from Bare Meadow Brook during all major storms. Haverhill Street is an arterial roadway and is the third highest priority for the town because of access issues. The most likely solution to flooding in this area would be to raise the roadway and construction of a new bridge.

Water treatment plant (#14) – The town recently joined the MWRA and closed the water treatment plant located on the Ipswich River. The town is required to maintain the existing wells for an emergency supply. The area in the vicinity of the water treatment plant has experienced flooding in the past and the cessation of daily pumping may cause increased flooding of the area as well as the emergency pump station and chlorine feed facility necessary for the emergency well system connection.

Other Flood Hazard Areas

Hopkins Street (#15) – There is one house on this street that experiences chronic flooding from roadway drainage from Reading and Wakefield. The property floods multiple times per year and the property owner has previously taken legal action against a nearby apartment complex and the town. The town has recently increased the capacity of the apartment complexes' detention basin. However, the improvements will offer little improvements during severe storm events as runoff from Wakefield cannot be controlled locally without extensive drainage system replacement. Another potential mitigation measure would be for FEMA to purchase the property.

Hunt Park (#16) – This neighborhood consists of Osborne, Wilson, Elm, Green and Eaton Streets. The stream that flows through this area comes down through Memorial Park from north of Charles Street and enters Walkers Brook through the large floodplain in the vicinity of Lakeview Avenue. Several houses, parts of the park and several additional yards are affected by flooding. Street drains surcharge and this affects travel.

Water Main Breaks

The town has the normal number of water main breaks. The water department does have a program for regularly exercising the water main gates and valves.

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Repetitive Loss Properties

There are no repetitive loss structures in Reading. 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>.

Existing Multi-Hazard Mitigation Measures

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

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

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

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

Existing Flood Hazard Mitigation Measures and Compliance with NFIP

Participation in the National Flood Insurance Program (NFIP) – The town of Reading participates in the NFIP. FEMA maintains a database on flood insurance policies and claims. This database can be found on the FEMA website at <http://www.fema.gov/business/nfip/statistics/pcstat.shtm>. The following information is provided for the Town of Reading.

Flood insurance policies in force (as of August 31, 2007)	18
Coverage amount of flood insurance policies	\$3,262,000
Premiums paid	\$8,920
Total losses (all losses submitted regardless of the status)	13
Closed losses (Losses that have been paid)	10
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	3
Total payments (Total amount paid on losses)	\$25,058.67

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Drainage Master Plan – The town is just starting on a comprehensive drainage master plan. The last drainage study was done in 1970 and is outdated. The town has hired SEA as their consultant and will also be providing in-house services. The consultant will be completing a map of the drainage system in Fiscal Year 2007. The second phase will be to identify problem areas and determine what is causing the problem. The third phase will be to develop a capital improvement plan to address the problem areas. The total project is approximately \$250,000.

Street sweeping – The town does most of its street sweeping in-house but hires a contractor in the spring to supplement the town's efforts. The town has two vacuum sweepers which are ten years old and will eventually need to be replaced. Every street is swept once in the spring and other problem areas throughout the town are swept several times a year.

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

Stormwater utility – In 2007 the Town initiated a stormwater utility fee. All property owners receive a bill similar to their water and sewer bills. The fees go to a dedicated fund that the DPW may use for equipment and labor to maintain the drainage infrastructure.

Roadway treatments – Because of the town's reliance on groundwater, a salt and sand mix is used to treat the roads. Straight salt is used only when there are severe icing conditions. Otherwise, the town uses calcium chloride. The use of sand contributes to siltation in streams and within culverts.

Reading Zoning By-Laws Related to Flooding

Establishment and Purpose of Districts - The zoning bylaw establishes three overlay districts that are relevant to hazard mitigation: the Flood Plain District, the Wetlands Protection District and the National Flood Insurance Flood Management District.

Section 3.6.0 of the zoning bylaw states that the purpose of the Floodplain District is to “provide that land in the Town of Reading subject to seasonal or periodic flooding shall not be used for residence or other purposes in such a manner as to endanger the health or safety of the occupants thereof”.

Section 3.6.1 describes the purposes of the Wetlands Protection District as follows:

- a. To provide that lands in the Town of Reading subject to seasonal or periodic flooding shall not be used for residence or other purposes in a manner as to endanger the health or safety of the occupants thereof, or the public generally or to burden the public with costs resulting from the unwise individual choices of land use;

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- b. To protect water supplies;
- c. To assure the continuation of the natural flow patterns of the water courses within Reading and to preserve natural flood water storage areas so as to protect persons and property against the hazards of flood inundation.

Site Plan Requirements - Section 4.3.3.5.1 b requires that all site plans show proposed storm water drainage facilities. Section c. requires that site plans show all wetlands and flood plain areas. The site plan must also be accompanied by drainage calculations performed by a registered engineer and storm drainage design must conform to the subdivision regulation and DEP storm water regulations. One of the criteria for site plan approval is that the plan must minimize the extent of storm water flow from the site.

National Flood Insurance Flood Management District – The boundaries of this district are the boundaries of the National Flood Insurance Flood Management District and includes those areas designated as Zone A and Zone B on the FIRM maps. In this district, certain municipal recreation and water supply uses are allowed, as well as agriculture but no new buildings may be erected. Other uses may be allowed by special permit if it can be proven that the land is not subject to flooding.

Wetlands Protection District – This district allows outdoor recreation, conservation, agricultural uses and the creation of ponds. It allows the removal of silt and other debris that may be interfering with the natural flow of water.

Dam Failures

There are no dams in Reading.

Wind-Related Hazards

There was a tropical storm that tracked through Reading in 1861. This storm track is shown on Map 5 in Appendix B. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. The Town does experience the impacts of the wind and rain of hurricanes and tropical storms, regardless of the storm track. The hazard mapping indicates that the 100 year wind speed is 110 miles per hour. Tornadoes are extremely rare in this part of Massachusetts. No tornadoes have been recorded within the Town of Reading.

Existing Wind Hazard Mitigation Measures

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

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

Winter-Related Hazards

Winter hazards include regular snowfalls and blizzards. The average annual snowfall for the majority of the town is 48.1 – 72.0 inches. The most severe winter storm was the blizzard of 1978.

Existing Winter Hazard Mitigation Measures

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

Existing Winter-Storm Related Mitigation Measures

Section 4.3.3.5.1 a requires that all site plans show areas for snow storage after plowing.

Roadway treatments – Because of the towns' reliance on groundwater, a salt and sand mix is used to treat the roads. Straight salt is used only when there are severe icing conditions. Otherwise, the town uses calcium chloride. The use of sand contributes to siltation in streams and within culverts.

Fire-Related Hazards

The Reading Fire Department responds to approximately 26 brush fires annually. None of these have been major in terms of property damage and none have resulted in any deaths. Most brush fires are accidentally caused. The incidence of brush fires is distributed throughout the town with only two areas with a higher frequency.

North of Fairchild Drive (#17) – This is a wooded area within a residential neighborhood.

Northeastern Reading (#18) – This is a large wooded area east of Haverhill Street and abutting Lynnfield and North Reading.

Existing Fire Hazard Mitigation Measures

Permits required for outdoor burning - The Town allows outdoor burning but a permit is required. The resident must go to the fire station and fill out a permit application.

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

Geologic Hazards

Most municipal officials acknowledged that earthquakes were the hazard for which their community was least prepared. There have been no recorded earthquake epicenters within the Town of Reading although residents may feel the tremors from one or more of the infrequent earthquakes recorded within the region. The entire town is classified as having a low risk for landslides. Information on earthquakes and landslides is shown on Map 4 in Appendix B.

Although new construction under the most recent building codes generally will be built to seismic standards, much of the development in the town pre-dates the most recent building code. Massachusetts in general has a low risk for earthquakes.

Existing Geologic Hazard Mitigation Measures

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

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

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Table 12
Existing Mitigation Measures

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

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Table 12
Existing Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness /Enforcement	Improvements/ Changes Needed
FLOOD RELATED HAZARDS				
Drainage Master Plan	The town has begun a comprehensive drainage master plan.	Town-wide.	Study is currently underway.	Study is currently underway.
Participation in the National Flood Insurance Program	The town participates in the National Flood Insurance Program and has adopted the effective FIRM maps. The town actively enforces the floodplain regulations.	Areas identified on the FIRM maps	There are 18 policies in force.	Encourage all eligible homeowners to obtain insurance.
Street sweeping	Every street is swept once in the spring and other problem areas in town are swept several times a year.	Town-wide.	Effective.	Equipment is old and will need to be replaced.
Catch basin cleaning	Every basin is cleaned every other year.	Town-wide.	Effective.	None.
Roadway treatments	Because of the town’s reliance on groundwater, a mixture of salt and sand is used in winter.	Town-wide.	Effective.	None.
Zoning District: National Flood Insurance Flood Management District	Zoning allows certain municipal recreation and water supply uses and agriculture but no new buildings. Other uses may be allowed by special permit if land is proven to not be subject to flooding.	Zone A and Zone B on the FIRM maps.	Effective.	None.

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Table 12
Existing Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness /Enforcement	Improvements/ Changes Needed
Floodplain District	The purpose is to ensure that land subject to seasonal or periodic flooding shall not be used for residences or in other ways that endanger the health or safety of residents.			
Site Plan Section 4.3.3.5.1 (b)	All site plans must show storm water drainage facilities as well as wetlands and flood zones. Plans must show that development will minimize the extent of storm water flow from the site.	Town-wide.	Effective.	None.
Wetlands Protection Overlay District	Allows outdoor recreation, conservation and agricultural uses. Allows the removal of silt and debris that interfere with the natural flow of water.	Town-wide.	Effective.	None.
DAM FAILURES				
There are no dams in Reading.				

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Table 12
Existing Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness /Enforcement	Improvements/ Changes Needed
WIND-RELATED HAZARDS				
Massachusetts State Building Code	The town enforces the Massachusetts State Building Code.	Town-wide.	Effective for most situations except severe storms	None.
Tree trimming program	The town has a three person crew with a brush grinder and a bucket truck. The crew does preventative maintenance and clean-up after storms.	Town-wide.	Effective.	None.
WINTER-RELATED HAZARDS				
There are no specific measures beyond regular salting and sanding of the roads and local plowing.				
FIRE RELATED HAZARDS				
Permits required for outdoor burning	Residents must obtain a permit by filling out an application at the fire station.	Town-wide.	Effective.	None.
Subdivision review	The Fire Prevention Officer is involved in site plan review to ensure there is access for fire trucks and an adequate water supply.	Town-wide.	Effective.	None.

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Table 12
Existing Mitigation Measures

Type of Existing Protection	Description	Area Covered	Effectiveness /Enforcement	Improvements/ Changes Needed
GEOLOGIC HAZARDS				
Massachusetts State Building Code	The town enforces the state building code.	Town-wide.	Effective for most situations.	None.

VI. HAZARD MITIGATION GOALS AND OBJECTIVES

The Reading Local Multiple Hazard Community Planning Team met on November 7, 2007. At that meeting, the members reviewed and discussed options for setting goals and objectives for the Multihazard Mitigation Plan. The following nine goals and objectives resulted from that discussion and were endorsed by the team:

1. Prevent and reduce the loss of life, injury and property damages resulting from all major natural hazards.
2. Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.
3. Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.
 - Ensure that all relevant municipal departments consider hazard mitigation in the course of carrying out their responsibilities.
 - Review zoning regulations to ensure that the ordinance incorporates all reasonable hazard mitigation provisions.
 - Ensure that all relevant municipal departments have the resources to continue to enforce codes and regulations related to hazard mitigation.
4. Prevent and reduce the damage to public infrastructure resulting from all hazards.
 - Begin to assess the vulnerability of municipal buildings and infrastructure to damage from an earthquake.
 - Maintain existing mitigation infrastructure in good condition.
5. Encourage the business community, major institutions and non-profits to work with the 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.
 - Continue to participate in the Mystic Region LEPC.
7. Ensure that future development meets federal, state and local standards for preventing and reducing the impacts of natural hazards.
8. Educate the public about natural hazards and mitigation measures that can be undertaken by property-owners.

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

VII. POTENTIAL MITIGATION MEASURES

What is hazard mitigation?

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

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

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

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

Identification and Prioritization of Potential Mitigation Measures

Process for Setting Priorities

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

MAPC staff attended a Benefit-Cost Analysis Training Course on October 31-November 1, 2005 and a workshop on project development on October 23, 2007. Information from these two training workshops was shared with local officials when MAPC made a Power Point presentation at the June 26, 2008 meeting of the Metro Boston North/West Multi-Hazard Mitigation Community Planning Team. This was done in order to help local officials understand the role of a benefit/cost analysis in developing and evaluating potential mitigation projects and to provide guidance concerning project development.

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

High Priority Mitigation Measures

Potential Flood Hazard Mitigation Measures

The town is in the process of funding two drainage studies. The sum of \$200,000 has been appropriated for a hydraulic and hydrological study of the Saugus River watershed and \$75,000 has been allocated for a study of the Aberjona River watershed. The town believes that it would be prudent to wait for the recommendations from these studies before identifying specific projects to be implemented in the future. Upon completion of these studies, the town will be in a better position to select potentially fundable projects to move forward with.

The town has identified the entire Saugus River watershed as the highest priority for action and the Aberjona River watershed as the second highest priority. Within those watersheds, certain specific flood hazard areas are particularly of concern because of access issues. Specific flood mitigation areas include the following:

1. ***Sunnyside and Fairview*** - This area will be included in the Saugus River watershed study.
2. ***New Crossing at the DPW Garage*** – This is a high priority for the town because it impacts access to the DPW facility.
3. ***Track Road at Line Road*** – This is a critical area because of the possibility of flood damage to the only remaining bridge in this area.
4. ***South Main Street*** – This is a high priority area because of flooding on a major arterial, Route 28.
5. ***Brook and Ash Streets*** – This area could benefit from the removal of sediments in the drainage channel.
6. ***Morgan Park*** – The town will be dredging the drainage channel to remove years of accumulated sediment. This is likely to improve flooding from smaller storms only.
7. ***150 West Street*** – This area has an undersized culvert and drainage channel which may need to be upgraded.
8. ***Lowell Street at Intervale***
9. ***Willow Street/Austin Prep***
10. ***Main Street (Church of the Nazarene) and neighboring streets.***
11. ***Milepost and Haystack***

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12. *Pine Ridge/Cherry Hill*

13 *Haverhill Street at the town line*

Potential Brush Fire Mitigation Measures

14 *Additional fir fighting equipment* – The Fire Department has identified the following equipment needs for fighting brush fires: lightweight hose and portable small pumps for pickup trucks.

Measures to Ensure Compliance with NFIP

15. *Local Bylaws and Regulations* – Review and revise local bylaws and regulations on storm water and floodplains.

16. *Land Acquisition / Protection of Open Space* - Protection of open space is important to ensure future development does not increase flooding. The town should continue its efforts for open space purchases and negotiate conservation restrictions and easements

Medium Priority Mitigation Measures

Additional potential flood mitigation areas that will be evaluated in the town’s two drainage studies that were given a medium priority by the local team include:

17. *Hopkins Street*

18. *Hunt Park*

As with the high priority area, when the drainage studies are completed the town will evaluate which specific mitigation projects to pursue for implementation.

Introduction to Summary of Potential Mitigation Measures (Table 13)

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

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

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

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

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

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

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

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

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

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

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Table 13
Potential Mitigation Measures

Hazard Area/ Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
High Priority Mitigation Measures					
1. Sunnyside and Fairview	First highest priority	DPW	Scheduling to be addressed following completion of the Saugus River drainage study.	Solutions will be identified as part of the Saugus River drainage study.	Town funds; FEMA grants.
2. New Crossing at the DPW Garage	First highest priority	DPW	Scheduling to be addressed following completion of the Saugus River drainage study.	Solutions will be identified as part of the Saugus River drainage study.	Town funds; FEMA grants.
3. Track Road at Line Road	First highest priority	DPW	Scheduling to be addressed following completion of the Saugus River drainage study.	Solutions will be identified as part of the Saugus River drainage study.	Town funds; FEMA grants.
4. South Main Street	First highest priority	DPW	Scheduling to be addressed following completion of the Saugus River drainage study.	Solutions will be identified as part of the Saugus River drainage study.	Town funds; FEMA grants.

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Table 13
Potential Mitigation Measures

Hazard Area/ Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
5. Brook and Ash Street	First highest priority	DPW	Scheduling to be addressed following completion of the Saugus River drainage study.	Solutions will be identified as part of the Saugus River drainage study.	Town funds; FEMA grants.
6. Morgan Park	First highest priority	DPW	Scheduling to be addressed following completion of the Saugus River drainage study.	Solutions will be identified as part of the Saugus River drainage study.	Town funds; FEMA grants.
7. 150 West Street and surrounding streets	Second highest priority	DPW	Scheduling to be addressed following completion of the Aberjona River drainage study.	Solutions will be identified as part of the Aberjona River drainage study.	Town funds; FEMA grants.
8. Lowell Street at Intervale	Second highest priority	DPW	Scheduling to be addressed following completion of the Aberjona River drainage study.	Solutions will be identified as part of the Aberjona River drainage study.	Town funds; FEMA grants.

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Table 13
Potential Mitigation Measures

Hazard Area/ Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
9. Willow Street/Austin Prep	Second highest priority	DPW	Scheduling to be addressed following completion of the Aberjona River drainage study.	Solutions will be identified as part of the Aberjona River drainage study.	Town funds; FEMA grants.
10. Main Street (Church of the Nazarene) and neighboring streets.	Second highest priority.	DPW	Scheduling to be addressed following completion of the Aberjona River drainage study.	Solutions will be identified as part of the Aberjona River drainage study.	Town funds; FEMA grants.
11. Milepost and Haystack	Second highest priority.	DPW	Scheduling to be addressed following completion of the Aberjona River drainage study.	Solutions will be identified as part of the Aberjona River drainage study.	Town funds; FEMA grants.
12. Pine Ridge/Cherry Hill	Second highest priority	DPW	Scheduling to be addressed following completion of the Aberjona River drainage study.	Solutions will be identified as part of the Aberjona River drainage study.	Town funds; FEMA grants.

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**Table 13
Potential Mitigation Measures**

Hazard Area/ Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
13 Haverhill Street at the town line	Third highest priority.	DPW	Beyond the five year time frame for this plan.	To be determined.	Town funds; FEMA grants.
14. Brush Fires – Additional firefighting equipment (lightweight hose and portable small pumps)	High	DPW	Beyond the five year time frame for this plan.	To be determined.	Town funds; FEMA grants.
Measures to Ensure Compliance with NFIP					
15. Review and revise local bylaws and regulations on storm water and floodplains	Medium/NFIP	Planning / Conservation / Engineering	Medium Term	Town Staff or consultant (cost TBD)	Town, EOEEA or DEP Grants
16. Land Acquisition / Protection of Open Space	Medium/NFIP	Conservation	Ongoing and Long-term	Varies significantly from town staff time to \$1 million or more to purchase land	Town, CPA funds, EOEEA, gifts
Medium Priority Mitigation Measures					
17. Hunt Park	Medium	DPW	2010 or beyond.	To be determined.	Town funds; FEMA grants.
18. Hopkins Street	Medium	DPW	2010 or beyond.	To be determined.	Town funds; FEMA grants.

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**Table 13
Potential Mitigation Measures**

Hazard Area/ Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Low Priority Mitigation Measures					
19. Water treatment plant	Low	DPW	Beyond the five year time frame for this plan.	To be determined.	Town funds; FEMA grants.

Abbreviations Used in Table 13

FEMA Mitigation Grants includes:

FMA = Flood Mitigation Assistance Program.

HMGP = Hazard Mitigation Grant Program.

PDM = Pre-Disaster Mitigation Program

ACOE = Army Corps of Engineers.

MHD = Massachusetts Highway Department.

EOT = Executive Office of Transportation.

DCR = Department of Conservation and Recreation

DHS/EOPS = Department of Homeland Security/Emergency Operations

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

USDA = United States Department of Agriculture

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VIII. REGIONAL AND INTER-COMMUNITY CONSIDERATIONS

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

Regional Partners

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

Regional Issues

Saugus River Watershed – The Town of Reading recognizes that planned improvements within Reading may impact communities downstream and therefore, the mitigation of flood damage to roadways and properties within the Saugus River watershed is a true urban challenge making resolution of flooding in this watershed the town's highest priority.

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IX. PLAN ADOPTION AND MAINTENANCE

Plan Adoption

The Reading Hazard Mitigation Plan was adopted by the Board of Selectmen on July 13, 2010. 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

MAPC worked with the Reading Hazard Mitigation Planning Team to prepare this plan. This group will continue to meet on an as-needed basis to function as the Local Hazard Mitigation Implementation Team, with one town official designated as the coordinator. Additional members could be added to the local implementation group from businesses, non-profits and institutions.

Implementation Schedule

Bi-Annual Survey on Progress– The coordinator of the Local Hazard Mitigation Implementation Team will prepare and distribute a biannual survey in years two and four of the plan. The survey will be distributed to all of the local implementation team 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 Reading Hazard Mitigation Plan. The Local Hazard Mitigation Implementation Team will have primary responsibility for tracking progress and updating the plan.

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

Prepare and Adopt an Updated Local Hazard Mitigation Plan – FEMA’s approval of this plan is valid for five years, by which time an updated plan must be prepared and approved in order to maintain the town’s approved plan status and its eligibility for FEMA mitigation grants. Because of the lead time required to secure a planning grant, prepare an updated plan, and complete the approval and adoption of an updated plan, the local Hazard Mitigation Planning Team should begin the process at the beginning of Year 4. This will help the town avoid a lapse in its approved plan status and grant eligibility when the current plan expires.

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

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to update the plan or to hire another consultant. However the Hazard Mitigation Implementation Team decides to update the plan, the group will need to review the current FEMA hazard mitigation plan guidelines for any changes. The update of the Reading Hazard Mitigation Plan will be forwarded to MEMA and DCR for review and to FEMA for approval.

Integration of the Plans with Other Planning Initiatives

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

- Police Department
- Fire Department
- Emergency Management
- Engineering Department
- Highway Department
- Department of Public Works
- Parks and Recreation Department
- Planning and Community Development Department
- Conservation Commission
- Board of Health

The actions in the hazard mitigation plan will be incorporated into the town's Capital Improvement Plan and departmental budgets. The actions will also be incorporated into the Community Development Plan and Open Space Plan where relevant. Hazard mitigation concerns are already included in the zoning ordinance as described on Page 32-33.

Other groups that will be coordinated with include large institutions (hospitals, colleges), Chambers of Commerce, land conservation organizations and watershed groups. The plans will also be posted on a community's website with the caveat that the local 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.

X. LIST OF REFERENCES

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

Town of Reading Zoning Bylaws, February, 2005.

Town of Reading, MA 2005 Master Plan

Town of Reading General Bylaws, Amended through February, 2006.

HAZUS-MH: Earthquake Event Report.

HAZUS-MH Hurricane Event Report.

Commonwealth of Massachusetts, MacConnell Land Use Statistics, 1999.

Federal Emergency Management Agency, Flood Insurance Rate Maps for Reading, MA

MA Executive Office of Environmental Affairs, Buildout Analysis for Reading, MA
2000

Metropolitan Area Planning Council, Geographic Information Systems Lab

Metropolitan Area Planning Council, Regional Plans and Data

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APPENDIX A HAZARD MAPPING

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

The map series consists of four panels with two maps each plus one map taken from the State Hazard Mitigation Plan.

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

Map 1: Population Density – This map uses the US Census block data for 2000 and shows population density as the number of people per acre in seven categories with 60 or more people per acre representing the highest density areas.

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

Map 3: Flood Zones – The map of flood zones used the FEMA Q3 Flood Zones as its source. For more information, refer to http://www.fema.gov/fhm/fq_q3.shtm. The definitions of the flood zones are described in Appendix III and in more detail at http://www.fema.gov/fhm/fq_term.shtm. The flood zone map for each community also shows critical infrastructure and municipally owned and protected open space.

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

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

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

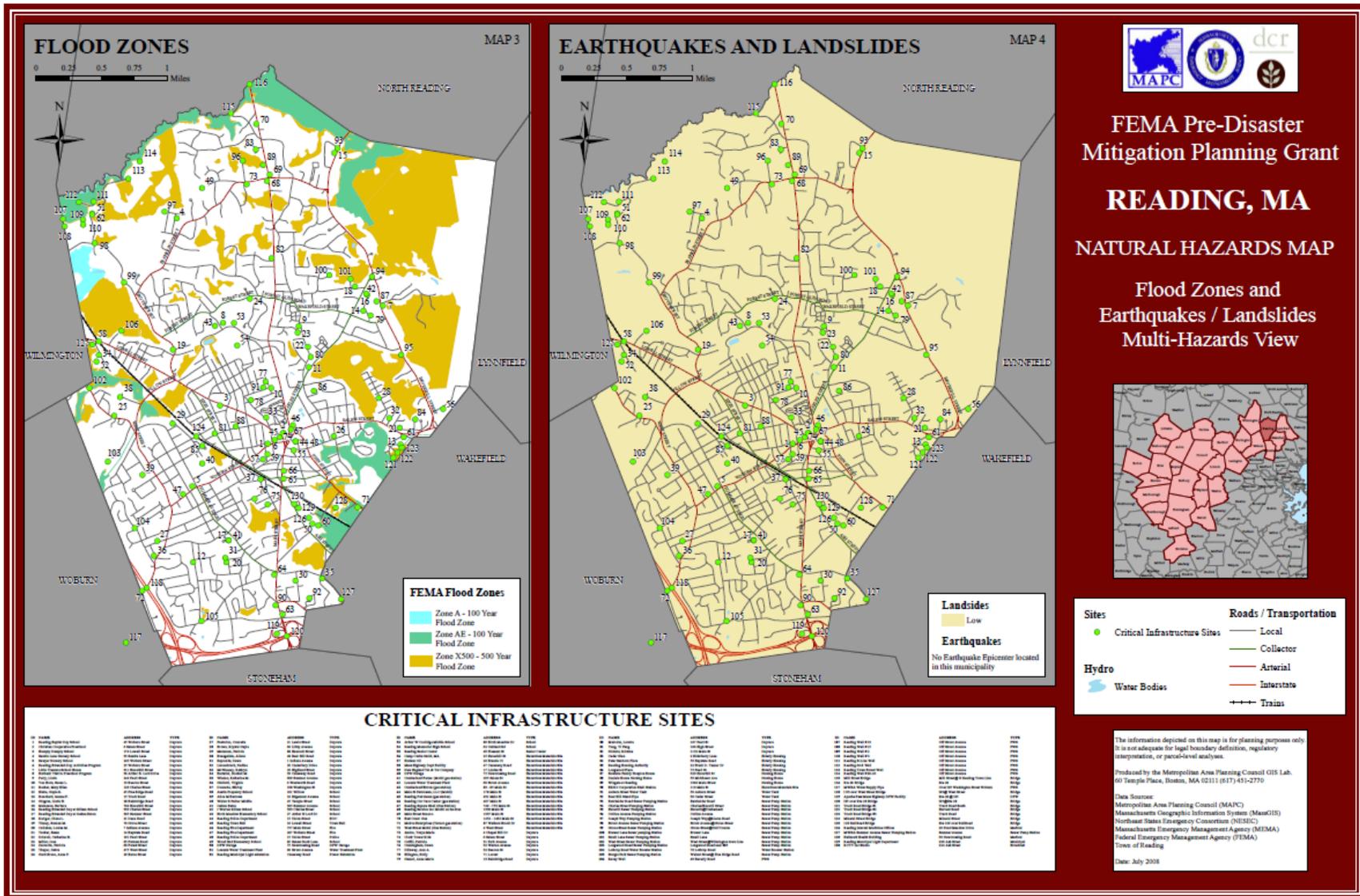
Hurricane storm surge is an abnormal rise in sea level accompanying a hurricane or other intense storm. Along a coastline a hurricane will cause waves on top of the surge. Hurricane Surge is estimated with the use of a computer model called SLOSH. SLOSH stands for Sea Lake and Overland Surge from Hurricanes.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

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

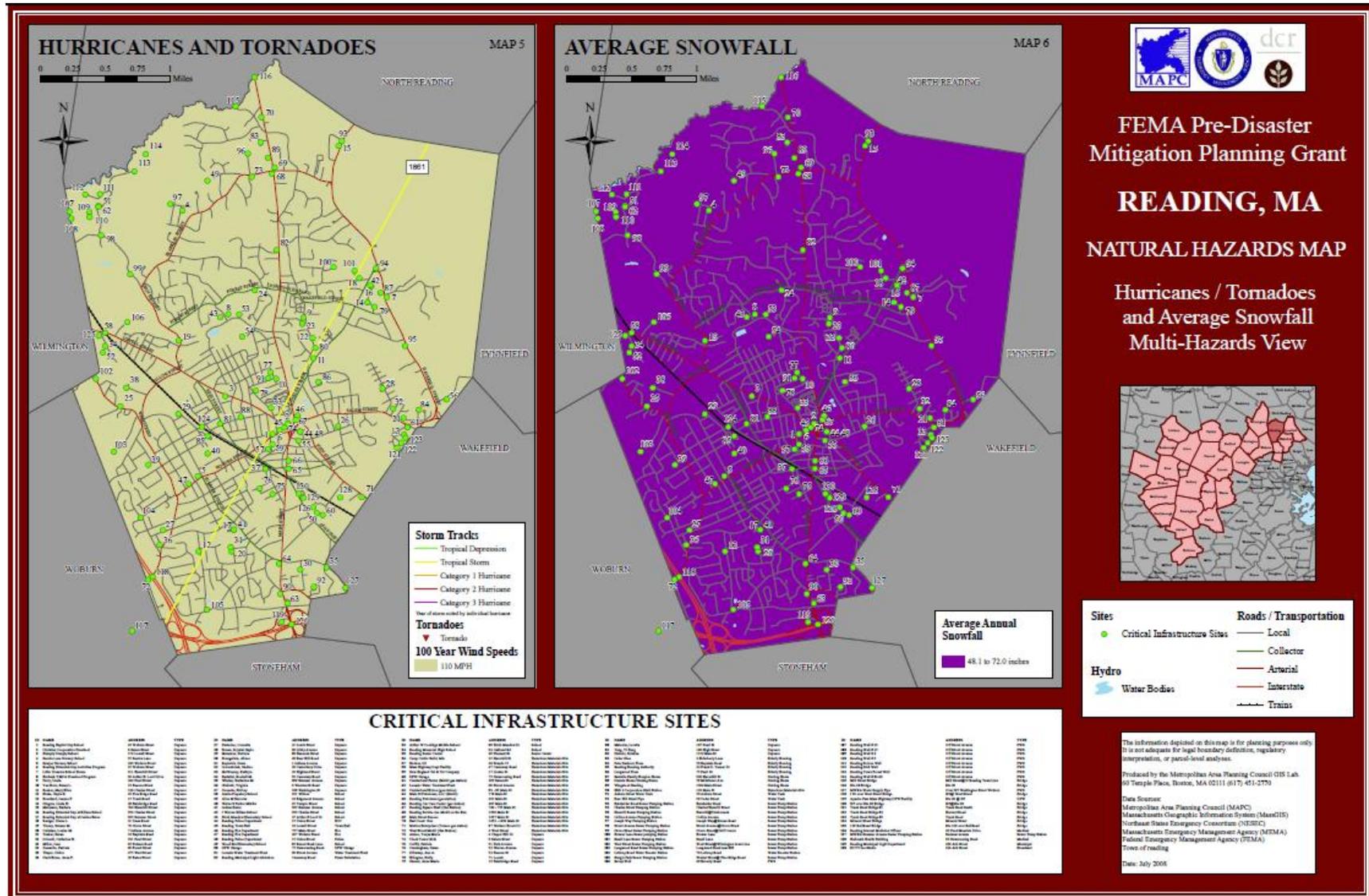
Map 7: Composite Natural Hazards - This map shows four categories of composite natural hazards for areas of existing development. The hazards included in this map are 100 year wind speeds of 110 mph or higher, low and moderate landslide risk, FEMA Q3 flood zones (100 year and 500 year) and hurricane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

Map 8: Hazard Areas – For each community, locally identified hazard areas are overlaid on an aerial photograph dated April, 2001. The critical infrastructure sites are also shown. The source of the aerial photograph is Mass GIS.

READING HAZARD MITIGATION PLAN



READING HAZARD MITIGATION PLAN



READING HAZARD MITIGATION PLAN

READING HAZARD MITIGATION PLAN

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READING HAZARD MITIGATION PLAN

**APPENDIX B
MEETING AGENDAS**

**NORTH SUBURBAN REGIONAL HAZARD MITIGATION
COMMUNITY PLANNING TEAM**

AND

**READING LOCAL
HAZARD MITIGATION PLANNING TEAM**



Cristine McCombs
Director

The Commonwealth of Massachusetts

MITT ROMNEY, GOVERNOR

Massachusetts Emergency Management Agency
400 WORCESTER ROAD, FRAMINGHAM, MA 01702-5399 508-820-2000 FAX 508-820-1404



Department of Conservation and Recreation
251 CAUSEWAY STREET, SUITE 600-900, BOSTON, MA 02114-2104 617-626-1250 FAX 617-626-1351



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

Stephen H. Burrington
COMMISSIONER

North Suburban

Hazard Mitigation Community Planning Team

First Meeting

WEDNESDAY, JULY 26, 2006, 9:30 AM

Community Room

Wakefield Public Safety Building

1 Union Street, Wakefield, MA



Marc D. Draisen
Executive Director

AGENDA

**METRO NORTH/WEST
PRE-DISASTER
MITIGATION PLAN**

9:30 WELCOME & INTRODUCTIONS (*Please sign contact sheet*)

**9:45 OVERVIEW OF FEDERAL DISASTER MITIGATION ACT &
PRE-DISASTER MITIGATION PLANNING**

- *Presentation, Questions & Discussion*
--Martin Pillsbury, Manager of Regional Planning, MAPC

**10:15 GETTING STARTED: THE METRO NORTH/WEST PRE-DISASTER
MITIGATION PLAN - NORTH SUBURBAN SUBREGION**

- *Review of Scope of Work & Schedule*
-- Joan Blaustein, MAPC Senior Planner
- *Questions & Discussion - Local Issues & Priorities*

11:00 PREVIEW OF MAPPING AND DATABASES FOR THE PLAN

- *Examples from the North Shore & Metro Boston PDM Plans*
--Alan Bishop, GIS Manager, MAPC

11:20 NEXT STEPS / MEETING SCHEDULE

NORTH SUBURBAN

Burlington
Lynnfield
Reading
Stoneham
Wakefield
Wilmington
Woburn



Ken McBride
acting Director

The Commonwealth of Massachusetts

DEVAL PATRICK, GOVERNOR

Massachusetts Emergency Management Agency
400 WORCESTER ROAD, FRAMINGHAM, MA 01702-5399 508-820-2000 FAX 508-820-1404



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Priscilla E. Geigis
ACTING COMMISSIONER



Marc D. Draisen
Executive Director

North Suburban Hazard Mitigation Community Planning Team

Second Regional Meeting
WEDNESDAY, MARCH 28, 2007, 9:30 AM
Wakefield Public Safety Building
1 Union Street, Wakefield, MA

**METRO NORTH/WEST
HAZARD MITIGATION
PLAN**

9:30 WELCOME, INTRODUCTIONS & OVERVIEW OF AGENDA
• *Martin Pillsbury, Project Manager*

NORTH SUBURBAN
*Burlington
Lynnfield
Reading
Stoneham
Wakefield
Wilmington
Woburn*

**9:40 REVIEW OF HAZARD MAPPING AND CRITICAL INFRASTRUCTURE
DATA COLLECTION**

- *Allan Bishop, GIS Manager, will present the draft regional hazard map and a sample community map,*
- *Draft local hazard maps will be distributed on CD ROM to all towns*
- *Update on Critical Facilities data base and process for local review and QA/QC of draft hazard maps and data*

10:30 UPDATE ON LOCAL PLANS

- *Joan Blaustein will discuss local and regional issues emerging in the planning process*
- *Review next steps in mapping localized hazard areas*
- *Martin Pillsbury will review plan approval requirements*

10:45 QUESTIONS AND DISCUSSION WITH TEAM MEMBERS

11:00 NEXT STEPS / MEETING SCHEDULE / ADJOURN



Dan Boyce
Director



Department of Conservation and Recreation
251 CAUSEWAY STREET, SUITE 600-900, BOSTON, MA 02114-2104 617-626-1250 FAX 617-626-1351



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

Richard Sullivan
COMMISSIONER

North Suburban Hazard Mitigation Community Planning Team



Marc D. Draisen
Executive Director

THURSDAY, NOVEMBER 1, 2007, 9:30 AM
Wakefield Public Safety Building
1 Union Street, Wakefield, MA

METRO NORTH/WEST HAZARD MITIGATION PLAN

NORTH SUBURBAN

Burlington
Lynnfield
Reading
Stoneham
Wakefield
Wilmington
Woburn

9:30 WELCOME, INTRODUCTIONS & OVERVIEW OF AGENDA

- *Martin Pillsbury, Project Manager*

9:40 REVIEW OF HAZARD MAPPING AND CRITICAL INFRASTRUCTURE DATA COLLECTION

- *Allan Bishop, GIS Manager, will present the final regional hazard maps and an example set of community maps*
- *Final hazard maps and Critical Facilities data bases will be distributed to all towns (hard copy and on CD-ROM)*

10:00 UPDATE ON LOCAL PLANS

- *Update on local PDM annexes (Joan Blaustein)*
- *Review of next steps for plan completion, review, and approval*

10:15 REGIONAL ISSUES IN THE PDM PLAN

- *Facilitated discussion to identify and prioritize key regional issues that should be included in the Regional PDM Plan for North Suburban*

10:35 BRIEFING ON FEMA TRAINING FOR PROJECT DEVELOPMENT

11:00 NEXT STEPS / MEETING SCHEDULE / ADJOURN



Dan Boyce
Director



Department of Conservation and Recreation
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Richard Sullivan
COMMISSIONER



Marc D. Draisen
Executive Director

**METRO NORTH/WEST
HAZARD MITIGATION
PLAN**

NORTH SUBURBAN

Burlington
Lynnfield
Reading
Stoneham
Wakefield
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Woburn

The Commonwealth of Massachusetts
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**North Suburban
Hazard Mitigation Community Planning Team**

**THURSDAY, JUNE 26, 2008, 10:00 AM
Community Room
Wakefield Public Safety Building
1 Union Street, Wakefield, MA**

10:00 WELCOME & INTRODUCTIONS *(Please sign contact sheet)*

10:05 REVIEW OF THE REGIONAL HAZARD MITIGATION MAP SERIES

Martin Pillsbury will present an overview of the regional Hazard Mitigation maps (copies will be distributed on CD-ROM)

10:25 REGIONAL GOALS AND OBJECTIVES, ISSUES, RECOMMENDATIONS

Martin Pillsbury will review the draft goals and objectives for the Regional Hazard Mitigation Plan. Joan Blaustein will facilitate a discussion of the regional issues and recommendations for the plan.

11:00 OVERVIEW OF FEMA BENEFIT-COST ANALYSIS FOR GRANTS

Joan Blaustein will present an overview of FEMA's requirements for Benefit-Cost Analysis for grant applications for mitigation projects.

11:25 REVIEW OF NEXT STEPS:

- Complete remaining local annexes and public meetings
- Plan review and approval by MEMA & FEMA
- Plan Adoption by the towns (Selectmen/City Council)
- Final Approval letter issued by FEMA

READING HAZARD MITIGATION PLAN

The Reading Multi-Hazard Mitigation Planning Team

November 7, 2007

Reading Town Hall

9:00 – 10:30 AM

1. Welcome and introductions
2. Review of grant scope of work and progress to date
3. Maps and critical infrastructure
4. Review aerial photograph showing natural hazard areas and future development
5. Develop goals and objectives
6. Discuss potential mitigation measures
7. Next steps

READING HAZARD MITIGATION PLAN

APPENDIX C

DOCUMENTATION OF PUBLIC MEETING

TOWN OF READING

NOTICE OF MEETING – BOARD OF SELECTMEN

DATE: August 5, 2008

CALL TO ORDER: 7:00 p.m.

PLACE: Selectmen's Meeting Room
16 Lowell Street, Reading, Massachusetts

- OFFICE HOURS – Richard Schubert** **6:30**
- 1) **Executive Session** **7:00**
- a. Labor Negotiations
 - b. Approval of Minutes
June 3, 2008
- 2) **Reports and Comments**
- a. *Selectmen's Liaison Reports and Comments*
 - b. *Public Comment*
 - c. *Town Manager's/Assistant Town Manager's Report*
- 3) **Proclamations/Certificates of Appreciation**
- 4) **Personnel & Appointments**
- 5) **Discussion/Action Items**
- a. Highlights – RCTV **7:30**
 - b. Presentation of Hazard Mitigation Plan – MAPC **8:00**
 - c. Approval of Alley Way Agreements **8:30**
 - d. Update – Downtown **8:45**
 - e. Close Warrant for State Primary Election
 - f. Review Action Status Reports
- 6) **Approval of Minutes**
- a. June 3, 2008
 - b. July 29, 2008
- 7) **Licenses, Permits and Approvals**
- a. Special Three Day License issued to Meadow Brook Social Committee for sale of all alcoholic beverages for a Summer Social on August 2, 2008
 - b. Special Three Day License issued to Meadow Brook Social Committee for sale of all alcoholic beverages for a Police Department Summer Party on August 23, 2008

READING HAZARD MITIGATION PLAN

APPENDIX D

DOCUMENTATION OF PLAN ADOPTION

READING HAZARD MITIGATION PLAN



Town of Reading
16 Lowell Street
Reading, MA 01867

James E. Bonazoli, Chairman
Camille W. Anthony, Vice Chairman
Richard W. Schubert, Secretary
Stephen A. Goldy
Ben Tafoya

BOARD OF SELECTMEN
(781) 942-9043
FAX: (781) 942-9071
Website: www.ci.reading.ma.us

CERTIFICATE OF ADOPTION
Town of Reading, Massachusetts
Board of Selectmen
A RESOLUTION ADOPTING THE
TOWN OF READING
HAZARD MITIGATION PLAN

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

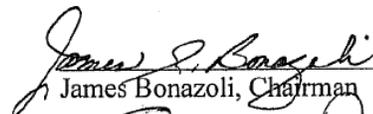
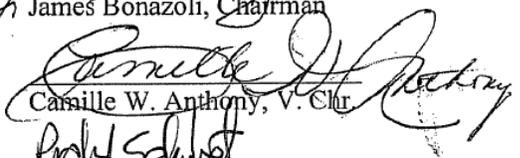
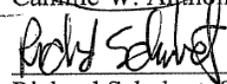
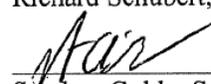
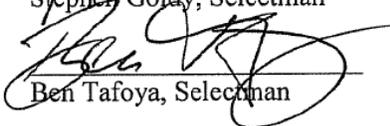
WHEREAS, the Town of Reading Hazard Mitigation Plan contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Reading, and

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

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

NOW, THEREFORE BE IT RESOLVED that the Town of Reading Board of Selectmen adopts the Hazard Mitigation Plan, in accordance with M.G.L. c.40 or the code/ordinance/bylaw/charter of the Town of Reading.

ADOPTED AND SIGNED this 13th day of July, 2010.


James Bonazoli, Chairman

Camille W. Anthony, V. Chr.

Richard Schubert, Secretary

Stephen Goldy, Selectman

Ben Tafoya, Selectman

ATTEST

cc: George Zambouras
Martin Pillsbury
Joan Blaustein