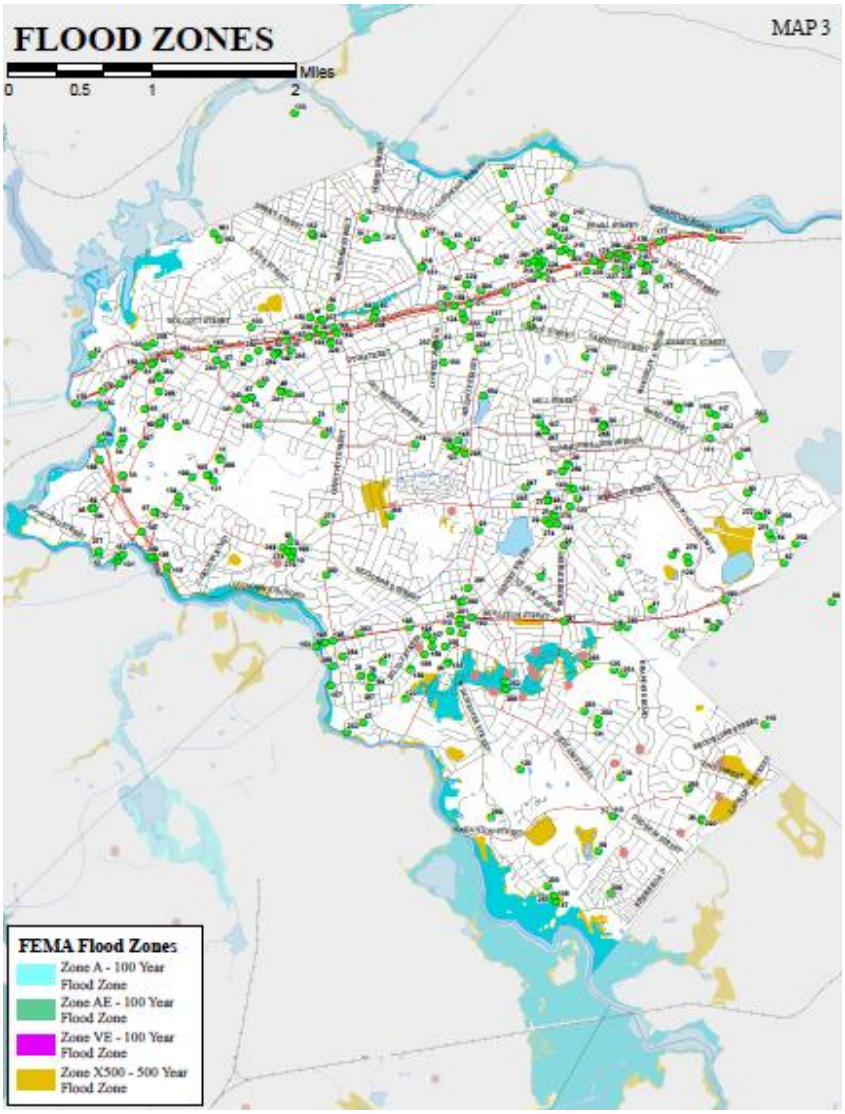
CITY OF NEWTON
HAZARD MITIGATION PLAN



MAPC
METROPOLITAN AREA PLANNING COUNCIL

Metropolitan Area Planning Council

Conditionally Approved by FEMA
September 5, 2012

S

[This page intentionally left blank]

ACKNOWLEDGEMENTS AND CREDITS

This plan was prepared for the City of Newton 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 Shepard
Executive Director:	Marc D. Draisen

Credits

Project Manager:	Martin Pillsbury
Lead Project Planner:	Christine Wallace, P.E.
Mapping/GIS services:	Susan Brunton

Massachusetts Emergency Management Agency

Director:	Don Boyce

Department of Conservation and Recreation

Commissioner:	Rick Sullivan

City of Newton Emergency Management

Director:	Hugh Downing

MAPC
METROPOLITAN AREA PLANNING COUNCIL

Metropolitan Area Planning Council

[This page intentionally left blank]

TABLE OF CONTENTS

[This page intentionally left blank]

LIST OF TABLES

APPENDICES

[This page intentionally left blank]

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 Federal Emergency Management Agency (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 communities. The Metropolitan Area Planning Council (MAPC) received a grant from FEMA under the Pre-Disaster Mitigation (PDM) Program to assist the City of Newton and 16 other communities in the greater Boston region to develop local hazard mitigation plans. The 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 damage resulting from natural hazards through long-term strategies. These long-term strategies can include planning, policy changes, programs, projects, and other activities.

[This page intentionally left blank]

II. COMMUNITY PROFILE

Overview

Newton is located in Middlesex County in Eastern Massachusetts and is bordered by Needham on the southwest, Wellesley and Weston on the west, Waltham and Watertown on the north, Brookline on the east, and Boston on the southeast. Newton has a total area of 18.22 square miles and is located 8 miles west of Boston. Principal roadways that run through Newton include the Massachusetts Turnpike (Interstate Route 90), State Route 9, State Route 128 (Interstate 95), State Route 30, and State Route 16. The Massachusetts Bay Transportation Authority (MBTA) Commuter Rail, the MBTA Green Line Trolley, and MBTA bus service also service Newton. Newton is home to the regional Newton-Wellesley Hospital. A mayor and a Board of Aldermen consisting of 24 members, 16 At-Large Aldermen and 8 Ward Aldermen, govern the city.

Newton, known as the Garden City, is bounded on three sides by the Charles River and is a diverse community comprised of 13 villages, each with a unique character. Originally a part of Cambridge, Newton was settled in 1630 and incorporated in 1688 with the first settlement in Newton Corner. The Boston and Worcester Railroads established depots at what later became Newtonville and Auburndale in 1834. Newton is a vibrant community that is desirable as a place to live and work due to its proximity to Boston, nearness to various highway and public transportation systems, attractive neighborhoods and high property values, well-run municipal government, and a strong, nationally-recognized school system. Among the myriad of arts and cultural organizations and activities, Newton has a Symphony Orchestra, resident theatre groups and an Arts in the Parks Program.

There are about 20,000 jobs in Newton. Newton hosts business opportunities ranging from retail, service industry, and several higher learning educational institutions. Business centers are located in many of the city's villages, including Chestnut Hill, Newton Center, Newton Corner, Newtonville, Auburndale, West Newton, Newton Highlands, and Waban.

According to the 2000 Census, over 83,000 people live in Newton. The city has a fairly high percentage of residents that are over age 65 (15.1%). Of the city's 32,112 housing units, more than half of them were built before 1940.

Table 1: Newton Characteristics from 2000 Census

Population = 83,829

- 5.2 % are under age 5
- 15.2 % are over age 65
- 7.3 % speak English less than "very well" (over age 5)
- 6.7 of households have no vehicle*
- 12.6 % have a disability (over age 5)
- 6.7% live in group quarters

Number of Housing Units = 32,112

- 30.5 % are renter-occupied housing units
- 52.8 % of housing units were built before 1940

Employment = 45,018 *

Source: 2000 Census.
* MetroBoston Data Common

The City of Newton maintains a website at www.newtonma.gov

Existing Land Use

The most recent land use statistics available from the state are from 1999 aerial photography. Table 2 breaks the city into 21 land use categories. The table shows the acreage of each land use category and the percentage of land area in Newton in each category. Open Land includes areas with abandoned agriculture, power lines or areas devoid of vegetation. Urban Open Land includes undeveloped land and protected green space.

Almost half of Newton is high-density residential. Other prominent land uses include medium-density residential development (11% of the city), and forest (10%).

Table 2: Existing Land Use in Newton, 1999

Land Use	Acres	% of City
Cropland	2.2	0.02
Pasture	0	0.00
Forest	1,180.1	10.14
Non-forested Wetlands	167.6	1.44
Mining	0	0.00
Open Land	60.2	0.52
Participatory Recreation	801.9	6.89
Spectator Recreation	0	0.00
Water Recreation	2.7	0.02
Multi-family Residential	144.6	1.24
High Density Residential (less than ¼ acre lots)	5,769.6	49.56
Medium Density Residential (¼ – ½ acre lots)	1,297.1	11.14
Low Density Residential (Larger than ½ acre lots)	146.1	1.25
Salt Water Wetlands	0	0.00
Commercial	499.8	4.29
Industrial	209.3	1.80
Urban Open	800.0	6.87
Transportation	325.4	2.80
Waste Disposal	0	0.00
Water	234.8	2.02
Woody Perennials	0	0.00
Total	**11,641.4**	

For more information on land use categories, see www.mass.gov/mgis/lus.htm.

Although the Mass GIS land use data for Newton shows no land in the "waste disposal" category, the city does have a former landfill site on Rumford Ave, which is no longer operated as a waste disposal facility.

Potential Future Land Use

In 2000, MAPC, under contract to the Executive Office of Environmental Affairs, prepared a build out analysis for every community in the Boston region. A build out analysis is a tool to help communities understand the potential impacts of future growth that might occur given the amount of developable land remaining and how that land is zoned.

The build out is based on available land within each zoning district and it estimates the number of additional housing units and commercial development that could be accommodated. Generally, the projections account only for as-of-right development. The results of the 2000 Census were not released when MAPC performed the analyses.

Table 3: Build out Impacts in Newton, MAPC Analysis

Developable Land Area (acres)	601
Additional Residents	2,838
Additional K-12 Students	414
Additional Residential Units	1,158
Additional Commercial/Industrial (sq. ft.)	203,861
Additional Roadway at Build out (miles)	14.0

While these statistics give an idea of how Newton could grow, MAPC consulted with city staff to provide a more realistic picture of future development based on the city's recent comprehensive planning efforts and current trends and projects. The potential future development and redevelopment areas are shown on Map 2, "Potential Development" and are described below. The letters refer to those on Map 2.

Since most of Newton is already built-out, any new growth would largely be in areas that have potential for redevelopment. Currently there are no residential subdivisions underway; rather, the potential development is mostly commercial.

Route 9 (A) – Potential Development

This portion of Route 9 stretches from Florence Street to the city line. This area has the potential for future redevelopment as the city is looking at mixed uses for the area.

Riverside MBTA Station (B) – Potential Development

A portion of the Riverside Green Line MBTA Station, located near the western border of the city, is slated for a 20-acre redevelopment. The MBTA would lease the land to a neighboring hotel for a 600,000 square foot mixed-use development. The proposed development would include 420,000 square feet of office space, 60,000 square feet of retail space, and 190 residential units.

Needham Street Corridor (C) – Potential Development

The Needham Street Corridor, located in the southwest portion of the city and south of Route 9 from Winchester Street to the Charles River, has the potential for redevelopment as the city is looking at mixed uses for this area.

III. PUBLIC PARTICIPATION

Public participation occurred primarily at two levels: the Greater Boston Inner Core-West Hazard Mitigation Community Planning Team (regional committee) and the Newton Multiple Hazard Community Planning Team (local committee). In addition, the city held one public meeting to present the plan and solicit input.

Newton's Participation in the Regional Committee

MAPC notified the six communities (Arlington, Belmont, Newton, Waltham, Watertown, and Wellesley) of the first meeting of the Greater Boston Inner Core-West Regional Hazard Mitigation Community Planning Team (HMCPT) and requested that the Chief Elected Official designate municipal employees and/or officials to represent the community. The following individual represented Newton on the regional committee:

- Lieutenant Hugh J. Downing, Executive Officer, Police Department

The regional committee serves as an opportunity for neighboring communities to discuss hazard mitigation issues of shared concern. In addition, as the same group of MAPC staff is working on each community's plan, these issues of shared concern, and other issues that may arise between neighboring communities, are discussed in greater detail in local committee meetings and resulting actions are reflected in the identified mitigation measures, as noted in Chapter VIII. The Greater Boston Inner Core West Regional Committee met on April 16, 2008 and December 15, 2008.
Agendas from these meetings are located in Appendix B.

The Local Multiple Hazard Community Planning Team

In addition to the regional committee meetings, MAPC worked with the local community representatives to organize a local Multiple Hazard Community Planning Team (MHCPT) for Newton. 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. This local team held a meeting on September 29, 2009 to review existing mitigation measures, develop hazard mitigation goals, and discuss potential mitigation measures. Table 4 lists the attendees at the local team meeting. The agenda for the meeting is included in Appendix B. In addition, MAPC collected information via one-on-one meetings, phone interviews, or email.

Table 4: Attendance at the Newton Local Multiple Hazard Community Planning Team Meeting

September 29, 2009
Hugh Downing, Executive Officer, Police Department
Matt Cummings, Police Chief
David Turocy, DPW Deputy Commissioner
Mike Kruse, City Planning Director
Mike Castro, Deputy Fire Chief
Tom Daley, DPW Commissioner
Doug Greenfield, City Information Technology
Jeremy Solomon, Executive Department (Mayor's Office)

Public Meeting

The city held a public meeting on November 18, 2010 jointly with the Conservation Commission at the Newton City Hall to introduce the plan to the public. Notice of the meeting was posted at City Hall and on the city's website. MAPC presented an overview of the planning process and priority mitigation strategies to attendees. MAPC then edited the plan based on the comments at the meeting. The attendance list for the meeting is shown in Table 5 below.

Table 5: Attendance at the November 18, 2010 Public Meeting

Conservation Commission Members
Brian Yates, Newton Alderman
Anne Phelps, Senior Environmental Planner
Hugh Downing, Newton Emergency Management
Candace Havens, Director of City Planning
Martin Pillsbury, Metropolitan Area Planning Council
Members of the Generalo Public

Local Stakeholder Involvement

City staff were encouraged to reach out to local stakeholders that might have an interest in the Hazard Mitigation Plan including neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties. These stakeholders had an opportunity to participate in the public meeting, which was subject to the requirements of the Open Meeting Law requiring that the agenda for the meeting be advertised in a local paper of general circulation and posted in a public location. Meeting agendas are also posted on the city's website in advance of the meeting.

Planning Timeframe

March 14, 2008	Letter to the participating communities initiating the project.
April 16, 2008	First meeting of the Regional Committee
December 15, 2008	Second meeting of the Regional Committee
September 29, 2009	First meeting of the Local Committee
April 1, 2010	Second meeting of the Local Committee
November 18, 2010	Public meeting with the Conservation Commission
December 15, 2010	Plan submitted to MEMA

[This page intentionally left blank]

IV. OVERVIEW OF HAZARDS AND VULNERABILITIES

This section provides a general overview of how a number of natural hazards impact Newton. The next section provides more detail about impacts at specific locations and existing mitigation efforts.

Overview of Hazards and Impacts

The 2007 Massachusetts Hazard Mitigation Plan provides an overview of natural hazards in Massachusetts. It 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.

Table 6 summarizes the hazard risks for the state and notes where risks in Newton differ from the state assessment. The state analysis takes into account the frequency of the hazard, historical records and variations in land use. An explanation of the definitions used can be found at the end of the table. Table 7 lists those federal disaster and emergency declarations for Middlesex County.

Table 6: Frequency and Severity of Natural Hazards in the State

Hazard	Frequency in State	Severity in State	Issues in Newton
Flood	High	Serious to extensive	Same as state
Dam Failure	Low	Extensive	Same as state
Hurricanes	Medium	Extensive to catastrophic	Same as state
Severe Storms (wind, hail, etc.)	Medium	Serious	Same as state
Tornadoes	Medium	Extensive to catastrophic	Not a major issue in Newton
Winter Storms	High	Serious	Same as state
Earthquakes	Low	Catastrophic	Not a major issue in Newton
Landslides	Low	Minor	Not a major issue in Newton
Brush Fires	Medium	Serious	Not a major issue in Newton

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., 1 or 2 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 to public infrastructure (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.

Table 7: Disaster and Emergency Declarations for Middlesex County

ID Number	Type	Date
3315	Hurricane Earl	September 2010
1895	Severe Storm and Flooding	March 2010
1813	Severe Winter Storm and Flooding	January 2009
3296	Severe Winter Storm	December 2008
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.

Flood-Related Hazards

Flooding can occur during hurricanes, nor'easters, severe rainstorms, and thunderstorms. There have been a number of major rainstorms that have resulted in significant flooding in eastern Massachusetts over the last fifty years. Excluding hurricanes, significant rainstorms include:

- August 1954
- March 1968
- January 1979
- April 1987
- October 1991 ("The Perfect Storm")
- October 1996
- June 1998
- March 2001
- April 2004
- October 2005
- May 2006
- April 2007
- March 2010

Through December 2009, Newton property owners filed a total of 288 losses with the National Flood Insurance Program. Of these, 207 have been paid for a total of just over $1,050,175. FEMA maintains a database on these flood insurance policies and claims,

which can be found at http://www.fema.gov/business/nfip/statistics/pcstat.shtm. The following table provides further detail from the database:

Table 8: Flood Insurance Policies and Claims in Newton (as of December 31, 2009)

Flood insurance policies in force	397
Coverage amount of flood insurance policies	$102,230,800.
Premiums paid	$392,728.
Total losses (All losses submitted regardless of the status)	288
Closed losses (Losses that have been paid)	207
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	81
Total payments (Total amount paid on losses)	$1,050,175.76

As defined by the Community Rating System (CRS) of the National Flood Insurance Program (NFIP), a repetitive loss property is any property for which the NFIP has paid two or more flood claims of $1,000 or more in any given 10-year period since 1978. The state plan indicates that Massachusetts is one of the 10 states that cumulatively account for 76% of all repetitive loss buildings in the United States. For more information on repetitive losses, see http://www.fema.gov/nfip/replps.shtm.

There are 29 repetitive loss properties in Newton, 28 single-family homes and one 2-4 unit residential property. These 29 properties have experienced a total of 79 losses between 1978 and 2010. Damage claims over this period totaled $536,038.

All of the city's repetitive loss properties are located within the Charles River watershed, with most in the central to southern part of the city. Many of the properties are clustered in a designated flood zone A south of Route 9, while others are not located within a designated flood zone.

Wind-Related Hazards

Wind-related hazards include hurricanes and tornadoes as well as high winds during severe rainstorms and thunderstorms.

The region has been impacted by hurricanes throughout its history, starting with the Great Colonial Hurricane of 1635. The eye of one hurricane passed right through Boston in 1944. Between 1858 and 2000, Massachusetts has experienced approximately 32 tropical storms, 10 Category 1 hurricanes, 5 Category 2 hurricanes, and 4 Category 3 hurricanes.

This equates to a frequency of once every six years. Hurricanes that have occurred in the region include:

- Great New England Hurricane* September 21, 1938
- Great Atlantic Hurricane* September 14-15, 1944
- Hurricane Doug September 11-12, 1950
- Hurricane Carol* August 31, 1954
- Hurricane Edna* September 11, 1954
- Hurricane Hazel October 15, 1954
- Hurricane Diane August 17-19, 1955
- Hurricane Donna September 12, 1960
- Hurricane Gloria September 27, 1985
- Hurricane Bob August 19, 1991
- Hurricane Earl September 4, 2010

*Category 3.

Not included in this list is the Portland Gale of November 26-28, 1898, which may well have been the most damaging coastal storm in the history of Massachusetts.

As shown in Map 5 in Appendix A, a category 3 hurricane tracked just northwest of Newton in 1869, a tropical storm tracked through Newton in 1861, and a category 1 tracked through the city in 1944. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. The city does experience the impacts of the wind and rain of hurricanes and tropical storms regardless of whether the storm track passed through the city. The hazard mapping also indicates that the 100-year wind speed is 110 miles per hour. No tornadoes have been recorded in the city, although one was recorded to the southwest in Wellesley.

Winds during other storms also can cause damage. Downed trees and limbs can be a problem due to weather conditions such as strong wind or heavy snow and ice. Tree limbs can down power and communication lines and impact major roadways.

Winter-Related Hazards

In Massachusetts, northeast coastal storms known as nor'easters occur one to two times per year. Winter storms are a combination of hazards because they often involve wind, ice, flooding and snow fall. The average annual snowfall for most of the city is 48 – 72 inches.

As expected, a number of public safety issues can arise during snowstorms. Impassible streets are a challenge for emergency vehicles and affect residents and employers. Snow-covered sidewalks force people to walk in streets, which are already less safe due to snow, slush, puddles, and ice. Large piles of snow can also block sight lines for drivers, particularly at intersections. Not all residents are able to clear their properties, especially the elderly. In addition, when that snow melts, flooding occurs. Refreezing of melting snow can cause dangerous roadway conditions.

Fire Related Hazards

Brush fires and drought fall under the category of fire-related natural hazards.

According to the State Plan, the most recent severe drought in the state occurred from 2001 to 2003, and other multi-year droughts occurred in 1879-1883, 1908-1912, 1929-1932, 1939-1944, 1961-1969, and 1980-1983.

Recent wild fires in the state, according to the state plan, affected 2,600 acres in 2002, and 1,600 acres in 2003. Humans caused approximately 90% of wild fires in the past 10 years, and 10% of fires were caused by lightning. In addition to obvious threats to humans and property, because wildfires burn ground vegetation and ground cover, subsequent rains can worsen erosion.

According to local officials, the city sees several brush fires annually, but these fires do not usually cause major property damage or injuries. Wooded and conservation areas in the city have a greater brush fire risk. It is important to remember that fire can also be a result of other events, such as from the aftermath of an earthquake.

Geologic Hazards

Geologic hazards include earthquakes, landslides, sinkholes, subsidence, and unstable soils such as fill, peat, and clay.

Earthquakes

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 Ann fault located off the coast of Rockport. The region has experienced larger earthquakes of magnitude 6.0 to 6.5 in 1727 and 1755. Other notable earthquakes occurred here in 1638 and 1663 (Tufts University).

As shown on Map 4 in Appendix A, no earthquake epicenters have been recorded within Newton. Although new construction under the most recent building codes generally will be built to seismic standards, much of the development in the city pre-dates the most recent building code.

Earthquakes can result in many impacts beyond the obvious structural impacts. Buildings may suffer structural damage that is not readily apparent. Earthquakes can cause major damage to roadways, making emergency response difficult. Water lines and gas lines can break, causing flooding and fires. Equipment in buildings can be vulnerable. 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.

The State Plan includes a map of Peak Ground Acceleration (PGA). The Plan explains that:

> "PGA measures the strength of a potential earthquake in terms of the peak acceleration of ground movement. The potential damages due to an earthquake increase as the acceleration of ground movement increases. Peak ground acceleration is expressed as a percentage of a known acceleration, the acceleration of gravity…Therefore, the geographic areas with the highest PGA have the highest potential for damages during an earthquake."

According to the State Plan, Newton is located in a section of the state with a PGA of 14 to 16 with a 2% probability of exceedance in 50 years; this is the third/fourth highest zone in the state.

Landslides

Landslides can result from human activities that destabilize an area, or can occur as a secondary impact from another natural hazard such as flooding. In addition to structural damage to buildings and the blockage of transportation corridors, landslides can lead to sedimentation of water bodies.

All of Newton is classified as having a low risk for landslides. Local officials did not identify any significant issues related to landslides.

Overarching Impacts from Natural Hazards

A number of impacts can occur from any of the above-mentioned natural hazards. Most common and most visible are electrical outages and closures of roadways. This can occur due to high winds that knock down wires and limbs, from heavy snowfalls that take time to clear, or from a landslide that carries large boulders or soil onto a roadway. In addition to causing inconveniences, these impacts can result in economic losses to local businesses that cannot function without electricity, or their customers or employees cannot get to the business. Minimizing vulnerability to natural hazards can help to reduce these and other impacts to people's safety, health, and overall economic viability.

Critical Facilities Infrastructure in Hazard Areas

Maps 1-7 in Appendix A and Table 9 list critical infrastructure in Newton. Critical infrastructure includes those facilities that perform an important function during a natural disaster such as shelters and emergency operation centers. Critical infrastructure also includes locations that house sensitive populations, such as schools or nursing homes. There are other critical facilities and infrastructure that may not be mapped because the

information was not available. These may include utilities, communication facilities, or transportation corridors. The purpose of mapping the natural hazards and critical facilities is to present an overview of hazards in the community and how they relate to critical facilities.

Much of the Critical infrastructure in Newton is scattered throughout the city, however there are clusters near the main corridors and city village centers. Specifically, four facilities are located in the 500-year FEMA floodplain (X500), and eight facilities are located within the 100-year floodplain (A & AE). Four additional facilities are located within locally identified areas of flooding.

The entire city has annual snow accumulation averages of 48-72 inches. Therefore, during snow storms all critical facilities fall within a potential hazard category. This also holds true for average wind speeds during a potential 100-year storm, which could be uniform at 110 mph throughout the city. Risk to critical infrastructure for landslides is low.

In addition to the numerous city-owned critical infrastructure sites, city officials noted that the Massachusetts Water Resources Authority (MWRA) large water distribution pipes (about 5-6 feet in diameter) and the Algonquin gas pipeline (about 24 inch in diameter) also run through Newton.

The breakdown of the critical sites and how they relate to selected hazards follows in Table 9.

Table 9: Relationship of Critical Facilities and Selected Hazard Types in Newton

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area	Landslide Risk
1	Evans Park	Assisted Living	No	No	Low
2	Weeks House	Assisted Living	No	No	Low
3	Cabot Park Village	Assisted Living	No	No	Low
4	Pelham House	Assisted Living	No	No	Low
5	Golda Meir House	Assisted Living	No	No	Low
6	Casselman House	Assisted Living	No	No	Low
7	Falls at Cordingly	Assisted Living	AE	No	Low
8	Jams Preschool	Childcare	No	No	Low
9	Parkside Preschool Inc.	Childcare	No	No	Low
10	Riverside Childrens Center	Childcare	No	No	Low
11	Rosenshine Nursery School	Childcare	No	No	Low
12	Hills & Falls Cooperative Nursery School	Childcare	No	No	Low
13	Activity Academy Inc/ West Newton School	Childcare	No	No	Low
14	Auburndale Community Nursery School	Childcare	No	No	Low
15	West Newton Childrens Center, Inc.	Childcare	No	No	Low
16	Newton Police Headquarters	EOC (Primary)	No	No	Low
17	Close To Home Children's Center, Inc.	Childcare	No	No	Low
18	Toddler's Loving Care, Inc.	Childcare	No	No	Low
19	Newton Creative Start	Childcare	No	No	Low
20	Plowshares At Lincoln Eliot	Childcare	No	No	Low
21	Live Y'ers Preschool Program /W. Suburban	Childcare	No	No	Low
22	Presbyterian Church Nursery School	Childcare	No	No	Low
23	Victorian Montessori Day Care	Childcare	No	No	Low

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area	Landslide Risk
24	Holloway Child Study Center	Childcare	No	No	Low
25	Upper Falls Nursery School	Childcare	No	No	Low
26	The Preschool Experience, Inc.	Childcare	No	No	Low
27	Meeting House Child Care Center	Childcare	No	No	Low
28	Temple Beth Avodah Nursery School	Childcare	No	No	Low
29	Newton Montessori School	Childcare	No	No	Low
30	Temple Emanuel Nursery School	Childcare	No	No	Low
31	Children's Cooperative Nursery School	Childcare	No	No	Low
32	Marriott Hotel	Lodging	No	No	Low
33	Indigo Hotel	Lodging	No	No	Low
34	Riverside MBTA Station	Transportation	No	No	Low
35	MBTA Riverside Line Electric Station 1	Transportation	No	No	Low
36	NSTAR Electric Facility (Station 316)	Energy	No	No	Low
37	Gan Yeladim Day Care Center	Childcare	X500	No	Low
38	Rae & Joseph Gann Beth El Preschool	Childcare	No	No	Low
39	Longfellow Preschool	Childcare	No	No	Low
40	Auburndale Community Nursery School 2	Childcare	No	No	Low
41	NSTAR Electric Facility (Station 369)	Energy	No	No	Low
42	Bowen Cooperative Nursery School	Childcare	No	No	Low
43	Weekday Church Nursery School	Childcare	No	No	Low
44	Golden Days Children's Center	Childcare	No	No	Low
45	Little Red Wagon Playschool	Childcare	No	No	Low
46	Echo Falls Preschool	Childcare	No	No	Low

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area	Landslide Risk
47	Happy Child Preschool/Day Care Center	Childcare	No	No	Low
48	Temple Shalom Nursery School	Childcare	No	No	Low
49	Plowshares at Franklin School	Childcare	No	No	Low
50	Learning Prep School Child Care Center	Childcare	No	No	Low
51	Fessenden Day Care	Childcare	No	No	Low
52	Second Church Nursery School	Childcare	No	No	Low
53	Newton Creative Start	Childcare	No	No	Low
54	Newton Community Service Centers	Childcare	No	No	Low
55	The Teddy Bear Club, Inc.	Childcare	No	No	Low
56	Burr Cooperative Nursery School	Childcare	No	No	Low
57	Brookline Infant Toddler Center	Childcare	No	No	Low
58	The Kids Inn	Childcare	No	No	Low
59	Church of the Redeemer Cooperative Nurse	Childcare	No	No	Low
60	Boston College Childrens Center	Childcare	No	No	Low
61	Congregation Mishkan Tefila Nursery School	Childcare	No	No	Low
62	Morning Play Program	Childcare	No	No	Low
64	Beaver Country Day School Nursery School	Childcare	No	No	Low
65	Temple Emeth	Childcare	No	No	Low
66	Pine Manor Child Study Group	Childcare	No	No	Low
67	Golden Living Center - Chetwynde	Healthcare	No	No	Low
68	Golden Living Center – West Newton	Healthcare	No	No	Low
69	Lasell House	Healthcare	No	No	Low
70	Heathwood Nursing & Rehab Center	Healthcare	No	No	Low

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area	Landslide Risk
71	Fire Station 10	Government	No	No	Low
72	Sunbridge Care & Rehab for Newton	Healthcare	No	No	Low
73	Waban Health & Rehabilitation	Healthcare	No	No	Low
74	Scandanavian Living Center	Healthcare	No	No	Low
75	Mt. Ida Nursing Home	Healthcare	No	No	Low
76	Stone Institute - McLellan Rehab	Healthcare	No	No	Low
77	Pelham House Nursing Home	Healthcare	No	No	Low
78	Chetwynde Health & Rehabilitation	Healthcare	No	No	Low
79	Newton-Wellesley Hospital	Healthcare	No	No	Low
80	W. Newton Health & Rehab	Healthcare	No	No	Low
81	Centennary Village Apts.	Healthcare	No	No	Low
82	Lasell House	Healthcare	No	No	Low
83	Newton Education Center	School	No	No	Low
84	Heathwood Nursing & Rehab Center	Healthcare	No	No	Low
85	Vernon Court	Special Needs	No	No	Low
86	Cabot Park Village	Special Needs	No	No	Low
87	Sunbridge Care & Rehab for Newton	Special Needs	No	No	Low
88	Learning Prep School	School	No	No	Low
89	Hamilton Grove Apartments	Special Needs	No	No	Low
90	Waban Health & Rehabilitation	Healthcare	No	No	Low
91	Echo Ridge Apts - Elderly Housing	Special Needs	No	No	Low
92	Mt. Ida Nursing Home	Healthcare	No	No	Low
93	NWW Group Home	Special Needs	No	No	Low
94	Elder Residence of Stone Institute	Assisted Living	No	No	Low
95	Parker House	Special Needs	No	No	Low
96	Jackson Gardens	Special Needs	No	No	Low
97	Nonantum Village	Special Needs	No	No	Low
98	Pelham House Nursing Home	Healthcare	No	No	Low

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area	Landslide Risk
99	NWW Group Home	Special Needs	No	No	Low
100	NWW Group Home	Special Needs	No	No	Low
101	Heritage House	Special Needs	AE	No	Low
102	Hampton Place	Special Needs	No	No	Low
103	Norumbega Gardens	Special Needs	No	No	Low
104	Lower Falls Community Center	Special Needs	No	No	Low
105	Golda Meir Housing	Special Needs	No	No	Low
106	Soloman Schechter Day School	School	X500	No	Low
107	NSTAR Electric Facility (Station 292)	Energy	No	No	Low
108	NSTAR Electric Facility (Station 285)	Energy	No	No	Low
109	NSTAR Electric Facility (Station 17)	Energy	No	No	Low
110	MBTA Riverside Line Electric Station	Transportation	No	No	Low
111	Manet Road Pumping Station	Water	No	No	Low
112	Langley Road Pumping Station	Water	No	No	Low
113	Engine 10 Fire Station Pump	Water	No	No	Low
114	Commonwealth Ave Pumping Station	Water	No	No	Low
115	Pumping Station	Water	No	No	Low
116	Dudley Road Pumping Station	Water	No	No	Low
117	Waban Hill Reservoir	Water	No	No	Low
118	Quinobequin Road Sewer Pump Station	Sewer	No	No	Low
119	Ober Road Tower	Water	No	No	Low
120	Countryside Road Tower	Water	No	No	Low
121	Stanton Avenue Tower	Water	No	No	Low
122	TV/Radio Tower	Communications	No	No	Low
123	Newton Center Municipal Lot	Points of Distribution	No	No	Low

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area	Landslide Risk
124	Austin Street Municipal Lot	Points of Distribution	No	No	Low
125	Newton South High School	Points of Distribution	No	No	Low
126	Our Lady's Parish Parking Lot	Points of Distribution	No	No	Low
127	Newton Free Library	Points of Distribution	X500	No	Low
128	The Rashi School	Points of Distribution	No	No	Low
129	Congregation Mishkin Tefila	Points of Distribution	No	No	Low
130	Newton North High School	School / Shelter	No	No	Low
131	Charles Brown Middle School	School / Shelter	No	No	Low
132	Franklin School	School	No	No	Low
133	Burr School	School	No	No	Low
134	Newton-Wellesley Children's Corner	Childcare	No	No	Low
135	Golden Days Children's Center	Childcare	No	No	Low
136	Temple Emanuel Nursery School	Childcare	No	No	Low
137	After School Arts Program	School	No	No	Low
138	Ward School Afternoon Program	Childcare	No	No	Low
139	Fire Station 7	Government	No	No	Low
140	Newton Fire Department Headquarters	Government	No	No	Low
141	Fire Station 2	Government	No	No	Low
142	Fire Station 4	Government	No	No	Low
143	Fire Station 3	Government	No	No	Low
144	Newton Police Annex Building	Government	No	No	Low
145	Newton City Hall	Government	No	No	Low
146	B C Campus Day School	School	No	No	Low
147	Bais Yaakov of Boston High School	School	No	No	Low
148	John Ward School	School	No	No	Low
149	Learning Prep School	School	No	No	Low
150	EDCO Collaborative - N.E.W. Academy	School	No	No	Low

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area	Landslide Risk
151	The Education Cooperative (TEC) - TEC Hi	School	No	Albermarle Park	Low
152	Newton Lower Falls Dam	Dam	AE	No	Low
NA	Silk Mill Dam	Dam	AE	No	Low
NA	Cordingly Dam	Dam	AE	No	Low
153	Newton Upper Falls Dam	Dam	AE	No	Low
154	Bulloughs Pond Dam	Dam	No	No	Low
155	Brae Burn Dam	Dam	No	No	Low
156	Radio Tower	Communications	No	No	Low
157	Elliot Street Sewer Pump Station	Sewer	No	No	Low
158	Elliot Street DPW Yard	Government	No	No	Low
159	Utilities Building	EOC (Alternate)	No	No	Low
160	Crafts Street DPW Yard	Government	No	No	Low
161	Rumford Avenue Recycling Center	Government Hazmat Sites	No	No	Low
162	WNTN Tower	Communications	No	No	Low
163	Woodland Road Bridge	Transportation	No	No	Low
164	Auburn Street Bridge	Transportation	No	No	Low
165	Commonwealth Avenue Bridge	Transportation	No	No	Low
166	Washington Street West Bridge	Transportation	No	No	Low
167	Washington Street East Bridge	Transportation	No	No	Low
168	Highland Street Bridge	Transportation	No	No	Low
169	Chestnut Street Bridge	Transportation	No	No	Low
170	Lowell Avenue Bridge	Transportation	No	No	Low
171	Walnut Street Bridge	Transportation	No	No	Low
172	Harvard Street Bridge	Transportation	No	No	Low
173	Lewis Terrace Bridge	Transportation	No	No	Low
174	Church Street Bridge	Transportation	No	No	Low
175	Centre Avenue Bridge	Transportation	No	No	Low

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area	Landslide Risk
176	Centre Street Bridge	Transportation	No	No	Low
177	St. James Bridge	Transportation	No	No	Low
178	Charles River I-90 Overpass	Transportation	No	No	Low
179	Charles Street I-90 Underpass	Transportation	No	No	Low
180	CSX Railroad Bridge	Transportation	AE	No	Low
181	Railroad Underpass	Transportation	No	No	Low
182	Railroad Underpass	Transportation	No	No	Low
183	Crowne Plaza I-90 Underpass	Transportation	No	No	Low
184	Shaw's Market I-90 Underpass	Transportation	No	No	Low
185	Quinobequin Road Underpass	Transportation	No	No	Low
186	Grove Street Bridge	Transportation	No	No	Low
187	Washington Street Bridge	Transportation	No	No	Low
188	Abandoned Railroad Bridge	Transportation	No	No	Low
189	Recreation Road Bridge	Transportation	AE	No	Low
190	Hammond Pond Parkway Bridge	Transportation	No	No	Low
191	Parker Street Bridge	Transportation	No	Route 9 & Parker	Low
192	Centre Street Bridge	Transportation	No	No	Low
193	MBTA Trolley Bridge - Margaret Rd	Transportation	No	No	Low
194	MBTA Green Line Bridge - Elliot St	Transportation	No	No	Low
195	Chestnut Street Bridge	Transportation	No	No	Low
196	Quinobequin Road Bridge	Transportation	No	No	Low
197	MBTA Green Line Bridge - Grove St	Transportation	No	No	Low
198	MBTA Green Line - Beacon St	Transportation	No	No	Low
199	MBTA Green Line Bridge - Washington St	Transportation	No	No	Low
200	MBTA Green Line Bridge - Chestnut St	Transportation	No	No	Low

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area	Landslide Risk
201	MBTA Green Line Bridge - Floral St	Transportation	No	No	Low
202	Radio & TV Tower	Communications	No	No	Low
203	NECN Broadcast Facility	Communications	No	No	Low
204	Verizon Telephone Building	Communications	No	No	Low
205	NEW TV Tower	Communications	No	No	Low
206	Fire Station 1	Government	No	No	Low
207	Newton District Court	Government	No	No	Low
208	Army National Guard Armory	Government	No	No	Low
209	Algonquin Gas Pipeline	Energy	No	No	Low
210	Lincoln-Eliot School	School	No	No	Low
211	Day Middle School	School	No	No	Low
212	Fessenden School	School	No	No	Low
213	Walnut Park Montessori School	School	No	No	Low
214	Trinity Catholic High School	School	No	No	Low
215	Underwood School	School	No	No	Low
216	Horace Mann School	School	No	Albermarle Park	Low
217	Bigelow Middle School	School	No	No	Low
218	Cabot School	School	No	No	Low
219	Newton Country Day School	School	No	No	Low
220	Mt. Alvernia High School	School	No	No	Low
221	Rashi School	School	No	No	Low
222	The Evan Baptist Church	Religious	No	No	Low
223	Congregation Agudas Achim Sfard	Religious	No	No	Low
224	Our Lady Help of Christians	Religious	No	No	Low
225	Newton Presbyterian Church	Religious	No	No	Low
226	Second Church in Newton	Religious	No	No	Low
227	Hellenic Gospel Church	Religious	No	No	Low
228	Eliot Church of Newton	Religious	No	No	Low

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area	Landslide Risk
229	Boston Chinese Evangelical Church	Religious	No	No	Low
230	Grace Church	Religious	No	No	Low
231	Italian Pentecostal Christian Church	Religious	No	No	Low
232	Church of the Open Word	Religious	No	No	Low
233	Corpus Christi Church	Religious	No	No	Low
234	Myrtle Baptist Church	Religious	No	No	Low
235	Lincoln Park Baptist Church	Religious	No	No	Low
236	First Unitarian Church	Religious	No	No	Low
237	St. John's Church	Religious	No	No	Low
238	United Methodist Church of Newton	Religious	No	No	Low
239	St Bernard's Church	Religious	No	No	Low
240	Church of the Messiah	Religious	No	No	Low
241	Temple Shalom	Religious	No	No	Low
242	St Ignatius Church	Religious	No	No	Low
243	Newton Cong. of Jehovah's Witnesses	Religious	No	No	Low
244	Congregation Shaarei Tefillah	Religious	No	No	Low
245	Peirce School	School	No	No	Low
246	Williams School	School	No	No	Low
247	Mason-Rice School	School	No	No	Low
248	Zervas School	School	No	No	Low
249	Angier School	School	No	No	Low
250	Bowen School	School	No	No	Low
251	Newton South High School	School	No	No	Low
252	Countryside School	School	AE	No	Low
253	Oak Hill Middle School	School	No	No	Low
254	Charles Brown Middle School	School / Shelter	No	No	Low
255	Memorial-Spaulding School	School	No	No	Low
256	Solomon Schecter Lower School	School	No	No	Low
257	Solomon Schecter Upper School	School	X500	No	Low

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area	Landslide Risk
258	Chestnut Hill School	School	No	No	Low
259	Brimmer and May School	School	No	No	Low
260	Jackson School	School	No	No	Low
261	Jewish Community Day School	School	No	No	Low
262	Mt. Alvernia Academy	School	No	No	Low
263	Aquinas Junior College	School	No	No	Low
264	United Parish of Auburndale	Religious	No	No	Low
265	Congregation Bnai Jacob	Religious	No	No	Low
266	Temple Emanuel	Religious	No	No	Low
267	Bethel Atereh Israel Congregation	Religious	No	No	Low
268	Temple Reyim	Religious	No	No	Low
269	Trinity Church	Religious	No	No	Low
270	First Baptist Church in Newton	Religious	No	No	Low
271	Greek Evangelical Church of Boston	Religious	No	No	Low
272	Church of the Redeemer	Religious	No	No	Low
273	St Philip Neri Church	Religious	No	No	Low
274	Sacred Heart Church	Religious	No	No	Low
275	First Church in Chestnut Hill	Religious	No	No	Low
276	Congregation Mishkan Tefila	Religious	No	No	Low
277	St Mary's Church	Religious	No	No	Low
278	Parish of the Good Shepard	Religious	No	No	Low
279	Union Church in Waban	Religious	No	No	Low
280	Newton Highlands Congregational Church	Religious	No	No	Low
281	St. Paul's Church	Religious	No	No	Low
282	Myogo-Ji Buddhist Temple	Religious	No	No	Low
283	The Church in Boston	Religious	No	No	Low
284	The First Methodist Church	Religious	No	No	Low

ID	Name	Type	FEMA Flood Zone	Locally-Identified Flood Area	Landslide Risk
285	Congregation Mishkan Tefila	Religious	X500	No	Low
286	Second Baptist Church	Religious	No	No	Low
287	Mary Immaculate of Lourdes	Religious	No	No	Low
288	Beth Menachem Chabad	Religious	AE	No	Low
289	Jewish Community Center	Religious	No	No	Low
290	Temple Beth Avodah	Religious	No	No	Low
291	Congregation Dorshei Tzedek	Religious	No	No	Low
292	First Church of Christ Scientist	Religious	No	No	Low
293	Lutheran Church of the Newtons	Religious	No	No	Low
294	Crowne PlazaHotel & Offices	Lodging	No	No	Low
295	Newton Free Library	Public Meeting	X500	Homer Street	Low

Explanation of Columns in Table 9

***Column 1**: ID #:* ID number that appears on the maps. See Appendix A.
***Column 2**: Site Name:* Name of the site. If no name appears in this column the community did not provide the information to MAPC.
***Column 3**: Site Type*: Type of site.
***Column 4:** FEMA Flood Zone*: Risk of flooding. 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). If there is an entry in this column, it indicates the type of flood zone as follows:

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

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

Zones B, C, and X500 - Zones B, C, and X are the flood insurance rate zones that correspond to areas outside of the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.

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

***Column 5:** Locally-Identified Flood Area*: Whether the site is located within an area that was identified by city officials and staff as a localized area of flooding. These areas may or may correspond with FEMA flood zones.

***Column 6**: Landslide Risk:* The degree of landslide risk for that site. This information came from NESEC. The landslide information shows areas with moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information, refer to http://pubs.usgs.gov/pp/p1183/pp1183.html. If there is no entry, it indicates that the site is located in an area with little or no risk of landslides. The other two risk categories, low and moderate, indicate higher degrees of risk.

Potential Damages to Existing Development

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

Introduction to HAZUS-MH

HAZUS-MH is a tool to help estimate potential damages from certain types of natural hazards. We used HAZUS to estimate losses from a hurricane and earthquake. We did not use HAZUS to estimate flooding damages, for reasons explained below. The following overview of the HAZUS-MH is taken from the FEMA website. For more information, go to http://www.fema.gov/plan/prevent/hazus/.

> "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 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 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 allow for a comparison between different types of disasters. Therefore, this

analysis should be considered a starting point to understanding potential damage from the hazard events.

Estimated Damages from Hurricanes

According to the State Hazard Mitigation Plan, between 1858 and 2004, there were 10 hurricanes: 50% were Category 1, 20% were Category 2, and 30% were Category 3. For this plan HAZUS was used to estimate potential damages from a 100 year and 500 year hurricane; storms that are .01% and .005% likely to happen in a given year and are equivalent to Category 2 and Category 4 hurricanes. These storms were modeled as if they passed directly through the city, causing the greatest damage. Though there have been no instances of a 500-year hurricane passing through Massachusetts, this scenario was included in order to present a reasonable "worst case scenario" that would help planners and emergency personnel evaluate the impacts of storms that might be more likely in the future, as we enter into a period of more intense and frequent storms.

Table 10 displays estimated damages from hurricanes of 100 and 500-year return periods.

Table 10: Estimated Damage in Newton from a Probable 100 Year and 500 Year Return Period Hurricane

	100 Year	500 Year
Building Characteristics		
Estimated total buildings	24,186	
Estimated total building replacement value (Year 2002 $)	$9,161,174,000	
General Building Damage		
# of buildings sustaining minor damage	2899	8,479
# of buildings sustaining moderate damage	423	3,704
# of buildings sustaining severe damage	17	590
# of buildings destroyed	7	361
Population Needs		
# of households displaced	124	1,334
# of people seeking public shelter	24	266
Debris		
Building debris generated (tons)	12,935	74,602
Tree debris generated (tons)	9,367	26,212
# of truckloads to clear building debris	521	2,984
Value of Damages		
Total property damage	$85,394,240	$713,114,410
Total business interruption loss	$10,254,000	$99,043,130

Estimated Damages from Earthquakes

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

Table 11 displays estimated damages in Newton from earthquakes of 5.0 and 7.0 magnitudes.

Table 11: Estimated Damage in Newton from Magnitude 5 and 7 Earthquakes

	Magnitude 5.0	**Magnitude 7.0**
Building Characteristics		
Estimated total number of buildings	24,186	
Estimated total building replacement value (Year 2002 $)	$9,161,174,000	
Building Damages		
# of buildings sustaining slight damage	3,778	5,228
# of buildings sustaining moderate damage	1,098	8,884
# of buildings sustaining extensive damage	156	6,795
# of buildings completely damaged	19	4,864
Population Needs		
# of households displaced	201	10,424
# of people seeking public shelter	40	2,069
Debris		
Building debris generated (tons)	0	1,000,000
# of truckloads to clear building debris	0	40,000
Value of Damages		
Total property damage	$26,210,000	$695,500,000
Total losses due to business interruption	$441,720,000	$5,899,500,000

Estimated Damages from Flooding

MAPC did not use HAZUS-MH to estimate flood damages in Newton. In addition to technical difficulties with the software, the riverine module is not a reliable indicator of flooding in areas where inadequate drainage systems, or increased impervious surfaces contribute to flooding even in areas outside of mapped flood zones. In lieu of using HAZUS, MAPC developed a methodology to give a rough approximation of flood damages.

Newton officials have identified the potential for flooding on approximately 271 acres of the city's total land area of 11,619. This amounts to 2.32% of the total land area. The number of structures in each flood area was estimated by applying the percentage of the total land area to the total number of structures (24,186) in Newton, which is the same number of structures used by HAZUS for the hurricane and earthquake calculations. HAZUS uses an average value of $378,780 per structure for the building replacement value in this community. Since property values have increased over the past several years, actual current values would be higher, but the HAZUS model is useful to estimate the relative impacts of different hazard scenarios. 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 $21,401,072 - $107,005,361. These calculations are approximate only and are meant to show an order of magnitude of damage. These calculations are not based solely on location within the floodplain or a particular type of storm (i.e. 100-year flood).

Table 12: Estimated Damages from Flooding in Newton

ID	Flood Hazard Area	Approx Area (Acres)	% of Total Land Area in Newton	# of Struct.	Replacement Value	Low Estimate of Damages	High Estimate of Damages
1	Old Farm Road	34.89	0.30%	73	$27,650,943	$2,765,094	$13,825,471
2	Wayne Road	14.24	0.12%	30	$11,363,401	$1,136,340	$5,681,701
3	Homer Street	9.47	0.08%	20	$7,575,601	$757,560	$3,787,800
4	Albermarle Park	79.20	0.68%	165	$62,498,706	$6,249,871	$31,249,353
5	Quinobequin Road	77.74	0.67%	162	$61,362,366	$6,136,237	$30,681,183
6	Lyons Field	14.29	0.12%	30	$11,363,401	$1,136,340	$5,681,701
7	Route 9 & Parker St	25.76	0.22%	54	$20,454,122	$2,045,412	$10,227,061
8	Tanglewood Road off of Florence St	14.51	0.12%	31	$11,742,181	$1,174,218	$5,871,091
	Total	**270.10**	**2.32%**	**565**	**$214,010,721**	**$21,401,072**	**$107,005,361**

Potential Impacts to Future Development

The City of Newton has identified a number of parcels where development has been proposed, is underway, or is expected to occur in the future. Table 13 indicates where areas of likely future development may be located within, or partially within, a natural hazard area.

Table 13: Relationship of Potential Development in Hazard Areas in Newton

Parcel	Land Slide Risk	Flood Zone
Route 9 (A)	Low	No
Riverside MBTA Station (B)	Low	< 0.05% in AE
Needham Street Corridor (C)	Low	9.45% in X500 13.54% in AE

V. HAZARDS AND EXISTING MITIGATION MEASURES

This section provides more detail on how certain natural hazards affect specific parts of Newton. Existing mitigation measures are discussed under each hazard heading and existing mitigation measures for all natural hazards are compiled in Table 14.

Flood-Related Hazards

Overview of City-wide Flooding

All of Newton is located within the Charles River Watershed and numerous rivers, streams, and bodies of water in the city account for significant amounts of the local floodplain. Newton is bordered by the Charles River and associated 100-year flood plain to the south and north of the city. Cheesecake Brook is located to the north, and is tributary to the Charles. South Meadow Brook and its associated floodplain are located in the south. Other significant bodies of water include Sawmill Brook, Crystal Lake, Bullough's Pond, and Hammond Pond.

Newton experiences flooding during heavy rainstorms not only as a result of its numerous water resources and floodplain, but also because it is urbanized and historical floodplains have been filled in. Localized flooding will also occur due to undersized or outdated drainage infrastructure. More detail on specific flooding regions within the city is described in the site-specific flooding section below.

Newton employs a number of practices to help minimize potential flooding and impacts from flooding. Existing city-wide mitigation measures are listed below:

Existing City-wide Mitigation for Flood-Related Hazards

a) *Participation in the National Flood Insurance Program (NFIP*) – FEMA maintains a database on flood insurance policies and claims. This database is found on the FEMA website at http://bsa.nfipstat.com/reports/1040.htm. The city complies with the NFIP by enforcing floodplain regulations, maintaining up-to-date floodplain maps, and providing information to property owners and builders regarding floodplains and building requirements.

b) *Stormwater System and Outfalls Mapped in GIS* – The city has developed a drainage system inventory and integrated the data into a Geographical Information System (GIS).

c) *Drainage System Maintenance* – The city has a goal to clean all of its thousands of catch basins annually. The city aims to sweep all streets at least twice per year, but has swept some up to five times per year.

d) *On-going Drainage Improvement Program* – The city has a strong program of drainage maintenance and upgrades. The Public Works Department regularly

provides maintenance to culverts, drainage pipes, channels, and other drainage infrastructure and on an as-needed basis.

e) *Floodplain / Watershed Protection District* – Chapter 22 (Planning and Development), Article II (Conservation Commission), Section 22-22 of the City Ordinance, establishes a Floodplain/Watershed Protection District with provisions to protect against flooding and protect subsurface water resources. This section describes exact districts with elevations, and regulates certain activities within the districts.

f) *Wetland Protection Act and Regulations* – The Newton Conservation Commission administers the state Wetlands Protection Act (MGL Ch. 131, s. 40), the Wetlands Regulations (310 CMR 10.00) and the City of Newton Floodplain Ordinance 22-22 to preserve and protect Newton's wetlands and floodplains.

g) *The Massachusetts Stormwater Regulations* – These regulations are applied to developments within the jurisdiction of the Conservation Commission.

h) *Subdivision Development Drainage Design Controls* – The Rules and Regulations of the Planning Board for Subdivisions require natural watercourses to be protected and preserved, and all drainage to conform to the design criteria of the City Engineer.

i) *Site Plan Approval Drainage Design Controls* – Section 30-23 of the City Zoning Ordinance establishes Site Plan review requirements that must include provisions for disposal of surface water drainage. In addition, several sections of the Zoning state that no surface water may discharge to adjacent properties or public ways.

j) *Open Space Districts* – Section 30-7 of the City Zoning Ordinance establishes Open Space/Recreation Districts to protect and preserve open space and natural resources such as aquifers and water resources.

k) *Stormwater Utility* – Section 29-80 of the City Ordinance establishes a sewer/stormwater use charge. Currently the stormwater fee is $25/residence per year and $150/business per year, but the city is revising the fee to be based upon impervious area. The revenue generated goes towards stormwater operation and maintenance, routine maintenance, and a stormwater engineer on staff.

l) *Open Space Initiatives* – Newton has protected open space and proactive land acquisition and preservation programs, including:

- The city already owns and has purchased numerous parcels for open space and recreation, and is currently investigating the acquisition of additional properties. The city recently purchased 24 acres of land at Kesseler Woods using CPA funds.
- The city adopted the Community Preservation Act with a 1% surcharge in 2001.

- The city's Community Preservation Committee is very active and helps decide key parcels for purchase or protection.

m) *Reviews and Inspections of New Developments* - City staff and boards provide drainage reviews and the Engineering Department inspects streets and drainage once construction is completed of a site.

n) *Public Education on Stormwater* – The city continues to implement its NPDES Phase II stormwater program that includes public education and participation programs. In addition, the city provides educational stormwater materials on the city's website.

o) NPDES Phase II Stormwater Program – The city continues to implement a very aggressive NPDES stormwater program that includes measures for public education and outreach, illicit discharge detection and elimination, construction and post-construction controls, and city-wide good housekeeping and stormwater maintenance procedures. There is also a webpage on the city's website dedicated to only stormwater matters.

p) *Stormwater/Environmental Engineer* – The city has an engineer on staff that is dedicated specifically for stormwater management projects, reviews, and NPDES implementation.

Site-Specific Flooding

City officials identified the following sites that have experienced the most significant flooding in the past. The numbers in parentheses refer to the Areas of Concern on Map 8 in Appendix A.

Old Farm Road (1)

The area of Old Farm Road, in the southeast part of the city near the border of West Roxbury, floods backyards and basements. The adjacent Sawmill Brook is undersized and has poor drainage. City officials state that sewerage is routinely pumped from this area to West Roxbury.

Existing Mitigation
A new sewer line is being installed in the area, but further mitigation is needed for drainage upgrades, including looking at the downstream side in West Roxbury.

Wayne Road (2)

This area in and around Wayne Road is near Old Farm Road in the Southeast, is connected to the same drainage system as Old Farm Road. This site is also near the border with West Roxbury and near 500-year floodplain of Sawmill Brook. Flooding occurs in residences, such as backyards and basements. Drainage upgrades are needed in general in order to handle the stormwater flows. Upgrades are also needed downstream to increase capacity.

Homer Street (3)

This area is in the middle of city near a small patch of 500-year flood plain just south of Bullough's Pond. City Hall and the Library are in this vicinity near Hull Street, and this whole area experiences flooding during heavy rainstorms. There is an issue with the capacity of the ponds. The city last dredged the ponds in 1992, but the area still experiences periodic flooding.

Existing Mitigation
Surveying and engineering work are currently underway to re-dredge the ponds in from of City Hall. Permitting and construction are expected to take place in the summer of 2011 and late fall of 2011, respectively. In addition, a project to remove excessive vegetation and hazardous trees from the banks of Coleman brook which cuts across the Library property will be complete by the end of 2010.

Albermarle Park (4)

Albermarle Park is located along Cheesecake Brook, which is a tributary to the Charles River. This area experiences flooding due to a capacity problem with the brook, which over time has become more of a channel. There is a need to restore the channel, as it has deteriorated and the pedestrian bridges need to be replaced.

Quinobequin Road (5)

Quinobequin Road, located in the western part of the city directly abutting the Charles River, experiences roadway flooding and may experience flooding in backyards. This area is located in and near the 100-year flood plain of the Charles River.

Existing Mitigation
A new drainage pipe was installed to help alleviate flooding in the area. The mitigation helped remove flooding from yards, but flooding still occurs on the road.

Lyons Field (6)

Lyons Field in the northwest portion of the city, adjacent to inlets of the Charles River and associated 100-year flood plain, experiences flooding during heavy rainstorms.

Route 9 and Parker Street (7)

This area of Route 9 near Parker Street is a significant hazard area when it floods. This is a highly urbanized and heavily traveled area that floods during heavy rainstorms. Poor drainage under the Route 9 overpass can stop traffic, including the potential to stop emergency vehicles.

Tanglewood Road off of Florence Street (8)

This area just south of Route 9 toward the eastern part of city experiences periodic street flooding during heavy rain.

Sevland Road / Placid Road

Paul Brook merges into South Meadow Brook in this area.

Dams

According to data provided by the Massachusetts Department of Conservation and Recreation and city staff, the following dams are located in Newton. Where numbers are provided following the dam names, they correspond to the Critical Infrastructure ID number provided on maps 1-8 in Appendix A.

Newton Lower Falls Dam (152)

The Newton Lower Falls Dam, located on the Charles River in the western part of the city bordering Wellesley at the junction of Routes 95 and 16, and is downstream of the Newton Upper Falls and Cordingly Dams. This dam is owned the Commonwealth of Massachusetts Department of Conservation and Recreation, and is in fair condition.

Silk Mill Dam

The Silk Mill Dam is located on the Charles River, approximately 600 feet northwest of the Elliot Street bridge on the Newton / Needham line. The dam as the name suggests was built to support a textile mill and building located in Newton. The dam is in fair condition

Newton Upper Falls Dam (153)

The Newton Upper Falls Dam (Circular Dam and Right Circular Dam), located on the Charles River in the western part of the city bordering Wellesley and Needham near Route 9 and Ellis Street, is owned the Commonwealth of Massachusetts Department of Conservation and Recreation. This dam is in fair condition. City officials stated this dam would be of concern to Newton if it were to breach in Wellesley.

Cordingly Dam

The Cordingly Dam is located on the Charles River approximately 500 feet downstream of the Wales Street (Newton) / Walnut Street (Wellesley) bridge and directly behind an assisted living complex on Washington Street. It is located between the better known Upper Falls Circular Dam and the Lower Falls Dam. There is a footbridge that crosses the river at this location. A breach of this dam would likely only be problematic if it occurred simultaneously with the 1% annual chance (100-year) or larger flood event. This dam is in good condition.

Bullough's Pond Dam (154)

This dam is located on Bullough's Pond near the center of the city. Although the dam may not be an official dam as designated by the state, it is still considered critical infrastructure by the city.

Brae Burn Dam (155)

The Brae Burn Dam is located on a pond just north of the Brae Burn Country Club golf course in the northwest portion of the city. Although the dam may not be an official dam as designated by the state, it is still considered critical infrastructure by the city.

Other Dams

Other dams listed in the DCR dam database include:

- *Bleachery Dam* – Located on the Charles River, owned by the Commonwealth of Massachusetts Department of Conservation and Recreation (MA DCR), rated as low hazard risk.
- *Waban Hill Reservoir Dam* – Located at the Waban Hill Reservoir, owned by the MA DCR, rated as a high hazard, in fair condition.
- *Dudley Pond Dam* – Located at Dudley Pond, owned by the MA DCR.
- *The Nonantum Dam* – Located on the Charles River, owned by the MA DCR, rated as a low hazard risk.
- *Carlisle Street Dam* – Owned by Newton Community Development, rated as a low hazard risk.

Existing City-wide Mitigation for Dam Hazards

a) *DCR Dam Safety Regulations* – All dams are subject to the Division of Conservation and Recreation's dam safety regulations. The dams must be inspected regularly and reports filed with the DCR Office of Dam Safety.

b) *Permits Required for Construction* – State law requires a permit for the construction of any dam.

c) *Maintenance of City-Owned Dams* – All city-owned dams are routinely inspected and maintained.

Wind-Related Hazards

As shown in Map 5 in Appendix A, a category 3 hurricane tracked just northwest of Newton in 1869, a tropical storm tracked through Newton in 1861, and a category 1 tracked through the city in 1944. The hazard mapping also indicates that the 100-year wind speed is 110 miles per hour. No tornadoes have been recorded in the city, although one was recorded to the southwest in Wellesley.

Tree damage during high winds has the potential to be a hazard in Newton. Trees can knock out power lines and block major roadways, which hinders emergency response.

An issue during storms in Newton is the damage to power and phone wires from overhanging trees that have not been trimmed by electric, telephone or cable companies. An issue was raised in Newton as to whether the utility tree-pruning program actually helps to minimize utility wires damage. City officials are studying this issue in collaboration with local utility companies. The city's Parks and Recreation Department manages a program for city-owned property through an arborist in their Forestry Division.

Newton has reliable communications towers on Manet Road, Tower Road, Chestnut Street, Sawmill Brook Parkway, and at the fire and police headquarters buildings. City officials stated that their communications systems are not at risk during high wind events, however, the towers located on Tower Road and Chestnut Street are hazardous when ice falls from the towers. To mitigate this the city installs police caution tape and safety barricades in the vicinity.

The city of Newton makes every effort to mitigate against damage due to high winds. Some of the specific actions are provided below.

Existing City-wide Mitigation for Wind-Related Hazards

a) *Tree Maintenance by NSTAR* – NSTAR trims trees along the power lines for preventative maintenance.

b) *Tree Maintenance by the City* – The city has an arborist through its Forestry Division that manages a program that maintains street trees and numerous trees on public property.

c) *Urban Tree Commission* – Chapter 21, Article III of the City Ordinance establishes an urban tree commission to advise the tree warden, the mayor, the board of aldermen and the general public on all matters concerning public trees, including but not limited to, the selection of trees for planting, planting and pruning of trees, the treatment of disease, and the preservation and regular maintenance of trees.

d) *Tree Inventory* – As part of its tree management program, the city has developed and maintains a tree inventory.

e) *Task Force on Undergrounding Utilities* – In 2005, the mayor established a task force to investigate the feasibility of installing utilities in the city underground. The Task Force examined the financial, technical and policy feasibility of undergrounding utility cables and prioritized certain locations that should be addressed first. The costs to install utilities from overhead to underground are somewhat prohibitive, and the city would need to secure funding.

f) *Stable Communications System* – Newton does have reliable communications towers on Manet Road, Tower Road, Chestnut Street, Sawmill Brook

Parkway, and at the fire and police headquarters buildings. None of these towers are generally considered vulnerable in the event of high winds.

g) *Backup Generators at City Facilities* – In the event of power outages due to downed limbs and power lines, the city does have backup generators for most of its critical city buildings and other facilities. One exception is the Police Annex building and the Public Works Utilities building, but portable generators can be moved to these locations if necessary.

Winter-Related Hazards

Map 6 in Appendix A indicates that the average annual average snowfall in Newton is between 48.1 inches to 72 inches. The city provides standard snow plowing operations, and clearing snow has not posed any significant challenges. The city does have a policy to have the roads completely cleared of snow and ice within 8 hours after a storm.

Other winter issues include ice storms that can affect utilities and cause isolated power outages.

The city of Newton currently employs a number of measures to mitigate for winter storm events. These are described below.

Existing City-wide Mitigation for Winter-Related Hazards

a) *Snow Plowing Operations* – The Public Works Department provides standard snow plowing operations. Sand is not used, only salt. The city clears most sidewalks and nearly all streets.

b) *Overnight Parking Ban* – The City of Newton has an overnight parking ban on the street each year from November 15th to April 15th.

c) *Tree Maintenance* by the City and NSTAR– Both the city and NSTAR provide tree trimming and removal in order to prevent limbs from coming down during heavy and wet snow events (See more detailed description above under the Wind section).

h) *Backup Generators at City Facilities* – In the event of power outages due to downed limbs and power lines, the city does have backup generators for most of its critical city buildings and other facilities. One exception is the Police Annex building and the Public Works Utilities building, but portable generators can be moved to these locations if necessary.

d) *Public Education* – Winter emergency information is available on websites for the city and public schools. School closings are announced via a recorded call-in telephone message line and via local media.

e) *Snow Removal Requirements in the City Ordinance* – Sections 26-8 and 26-9 of the City Ordinance have substantial requirements for both private

landowners and city property for removal of snow from sidewalks or other public ways. In addition, no person shall put snow that will block any public ways. The city's ordinance also states the Commissioner of Public Works is authorized to establish parking prohibitions if cars would obstruct snow removal.

Fire-Related Hazards

The Newton Fire Department responds to several brush fires annually, but the fires have not resulted in major property damage or injuries. Causes of brush fires may be related to juvenile activity. Wooded and conservation areas in the city have a greater brush fire risk, and in some cases there may be large seasonal brush fires. Brush fires in conservation area sites are difficult to fight, as there is limited firefighting and emergency vehicle access.

Another issue of concern is brush fires caused by sparking or friction from the commuter rail trains and trolley lines managed by CSX and the MBTA. Routine preventative maintenance including trimming away vegetation along rail lines and tracks may help alleviate this problem.

City officials also noted that general public education for school children on fire prevention has not been very well funded of late. There is a real need to fund these types of educational school programs.

City officials also noted the need for inflatable type equipment in the event of a water rescue required on sites such as the Charles River or Crystal Lake.

City officials identified the following sites as having a high brush fire risk. The numbers in parentheses refer to the Areas of Concern on Map 8 in Appendix A.

Hammond Pond Woods (9)

The Hammond Pond Woods conservation area in the eastern portion of the city north of Route 9 has a higher risk of brush fires, and in some cases will experience seasonally large brush fires. According to city officials, this area and other conservation area sites do not have good firefighting and emergency vehicle access.

Newton/Needham Line (10)

This area of higher brush fire risk is located in the very southern part of the city along the Charles River bordering Needham, MA, near Cutler Park. Street access to this conservation land is primarily from Nahanton Street and Wells Avenue in Newton.

Uninproved Fields Bordering West Roxbury Cemeteries (11)

This area of a higher brush fire risk is in the southern part of the city near the border with West Roxbury, near the Holyhood and Mt. Lebanon cemeteries.

The city of Newton employs a number of measures to mitigate for brush fires. Several of these measures are described below.

Existing City-wide Mitigation for Fire-Related Hazards

a) *Open Burning Permits Required* – The city allows controlled open burning in accordance with state regulations, but a permit is required from the Fire Department for each day of intended burning. Burning is only allowed during the burning season, typically January through April each year.

b) *Public Education* – The Fire Department provides most substantial public education on fire prevention on the city's website.

c) *Fire Department Review of Proposed Developments* – The Fire department reviews all subdivision and site plans for compliance with site access, water supply needs, and all other applicable regulations.

d) *Backup Firefighting Water Supplies* – The city has several surface water bodies that can be used for backup firefighting water supplies. However, access to these rivers, streams, and ponds can often be difficult.

e) *Statewide Fire Mobilization Plan* – The state has a fire mobilization plan for wildland fires, as well as a separate plan for Newton's fire district.

Geologic Hazards

Earthquakes

Most municipal officials acknowledged that earthquakes were the hazard for which their community was least prepared. There have been no recorded earthquake epicenters within Newton. If an earthquake hits, the entire region, not just the city, would face significant challenges. Earthquakes often trigger fires. The water distribution system may be disrupted, thus posing a risk for public health and fighting the fires.

Although new construction under the most recent building codes generally will be built to seismic standards, much of the development in the city predates the most recent building code.

Existing City-wide Mitigation for Earthquake Hazards

a) *Backup Firefighting Water Supplies* – The city has several surface water bodies that can be used for backup firefighting water supplies. However, access to these rivers, streams and ponds can often be difficult, particularly in the event of an earthquake.

b) *Shelters and Backup Facilities* – The city does have designated shelters and backup facilities (see multi-hazard mitigation below).

c) *Evacuation Plan* – The city does have an evacuation plan as specified in its Comprehensive Emergency Management Plan (CEMP).

Landslides

Map 4 in Appendix A indicates that all of Newton is classified as having a low risk for landslides. Local officials state that landslides are not a major threat or occurrence in Newton. Rather, there are localized issues of erosion during construction, as a result of development, or as a result of clearing vegetation.

Existing City-wide Mitigation for Landslide Hazards

a) *Subdivision Road Maximum Slopes* – The Planning Board Rules and Regulations for Subdivisions have maximum slope requirements for new roads.

b) *Slope Stabilization Requirements* – The Planning Board Rules and Regulations for Subdivisions have requirements for slope maximums and slope stabilization.

c) *Erosion and Sediment Controls in Zoning* – Chapter 30 of the City Ordinance (Zoning) has requirements for erosion and sediment controls in several districts.

Existing Multi-Hazard Mitigation Measures

The city of Newton has several mitigation measures in place that address more than one hazard. The city is well equipped to deal effectively on a wide range of hazards.

The following describes the existing measures in place that address multiple hazards:

Existing City-wide Mitigation for Multiple Hazards

a) *Multi-Department Review of Developments* – Multiple departments, such as Planning, Zoning, Health, Public Works, Engineering, Fire, Police, and Conservation, review all subdivision and site plans prior to approval.

b) *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. The CEMP is available online through secure access for city personnel.

c) *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.

d) *Newton Local Emergency Planning Committee (LEPC)* – The LEPC is chaired by the Newton Fire Department. Recurring meetings are attended by government officials and non-government organizations (NGOs).

e) *Newton Emergency Management Working Group* – Meetings are chaired by the community's Emergency Management Director. Municipal and private officials collaborate on the development of local emergency management policies and procedures, along with tabletop exercises, drills and field exercises.

f) *Public Education* – Substantial Emergency Preparedness public education is available on the Fire and Police Department websites, accessible via the city's website. Newton emergency management officials attend numerous community group and NGO meetings. Safety campaigns and health clinics are run throughout the year.

g) Emergency Communications – In emergencies the city is capable of deploying rapid emergency communications with residents and business owners and using state-of-the-art mapping technology as a result of their subscription to CodeRED, a reverse 9-1-1 system.

h) *Schools as Emergency Shelters* – Newton North High School and the Charles Brown Middle School serve as primary city shelters in the event of

emergencies. Each school contains backup emergency power and is approved to host shelter operations by the American Red Cross.

i) *Generators at City Buildings* – Most of the critical city buildings and facilities have backup generators. The only exception is the Police Annex and Utilities buildings, but portable emergency generators can be moved to these locations if necessary.

j) *Medical Reserve Corps Volunteers* – Newton has a volunteer program run through the Department of Health and Human Services, where residents can help provide critical services during emergency situations.

k) *Volunteers in Police Service (VIPS)* – The Newton Police Department runs an Auxiliary Police program that is capable of deploying 40-50 additional emergency first responders in the city during critical incidents or other emergencies.

l) *Outreach to Residents for Emergency Preparedness* – The city has brochures available on the city and police websites for emergency preparedness. These websites also host a document entitled "City of Newton Citizen's Guide to Emergency Preparedness." It provides guidance on emergency supplies, shelters, sheltering in place, and emergency evacuations.

m) *FEMA Deployment* –FEMA can deploy vehicles in the event of an emergency.

An important issue related to interoperable communications is the need for Public Works to have a backup high band radio communications system. Currently they only operate Nextel portable telephones. A new high band radio communications system could cost in the range of $500,000.

Compilation of Existing Mitigation

The following table summarizes the many existing natural hazard mitigation measures already in place in Newton. Because of the number of entities, public and private, involved in natural hazard mitigation, it is likely that this list is a starting point for a more comprehensive inventory of all measures. Please note that the numbers shown in parentheses correspond to the Hazard Areas of Concern included on the maps in Appendix A.

Table 14: Existing Natural Hazard Mitigation Measures in Newton

Hazard	Area	Mitigation Measure
Flood-Related	City-Wide	A) The city participates in the National Flood Insurance Program and has adopted the effective FIRM maps. The city actively enforces the floodplain regulations. B) Stormwater System and Outfalls Mapped in GIS C) Drainage System Maintenance D) On-going Drainage Improvement Program E) Floodplain/Watershed Protection District F) Wetland Protection Act and Regulations G) Massachusetts Stormwater Regulations H) Subdivision Development Drainage Design Controls I) Site Plan Approval Drainage Design Controls J) Open Space Districts K) Stormwater Utility L) Open Space Initiatives: • Open Space parcels purchase by city • Community Preservation Act • Community Preservation Committee M) Reviews and Inspections of New Developments N) Public Education on Stormwater O) NPDES Phase II Stormwater Program P) Stormwater / Environmental Engineer
	Old Farm Road (1)	Sewer line recently installed
	Quinobequin Road (5)	New drainage pipe installed to alleviate flooding
Dams	City-Wide	A) DCR Dam Safety Regulations B) Construction Permits Required
Wind-Related	City-Wide	A) Tree Maintenance by NSTAR B) Tree Maintenance by the City C) Urban Tree Commission D) Tree Inventory E) Task Force on Undergrounding Utilities F) Stable Communications Systems G) Backup Generators at City Facilities

Table 14: Existing Natural Hazard Mitigation Measures in Newton

Hazard	Area	Mitigation Measure
Winter-Related	City-Wide	A) Snow-Plowing Operations B) Overnight Parking Ban C) Tree Maintenance by the City and NSTAR D) Backup Generators at City Facilities E) Public Education F) Snow Removal Requirements in the City Ordinance
Fire-Related	City-Wide	A) Open Burning Permits Required B) Public Education C) Fire Department Review of Proposed Developments D) Backup Firefighting Water Supplies E) Statewide Fire Mobilization Plan
Geologic – *Earthquake*	City-Wide	A) Backup Firefighting Water Supplies B) Shelters and Backup Facilities C) Evacuation Plan
Geologic – *Landslides*	City-Wide	A) Subdivision Road Maximum Slopes B) Slope Stabilization Requirements C) Erosion and Sediment Controls in Zoning
Multi-Hazard	City-Wide	A) Multi-Department Review of Developments B) Comprehensive Emergency Management Plan (CEMP) C) Enforcement of State Building Code D) Local Emergency Management Planning Committee (LEPC) E) Emergency Management Working Group F) Public Education G) Schools as Emergency Shelters H) Generators at City Facilities I) CodeRED Emergency Communications System J) Medical Reserve Corp Volunteers K) Volunteers in Police Service (VIPS) L) Outreach to Residents for Emergency Preparedness M) FEMA Deployment

[This page intentionall left blank]

VI. HAZARD MITIGATION GOALS AND OBJECTIVES

The Newton Local Multiple Hazard Community Planning Team endorsed the following eight hazard mitigation goals at its September 29, 2009 team meeting:

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

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

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

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

5. Encourage the business community, major institutions, and non-profits to work with the City to develop, review, and implement the hazard mitigation plan.

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

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

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

[This page intentionally left blank]

VII. POTENTIAL MITIGATION MEASURES

What is Hazard Mitigation?

Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries, and property damage 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 (HMGP), the Pre-Disaster Mitigation program (PDM), and the Flood Mitigation Assistance (FMA) program. Please see http://www.fema.gov/government/grant/government.shtm for more information.

Identification and Prioritization of Potential Mitigation Measures

During the local hazard mitigation team meetings, officials in Newton determined possible mitigation measures for the various natural hazards that have impacted or could impact the city. In addition, MAPC solicited suggestions for mitigation measures when it collected hazard information from city officials and from other city plans and studies. MAPC compiled all suggested strategies into a matrix.

MAPC staff attended the FEMA Benefit-Cost Analysis Training Course on October 31-November 1, 2005 and on November 15, 2007. Information from this training was shared with local officials in order to help them understand the role of a benefit/cost analysis in developing and evaluating potential mitigation projects.

Local officials then prioritized the measures using the matrix. Prior to choosing priorities, participants reviewed the project Goals and STAPLEE evaluation considerations, such as:

- The number of homes and businesses affected by the hazard
- Whether or not road closures occurred, and what impact closures had on delivery of emergency services and the local economy
- Whether any environmental constraints existed
- Is there political support and public support to implement the mitigation measures?
- Can the city provide the necessary maintenance when the mitigation measure is completed?
- Does the cost seem reasonable when considering the size of the problem and likely benefits from mitigation?

The breakdown of high and medium priority measures, along with any other possible measures, is provided in the discussions below. The priority "NFIP" refers to potential mitigation measures that would ensure continued compliance with the National Flood Insurance Program.

High Priority Mitigation Measures

A) High Band Radio Communication System for Public Works

One important issue related to communications is the need for Public Works to have a high band radio communication system. Currently they only have Nextel service, and no back up communications system. The cost of a high band radio communication system could be in the range of $500,000.

B) Channel and Bridge Upgrades at Albermarle Park

Albermarle Park is located along Cheesecake Brook, which is a tributary to the Charles River. This area experiences flooding due to a capacity problem with the brook, which over time has become more of a channel. There is a need to restore the channel, as it has deteriorated and the pedestrian bridges need to be replaced. This work should be performed in close coordination with the Conservation Commission.

C) Repair to Culvert on Needham Street

City officials noted the need to replace a culvert on Needham Street. There is a need to replace one of the culvert walls and the grate has broken off. The grate has been temporarily welded, but it needs a permanent fix.

D) Drainage System Upgrades at Old Farm Road and Wayne Road

The area of Old Farm Road and Wayne Road in the southeast part of the city near the border of West Roxbury has flooded backyards and basements during heavy rain events. These two areas are connected by the same drainage system. The adjacent Sawmill Brook is undersized and has poor drainage. A new sewer line is being installed in the area, but further mitigation is needed for drainage upgrades in order to handle the stormwater flows. Upgrades are also needed downstream to increase capacity, which would include looking at the downstream side in West Roxbury.

E) Drainage Study and Upgrades along Route 9 near Parker Street

The area of Route 9 near Parker Street is a significant hazard area when it floods. The neighborhood is a highly urbanized and heavily traveled area that floods during heavy rainstorms. Poor drainage on Route 9 under the Parker Street bridge can stop traffic, including the potential to stop emergency vehicles. This site warrants a drainage study and potential upgrades to help alleviate the problem. The Massachusetts Highway Division owns this portion of the roadway.

Medium Priority Mitigation Measures

F) Youth Education on Brush Fire Prevention

City officials also noted that public education for school children on fire prevention has not been as well funded as it has been in the past, and that there is a need to increase the school programs.

G) Water Rescue Equipment

City officials also noted the need for inflatable type of equipment in the event of a water rescue, such as at the Charles River or Crystal Lake.

H) Further Investigate Feasibility of Underground Utilities

In 2005, the mayor established a task force to investigate the feasibility of installing utilities in the city underground. The Task Force examined the financial, technical and policy feasibility of undergrounding utility cables and prioritized certain locations that should be addressed first. The costs to install utilities from overhead to underground are somewhat prohibitive, and the city would need to secure funding. The city may want to revisit the issue and come up with a revised long-term plan for installing the utilities underground that takes into account safety and not only aesthetics.

I) Continuation of Open Space Protection and Land Acquisition

Although Newton is generally built-out and has a significant amount of protected land, further protection of open space in the wake of development is important in order to ensure future development does not increase vulnerability to natural hazards, such as flooding. The city should continue its efforts for open space protection and purchases.

Other Potential Mitigation Measures

A number of additional side issues arose during the course of the project. These issues require more discussion between or among internal city departments/agencies. It is well worth documenting these issues as they evolve into medium or high priority issues in the future.

J) Evaluation of the Circular Dam/Right Circular Dams and Bathymetric Study of the Charles River

These dams are owned by the Dept. of Conservation and Recreation. The city would like to see these dams studied to evaluate their condition and assess if any repairs are needed. Also in this area of the Charles River, the city would like to see a bathymetric study and hydraulic modeling to determine if siltation is increasing lateral flooding in Newton.

K) Continuation of Ongoing Replacement of Drainage Pipes and Outdated Infrastructure

The city should continue to monitor and alleviate localized flooding problems with culvert or drainage infrastructure upgrades, as it has done successfully in the past.

L) Provide Public Information on NFIP Compliance

The city can distribute and make available information on the National Flood Insurance Program including information on insurance and building code requirements through explanatory pamphlets, booklets and on-line resources.

M) Evaluate Emergency Access to Conservation Areas

Newton is home to several forested and vegetated conservation areas that pose a risk for brush fires. Hammond Pond Woods is an example of a conservation area with an increased fire hazard. City officials are continuing discussions on how to improve firefighting and emergency vehicle access to these remote sites.

Measures to Ensure Continued Compliance with National Flood Insurance Program (NFIP) Requirements

From the proposed mitigation above, several measures also fall into the category of those that ensure continued compliance with National Flood Insurance Program (NFIP) requirements. Those measures include (see previous sections for further detail on each):

(I) Continuation of Open Space Protection and Land Acquisition
(M) Provide Public Information on NFIP Compliance

Potential Mitigation Summary Table

The following columns are included in the summary table:

Description of the Mitigation Measure – Brief description of each mitigation measure:

Priority – The designation of high, medium, or other priority was determined by the Local Multiple Hazard Community Planning Team meeting. In determining project priorities, the local team considered potential benefits and project costs. The priority "NFIP" refers to potential mitigation measures that would ensure continued compliance with the National Flood Insurance Program. The designations could change as conditions in the community change.

Lead Implementation – MAPC designated implementation responsibility based on general knowledge of the community. 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. In some cases, a non-local entity would ideally be the lead implementer.

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. The identification of a likely time frame is not meant to constrain a community from taking advantage of funding opportunities as they arise. "Short-term" is an item that generally would not take more than a year or two to complete, and could conceivably occur within the 5 years of this plan. "Long-term" is a project that will could take more than one to two years to complete, and may not be completed within the five years of this plan.

Estimated Cost – The cost data are estimates that 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. Cost information is approximate only, and is either provided by the community or from MAPC staff experience.

Potential Funding Sources – This column attempts to identify possible sources of funding for a specific measure. This information is preliminary and varies depending on a number of factors such as whether a mitigation measure has been studied, evaluated, or designed or is still in the conceptual stages. 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.

The best way to determine eligibility for a particular funding source is to review the project with 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 for a number of types of projects including shoreline/stream bank protection, flood damage reduction, flood plain management services and planning services.

FEMA – See http://www.fema.gov/government/grant/government.shtm for more information as noted earlier.

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

Table 15: Potential Mitigation Measures in Newton

Mitigation Measure	Priority	Lead Implementation	Time Frame	Estimated Cost Range	Potential Funding Sources
A. High Band Radio Communication System for Public Works	High	Public Works	1-3 years	$500,000	City, Public Safety Grants
B. Channel and Bridge Upgrades at Albermarle Park	High	Public Works	1-3 years	Varies significantly based on staff time and materials	City, FEMA, ACOE
C. Repair to Culvert on Needham Street	High	Public Works	1-3 years	Varies Significantly based on staff time and materials	City, FEMA, ACOE

Mitigation Measure	Priority	Lead Implementation	Time Frame	Estimated Cost Range	Potential Funding Sources
D. Drainage System Upgrades at Old Farm Road and *Wayne Road*	High	Public Works	3-5 years	Varies Significantly based on staff time and materials	City, FEMA, ACOE
E. Drainage Study and Upgrades along Route 9 near Parker Street	High	Public Works, State Highway	3-5 years	Varies Significantly based on consultant time, staff time, and materials	City, FEMA, ACOE
F. Youth Education on Brush Fire Prevention	Medium	Fire Department	1-3 years	Varies from City Staff Time to $2-$15k for a consultant and materials	City, Public Safety Grants
G. Water Rescue Equipment	Medium	Fire Department	1-3 years	Varies, up to $50,000	City, Public Safety Grants
H. Further Investigate Feasibility of Underground Utilities	Medium	Mayor's Office, Public Works	1-3 years (for revisiting the study), 3-5 years (for Implementation)	City Staff Time (for the study)	City
I. Continuation of Open Space Protection and Land Acquisition	Medium & NFIP	Conservation, Planning	1-5 years	Varies from city staff time to up to $1m or more to purchase land	City, Community Preservation Act Funds, Gifts

Mitigation Measure	Priority	Lead Implementation	Time Frame	Estimated Cost Range	Potential Funding Sources
Evaluate the Circular Dam, Right Circular Dam, and Perform Bathymetric study of the Charles River	Other	Conservation, DCR	3-5 years	TBD	City of Newton DCR
Continuation of Ongoing Replacement of Drainage Pipes and Outdated Infrastructure	Other	Public Works	3-5 years	City staff time and material costs vary	City, FEMA, ACOE
J. Provide Public Information on NFIP Compliance	Other & NFIP	Planning/ Public Works	1-5 years	City staff time and material costs vary	City
Evaluate Emergency Access to Conservation Areas	Other	Conservation, Fire Dept.	1-3 years	TBD	City of Newton

Abbreviations Summary

FEMA Mitigation Grants:

FMA	Flood Mitigation Assistance Program
HMGP	Hazard Mitigation Grant Program
PDM	Pre-Disaster Mitigation Program
RFC	Repetitive Flood Claims
SRL	Severe Repetitive Loss

Other Potential Funding Sources:

ACOE	Army Corps of Engineers.
CMRP	Commonwealth of Massachusetts Riverways Program
DCR	Department of Conservation and Recreation
DEP	Massachusetts Department of Environmental Protection
	(SRF) Clean Water State Revolving Fund
	(NPS) Nonpoint Source Grant Program
DHS	Department of Homeland Security/Emergency Operations
EEA	Massachusetts Executive Office of Energy and Environmental Affairs
EOT	Executive Office of Transportation
MET	Massachusetts Environmental Trust
MHD	Massachusetts Highway Department.
USDA	United States Department of Agriculture

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

Regional Partners

In many communities, mitigating natural hazards is more than a local issue. The facilities that serve these communities are complex systems owned and operated by a wide array of agencies, government, and private entities. The planning, construction, operations, and maintenance of these facilities are integral to the 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 Facilities within Newton

Major facilities owned, operated and maintained by federal, state, regional or private entities in Newton include Interstate-90 (Massachusetts Turnpike Authority); Routes 9, 16, 30, 95 and 128 (MassHighway); the Massachusetts Bay Transportation Authority (MBTA) Bus Routes, Green Line Subway, and Commuter Rail; Newton-Wellesley Hospital, Massachusetts Water Resources Authority (MWRA) potable water distribution pipes; and the Algonquin Gas pipeline owned and managed by Spectra Energy.

Inter-Community Considerations

Mitigation measures for the following regional issues should be taken into account as Newton develops it own local plan:

A) Better Coordination Between City and Local Utility Companies on Tree Trimming Operations

A problem was identified during storms in Newton involving damage to power and phone wires from overhanging trees that have not been trimmed by electric, telephone or cable companies. The issue was raised in Newton as to whether the utility tree-pruning program actually helps to minimize utility wires damage. City officials are studying this issue in collaboration with local utility companies. The city's Parks and

Recreation Department manages a program for city-owned property through an arborist in their Forestry Division.

B) Coordination and Review of Developments on a Regional Basis

As Newton and the surrounding communities are undergoing development, it is vital that these communities communicate and provide input during the review processes. When addressing housing, transportation, and economic development projects, the impacts to neighbors must be addressed.

C) MBTA Rail and Trolley Vegetation Maintenance

Another issue of concern is brush fires caused by sparking or friction from the commuter rail trains and trolleys. Trimming vegetation along Green Line tracks and other rail lines might help alleviate this problem. This requires coordination with the MBTA.

D) Coordination with Boston for Increased Drainage Capacity Downstream of Old Farm and Wayne Roads

The area of Old Farm Road and Wayne Road in the southeast part of the city near the border of West Roxbury has flooded backyards and basements during heavy rain events. These two areas are connected by the same drainage system. The adjacent Sawmill Brook is undersized and has poor drainage. A new sewer line is being installed in the area, but further mitigation is needed for drainage upgrades in order to handle the stormwater flows. Upgrades are also needed downstream to increase capacity, which would include coordinating this effort with West Roxbury.

IX. PLAN ADOPTION AND MAINTENANCE

Plan Adoption

The Newton Hazard Mitigation Plan was adopted by the City on [ADD DATE]. See Appendix D for documentation. The plan was approved by FEMA on [ADD DATE] for a five-year period that will expire on [ADD DATE].

Plan Maintenance

MAPC worked with the Newton Hazard Mitigation Planning Team to prepare this plan. This group will continue to meet on an as-needed basis to function as the Local Hazard Mitigation Implementation Group, with one city 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 Hazard Mitigation Implementation Team will prepare and distribute a biannual survey in years two and four of the plan. The survey will be distributed to all of the local implementation group members and other interested local stakeholders. The survey will poll the members on any changes or revisions to the plan that may be needed, progress and accomplishments for implementation, and any new hazards or problem areas that have been identified.

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

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

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

At this point, the Hazard Mitigation Implementation Team may decide to undertake the update on their own, contract with the Metropolitan Area Planning Council to update the plan, or hire another consultant. No matter how the Hazard Mitigation Implementation Team decides to update the plan, the team will need to review the current FEMA hazard mitigation plan guidelines for changes. The update of the Newton Hazard Mitigation Plan will be forwarded to MEMA and DCR for review, and then to FEMA for approval.

Integration of the Plans with Other Planning Initiatives

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

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

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

X. RESOURCES

City of Newton, Massachusetts. *Citizen's Guide to Emergency Preparedness.* Obtained from http://www.newtonpolice.com.

City of Newton, Massachusetts. *Comprehensive Emergency Management Plan.*

City of Newton, Massachusetts. *Newton Comprehensive Plan.* Prepared by the Mayor's Comprehensive Plan Advisory Committee. November 19, 2007.

City of Newton, Massachusetts. *Ordinances of the City of Newton.* Amended through October 30, 2009.

City of Newton, Massachusetts. *Personal Communication with Local Multiple Hazard Community Planning Team.* September 29, 2009.

City of Newton, Massachusetts. *Rules and Regulations of the Planning Board Acting as a Board of Survey.* Amended through July 1997.

City of Newton, Massachusetts. *Website www.ci.newton.ma.us.*

Commonwealth of Massachusetts, *Community Profile Website (DHCD). http://www.mass.gov/?pageID=mg2terminal&L=3&L0=Home&L1=State%20Government&L2=Local%20Government&sid=massgov2&b=terminalcontent&f=cc_landing&csid=massgov2*

Commonwealth of Massachusetts. *McConnell Land Use Statistics*. 1999.

Commonwealth of Massachusetts. *State Hazard Mitigation Plan*. October 2007. Prepared by the Massachusetts Emergency Management Agency and the Massachusetts Department of Conservation and Recreation.

Federal Emergency Management Agency. *Mitigation Planning Workshop for Local Governments, Student Manual.* May 2004.

Federal Emergency Management Agency. *State and Local Mitigation Planning How-to Guide, Understanding Your Risks: Identifying Hazards and Estimating Losses*. August 2001.

Federal Emergency Management Agency. *Website www.fema.gov.*

Massachusetts Executive Office of Environmental Affairs. *Build out Analysis for Newton, MA.* 2000. Prepared by the Metropolitan Area Planning Council.

United States Environmental Protection Agency. *NPDES Phase II Small MS4 General Permit Annual Report*. Reporting Period April 2008 – April 2009. Prepared by the City of Newton Department of Public Works.

United States Census Bureau. *United States Census*. 2000.

APPENDIX A: NATURAL HAZARDS MAPS

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

Map1: 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 city 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 much more detail at this website http://www.fema.gov/fhm/fq_term.shtm. The flood zone map for each community also shows repetitive loss sites, critical infrastructure and municipally owned and protected open space. 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/nfip/replps.shtm.

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

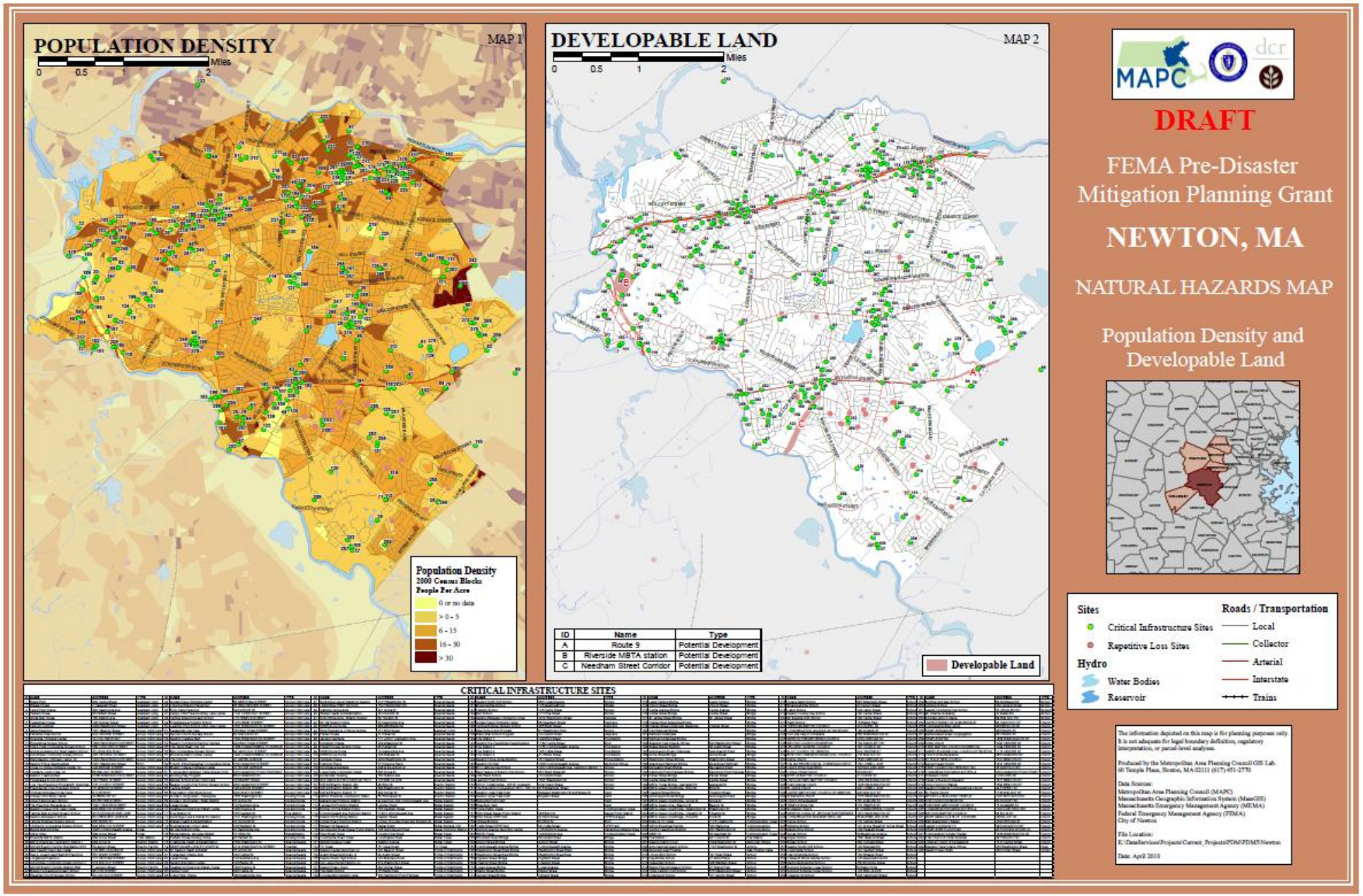
The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to http://pubs.usgs.gov/pp/p1183/pp1183.html.

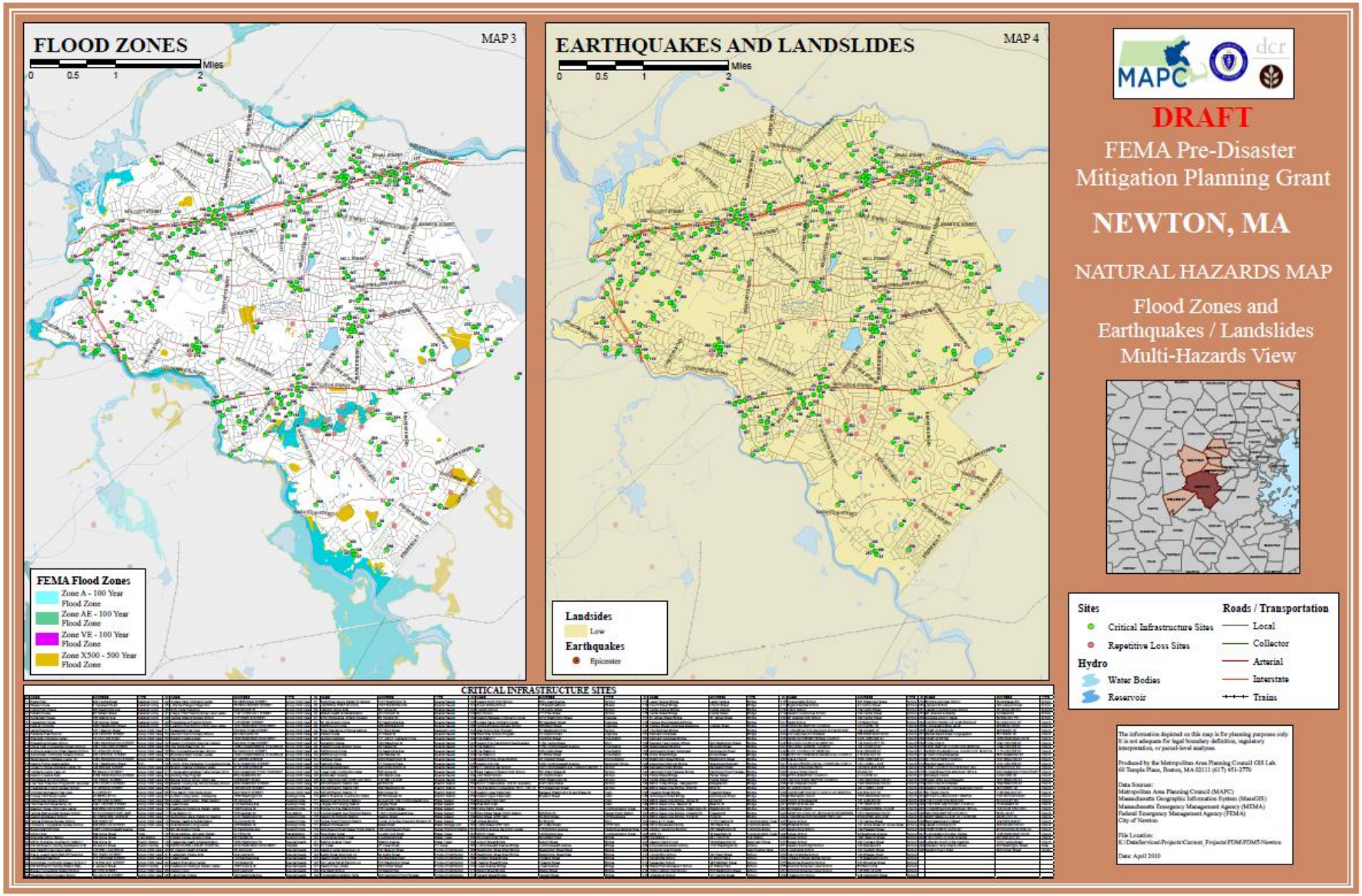
Map 5: Hurricanes and Tornadoes – This map shows a number of different items. The map includes the storm tracks for both hurricanes and tropical storms. This information must be viewed in context. A storm track only shows where the eye of the storm passed through. In most cases, the effects of the wind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

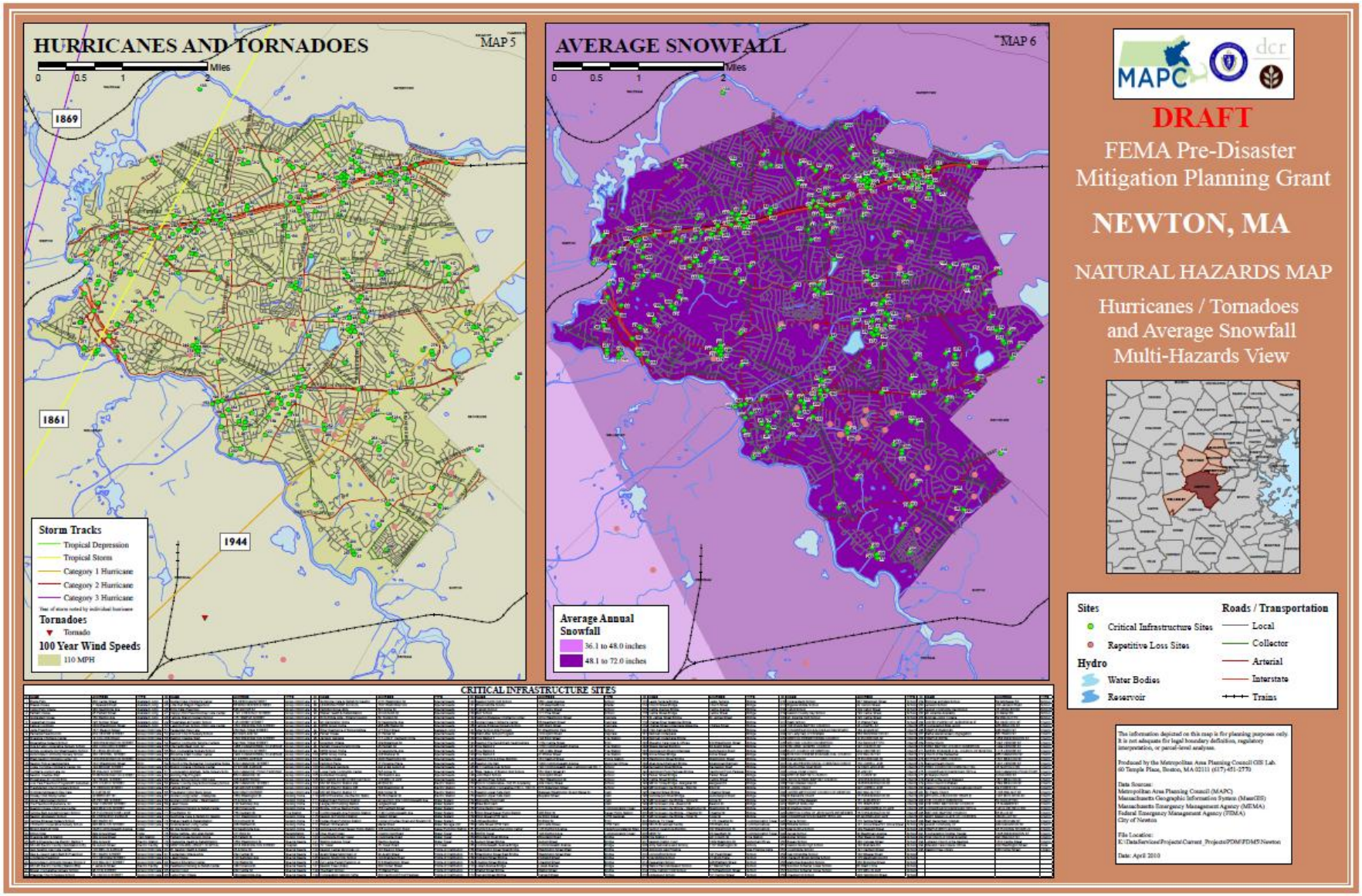
Map 6: Average Snowfall – This map shows the average snowfall, repetitive loss structures and open space. It also shows storm tracks for nor'easters, if any storms tracked through the community.

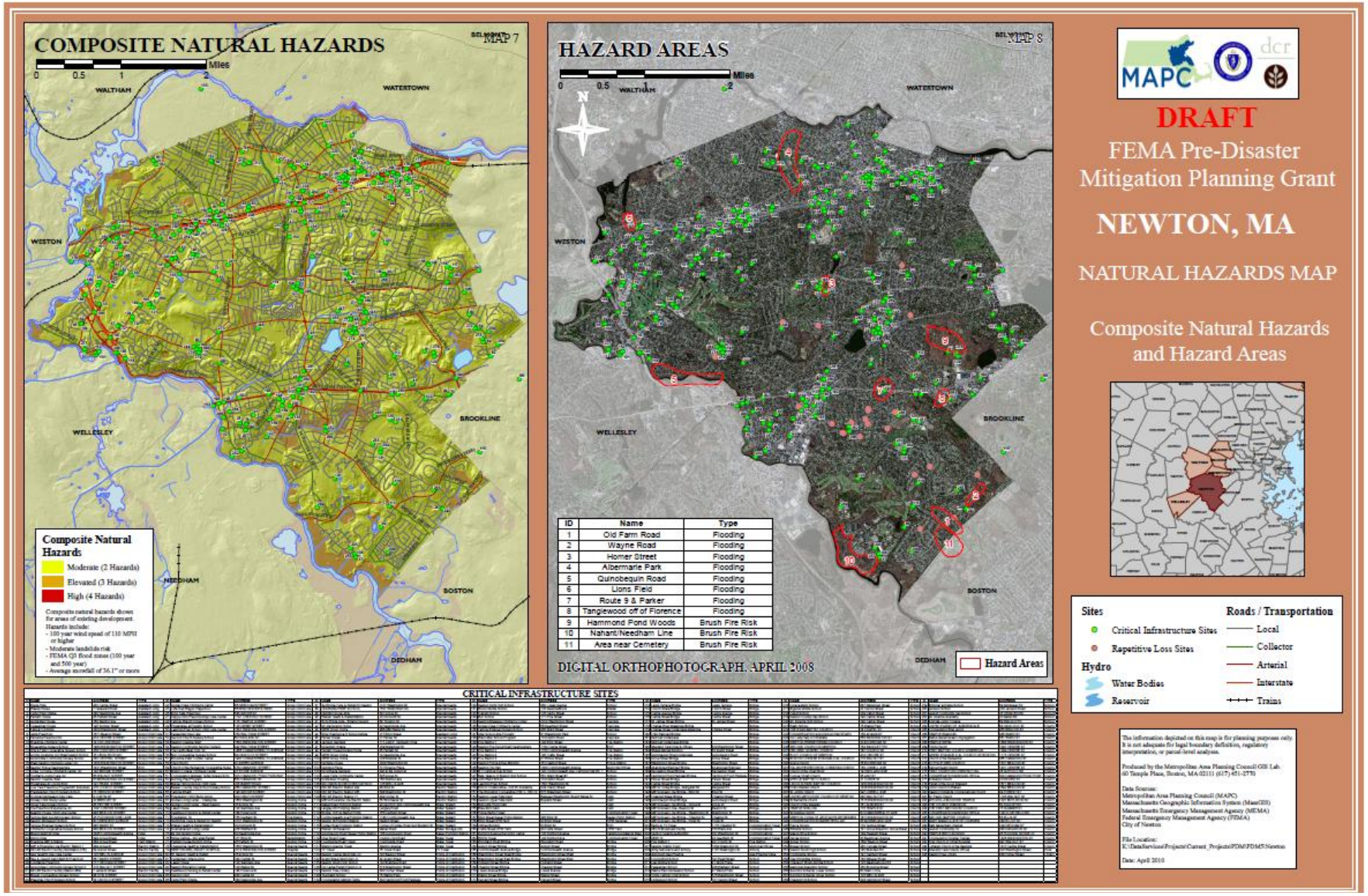
Map 7: Composite Natural Hazards - This map shows four categories of composite natural hazards for areas of existing development. The hazards included in this map are 100-year wind speeds of 110 mph or higher, low and moderate landslide risk, FEMA Q3 flood zones (100 year and 500 year) and hurricane 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 2005. The critical infrastructure sites and repetitive loss sites are also shown. The source of the aerial photograph is Mass GIS.


POPULATION DENSITY
MAP 1
Miles
0 0.5 1 2
Population Density
2000 Census Blocks
People Per Acre
0 or no data
> 0 - 5
6 - 15
16 - 30
> 30
DEVELOPABLE LAND
MAP 2
Miles
0 0.5 1 2
ID Name Type
A Route 9 Potential Development
B Riverside MBTA station Potential Development
C Needham Street Corridor Potential Development
Developable Land
CRITICAL INFRASTRUCTURE SITES
MAPC
dcr
DRAFT
FEMA Pre-Disaster Mitigation Planning Grant
NEWTON, MA
NATURAL HAZARDS MAP
Population Density and Developable Land
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
Produced by the Metropolitan Area Planning Council GIS Lab.
60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
City of Newton
File Location:
K:\DataServices\Projects\Current_Projects\PDM\PDM5\Newton
Date: April 2010


FLOOD ZONES
MAP 3
Miles
0 0.5 1 2
FEMA Flood Zones
Zone A - 100 Year Flood Zone
Zone AE - 100 Year Flood Zone
Zone VE - 100 Year Flood Zone
Zone X500 - 500 Year Flood Zone
EARTHQUAKES AND LANDSLIDES
MAP 4
Miles
0 0.5 1 2
Landsides
Low
Earthquakes
Epicenter
CRITICAL INFRASTRUCTURE SITES
MAPC
dcr
DRAFT
FEMA Pre-Disaster Mitigation Planning Grant
NEWTON, MA
NATURAL HAZARDS MAP
Flood Zones and Earthquakes / Landslides Multi-Hazards View
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis.
Produced by the Metropolitan Area Planning Council GIS Lab. 60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
City of Newton
File Location:
K:\Data\Services\Projects\Current_Projects\PDM\PDMS\Newton
Date: April 2010


HURRICANES AND TORNADOES
MAP 5
Miles
0 0.5 1 2
1869
1861
1944
Storm Tracks
Tropical Depression
Tropical Storm
Category 1 Hurricane
Category 2 Hurricane
Category 3 Hurricane
Tornadoes
Tornado
100 Year Wind Speeds
110 MPH
AVERAGE SNOWFALL
MAP 6
Miles
0 0.5 1 2
Average Annual Snowfall
36.1 to 48.0 inches
48.1 to 72.0 inches
MAPC
dcr
DRAFT
FEMA Pre-Disaster Mitigation Planning Grant
NEWTON, MA
NATURAL HAZARDS MAP
Hurricanes / Tornadoes and Average Snowfall Multi-Hazards View
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
CRITICAL INFRASTRUCTURE SITES


COMPOSITE NATURAL HAZARDS
MAP 7
Miles
0 0.5 1 2
WALTHAM
WATERTOWN
WESTON
WELLESLEY
BROOKLINE
NEEDHAM
BOSTON
DEDHAM
Composite Natural Hazards
Moderate (2 Hazards)
Elevated (3 Hazards)
High (4 Hazards)
Composite natural hazards shown for areas of existing development.
Hazards include:
- 100 year wind speed of 110 MPH or higher
- Moderate landslide risk
- FEMA Q3 flood zones (100 year and 500 year)
- Average snowfall of 36.1" or more
HAZARD AREAS
MAP 8
Miles
0 0.5 1 2
N
ID Name Type
1 Old Farm Road Flooding
2 Wayne Road Flooding
3 Homer Street Flooding
4 Albermarle Park Flooding
5 Quinobequin Road Flooding
6 Lions Field Flooding
7 Route 9 & Parker Flooding
8 Tanglewood off of Florence Flooding
9 Hammond Pond Woods Brush Fire Risk
10 Nahant/Needham Line Brush Fire Risk
11 Area near Cemetery Brush Fire Risk
DIGITAL ORTHOPHOTOGRAPH, APRIL 2008
Hazard Areas
CRITICAL INFRASTRUCTURE SITES
MAPC
dcr
DRAFT
FEMA Pre-Disaster Mitigation Planning Grant
NEWTON, MA
NATURAL HAZARDS MAP
Composite Natural Hazards and Hazard Areas
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis.
Produced by the Metropolitan Area Planning Council GIS Lab.
60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
City of Newton
File Location:
K:\DataServices\Projects\Current_Projects\PDM\PDM5\Newton
Date: April 2010

APPENDIX B:

MEETING AGENDAS FOR:

THE GREATER BOSTON INNER CORE-WEST REGIONAL HAZARD MITIGATION COMMUNITY PLANNING TEAM

AND

LOCAL MULTIPLE HAZARD COMMUNITY PLANNING TEAM

Don Boyce
DIRECTOR

dcr

Richard Sullivan
COMMISSIONER

MAPC

Marc D. Draisen
EXECUTIVE DIRECTOR

GREATER BOSTON PRE-DISASTER MITITGATION PLAN

UPPER NORTH SHORE REGIONAL HAZARD MITIGATION TEAM
Danvers
Essex
Gloucester
Hamilton
Ipswich
Manchester
Middleton
Rockport
Wenham

INNER CORE-WEST REGIONAL HAZARD MITIGATION TEAM
Arlington
Belmont
Newton
Waltham
Watertown
Wellesley

SOUTH SHORE REGIONAL HAZARD MITIGATION TEAM
Duxbury
Norwell

THE COMMONWEALTH OF MASSACHUSETTS

Deval Patrick, Governor

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

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

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

Hazard Mitigation Community Planning Team
Greater Boston / Inner Core-West

First Meeting

Wednesday, April 16, 10:00 AM
Waltham Government Center
119 School Street, Waltham
Meeting Room 5 (lower level)

AGENDA

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

10:10 OVERVIEW OF FEDERAL DISASTER MITIGATION ACT & PRE-DISASTER MITIGATION PLANNING

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

10:30 GETTING STARTED: THE HAZARD MITIGATION PLAN FOR THE INNER CORE-WEST COMMUNTIES

- Review of Scope of Work & Schedule
- Questions & Discussion - Local Issues & Priorities

10:50 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

11:30 ADJOURN

Please contact Martin Pillsbury at MAPC if you have any questions:
617-451-2770, ext. 2012 or mpillsbury@mapc.org

Don Boyce
DIRECTOR

Richard Sullivan
COMMISSIONER

Marc D. Draisen
EXECUTIVE DIRECTOR

GREATER BOSTON PRE-DISASTER MTITGATION PLAN

UPPER NORTH SHORE REGIONAL HAZARD MITIGATION TEAM
Danvers
Essex
Gloucester
Hamilton
Ipswich
Manchester
Middleton
Rockport
Wenham

INNER CORE-WEST REGIONAL HAZARD MITIGATION TEAM
Arlington
Belmont
Newton
Waltham
Watertown
Wellesley

SOUTH SHORE REGIONAL HAZARD MITIGATION TEAM
Duxbury
Norwell

THE COMMONWEALTH OF MASSACHUSETTS

Deval Patrick, Governor

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

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

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

Hazard Mitigation Community Planning Team
Greater Boston / Inner Core-West

Second Meeting

Monday, December 15, 2:00 PM
Waltham Government Center
119 School Street, Waltham
Public Meeting Room (lower level)

AGENDA

2:00 WELCOME, INTRODUCTIONS & OVERVIEW OF AGENDA
- *Martin Pillsbury, Project Manager*

2:05 REVIEW OF HAZARD MAPPING AND CRITICAL INFRASTRUCTURE DATA COLLECTION
- *Allan Bishop, GIS Manager, will present an overview of the draft Critical Facilities database and community hazard maps*

2:45 UPDATE ON LOCAL PLANS
- *Martin Pillsbury and Christine Wallace will review next steps for developing the local PDM Plan Annexes for each community*

3:00 SETTING GOALS AND OBJECTIVES FOR THE REGIONAL PDM PLAN

Martin Pillsbury will in review goals and objectives and ask the team to discuss priorities for the North Shore communities (see attachment)

3:20 NEXT STEPS / MEETING SCHEDULE

3:30 ADJOURN

Please contact Martin Pillsbury at MAPC if you have any questions:
617-451-2770, ext. 2012 or mpillsbury@mapc.org

Meeting Agenda
Local Multiple Hazard Community Planning Team
City of Newton, MA

September 29, 2009 1:30-3:00 PM
Newton City Hall, Room 222

I. Overview of Project Scope and Status

II. Review of Critical Infrastructure Mapping

III. Identification of Goals

IV. Identification of Hazard Areas and Future Development

V. Discussion of Existing Mitigation Practices in Newton and Preliminary Discussion of Potential Proposed Practices

VI. Next Steps

APPENDIX C:

DOCUMENTATION OF THE PUBLIC MEETING

Setti D. Warren
Mayor

CITY OF NEWTON, MASSACHUSETTS
Department of Planning and Development

Telephone
(617)-796-1120
Telefax
(617) 796-1086
TDD/TTY
(617) 796-1089

CONSERVATION COMMISSION
AGENDA
November 18, 2010
Beginning at 7:30 p.m.
City Hall, Room 209

The location of this meeting is handicap accessible, and reasonable accommodations will be provided to persons requiring assistance. If you have a special accommodation need, contact the Newton ADA Coordinator Kathleen Cahill, 617-796-1125, via email at kcahill@newtonma.gov or via TDD/TTY at (617) 796-1089 at least two days in advance of the meeting date.

1. **City of Newton, Library Abbreviated NOI**- Removal of vegetation and sediment from Coleman Brook to restore storm water storage;
2. **City of Newton, Hazard Mitigation Plan –MAPC**- for Commission review;
3. **Houghton Garden Maintenance Plan**-Jane Sender;
4. **34 Farwell St. NOI**-Continued from September meeting;
5. **3 Fuller Av NOI**- After-the-fact for driveway of pavers and grading in the 100 ft buffer to bank and buffer to bordering vegetated wetland;

Certificates of Compliance
9 Harwich Road- As-built and letter from surveyor submitted.
90 Wayne Road-As-built and letter from surveyor submitted.

Conservation Management Plan
October 21 meeting minutes for approval
Handout from Judy re Hunnewell
Management Plan minutes & next meeting
Announcements & General Business:
Election of Officers:
Chair – Ira Wallach
v-Chair- Susan Lunin
Secretary-Judy Hepburn
rep to Farm Commission-Judy Hepburn
rep to Nahanton Woods, Inc. – Judy Hepburn
CPA – Dan Green
Newton Comm. Golf Foundation-Norm Richardson
Kennard Park Trust ?? – last was Ira Wallach
Environmental Science Program-last was Susan Lunin

Anne Phelps, Sr. Environmental Planner

Conserva\agmin\11-18-10agenda

Conservation Commission
1000 Commonwealth Avenue, Newton, Massachusetts 02459
Email: aphelps@newtonma.gov
www.ci.newton.ma.us

APPENDIX D:

DOCUMENTATION OF PLAN ADOPTION

[TO BE ADDED]