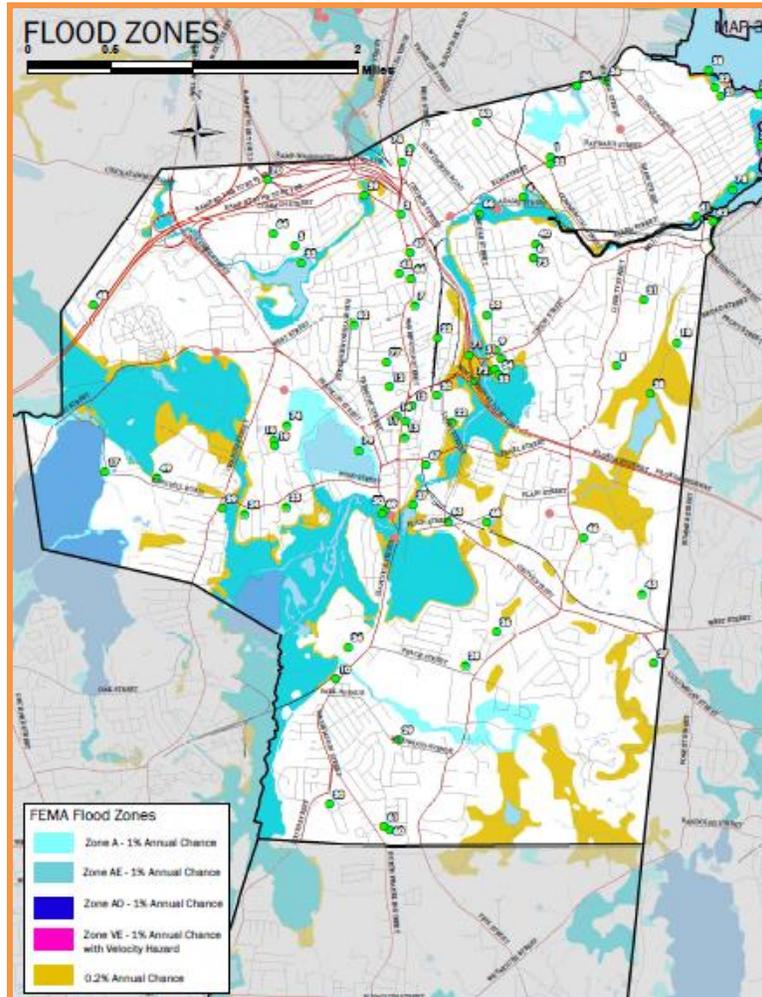


TOWN OF BRAINTREE HAZARD MITIGATION PLAN UPDATE



Mayor Joseph C. Sullivan



Draft for Review by MEMA & FEMA
March, 2011

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

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TOWN OF BRAINTREE HAZARD MITIGATION PLAN

ACKNOWLEDGEMENTS AND CREDITS

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

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Local Hazard Mitigation Planning Team

Christine Stickney	Planning & Community Development
Amy Carey	Health Department
Bob Campbell	DPW - Engineering
Eric C. Erskine	Building Department
Brian Kelley	Police Department
John Morse	DPW - Engineering
Kevin Murphy	Fire Department
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Kevin Nelligan	Fire Department
Kelly Phelan	Planning & Community Development
Mark Thompson	Water & Sewer Department
Joe Tosone	Police Department

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I. EXECUTIVE SUMMARY

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

Planning Process

Planning for the Braintree Hazard Mitigation Plan update was led by the Braintree Local Hazard Mitigation Planning Committee, composed of staff from a number of different Town Departments. This committee discussed where the impacts of natural hazards most affect the Town, goals for addressing these impacts, and hazard mitigation measures that would benefit the Town.

Public participation in this planning process is important for improving awareness of the potential impacts of natural hazards and to build support for the actions the Town takes to mitigate them. The Town hosted two public meetings, the first on February 24 and the second on March 16 and the plan was posted on the Town's website for public review.

Risk Assessment

The Braintree Hazard Mitigation Plan assesses the potential impacts to the Town from flooding, high winds, winter storms, brush fire, and geologic hazards. Flooding, driven by hurricanes, northeasters and other storms, clearly presents the greatest hazard to the Town, most especially in areas along the Monatiquot River and its tributaries.

The Braintree Local Committee identified those areas where flooding most frequently occurs, comprising 11.66% of the Town's land area, and approximately 1,253 buildings worth an estimated \$445,926,907.

Hazard Mitigation Goals

1. Ensure that critical infrastructure sites are protected from natural hazards.
2. Protect existing residential and business areas from flooding.
3. Maintain existing mitigation infrastructure in good condition.
4. Continue to enforce existing zoning and building regulations.
5. Educate the public about zoning and building regulations.

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6. Work with surrounding communities to ensure regional cooperation and solutions for hazards affecting multiple communities.
7. Encourage future development in areas that are not prone to natural hazards.
8. Educate the public about natural hazards and mitigation measures.
9. Make efficient use of public funds for hazard mitigation.
10. Pursue land acquisition strategies.

Hazard Mitigation Strategy

The Braintree Local Committee identified a number of mitigation measures that would serve to reduce the Town's vulnerability to natural hazard events. These include infrastructure improvements to the storm drainage system, a targeted study of the Monatiquot River watershed, where most flooding occurs in the Town, and public education efforts relating to flooding and other natural hazards potentially impacting the Town.

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

Plan Review and Update Process

Table 1 Plan Review and Update

Chapter	Reviews and Updates
III – Public Participation	The Braintree Local Committee placed an emphasis on public participation for the update of the Hazard Mitigation Plan, discussing strategies to enhance participation opportunities at the first local committee meeting. During plan development, the plan was discussed at two public meetings; the first hosted by the LEPC and the second a general public meeting. The plan was also available on the Town's website for public comment.
IV – Risk Assessment	MAPC gathered the most recently available hazard and land use data and met with Town staff to identify changes in local hazard areas and development trends. Town staff reviewed critical infrastructure with MAPC staff in order to create an up-to-date list. MAPC also used the most recently available version of HAZUS and assessed the potential impacts of flooding using the latest data.

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V - Goals	The Hazard Mitigation Goals were reviewed and endorsed by the Local Hazard Mitigation Committee.
VI – Existing Mitigation Measures	The list of existing mitigation measures was updated to reflect current mitigation activities in the Town.
VII & VIII – Hazard Mitigation Strategy	Mitigation measures from the 2005 plan were reviewed and assessed as to whether they were completed, on-going, or deferred. The Local Committee determined whether to carry forward measures into the 2011 plan or delete them. The 2011 Hazard Mitigation Strategy reflects both new measures and measures carried forward from the 2005 plan. The Committee re-prioritized all of these measures based on current conditions.
IX – Plan Adoption & Maintenance	This section of the plan was updated with a new on-going plan implementation review and five year update process that will assist the Town in incorporating hazard mitigation issues into other Town planning and regulatory review processes and better prepare the Town to update the plan in 2016.

As indicated on Table 15, Braintree has made good progress on implementing mitigation measures identified in the 2005 Hazard Mitigation Plan and the 2008 Flood Hazard Mitigation Plan. Many of the measures identified in that plan are now considered on-going aspects of the regular work of Town staff. The Town continues to seek funding to support implementation of many of the identified projects. Moving forward into the next five year plan implementation period there will be many more opportunities to incorporate hazard mitigation into the Town’s decision making processes.

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II. INTRODUCTION

Planning Requirements under the Federal Disaster Mitigation Act

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

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

In order to address multijurisdictional and regional issues, the participating municipalities were afforded the opportunity to meet with their neighboring communities during plan development, and MAPC has also produced a regional document that summarizes the issues and recommendations for the South Shore communities.

What is a Hazard Mitigation Plan?

Natural hazard mitigation planning is the process of determining how to systematically reduce or eliminate the loss of life and property damage resulting from natural hazards such as floods, earthquakes, and hurricanes. Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries, and property resulting from natural hazards through long-term strategies. These long-term strategies include planning, policy changes, programs, projects, and other activities.

Previous Federal/State Disasters

The Town of Braintree has experienced 17 natural hazards that triggered federal or state disaster declarations since 1991. These are listed in Table 1 below. The vast majority of these events involved flooding.

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Table 2 Previous Federal/State Disaster Declarations

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
Hurricane Bob (August 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (16 projects)
No-Name Storm (October 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	FEMA Individual Household Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (10 projects)
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	All 14 Counties
May Windstorm (May 1996)	State Public Assistance Project Grants	Counties of Plymouth, Norfolk, Bristol (27 communities)
October Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk

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DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk (36 projects)
1997	Community Development Block Grant-HUD	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
June Flood (June 1998)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (19 projects)
(1998)	Community Development Block Grant-HUD	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
March Flood (March 2001)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (16 projects)
February Snowstorm (Feb 17-18, 2003)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 22-23, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
Hurricane Katrina (August 29, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
May Rainstorm/Flood (May 12-23, 2006)	Hazard Mitigation Grant Program	Statewide
April Nor'easter (April 15-27, 2007)	Hazard Mitigation Grant Program	Statewide
Flooding (March, 2010)	FEMA Public Assistance FEMA Individuals and Households Program SBA Loan	Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester

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DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
	Hazard Mitigation Grant Program	Statewide

(Source: database provided by MEMA)

FEMA Funded Mitigation Projects

Over the last 20 years the Town of Braintree has received funding from FEMA for 4 mitigation projects under the Flood Mitigation Assistance (FMA) program. These projects totaled \$339,076 with \$201,932 covered by FEMA grants and \$84, 769 by local funding. The projects are summarized in Table 3 below.

Table 3 FEMA-Funded Mitigation Projects

Year	Project Title (Funding Source)	Scope of Work	Total Cost	Federal Funding	Local Funding
2003	Rex Drive Drainage Project (FMA)	Installation of approximately 1,235' of 24" drain line adjacent to One Rex Drive from West Street to the adjacent wetlands.	\$284,387.00	\$162,414.00	\$71,097.00
2008	FMA Plan Update (FMA)	FMA Plan update	\$10,500.00	\$7,875.00	\$2,625.00
	Hazard Mitigation Planning (FMA)	Develop a comprehensive flood mitigation plan for the community.	\$3,640.00	\$2,730.00	\$910.00
2002	Liberty Street Flood Mitigation (FMA)	Upgrading culvert at Smelt Brook under Liberty Street between Poulos Rd. and Plain St., bank improvements adjacent to the culvert	\$40,549.00	\$28,913.00	\$10,137.00

(Source: database provided by MEMA)

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Community Profile

Braintree is a large suburban community situated at the crossroads of Route 128, Route 3, and I-93 about 12 miles south of Boston. Incorporated in 1640, Braintree has a rich history. Braintree offers easy access to the Greater Boston area and Cape Cod as well as excellent public transportation to Boston and Logan International Airport. The community has a good mix of established neighborhoods, small clusters of new homes and several condominium complexes. There is a strong business base, which includes one of the largest regional shopping malls in the northeast, The South Shore Plaza. Braintree has a rich history, including the birthplace site of two presidents, John Adams and John Quincy Adams, as well as John Hancock. Residents feel that people are attracted to Braintree as a good place to live and work because it has an excellent public school system as well as Thayer Academy and Archbishop Williams High School, and a fine parks and recreation program with the availability of many recreational resources.

The town maintains a website at <http://www.townofbraintreegov.org/>

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III. PLANNING PROCESS AND PUBLIC PARTICIPATION

Public participation occurred at two levels; the South Shore Multiple Hazard Community Planning Team (regional committee) and the Braintree Multiple Hazard Community Planning Team (local committee). In addition, the town held two meetings open to the general public to present the plan and hear citizen input.

Braintree's Participation in the Regional Committee

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

Sean Collins Braintree Health Division

The South Shore Regional Committee met on February 9, 2010. At that meeting, Braintree's representative reviewed hazard mitigation strategies with representatives from the neighboring cities and towns of Milton, Randolph, Quincy, Hull, Weymouth, Hingham, Cohasset, Scituate and Marshfield.

The Local Multiple Hazard Community Planning Team

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

The Local Multiple Hazard Community Planning Team Meetings

On February 8, 2011, and February 24, 2011 MAPC conducted the meetings of the Braintree Local Committee. The meetings were organized by Christine Stickney, Director of Planning and Community Development and Amy Carey, Health Department. The purpose of the first meeting was to introduce the PDM program, develop hazard mitigation goals, and to gather information on local hazard mitigation issues and sites or areas related to these. The second meeting focused on verifying information gathered by MAPC staff and discussion of existing mitigation practices, the status of mitigation measures identified in the 2005 hazard mitigation plan, and potential mitigation measures. The second meeting concluded with prioritization of proposed mitigation measures as well as measures carried forward from the previous plan. Table 4 lists the attendees at each meeting of the team. The agendas for these meetings are included in Appendix A.

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Table 4	
Attendance at the Braintree Local Committee Meeting	
Name	Representing
<i>February 8, 2011</i>	
Christine Stickney	Planning & Community Development
Amy Carey	Health Department
Bob Campbell	DPW - Engineering
Eric C. Erskine	Building Department
Brian Kelley	Police Department
Kevin Murphy	Fire Department
Sean Murphy	Braintree Electric Light Department
Kelly Phelan	Planning & Community Development
Mark Thompson	Water & Sewer Department
<i>February 24, 2011</i>	
Kelly Phelan	Planning & Community Development
Amy Carey	Health Department
John Morse	DPW - Engineering
Kevin Nelligan	Fire Department
Joe Tosone	Police Department

Public Meetings

The plan was introduced to the public at two public meetings, once during the planning process and once after a final draft plan was completed. The public had an opportunity to provide input to the planning process during a meeting of the Local Emergency Planning Committee (LEPC), on February 24, 2011 held in the Braintree Municipal Building at 90 Pond Street. The final draft of the plan was presented at a public meeting held on March 16, 2011. This meeting was held at Braintree Town Hall.

The first meeting was publicized as part of a special LEPC meeting to focus on Hazard Mitigation. Both meetings were advertised in the local newspaper. The attendance list for each meeting can be found in Table 5.

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**Table 5
Attendance at Public Meetings**

Name	Representing
<u>First Public Meeting</u>	
Amy Carey	Braintree Health Department
Marybeth McGrath	Braintree Health Department
Sharmila Biswas	Braintree Elder Affairs
Joe Markman	Braintree Patch (Press)
Ken Stone	Braintree Electric Light Department
Joe Tosone	Braintree Police Department
Joe Powers	Braintree Town Clerk
Steve Baranowski	OSHA
Kelly Phelan	Braintree Planning Department
Brian Ellison	Fallon EMS
Kevin Nelligan	Braintree Fire
Mark Lin	Accounting
Marlene Michonski	Braintree DPW
John Morse	Braintree Engineering
Courtney Tape	Wollaston Alloys
Sean Collins	Braintree Health
Bob Ferrisi	Braintree Hospital
James Freas	MAPC
<u>Second Public Meeting</u>	
James Freas	MAPC
Christine Stickney	Planning & Community Development

Other Opportunities for Public Involvement

Review by Community Organizations

Notice was sent to the following organizations and neighboring municipalities inviting them to review the Braintree Hazard Mitigation Plan and submit their comments to the Town.

- Braintree Chamber of Commerce
- City of Quincy
- Town of Holbrook
- Town of Randolph
- Town of Weymouth

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Website

Draft copies of the Braintree Hazard Mitigation Plan were posted on the Town's website and updated over the course of the planning process. Members of the public could access the draft document and submit comments or questions.

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IV. RISK ASSESSMENT

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

Update Process

In order to update Braintree's risk assessment, MAPC gathered the most recently available hazard and land use data and met with Town staff to identify changes in local hazard areas and development trends. MAPC also used the most recently available version of HAZUS (described below).

Overview of Hazards and Impacts

The Massachusetts Hazard Mitigation Plan 2007 (state plan) provides an in-depth overview of natural hazards in Massachusetts. The state plan indicates that Massachusetts is subject to the following natural hazards (listed in order of frequency); floods, heavy rainstorms, nor'easters or winter storms, coastal erosion, hurricanes, tornadoes, wildfires, drought and earthquakes. Previous state and federal disaster declarations since 1991 are summarized in Table 1.

Table 6 summarizes the hazard risks for Braintree. This evaluation takes into account the frequency of the hazard, historical records, and variations in land use. This analysis is based on the vulnerability assessment in the Commonwealth of Massachusetts State Hazard Mitigation Plan, 2007. The statewide assessment was modified to reflect local conditions in Braintree using the definitions for hazard frequency and severity listed below Table 6.

**Table 6
Hazard Risks Summary**

Hazard	Frequency	Severity
Flooding	High	Serious
Winter storms	High	Serious
Hurricanes	Medium	Serious
Earthquakes	Low	Extensive
Tornadoes	Low	Serious
Landslides	Low	Minor
Brush fires	Medium	Minor
Dam failures	Low	Serious

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Definitions used in the Commonwealth of Massachusetts State Hazard Mitigation Plan

Frequency

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

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

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

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

Severity

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

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

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

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

Flood Related Hazards

Flooding was the most prevalent serious natural hazard identified by local officials in Braintree. Flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms. Sea level rise has the potential to exacerbate these issues over time.

Regionally Significant Storms

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

- March 1968
- The blizzard of 1978
- January 1979

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- April 1987
- October 1991 (“The Perfect Storm”)
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007
- March 2010

Overview of Town-Wide Flooding

The Town of Braintree is subject to two kinds of flooding; coastal flooding where wind and tide leads to flooding along tidal waterways and inland flooding where the rate of precipitation or amount of water overwhelms the capacity of natural and structured drainage systems to convey water causing it to overflow the system. These two types of flooding are often combined as inland flooding is prevented from draining by the push of wind and tide driven water. Both types of flooding can be caused by major storms, known as northeasters and hurricanes. Northeasters can occur at any time of the year but they are most common in winter. Hurricanes are most common in the summer and early fall. Northeasters cover a larger area than hurricanes although the winds are not as high. They also generally last long enough to include at least one high tide, which causes the most severe flooding. Large rain storms or snowfalls can also lead to inland flooding.

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

Locally Identified Areas of Flooding

1. Braintree Highway barn – Union Street pump station and neighboring homes - overflow from the Monatiquot River.
2. Harding Avenue – Overflow from the Monatiquot River floods homes in this area.
3. Hancock & Route 37 – Overflow from the Monatiquot River floods homes in this area.
4. Jefferson at Shepherd Street - Overflow from the Monatiquot River floods homes in this area.

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5. Jefferson at Ellery Street - Overflow from the Monatiquot River floods homes in this area.
6. Solar Avenue - Overflow from the Monatiquot River floods homes in this area.
7. Wayne Avenue - Overflow from tributary to the Monatiquot River floods homes in this area.
8. Winter – Groundwater sourced flooding
9. Hillside Road
10. Glendale - Groundwater sourced flooding
11. Braintree High School – Athletic fields flood.
12. Pearl Street at 140
13. Crawford Street, Webb Street, & Stevens Avenue
14. Union Street – Area can be prone to “flash flooding” as a large area of paved surface drains to this area. Overflow from the river also contributes to flooding at the rotary.
15. Staten & Dickerman – Flooding in this area includes the Common Street Sewer Pump Station.
16. Alida Road / Cedar Swamp – Flooding from the swamp reaches the adjacent homes.
17. Woodsum Drive - Groundwater sourced flooding
18. Adams Street – This area, from Elm to Commercial, may flood as a result of constriction in the downstream floodplain of the Monatiquot River.
19. Allen Street
20. Commercial Street, Downstream from the bridge
21. West Street / Great Pond Dam

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- 22. Dyke at Great Reservoir
- 23. Lundquist, Granite & Campanelli – Overflow from the Farm River
- 24. Norfolk Road, Andrea Drive, & Eileen Drive –Groundwater sourced flooding
- 25. Trotter Green – Groundwater infiltrating sewer, leading to flooding during large storms
- 26. Commercial Street & Brookside Road – Pump station floods
- 27. Quincy Avenue & Howard Street – Sewer pump station floods
- 28. Barstow Drive, off IDA – Farm River pump station

Repetitive Loss Structures

There are 11 repetitive loss structures in Braintree, an increase from the 8 structures identified in the 2005 plan. As defined by the Community Rating System (CRS) of the National Flood Insurance Program (NFIP), a repetitive loss property is any property which the NFIP has paid two or more flood claims of \$1,000 or more in any given 10-year period since 1978. For more information on repetitive losses see <http://www.fema.gov/business/nfip/replps.shtm>.

There are very few repetitive loss properties in Braintree and they are nearly evenly divided between single family homes and commercial structures. The commercial sites are clustered in one area. About half of the repetitive loss properties are within FEMA designated flood zones. The table below shows the breakdown of structure type by FEMA designated and locally identified flood zones.

**Table 7
Repetitive Loss Properties Summary**

Flood Zone	Single Family Residential Structures	Multi-Family Residential Structures	Commercial, Industrial, or Institutional Structures	Total Repetitive Loss Properties
FEMA Zone A & AE	0	0	3	3
FEMA Zone VE	0	0	0	0
FEMA .2% annual chance	1	0	0	1
Total: FEMA Flood Zones*	1	0	3	4

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Braintree Highway Barn	0	0	0	0
Harding Avenue	0	0	0	0
Hancock & Route 37	1	0	1	2
Jefferson at Shepherd Street	0	0	0	0
Jefferson at Ellery Street	0	0	0	0
Solar Avenue	0	0	0	0
Wayne Avenue	0	0	0	0
Winter Street	0	0	0	0
Hillside Road	0	0	0	0
Glendale	0	0	0	0
Braintree High School	0	0	0	0
Pearl at 140	0	0	0	0
Crawford, Webb & Stevens	0	0	0	0
Union Street	0	0	0	0
Staten & Dickerman	0	0	0	0
Alida Road / Cedar Swamp	0	0	0	0
Woodsum	0	0	0	0
Adams Street	0	0	3	3
Allen Street	0	0	0	0
Commercial Street, Downstream from the bridge	0	0	0	0
West Street / Great Pond Dam	0	0	0	0
Dyke at Great Reservoir	0	0	0	0
Lundquist, Granite & Campanelli	0	0	0	0
Norfolk, Andrea, & Eileen	0	0	0	0
Trotter Green	0	0	0	0
Commercial & Brookside	0	0	0	0
Quincy & Howard	0	0	0	0
Barstow, off IDA	0	0	0	0
Total: Locally Identified Areas of Flooding	1	0	4	5

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* Note totals for repetitive loss properties in FEMA flood zones and locally identified areas of flooding do not necessarily match the total number of repetitive loss properties in the community as there is considerable overlap between the two types of flood area and not all repetitive loss properties are located in an identified flood zone.

Dams and Dam Failure

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

In the event of a dam failure, the energy of the water stored behind even a small dam can cause loss of life and property damage if there are people or buildings downstream. The number of fatalities from a dam failure depends on the amount of warning provided to the population and the number of people in the area in the path of the dam's floodwaters. Dam failure in general is infrequent but has the potential for severe impacts. An issue for dams in Massachusetts is that many were built in the 19th century without the benefits of modern engineering or construction oversight.

All of the dams listed below are inspected frequently and a dam inspection report was completed for the Town in **date**.

MDC / Quincy Reservoir Dam (also known as the Braintree Dam) – The Dam is owned by the Massachusetts Department of Conservation and Recreation (DCR) previously known as the MDC. The dam is located off Lakeside Drive and if this dam broke, there would be substantial property damage but it is unlikely that there would be any loss of life.

Eatons Pond Dam – This pond and its dam are owned by the Braintree Conservation Commission and Peabody Properties. The pond drains into a stream that has the capacity to handle the waters in the event of a dam failure.

Hollingsworth Dam – This pond and its dam are owned by the F.X. Messina Corporation. The pond is a mill pond that was created to allow the water usage by the adjacent retired factory. The pond drains into the Monaquot River which has the capacity to handle the waters in the event of a dam failure.

Pond Meadow Park Dam – This pond and its dam are owned by the Braintree Weymouth Conservation District. The pond drains into a stream that has the capacity to handle the waters in the event of a dam failure.

Great Pond Dam – The dam has an inadequate spillway, trees growing on the embankment, erosion, and other issues that must be addressed. The State Office of Dam Safety has ordered the Tri-Town Water Board to bring the dam into compliance by the end of 2011. The Board has begun work on addressing these issues.

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Wind Related Hazards

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

Between 1858 and 2000, Massachusetts has experienced approximately 32 tropical storms, nine Category 1 hurricanes, five Category 2 hurricanes and one Category 3 hurricane. This equates to a frequency of once every six years. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. There have been two recorded storm tracks through Braintree, a tropical depression in 1876 and a tropical storm, recorded in 1888. Both storms passed roughly through the center of the Town. The Town experiences the impacts of the wind and rain of hurricanes and tropical storms regardless of whether the storm track passed through the town. The hazard mapping indicates that the 100 year wind speed is 110 miles per hour. There have been no recorded tornados within the Town limits.

Given its coastal location, the Town is highly vulnerable to hurricanes. A hurricane is a violent wind and rainstorm with wind speeds of 74-200 miles per hour. A hurricane is strongest as it travels over the ocean and is particularly destructive to coastal property as the storm hits the land. Hurricanes generally occur between June and November.

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

Winter Storms

Winter storms are the most common and most familiar of the region's hazards that affect large geographic areas. The majority of blizzards and ice storms in the region cause more inconvenience than they do serious property damage, injuries, or deaths. However, periodically, a storm will occur which is a true disaster, and necessitates intense large-scale emergency response. Occasionally winter storms can also hinder the tidal exchange in tidally restricted watersheds and result in localized flooding within these areas. Ice build-up at gate structures can also damage tide gates and increase the hazard potential as a result of malfunctioning tide gates.

In Massachusetts, northeast coastal storms known as nor'easters occur 1-2 times per year. Winter storms are a combination hazard because they often involve wind, ice and heavy snow fall. The average annual snowfall for most of the Town is 48.1 - 72 inches.

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

Blizzard of 1978	February 1978
Blizzard	March 1993
Blizzard	January 1996

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Severe Snow Storm	March 2001
Severe Snow Storm	December 2003
Severe Snow Storm	January 2005
Severe Snow Storm	December 2010
Severe Snow Storm	January 2011

Massachusetts experienced a record year for snowfall in 2008. By the end of the February 2008, Boston's Logan International Airport broke a new February record for total precipitation. In March 2008, many cities and towns in Massachusetts exceeded the highest snowfall records. The above-average snowfall that season increased groundwater and surface water levels to a high level, and contributed to flooding experienced in spring 2008.

Snowfall in winter 2010-11 has also approached the record mark with 60.3 inches measured at Logan for the season as of the end of January. Snow came in a series of severe storms, some of which included serious flooding in the South Shore area. The current winter snowfall record is 107.6 inches set in 1996-96.

Information on winter storm related hazards can be found on Map 6 in Appendix B.

Fire Related Hazards

The Fire Department responds to approximately 12 brush fires of varying sizes annually, ranging from very small mulch fires to small woods fires. Within the past year, there were none that resulted in significant property damage. The most common cause of wildfires is the careless disposal of smoking materials and untended campfires.

The following areas of Town were identified as having the highest potential for brush fires. The numbers correspond to the numbers on Map 8, "Hazard Areas":

29. Blue Hills Reservation, off Route 128

30. Town Forest

31. Pond Meadow

32. Gun Club

33. South Street/Hospital

34. Cranberry Pond Area

35. Smith Beach Marsh

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36. Great Pond Pumping Station Land

37. Skyline Drive / Eaton's Pond Area– Potentially caused by untended campfires.

38. Hillside

39. School Trust Land

40. South Braintree Office Park Area

41. Wooded Area South of South Shore Plaza

Geologic Hazards

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

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 Anne fault located off the coast of Rockport. The region has experienced larger earthquakes, of magnitude 6.0 to 6.5 in 1727 and 1755. Other notable earthquakes occurred here in 1638 and 1663 (Tufts University). There have been no recorded earthquake epicenters within Braintree.

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

Landslides

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.

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The southern half of the Town has been classified as having a low risk for landslides while the northern half is considered to have a moderate risk.

Land Use and Development Trends

Existing Land Use

The most recent land use statistics available from the state are from aerial photography done in 2005. Table 8 shows the acreage and percentage of land in 10 categories. If the three residential categories are aggregated, residential uses make up 36.6% of the area of the town (3,378.71 acres). The highest percentage is undeveloped which comprises 25.82% (2,383.49 acres).

Table 8
2005 Land Use

Land Use Type	Acres	Percent
High Density Residential	1,280.41	13.87
Medium Density Residential	1,801.49	19.52
Low Density Residential	296.81	3.22
Non-Residential, Developed	745.97	8.08
Commercial	614.53	6.66
Industrial	436.95	4.73
Transportation	295.55	3.2
Agriculture	7.24	.08
Undeveloped	2,383.49	25.82
Undeveloped Wetland	1,367.33	14.81
Total	9,229.76	100.00

Economic Elements

Historic, Cultural, and Natural Resource Areas

Development Trends

Under current zoning, the Town of Braintree is largely built out. Additional development in Braintree will primarily be redevelopment and improvement of existing sites. Over the course of the last several years, the town has seen several large redevelopment projects converting older development sites to high density residential. The majority of the Town is zoned for residential use and is almost entirely built-out. Approximately 21% of the land area of the town is zoned as Commercial, Highway Business or General Business.

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Some significant undeveloped land is found within these zoning districts. Finally, almost 23% of the town is zoned as Open Space which precludes most forms of development with the exception of day cares, schools, churches and cemeteries.

Potential Future Development

MAPC consulted with town staff to determine areas that are likely to be developed in the future, defined for the purposes of this plan as a ten year time horizon. These areas are shown on Map 2, “Potential Development” and are described below. The letter for each site corresponds to the letters on Map 2.

- A. Ivory Street Corridor – Potential for commercial redevelopment
- B. Commerce Park – Commercial and industrial development, with some potential for residential on the Gun Club property.
- C. Weymouth Landing – Mixed use village development
- D. Lungquist to Baystate – Industrial development
- E. Norfolk County Hospital Site – Residential Development

Future Development in Hazard Areas

Table 9 shows the relationship of these parcels to two of the mapped hazards. This information is provided so that planners can ensure that development proposals comply with flood plain zoning and that careful attention is paid to drainage issues.

Table 9: Relationship of Potential Development to Hazard Areas		
Parcel	Landslide risk	Flood Zone
Ivory Street Corridor	Moderate Susceptibility	9.1683% in X500 or 0.2% Annual Chance) 4.9812% in AE
Commerce Park	Moderate Susceptibility	2.6986% in X500 or 0.2% Annual Chance) 3.6004% in AE
Weymouth Landing	Moderate Susceptibility	0.7105% in X500 or 0.2% Annual Chance) 12.4839% in AE
Lungquest to Baystate	Low	15.4508% in X500 or 0.2% Annual Chance) 15.7539% in AE
Norfolk County Hospital Site	Low	No

Critical Infrastructure in Hazard Areas

Critical infrastructure includes facilities that are important for disaster response and evacuation (such as emergency operations centers, fire stations, water pump stations, etc.)

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and facilities where additional assistance might be needed during an emergency (such as nursing homes, elderly housing, day care centers, etc.). These facilities are listed in Table 10 and are shown on all of the maps in Appendix B.

The purpose of mapping the natural hazards and critical infrastructure is to present an overview of hazards in the community and how they relate to critical infrastructure, to better understand which facilities may be vulnerable to particular natural hazards.

Explanation of Columns in Table 10.

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

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

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

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

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

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

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Table 10: Relationship of Critical Infrastructure to Hazard Areas					
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area
1	Ross Elementary School	School	Moderate Susceptibility	No	No
2	Archbishop Williams High	Private School	Moderate Susceptibility	No	No
3	South Shore Seventh Day Advent School	Private School	Moderate Susceptibility	No	No
4	Pilgrim Center	Halfway House	Moderate Susceptibility	No	Adams Street
5	Mary E Flaherty School	School	Moderate Susceptibility	No	No
6	East Middle School	School	Moderate Susceptibility	No	No
7	Hollis Elementary School	School	Moderate Susceptibility	No	No
8	Morrison Elementary School	School	Moderate Susceptibility	No	Norfolk, Andrea, & Eileen
9	Braintree Police Dept HQ	Police Department	Moderate Susceptibility	No	Braintree Highway Barn
10	Braintree Fire Station #2	Fire Department	Low Susceptibility	No	No
11	Thayer Public Library	Library	Moderate Susceptibility	No	No
12	Thayer Academy	Private School	Moderate Susceptibility	No	No
13	Braintree Fire Dept HQ	Fire Department	Moderate Susceptibility	No	No
14	Braintree Town Hall	EOC	Moderate Susceptibility	No	No

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Table 10: Relationship of Critical Infrastructure to Hazard Areas					
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area
15	St Francis Of Assisi	Private School	Moderate Susceptibility	No	No
16	Braintree High	School	Low Susceptibility	No	No
18	T Station	Mbta Station	Moderate Susceptibility	No	Union Street
19	SeaMass Transfer Station	Waste Disposal	Moderate Susceptibility	No	No
21	School Dept. Offices	School Dept	Low Susceptibility	No	No
22	Braintree Rehab Hospital	Hospital	Low Susceptibility	No	No
23	Liberty Elementary School	School	Low Susceptibility	No	No
24	Massasoit School Inc - Private	Private School	Low Susceptibility	No	No
25	South Middle School	School	Low Susceptibility	No	No
26	Highlands Elementary School	School	Low Susceptibility	No	No
29	Braintree Fire Station # 3	Fire Department	Moderate Susceptibility	No	No
30	B.A.S.E.	School	Low Susceptibility	No	Lundquist, Granite & Campanelli
31	School Dept Maintenance	School Custodial	Moderate Susceptibility	No	No
37	Braintree Medical Center	Medical Facility	Low Susceptibility	No	No
39	Marge Crispin	Elderly Services	Low Susceptibility	No	No

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Table 10: Relationship of Critical Infrastructure to Hazard Areas					
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area
	Center				
40	National Guard Armory	Armory	Moderate Susceptibility	No	Braintree Highway Barn
41	Braintree Highway Dept	DPW Barn	Moderate Susceptibility	AE	Braintree Highway Barn
42	Braintree Sewer Dept and Garage	DPW	Moderate Susceptibility	No	Braintree Highway Barn
44	Braintree Council on Aging	Elderly Services	Moderate Susceptibility	No	No
45	Post Office	Post Office	Moderate Susceptibility	No	No
48	Tri-Level Bridge	Bridge	Moderate Susceptibility	No	No
49	Union Street Overpass	Bridge	Moderate Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No
50	Union Street Overpass	Bridge	Moderate Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No
51	Smith's Beach	Beach	Moderate Susceptibility	VE	No
52	Braintree High - HLZ	Helipad	Low Susceptibility	No	Braintree High School
53	East Middle School - HLZ	Helipad	Moderate Susceptibility	No	No
55	Montessori School	Private School	Moderate Susceptibility	No	No

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Table 10: Relationship of Critical Infrastructure to Hazard Areas					
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area
56	Braintree Recreation Department	Parks	Moderate Susceptibility	No	Braintree Highway Barn
57	Sunset Lake	Beach	Low Susceptibility	A	No

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Vulnerability Assessment

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

Introduction to HAZUS-MH

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

“HAZUS-MH is a nationally applicable standardized methodology and software program that contains models for estimating potential losses from earthquakes, floods, and hurricane winds. HAZUS-MH was developed by the Federal Emergency Management Agency (FEMA) under contract with the National Institute of Building Sciences (NIBS). Loss estimates produced by HAZUS-MH are based on current scientific and engineering knowledge of the effects of hurricane winds, floods and earthquakes. Estimating losses is essential to decision-making at all levels of government, providing a basis for developing and evaluating mitigation plans and policies as well as emergency preparedness, response and recovery planning.

HAZUS-MH uses state-of-the-art geographic information system (GIS) software to map and display hazard data and the results of damage and economic loss estimates for buildings and infrastructure. It also allows users to estimate the impacts of hurricane winds, floods and earthquakes on populations.”

There are three modules included with the HAZUS-MH software: hurricane wind, flooding, and earthquakes. There are also three levels at which HAZUS-MH can be run. Level 1 uses national baseline data and is the quickest way to begin the risk assessment process. The analysis that follows was completed using Level 1 data.

Level 1 relies upon default data on building types, utilities, transportation, etc. from national databases as well as census data. While the databases include a wealth of information on the Town of Braintree, it does not capture all relevant information. In fact, the HAZUS training manual notes that the default data is “subject to a great deal of uncertainty.”

However, for the purposes of this plan, the analysis is useful. This plan is attempting to only generally indicate the possible extent of damages due to certain types of natural disasters and to allow for a comparison between different types of disasters. Therefore,

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this analysis should be considered to be a starting point for understanding potential damages from the hazards. If interested, communities can build a more accurate database and further test disaster scenarios.

Estimated Damages from Hurricanes

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

Though there are no recorded instances of a hurricane equivalent to a 500 year storm passing through Massachusetts, this model was included in order to present a reasonable “worst case scenario” that would help planners and emergency personnel evaluate the impacts of storms that might be more likely in the future, as we enter into a period of more intense and frequent storms.

**Table 11
Estimated Damages from Hurricanes**

	100 Year	500 Year
Building Characteristics		
Estimated total number of buildings	10,742	10,742
Estimated total building replacement value (Year 2002 \$) (Millions of Dollars)	\$3,745	\$3,745
Building Damages		
# of buildings sustaining minor damage	1,481	3,866
# of buildings sustaining moderate damage	233	1,811
# of buildings sustaining severe damage	9	353
# of buildings destroyed	5	224
Population Needs		
# of households displaced	41	601
# of people seeking public shelter	9	128
Debris		
Building debris generated (tons)	5,339.25	34,494.74
Tree debris generated (tons)	6,525.75	23,951.26
# of truckloads to clear building debris	214	1,366
Value of Damages (Thousands of dollars)		
Total property damage	\$37,499.41	\$347,199.29
Total losses due to business interruption	\$4,958.06	\$52,272.31

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Estimated Damages from Earthquakes

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

Table 12
Estimated Damages from Earthquakes

	Magnitude 5.0	Magnitude 7.0
Building Characteristics		
Estimated total number of buildings	10,742	10,742
Estimated total building replacement value (Year 2002 \$)(Millions of dollars)	\$3,745	\$3,745
Building Damages		
# of buildings sustaining slight damage	103	603
# of buildings sustaining moderate damage	19	126
# of buildings sustaining extensive damage	2	15
# of buildings completely damaged	0	1
Population Needs		
# of households displaced	2	15
# of people seeking public shelter	0	3
Debris		
Building debris generated (tons)	Not available	Not available
Value of Damages (Millions of dollars)		
Total property damage	\$2.39	\$28.32
Total losses due to business interruption	\$.78	\$4.83

Estimated Damages from Flooding

MAPC did not use HAZUS-MH to estimate flood damages in Braintree. In addition to technical difficulties with the software, the riverine module is not a reliable indicator of flooding in areas where inadequate drainage systems contribute to flooding even when

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those structures are not within a mapped flood zone. In lieu of using HAZUS, MAPC developed a methodology to give a rough approximation of flood damages.

Braintree is 14.42 square miles or 9,229.76 acres. Approximately 1,077.083 acres have been identified by local officials as areas of flooding. This amounts to 11.66 % of the land area in Braintree. The number of structures in each flood area was estimated by applying the percentage of the total land area to the number of structures (10,742) in Braintree; the same number of structures used by HAZUS for the hurricane and earthquake calculations. HAZUS uses a value of \$348,631.54 per structure for the building replacement value. This was used to calculate the total building replacement value in each of the flood areas. The calculations were done for a low estimate of 10% building damages and a high estimate of 50% as suggested in the FEMA September 2002 publication, "State and Local Mitigation Planning how-to guides" (Page 4-13). The range of estimates for flood damages is \$44,592,690.75 - \$222,963,453.76. These calculations are not based solely on location within the floodplain or a particular type of storm (i.e. 100 year flood).

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**Table 13
Estimated Damages from Flooding**

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area in Braintree	Estimated Number of Structures	Replacement Value	Low Estimate of Damages	High Estimate of Damages
1	Braintree Highway Barn	70.160	0.760	82	\$29,058,085.37	\$2,905,808.54	\$14,529,042.69
2	Harding Avenue	9.204	0.100	11	\$3,823,432.29	\$382,343.23	\$1,911,716.14
3	Hancock & Route 37	34.918	0.378	41	\$14,452,574.04	\$1,445,257.40	\$7,226,287.02
4	Jefferson at Shepherd Street	19.040	0.206	22	\$7,876,270.51	\$787,627.05	\$3,938,135.25
5	Jefferson at Ellery Street	14.805	0.160	17	\$6,117,491.66	\$611,749.17	\$3,058,745.83
6	Solar Avenue	15.458	0.167	18	\$6,385,131.92	\$638,513.19	\$3,192,565.96

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**Table 13
Estimated Damages from Flooding**

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area in Braintree	Estimated Number of Structures	Replacement Value	Low Estimate of Damages	High Estimate of Damages
7	Wayne Avenue	20.770	0.225	24	\$8,602,722.64	\$860,272.26	\$4,301,361.32
8	Winter	14.837	0.161	17	\$6,155,725.98	\$615,572.60	\$3,077,862.99
9	Hillside Road	20.192	0.219	24	\$8,373,316.71	\$837,331.67	\$4,186,658.35
10	Glendale	19.872	0.215	23	\$8,220,379.41	\$822,037.94	\$4,110,189.71
11	Braintree High School	18.360	0.199	21	\$7,608,630.25	\$760,863.02	\$3,804,315.12
12	Pearl at 140	25.292	0.274	29	\$10,476,204.46	\$1,047,620.45	\$5,238,102.23

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**Table 13
Estimated Damages from Flooding**

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area in Braintree	Estimated Number of Structures	Replacement Value	Low Estimate of Damages	High Estimate of Damages
13	Crawford, Webb & Stevens	21.943	0.238	26	\$9,099,768.84	\$909,976.88	\$4,549,884.42
14	Union Street	25.465	0.276	30	\$10,552,673.11	\$1,055,267.31	\$5,276,336.55
15	Staten & Dickerman	34.829	0.377	40	\$14,414,339.72	\$1,441,433.97	\$7,207,169.86
16	Alida Road / Cedar Swamp	46.024	0.498	53	\$19,040,692.78	\$1,904,069.28	\$9,520,346.39
17	Woodsum	19.780	0.214	23	\$8,182,145.09	\$818,214.51	\$4,091,072.55
18	Adams Street	76.228	0.825	89	\$31,543,316.36	\$3,154,331.64	\$15,771,658.18

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**Table 13
Estimated Damages from Flooding**

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area in Braintree	Estimated Number of Structures	Replacement Value	Low Estimate of Damages	High Estimate of Damages
19	Allen Street	51.653	0.559	60	\$21,372,986.48	\$2,137,298.65	\$10,686,493.24
20	Commercial Street, Downstream from the bridge	17.935	0.194	21	\$7,417,458.63	\$741,745.86	\$3,708,729.32
21	West Street / Great Pond Dam	116.472	1.261	135	\$48,213,481.13	\$4,821,348.11	\$24,106,740.56
22	Dyke at Great Reservoir	64.958	0.703	76	\$26,878,728.97	\$2,687,872.90	\$13,439,364.49
23	Lundquist, Granite & Campanelli	82.604	0.895	96	\$34,219,718.96	\$3,421,971.90	\$17,109,859.48
24	Norfolk, Andrea, & Eileen	93.188	1.009	108	\$38,578,431.77	\$3,857,843.18	\$19,289,215.88

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**Table 13
Estimated Damages from Flooding**

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area in Braintree	Estimated Number of Structures	Replacement Value	Low Estimate of Damages	High Estimate of Damages
25	Trotter Green	15.210	0.165	18	\$6,308,663.27	\$630,866.33	\$3,154,331.64
26	Commercial & Brookside	35.159	0.381	41	\$14,567,277.01	\$1,456,727.70	\$7,283,638.50
27	Quincy & Howard	46.902	0.508	55	\$19,423,036.01	\$1,942,303.60	\$9,711,518.01
28	Barstow, off IDA	45.825	0.496	53	\$18,964,224.14	\$1,896,422.41	\$9,482,112.07
Totals		1,077.083	11.663	1,253	\$445,926,907.52	\$44,592,690.75	\$222,963,453.76

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

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V. HAZARD MITIGATION GOALS

The Braintree Local Multiple Hazard Community Planning Team met on February 8, 2011. At that meeting, the team reviewed and discussed the goals from the 2005 Hazard Mitigation Plan for the Town of Braintree. After some discussion, the existing goals were found to still be reflective of the Town's objectives with regard to addressing hazard mitigation in the community.

The following ten goals were endorsed by the Committee for the 2011 update of the Braintree Hazard Mitigation Plan:

1. Ensure that critical infrastructure sites are protected from natural hazards.
2. Protect existing residential and business areas from flooding.
3. Maintain existing mitigation infrastructure in good condition.
4. Continue to enforce existing zoning and building regulations.
5. Educate the public about zoning and building regulations.
6. Work with surrounding communities to ensure regional cooperation and solutions for hazards affecting multiple communities.
7. Encourage future development in areas that are not prone to natural hazards.
8. Educate the public about natural hazards and mitigation measures.
9. Make efficient use of public funds for hazard mitigation.
10. Pursue land acquisition strategies.

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TOWN OF BRAINTREE HAZARD MITIGATION PLAN

VI. EXISTING MITIGATION MEASURES

Existing Multi-Hazard Mitigation Measures

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

Communications Equipment – Braintree has full coverage of the Town with emergency services radio and the Braintree Electric Light Department (BELD) allows residents to enroll in a “Rapid Alert” system that calls and/or emails residents in case of an emergency. The Town also has a reverse 911 system. Incident command units are available through Norfolk County and MEMA.

Emergency Power Generators – The Town maintains emergency power generators in several important public facilities and emergency shelters. These include Braintree Fire Stations #2 and #3, the DPW Barn, Emergency Management, Braintree High School, East Middle School, and South Middle School.

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

Local Emergency Management Planning Committee (LEPC) – The Fire Department leads the LEPC, which meets on a quarterly or as-needed basis.

Existing Flood Hazard Mitigation Measures

National Flood Insurance Program (NFIP) – Braintree participates in the NFIP with 235 policies in force as of December 31, 2010. FEMA maintains a database on flood insurance policies and claims. This database can be found on the FEMA website at <http://www.fema.gov/business/nfip/statistics/pcstat.shtm>

The following information is provided for the Town of Braintree:

Flood insurance policies in force (as of December 31, 2010)	235
Coverage amount of flood insurance policies	\$55,087,900
Premiums paid	\$275,013
Total losses (all losses submitted regardless of the status)	156
Closed losses (Losses that have been paid)	129
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	27

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Total payments (Total amount paid on losses)	\$1,956,406.86
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The Town complies with the NFIP by enforcing floodplain regulations, maintaining up-to-date floodplain maps, and providing information to property owners and builders regarding floodplains and building requirements.

Since the 2005 plan, the policies in force have increased by 91 and the total losses have increased by 74. The total payments, as of December 21, 2004, were \$623,187.33, approximately \$1.3 million less than the most recent figure.

CRS Program Participation – The Town of Braintree participates in the Community Rating System (CRS) program, gaining a reduction in flood insurance rates for property owners in the Town in exchange for mitigation actions taken to reduce the Town’s potential vulnerability to flooding. The program functions on a rating system, with an individual community’s rating being based on the number of points they receive, with points allocated for each flood mitigation measure enacted. The Town of Braintree currently has a rating of Class 9, resulting in a 5% reduction in flood insurance rates in the Town.

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

- *Street sweeping* – All streets are swept three times a year.
- *Catch basin cleaning* – All are cleaned once every two to three years.
- *Roadway treatments* – Streets are treated with a mix of sand, salt, and liquid brine applicator.

Town of Braintree Master Plan – The most recent Braintree Master Plan was adopted in 1998. While it is much broader-based and focuses on all aspects of development in the Town, issues that touch on flooding and hazard mitigation can be found throughout the plan. The plan focuses more on policies and strategies than on detailed recommendations.

Flood Hazard Mitigation Plan – The 2008 Town of Braintree Flood Hazard Mitigation Plan presents a detailed analysis of flooding conditions in Braintree and a set of recommendations for mitigating the impacts of flooding on the Town.

Conservation/Recreation Open Space Plan – The Town of Braintree Open Space and Recreation Plan was completed in 2009. The plan identifies a number of open space parcels and actions to improve environmental quality, which could also benefit hazard mitigation efforts.

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Floodplain Zoning District – Zoning is intended to protect the public health and safety through the regulation of land use. The Braintree Zoning Bylaw includes a Wetlands and Floodplain District (Article VI, Section 135-608). The purposes of this district are:

1. Protect the health and safety of persons and property against one-hundred-year frequency flooding and the hazard of water inundation;
2. Control one-hundred-year-frequency flooding and regulate the development of land and the construction of buildings and structures within the district;
3. Preserve and maintain the groundwater table. Since these areas contribute to the natural storage of water during times of maximum rainfall, it is intended that the areas be controlled and conserved in as near their present state as possible, and that any change therein as herein provided shall not substantially affect surface or ground water levels nor jeopardize the public health or safety nor derogate from the intent and purpose of this district.

The Wetlands and Floodplain District is an overlay district, corresponding to the 100 year floodplain as defined by the most recent Flood Insurance Study and Flood Insurance Rate Map (FIRM). In addition, the Town allows for the application of this district to areas where there is a recorded observation of flooding. Within the District, no building or structure shall be constructed, improved, altered or modified and no land shall be filled, excavated or otherwise changed in grade except pursuant to a special permit authorized by the Braintree Planning Board. Further, no critical facility, defined as facilities handling hazardous materials, hospitals, nursing homes, and buildings used for the storage of important documents may be located in this district.

A proposed project in the Wetlands and Floodplain District must meet the following standards in order to be granted a special permit:

1. The proposed construction and/or change in grade will not derogate from the intent and purpose of the Wetlands and Floodplain District;
2. The proposed construction and/or change in grade will not endanger the health and safety of the public;
3. The lowest floor, including the basement or cellar, of any new or substantially improved residential building shall be at least one foot above the base flood elevation;
4. Nonresidential construction or improvements shall be elevated or flood proofed to one foot above the base flood elevation;
5. The proposed construction and/or change in grade shall not:
 - a. Obstruct or divert flood flow;
 - b. Reduce natural storage or increase stormwater runoff to the extent of raising the base flood elevation. Written certification of such shall be provided by a registered professional engineer;
6. The proposed system of drainage and sewage disposal shall not cause pollution or otherwise endanger public health;
7. The proposed structures shall be constructed to counteract any buoyancy or water impacts;
8. The proposed construction shall have street or other appropriate access at least one foot above the base flood elevation.

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In addition, all development activity in the District must meet all other applicable codes and regulations.

Cluster Zoning – The Town of Braintree has provisions in the Zoning Bylaw allowing for cluster development (Article VI, section 135-610). Amongst other purposes listed, the Town has identified cluster zoning as a means of protecting water bodies and water supplies, wetlands, and floodplains.

Watershed Protection District – 135-609

Wetland Bylaw – The purpose of the Wetland Bylaw (Chapter 12.20) is to further protect the Town's wetlands, water resources, groundwater quality, and adjoining areas for, among other reasons, flood control, storm damage prevention, and erosion and sedimentation control. The bylaw requires review of all development, excavation, or fill activities in or within 100 feet of any wetland, shoreline, coastal feature, etc and also any land subject to tidal action, coastal storm flowage, or flooding.

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

Floodplain Open Space Preservation – The Town acquires undeveloped properties within the floodplain when feasible. The Conservation Commission estimates that more than 60% of the Town's floodplain is permanently protected.

Dam Maintenance – The Water and Sewer Department is responsible for inspecting and maintaining several publicly owned dams in the Town. The Highway Department maintains the embankments of the Braintree and Eaton's Pond Dams.

Bulkhead at Allen Street– The former BELD property on Allen Street has a short segment of bulkhead along tidal portion of the Monaquot River.

Public Education – The Flood Hazard Mitigation Division of the Braintree Planning and Community Development Department provides a great deal of information on flood mitigation techniques for residents and business owners on their website. The Fire Department and Department of Public Works also provide some information on fire safety and snow hazards, respectively, on their websites.

Existing Wind Hazard Mitigation Measures

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

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Tree-trimming program – The Town and the Braintree Electric Light Department, supplemented by a private tree contractor, conduct tree maintenance on public property. The Town has equipment to trim and remove trees as needed.

Existing Winter Hazard Mitigation Measures

Snow disposal –The Town conducts general snow removal operations with its own equipment. Where necessary, snow is removed and dumped on other Town properties. The Town has four designated snow dumping locations.

Development Review – Where possible, the Town includes conditions on development proposals relative to snow removal and storage.

Existing Brush Fire Hazard Mitigation Measures

Burn Permits – The Braintree Fire Department follows the State guidelines for outdoor burning. Outdoor burn season is from January 15 through May 1 and a permit is required.

Subdivision/Development Review – The Fire Department is involved in all development project reviews.

Existing Geologic Hazard Mitigation Measures

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

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

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Table 14- Braintree Existing Mitigation Measures			
Type of Existing Mitigation Measures	Area Covered	Effectiveness/ Enforcement	Improvements/ Changes Needed
MULTIPLE HAZARDS			
Comprehensive Emergency Management Plan (CEMP)	Town-wide.	Emphasis is on emergency response.	None.
Communications Equipment	Town-wide.	Effective	Address communication dead zones.
Massachusetts State Building Code	Town-wide.	Effective for new construction.	None.
Emergency Power Generators	Town-wide.	Effective.	Upgrade generators as needed; provide generators at additional locations; provide alternative fuel sources and generator power source flexibility.
Participation in the Local Emergency Planning Committee (LEPC)	Town-wide.	A forum for inter-departmental cooperation on natural and manmade disasters.	None.
FLOOD HAZARDS			
Participation in the National Flood Insurance Program (NFIP)	Areas identified on the FIRM maps.	There are 235 policies in force.	Encourage all eligible homeowners to obtain insurance.
CRS Program Participation	Town-wide	Class 9	Seek more CRS points.
Public Works Operations/Maintenance Activities	Town-wide.	Effective.	None.
Master Plan	Town-wide	Effective	Incorporate hazard mitigation and sea level rise into future updates.
Floodplain Management Plan	Town-wide	Effective.	None.
Open Space Plan	Town-wide	Effective.	None
Zoning – Floodplain District	Town-wide.	Effective for new construction.	None.

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Table 14- Braintree Existing Mitigation Measures			
Type of Existing Mitigation Measures	Area Covered	Effectiveness/ Enforcement	Improvements/ Changes Needed
Cluster Zoning	Town-wide	Effective.	None.
Wetlands By-Law	Resource Areas	Effective.	None.
DCR Dam Safety Regulations	Dams	Effective.	None.
Floodplain Open Space Preservation	Flood Hazard Areas	Effective.	Continue to identify acquisition opportunities.
Dam Maintenance	Town-wide		Continue to monitor and repair.
Bulkhead at Allen Street	Monatiquot River	Somewhat effective.	Continue to monitor and repair.
Public Education	Town-wide	Effective.	None.
WIND HAZARDS			
The Massachusetts State Building Code	Town-wide.	Effective for most situations except severe storms	None.
Tree trimming program	Town-wide.	Satisfactory.	None.
WINTER HAZARDS			
Snow Disposal Site	As necessary	Satisfactory.	None.
BRUSH FIRE HAZARDS			
Burn Permit	Town-wide.	Effective.	None.
Development Review	Town-wide.	Effective.	None.
GEOLOGIC HAZARDS			
The Massachusetts State Building Code	Town-wide.	Effective	None.

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VII. MITIGATION MEASURES FROM THE 2005 & 2008 PLANS

Review and Update Process

At a meeting of the Braintree Hazard Mitigation Committee, Town staff reviewed the mitigation measures identified in the 2005 South Shore Regional Pre-Disaster Mitigation Plan Braintree Annex and the 2008 Flood Hazard Mitigation Plan and determined whether measures identified in each respective plan had been implemented or deferred. Of those measures that had been deferred, the committee evaluated whether the measure should be deleted or carried forward into the 2011 Braintree Hazard Mitigation Plan. The decision on whether to delete or retain a particular measure was based on the committee's assessment of the continued relevance or effectiveness of the measure and whether the deferral of action on the measure was due to the inability of the Town to take action on the measure.

Table 15			
Mitigation Measures from the 2005 Plan			
Mitigation Measures	Priority	Implementation Responsibility	2011 Status
West Street (B) / Pond Street (R) roadway elevation to prevent flooding	High	DPW	Deferred
Smith Beach: Drainage system that crosses the beach needs revamping	High	DPW	On-going
Catchbasin cleaning Town-wide allows for drainage capacity	High	DPW	On-going
Jet machine for flushing drainage lines	High	DPW	Complete
Monatiquot River flood control at Armstrong dam area	High	DPW	On-going
Vacuum truck for regional usage	High	DPW	Deferred
Pictometry 4-way and community shots	High	Planning Department, Public Safety Departments	Complete
Town Hall emergency shelter enhancement	High	Planning, Building, Health, Engineering, Finance, Emergency	Delete

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Table 15			
Mitigation Measures from the 2005 Plan			
Mitigation Measures	Priority	Implementation Responsibility	2011 Status
		Management Departments	
Public education on maintaining a setback between a home and the edge of brush	Medium	Fire Department	On-going

Table 16			
Mitigation Measures from the 2008 Flood Hazard Mitigation Plan			
Mitigation Measures	Priority	Implementation Responsibility	2011 Status
Outreach to Repetitive Loss Area Properties	Priority	Planning	Deferred
CRS Program Maintenance	Secondary	Planning	On-going
Reduce Impervious Area	Secondary	Planning	On-going
Bestick Road Area Flood Control	Priority	DPW	On-going
Acquire undeveloped floodplain properties	Secondary	Planning	On-going
Braintree Highway Dept. Barn	Priority	Mayor's Office & DPW	Deferred
Map Storm Drain System	Secondary	DPW	On-going
Evaluate drainage structures at key intersections	Unlisted	DPW & MA DOT	On-going

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Table 16			
Mitigation Measures from the 2008 Flood Hazard Mitigation Plan			
Mitigation Measures	Priority	Implementation Responsibility	2011 Status
Enhance drainage at Union Street	Priority	DPW & MA DOT	On-going
Increase Storm Drainage System maintenance	Unlisted	DPW	On-going
Restore floodplain & riverfront areas	Secondary	Planning	Deferred
Develop plans for lowering water levels behind dams in advance of severe storms	Unlisted	DPW	On-going
Install back-up generators at sewage pumping stations	Secondary	DPW	On-going
Promote LID	Priority	Planning	On-going

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VIII. HAZARD MITIGATION STRATEGY

What is Hazard Mitigation?

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

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

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

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

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

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

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include protection of warning system capability, protection of critical facilities, protection of emergency response infrastructure.
(Source: *FEMA Local Multi-Hazard Mitigation Planning Guidance*)

Regional and Inter-Community Considerations

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

Inter-Community Considerations

Tri-Town Water Board - Braintree's water is supplied by the Tri-Town Water Board and the water supply source and distribution system is regional. Tri-Town serves the towns of Braintree, Randolph, and Holbrook. It is important that the water board be involved in pre-disaster mitigation planning for all three communities.

West Street (Braintree) / Pond Street (Randolph) raise roadway elevation – This roadway traverses the Richardi Reservoir, which supplies drinking water to Braintree, Randolph, and Holbrook. When the area is inundated with heavy rains the roadway frequently floods resulting in loss of access and road damage. This regional project would build the roadway higher than the present roadbed and enlarge the culvert under the present road.

Regional Issues

Climate Change and Sea Level Rise – The entirety of Massachusetts's coastal environment faces potential risk from Climate Change and associated sea level rise. Models incorporating current trends indicate a gradual rise in global temperature, with a consequent increase in the volume of water in the world's ocean due to thermal expansion as the water warms and the addition of water from melting ice sheets and glaciers. Projections for sea level rise by the end of this century range from four to 33 inches. Higher temperatures and higher sea levels will result in a greater frequency and intensity of storms and higher flood levels.

Attempts to mitigate climate change or adapt to its potential impacts are largely outside the scope of this Hazard Mitigation Plan, which relies primarily on historic trends to assess risk and vulnerability. The potential changes to the State's storm damage profile caused by Climate Change will be well outside of historic trends, making those trends uncertain predictors of future risk and vulnerability at best. Coastal Cities, Towns and Regional Planning Agencies will need to advocate for a statewide response that includes using the best available information to map and model climate change and sea level rise data related to coastal hazards in Massachusetts and disseminate this information for use in hazard mitigation planning and land use policy development.

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

Process for Setting Priorities for Mitigation Measures

The decisions on priorities were made at a meeting of the local committee. Priority setting was based on local knowledge of the hazard areas, including impacts of hazard events and the extent of the area impacted and the relation of a given mitigation measure to the Town's identified goals. In addition, MAPC asked the local committee to take into consideration factors such as the number of homes and businesses affected, whether or not road closures occurred and what impact closures had on delivery of emergency services and the local economy, anticipated project costs, whether the town currently had the technical and administrative capability to carry out the mitigation measures, whether any environmental constraints existed, and whether the town would be able to justify the costs relative to the anticipated benefits.

The listing of high, medium, and low potential mitigation measures is provided in the sections below and summarized in Table 16.

High Priority Mitigation Measures

Flooding, Drainage Infrastructure, and Dams

- A) Dickerman Lane and Staten Road Project: This project includes the installation of two new culverts and an upstream runoff impoundment area to address frequent storm driven flooding in this dense residential neighborhood. The existing culverts are undersized for addressing current storm flow and are constricted with interior physical obstructions. The improvements will also include water quality treatment for road runoff. This project was identified as part of the Bestick Road Area Flood Control Study identified in the Flood Hazard Mitigation Plan.
- B) Monatiquot River Watershed Management Plan: The majority of flooding in Braintree occurs along the Monatiquot River and its tributaries. The proposed study would look at the watershed area in order to identify physical storm water management projects and policies that could serve to reduce flooding. This study

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could also look at addressing water quality and habitat issues in the river as well. Fairfax County, VA has conducted detailed watershed studies addressing multiple issues that could serve as one model for the Monatiquot study, available at <http://www.fairfaxcounty.gov/dpwes/watersheds/>. The City of Quincy recently conducted a flood control study of the Furnace Brook that involved studying the entire stream system and proposing infrastructure improvements to address flooding.

- C) Great Pond Dam: The Town has engaged an engineering consultant to assist with the development of a strategy to bring this dam back into compliance with State safety regulations. Once that strategy is complete the Town will implement the necessary repairs and modifications.
- D) West Street / Pond Street Roadway Elevation: This roadway traverses the Richardi Reservoir, which supplies drinking water to Braintree, Randolph, and Holbrook. When the area is inundated with heavy rains the roadway frequently floods resulting in loss of access and road damage. This regional project would build the roadway higher than the present roadbed and enlarge the culvert under the present road.
- E) Drainage System at Smith Beach: The drain pipe that carries stormwater across the beach is in need of repair.
- F) Catchbasin Cleaning: Continued active catch basin cleaning is essential to maintaining drainage capacity.
- G) Monatiquot River Flood Control – Armstrong Dam: The Town needs the ability to make adjustments to the outflow from this dam in advance of heavy rains in order to reduce or prevent upstream flooding. The ability to remove boards would be one solution.
- H) Regional Vacuum Truck: A vacuum truck allows for clearing debris and blockages from storm drain lines. On an individual basis, the Town would only occasionally make use of this truck, but, if it were purchased jointly with neighboring towns, the cost of the truck would be reduced for each participating town to the point where the cost would be more in line with the potential level of use.
- I) Repetitive Loss Area Property Owner Outreach: Targeting flood information outreach to repetitive loss area property owners would get valuable information to property owners in the Town who have historically experienced the greatest impact from flood events while also giving the Town an opportunity to learn from people in these areas about the causes and extent of flooding.
- J) Bestick Road Area Flood Control: A hydrologic study of the Bestick Road Area was recently completed. The Town will continue to assess the feasibility of recommendations provided in this report and implement those as appropriate. The Dickerman Lane and Staten Road Project resulted from this study.

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- K) Braintree Highway Department Barn: The Highway Department Barn is frequently flooded during large storm events. The best solution for addressing this problem would be to relocate the facility. Until that solution is feasible, Town staff should identify other measures that could be taken to reduce the vulnerability of the building and protect the equipment and materials stored there.
- L) Enhance Drainage at Union Street: Union Street is a critical pathway for emergency evacuation and response during a natural hazard event but is prone to flooding. A combination of physical drainage enhancements and enhanced maintenance are necessary to reduce flooding on this roadway.
- M) Promote Low Impact Development Techniques: Low impact development (LID) practices, including infiltration, dry wells, green roofs, cisterns, and other measures, minimize runoff and mimic the natural hydrology of a site. As much of the flooding in Braintree is the result of the rapid drainage of stormwater from impervious surfaces, to the extent that LID techniques can lead to less impervious area and reduced runoff these practices can also help to address flooding issues.

Multi-hazard

- N) Public Education: Continue active public education programs related to flood and hurricane awareness and mitigation measures. In proportion to the potential risk, consider creating educational information on other potential natural hazards impacting Braintree such as winter storms, tornadoes, and earthquakes.
- O) Emergency Power Generators: Upgrade all generators as needed; provide alternative fuel sources and generator power source flexibility.

Measures to Ensure Compliance with NFIP

- P) Floodplain Management: Continue to enforce the Floodplain Zoning District (Article VI, Section 135-608) and associated building regulations for floodplain areas. Update this district to remain consistent with FEMA guidelines and floodplain mapping.
- Q) Floodplain Mapping: Maintain up to date maps of local FEMA identified floodplains.

Medium Priority Mitigation Measures

Flooding, Drainage Infrastructure and Dams

- R) CRS Program Maintenance: Continue Active Participation in the Community Rating System program including regular public education events related to flood awareness and prevention as well as the availability of flood insurance through NFIP.

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Measures to Ensure Compliance with NFIP

- S) Acquisition of Vacant Flood Prone Lands: Acquire priority open space parcels in floodplain areas in order to maintain flood storage and water infiltration capacity. These parcels may also be used for general conservation and recreation purposes.

Low Priority Mitigation Measures

Brush Fire

- T) Brushfire Control Access Study: Look at the accessibility for firefighting apparatus for those areas identified as having the potential for brushfires and develop strategies for improving access.

Earthquakes

- U) Municipal Building Assessment: Investigate options to make all public municipal buildings earthquake resistant.

Introduction to Potential Mitigation Measures (Table 17)

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

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

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

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

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

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

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

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

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

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

Abbreviations Used in Table 17

FEMA Mitigation Grants includes:

FMA = Flood Mitigation Assistance Program.

HMGP = Hazard Mitigation Grant Program.

PDM = Pre-Disaster Mitigation Program

ACOE = Army Corps of Engineers.

DHS/EOPS = Department of Homeland Security/Emergency Operations

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

USDA = United States Department of Agriculture

Mass DOT = Massachusetts Department of Transportation

DCR = MA Department of Conservation and Recreation

DHCD = MA Department of Housing and Community Development

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

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TOWN OF BRAINTREE HAZARD MITIGATION PLAN

Table 17 Braintree Potential Mitigation Measures						
Hazard Area	Mitigation Measure	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
High Priority						
A) Flood Hazard	Dickerman Lane and Staten Road Project	Structural Projects	Public Works	2011-2013	\$244,000	Braintree/FEMA
B) Flood Hazard	Monatiquot River Watershed Management Plan	Prevention	Planning / Public Works	2011-2016	TBD	Braintree/FEMA/ DCR/MAPC DLTA
C) Flood Hazard	Great Pond Dam	Structural Project	Water Board	2011	TBD	Braintree
D) Flood Hazard	West Street / Pond Street Roadway Elevation*	Structural Projects	Public Works	2011-2016	TBD	Braintree/ Randolph/FEMA
E) Flood Hazard	Drainage System at Smith Beach*	Structural Projects	Public Works	2011-2015	TBD	Braintree/FEMA
F) Flood Hazard	Catchbasin Cleaning*	Structural Projects	Public Works	2011-2016	TBD	Braintree
G) Flood Hazard	Monatiquot River Flood Control– Armstrong Dam*	Structural Projects	Public Works	2011-2016	TBD	Braintree
H) Flood Hazard	Regional Vacuum Truck*	NA	Public Works	2011-2016	TBD	Braintree and neighboring towns

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

**Table 17
Braintree Potential Mitigation Measures**

Hazard Area	Mitigation Measure	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
I) Flood Hazard	Repetitive Loss Area Property Owner Outreach**	Public Education	Planning	2011-2016	TBD	Braintree
J) Flood Hazard	Bestick Road Area Flood Control**	Structural Projects / Property Protection	Public Works	2011-2016	TBD	Braintree/FEMA
K) Flood Hazard	Braintree Highway Department Barn**	Property Protection	Public Works	2011-2016	TBD	Braintree
L) Flood Hazard	Enhance Drainage at Union Street**	Structural Projects / Emergency Services Protection	Public Works	2011-2016	TBD	Braintree/FEMA
M) Flood Hazard	Promote Low Impact Development Techniques**	Prevention / Natural Resource Protection	Planning	2011-2016	TBD	Braintree
N) Multi-Hazard	Public Education	Public Education	CRS Coordinator / Planning	2011-2016	TBD	Braintree
O) Multi-Hazard	Emergency Power Generators	Emergency Services Protection	Public Works	2011-2016	TBD	FEMA/Braintree

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

Table 17 Braintree Potential Mitigation Measures						
Hazard Area	Mitigation Measure	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
P) NFIP Compliance	Floodplain Management	Prevention	Planning	2011-2016	TBD	Braintree
Q) NFIP Compliance	Floodplain Mapping	Prevention	Planning	2011-2016	TBD	Braintree
Medium Priority						
R) Flood Hazard	CRS Program Maintenance**			2011-2016	TBD	Braintree
S) NFIP Compliance	Acquisition of Vacant Flood Prone Lands	Prevention / Natural Resource Protection	Planning	2011- 2016	TBD	Braintree/FEMA/ DCR / Community Preservation Act
Low Priority						
T) Brush Fire Hazard	Brushfire Control Access Study	Emergency Services Protection	Fire Department	2011-2016	TBD	Braintree
U) Earthquake	Municipal Building Assessment	Property Protection	Building Department	2011-2016	TBD	Braintree

* Mitigation measures carried forward from the 2005 Braintree Hazard Mitigation Plan.

** Mitigation measures carried forward from the 2008 Braintree Flood Hazard Mitigation Plan

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

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TOWN OF BRAINTREE HAZARD MITIGATION PLAN

IX. PLAN ADOPTION AND MAINTENANCE

Plan Adoption

The Braintree Hazard Mitigation Plan was adopted by the Town Council 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 Braintree 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 town official designated as the coordinator. Additional members could be added to the local implementation group from businesses, non-profits and institutions.

Implementation Schedule

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

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

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

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

At this point, the Hazard Mitigation Implementation Team may decide to undertake the update themselves, contract with the Metropolitan Area Planning Council to update the plan or to hire another consultant. However the Hazard Mitigation Implementation Team

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

decides to update the plan, the group will need to review the current FEMA hazard mitigation plan guidelines for any changes. The update of the Braintree Hazard Mitigation Plan will be forwarded to MEMA and DCR for review and to FEMA for approval.

Integration of the Plans with Other Planning Initiatives

Upon approval of the Braintree 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
- Building

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

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

X. LIST OF REFERENCES

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

Town of Braintree, Code of the Town of Braintree.

Town of Braintree, Zoning Bylaw of the Town of Braintree.

Town of Braintree Flood Hazard Mitigation Plan, 2008.

Town of Braintree Comprehensive Emergency Management Plan.

MA Coastal Hazards Commission, Preparing For the Storm: Recommendations for Management of Risk from Coastal Hazards in Massachusetts, May 2007.

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

FEMA, Flood Insurance Rate Maps for Braintree, MA, 2010.

Metropolitan Area Planning Council, Geographic Information Systems Lab.

Metropolitan Area Planning Council, Regional Plans and Data.

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**APPENDIX A
MEETING AGENDAS**

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

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TOWN OF BRAINTREE HAZARD MITIGATION PLAN



Don Boyce
DIRECTOR



Richard Sullivan
COMMISSIONER



Marc D. Draisen
EXECUTIVE DIRECTOR

THE COMMONWEALTH OF MASSACHUSETTS

Deval Patrick, Governor

MASSACHUSETTS EMERGENCY MANAGEMENT AGENCY

400 WORCESTER ROAD, FRAMINGHAM, MA 01702-5399 508-820-2000 FAX 508-820-1404

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

South Shore Hazard Mitigation Planning Team

First Meeting

Tuesday, February 9, 10:00 AM

**McCulluch Building
(Whipple Senior Center)
Weymouth, MA**

(See map & directions attached)

SOUTH SHORE HAZARD MITIGATION PLANNING TEAM

Braintree
Cohasset
Hingham
Hull
Marshfield
Milton
Quincy
Randolph
Scituate
Weymouth

AGENDA

10:00 WELCOME & INTRODUCTIONS

10:05 OVERVIEW OF HAZARD MITIGATION PLANNING & GRANTS

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

10:20 UPDATING THE SOUTH SHORE HAZARD MITIGATION PLAN

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

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

- Chris Brown, GIS Analyst, MAPC

11:15 NEXT STEPS / ADJOURN

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

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

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TOWN OF BRAINTREE HAZARD MITIGATION PLAN

Meeting Agenda Local Multiple Hazard Community Planning Team Braintree, MA

February 8, 2011 10:30 AM - 12:00 AM
Pond Street Municipal Building, 90 Pond Street

1. Overview of Project Scope and Status.
2. Introduce Braintree Hazard Mitigation Planning map series and digitized ortho photo. Identify Flood and Fire Hazard Areas and areas of future potential development.
3. Review and Assess Plan Goals. (see over)
4. Discuss Public Involvement and Outreach (see over)
5. Set Date for Next Meeting to:
 1. Review Existing Mitigation Measures.
 2. Review Mitigation Measures from the 2005 Plan.
 3. Discuss Potential Mitigation Measures.
 4. Prioritize Mitigation Measures.

Project Overview - MAPC received a grant to update *Hazard Mitigation Plans* for the communities of Braintree, Cohasset, Hingham, Hull, Marshfield, Milton, Quincy, Randolph, Scituate, and Weymouth. MAPC is working with the ten communities to update plans to mitigate potential damages of natural hazards such as floods, winter storms, hurricanes, earthquakes, and wild fires, before such hazards occur. The federal *Disaster Mitigation Act of 2000* requires that all municipalities adopt a *Pre-Disaster Mitigation Plan* for natural hazards and update those plans every five years, in order to remain eligible for FEMA Hazard Mitigation Grants.

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

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

Public Participation

1. MAPC presents at a 2 public meeting
2. Post on Town/City website with a set public review period.
3. Distribute to specified organizations or boards/commissions for their review.

2005 Goals

1. Ensure that critical infrastructure sites are protected from natural hazards.
2. Protect existing residential and business areas from flooding.
3. Maintain existing mitigation infrastructure in good condition.
4. Continue to enforce existing zoning and building regulations.
5. Educate the public about zoning and building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction.
6. Work with surrounding communities to ensure regional cooperation and solutions for hazards affecting multiple communities.
7. Encourage future development in areas that are not prone to natural hazards.
8. Educate the public about natural hazards and mitigation measures.
9. Make efficient use of public funds for hazard mitigation.
10. Pursue land acquisition strategies:
 - Develop official criteria for properties to be purchased or relocated by the town.
 - Improve the inventory of town owned property that can be traded.

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

Meeting Agenda Local Multiple Hazard Community Planning Team Braintree, MA

February 24, 2011 10:30 AM - 12:30 PM
Pond Street Municipal Building, 90 Pond Street

- a. Presentation and Discussion
- b. Review Existing Mitigation Measures.
- c. Review Mitigation Measures from the 2005 Hazard Mitigation Plan and 2008 Flood Mitigation Plan.
- d. Discuss Potential Mitigation Measures.
- e. Prioritize Mitigation Measures.
- f. Assign Final Review Team

Project Overview - MAPC received a grant to update *Hazard Mitigation Plans* for the communities of Braintree, Cohasset, Hingham, Hull, Marshfield, Milton, Quincy, Randolph, Scituate, and Weymouth. MAPC is working with the ten communities to update plans to mitigate potential damages of natural hazards such as floods, winter storms, hurricanes, earthquakes, and wild fires, before such hazards occur. The federal *Disaster Mitigation Act of 2000* requires that all municipalities adopt a *Pre-Disaster Mitigation Plan* for natural hazards and update those plans every five years, in order to remain eligible for FEMA Hazard Mitigation Grants.

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

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APPENDIX B HAZARD MAPPING

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

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

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

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

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

Map 3: Flood Zones – The map of flood zones used the FEMA NFIP Flood Zones as depicted on the FIRMs (Federal Insurance Rate Maps) as its source. At the time this plan was developed, these flood zones had not yet been officially adopted and were therefore considered draft. This map is not intended for use in determining whether or not a specific property is located within a FEMA NFIP flood zone. The currently adopted FIRMs for Braintree are kept by the Town. For more information, refer to the FEMA Map Service Center website <http://www.msc.fema.gov>. The definitions of the flood zones are described in detail on this site as well. The flood zone map for each community also shows critical infrastructure and repetitive loss areas.

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

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>.

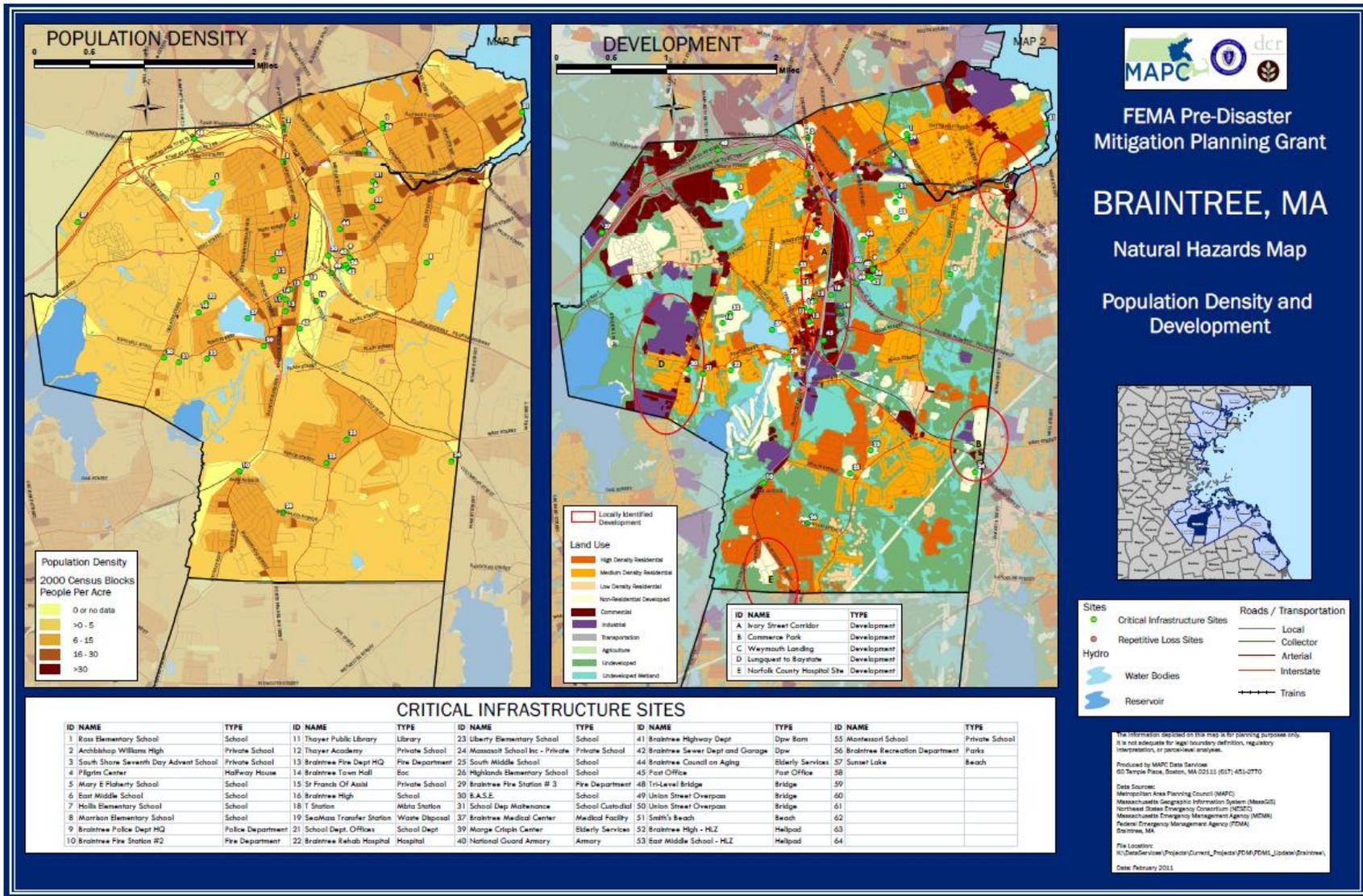
Map 5: Hurricanes and Tornadoes – This map shows a number of different items. The map includes the storm tracks for both hurricanes and tropical storms. This information must be viewed in context. A storm track only shows where the eye of the storm passed through. In most cases, the effects of the wind 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 and open space. It also shows storm tracks for nor'easters, if any storms tracked through the community.

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

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

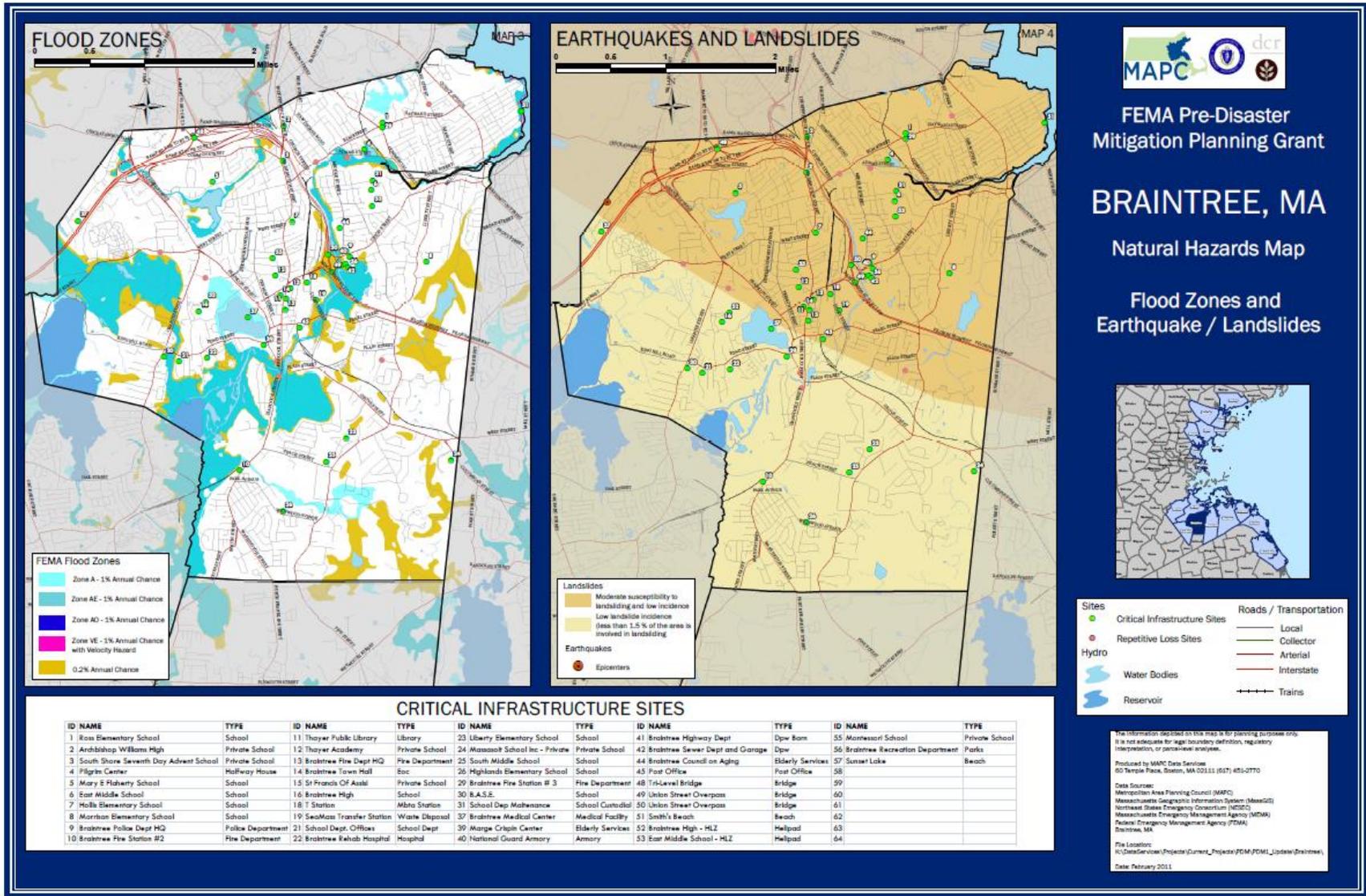
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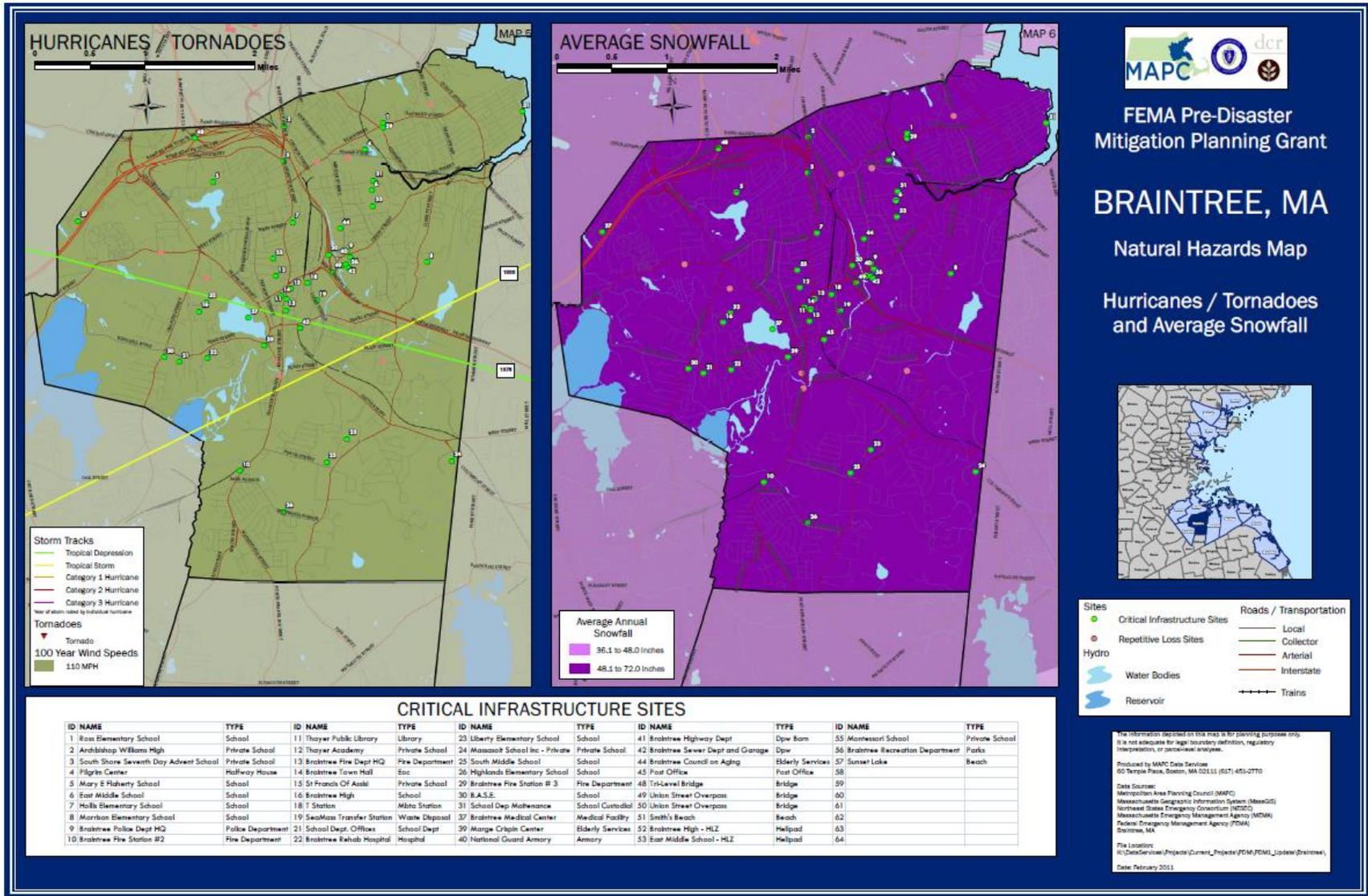
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**APPENDIX C
DOCUMENTATION OF PUBLIC PARTICIPATION**

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

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TOWN OF BRAINTREE HAZARD MITIGATION PLAN

**LEGAL NOTICE
MEETING**

**Town of Braintree
Local Emergency Planning Committee
(LEPC)
1 Union Place
Braintree, MA 02184**

Please be advised that the Town of Braintree Local Emergency Planning Committee (LEPC) next meeting will be February 24, 2011, at 10:30 a.m. in the lower level meeting room at 90 Pond Street.

Agenda for this meeting:

Braintree Hazard Mitigation Plan (2011)

AD#12446976

Braintree Forum 2/16/11

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TOWN OF BRAINTREE HAZARD MITIGATION PLAN

**APPENDIX D
DOCUMENTATION OF PLAN ADOPTION**

TOWN OF BRAINTREE HAZARD MITIGATION PLAN

DOCUMENTATION OF PLAN ADOPTION

[To be added to final plan after adoption by the town]