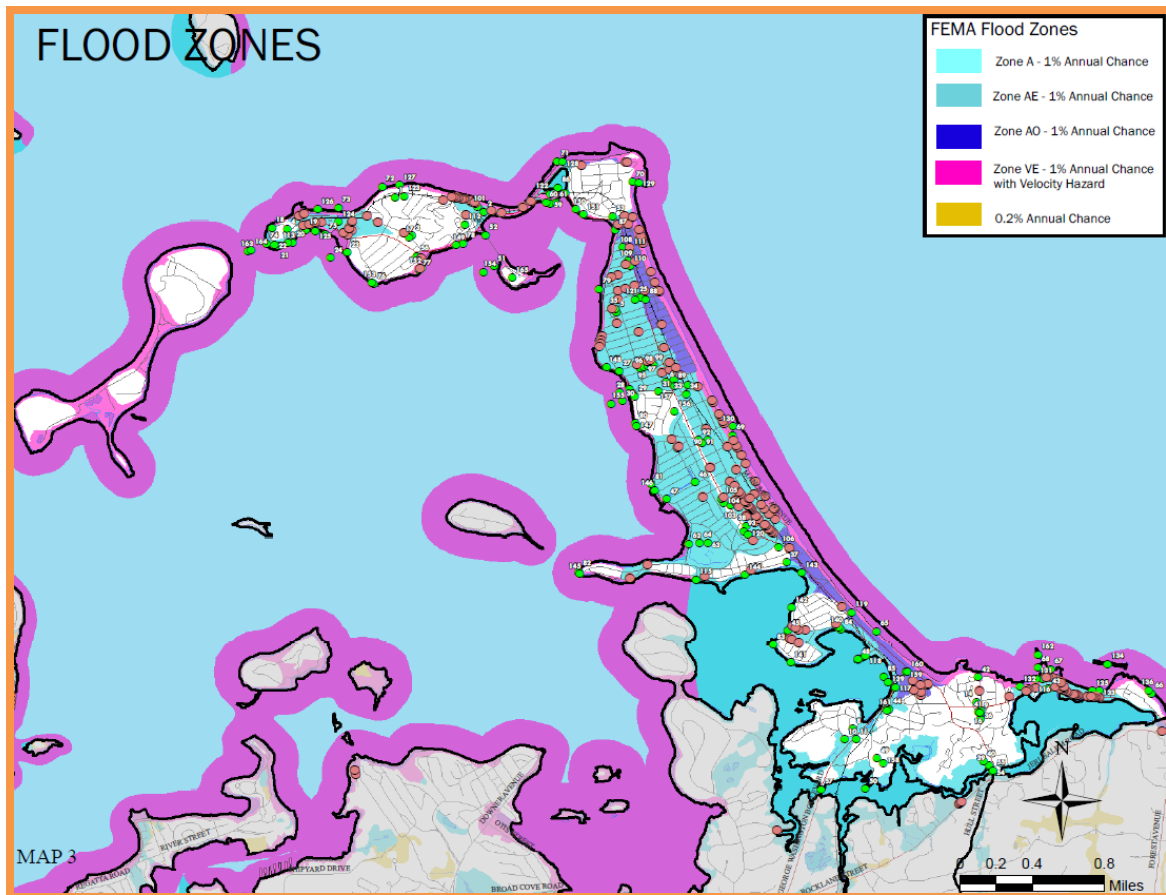


TOWN OF HULL HAZARD MITIGATION PLAN 2012 UPDATE



**Draft for Review by MEMA & FEMA
March, 2011
Revised January 25, 2012**

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ACKNOWLEDGEMENTS AND CREDITS

This plan was prepared for the Town of Hull 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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Vice President:	Lynn Duncan
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Department of Conservation and Recreation

Commissioner:	Edward M. Lambert, Jr.
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Local Hazard Mitigation Planning Team

Rick Billings	Police Chief
Dan Evans	Fire Dept.
Bob Fultz	Planning & Community Development
Anne Herbst	Conservation
Robert Hollingshead	Fire Chief, Director of Emergency Management
Phil Lemnios	Town Manager
Janice Lichtenberger	Assistant Emergency Manager
Peter Lombardo	Building Commissioner
Christopher Russo	Deputy Fire Chief
Robert Sawtelle	Police Captain
Joe Stigliani	DPW Director
Joyce Sullivan	Board of Health

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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 Hull Hazard Mitigation Plan update was led by the Hull 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. Two public meetings were held November 10, 2010 and March 29, 2011 and the plan was posted on the Town's website for public review.

Risk Assessment

The Hull 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 those areas directly on the coast where storm driven waves top the sea wall and dunes to flood adjacent low lying areas.

The Hull Local Committee identified those areas where flooding most frequently occurs, comprising 21% of the Town's land area, and approximately 931 buildings worth an estimated \$244,639,281.

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.

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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 such as coastal erosion.
7. Encourage future development that addresses hazard mitigation including measures that reflect mitigation and adaptation to climate change and the risk of sea level rise.
8. Educate the public about natural hazards and mitigation measures including the potential impacts of climate change.
9. Make efficient use of public funds for hazard mitigation.

Hazard Mitigation Strategy

The Hull Local Committee identified a number of mitigation measures that would serve to reduce the Town's vulnerability to natural hazard events. These include infrastructure projects such as continued maintenance and proactive identification of improvements for sea walls and the storm drainage system, continuation of the structure elevation program for floodplain properties, actions to protect and restore the beach dune system, and public education efforts relating to flooding and other natural hazards potentially impacting the Town. Many of the identified measures are continuations of existing programs and projects identified in the 2005 Hazard Mitigation Plan.

Overall, the hazard mitigation strategy recognizes that mitigating hazards for Hull 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, erosion of beaches, and a variety of other factors 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 – Planning Process & Public Participation	The Hull 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 presented to the Planning Board and the Board of Selectmen in public meetings. Both public meetings were televised. The plan was also

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	available on the Town's website for public comment.
IV – Risk Assessment	MAPC gathered the most recently available hazard and land use data and met with Town staff to identify changes in local hazard areas and development trends. Town staff reviewed critical infrastructure with MAPC staff in order to create an up-to-date list. MAPC also used the most recently available version of HAZUS and assessed the potential impacts of flooding using the latest data.
V - Goals	The Hazard Mitigation Goals were reviewed by the Local Hazard Mitigation Committee and Goals 7 and 8 were modified.
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, In-process, or deferred. The Local Committee determined whether to carry forward measures into the 2010 plan or delete them. The 2010 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 16, Hull made considerable progress on implementing mitigation measures identified in the 2005 Hazard Mitigation Plan. A few of the measures identified in that plan are now considered on-going aspects of the regular work of Town staff from the department head level to the regular work of Public Works staff. Individual projects have been incorporated into the Town's capital improvement plan. 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, such as the update to the Town's Open Space and Harbor Management Plans.

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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 Hull and nine other South Shore communities to update their local Hazard Mitigation Plans, which were first adopted in as part of a South Shore Multi-Jurisdictional 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 Hull 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)
December Blizzard (December 1992)	FEMA Public Assistance Project Grants	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk (7 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)

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DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
October Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk (36 projects)
1997	Community Development Block Grant-HUD	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
June Flood (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

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DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
April Nor'easter (April 15-27, 2007)	FEMA Public Assistance Project Grants	Barnstable, Berkshire, Dukes, Essex, Franklin, Hampden, Hampshire, Plymouth
	Hazard Mitigation Grant Program	Statewide
Flooding (March, 2010)	FEMA Public Assistance FEMA Individuals and Households Program SBA Loan	Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Statewide

(Source: database provided by MEMA)

FEMA Funded Mitigation Projects

Over the last 20 years the Town of Hull has received funding from FEMA for five mitigation projects under the Hazard Mitigation Grant Program (HMGP) and the Flood Mitigation Assistance Program (FMA). In addition, the Massachusetts DEM received HMGP funding to support work at Allerton Point. These projects totaled more than \$2,003,377, with \$1,475,820 covered by FEMA grants and \$491,315 by local funding. The projects are summarized in Table 3 below.

Table 3 FEMA-Funded Mitigation Projects
(Utilizing the Hazard Mitigation Grant Program)

Year	Project Title	Scope of Work	Total Cost	Federal Funding	Local Funding
2009	FMA – Elevations & Retrofits	Elevate three (3) properties, retrofit utilities at one (1) home	\$310,460.2	\$240,889.28	\$69,560.92
2007 (April Nor'easter)	HMGP - Elevations and Retrofits	Elevate five (5) homes, retrofit utilities at one (1) home.	\$315,539	\$236,519	\$78,840
1996 (October Flood)	HMGP - Allerton Point Seawall Upgrade	Placement of an embedded toe and reconstruction of existing revetment.	\$1,294,262	\$940,360	\$323,566 (DEM)

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1992 (December Blizzard)	HMGP - Ocean Meadows – Retrofitting / Elevation	Retrofitting: relocating heating systems; elevation	\$52,312	\$36,982	\$12,327
1991 (Hurricane Bob)	HMGP - Ocean Meadows – Retrofitting / Elevation	Retrofitting: relocating heating systems; elevation	\$17,155	\$12,128	\$4,042
1991 (No-Name Storm)	HMGP - Treatment Plant	Purchase emergency generator for Pumping Station A	\$13,649	\$8,942	\$2,980

(Source: database provided by MEMA)

Community Profile

Hull is located 18 miles southeast of Boston on a long narrow peninsula projecting into Boston harbor. In 1825 a new industry was launched in Hull when Paul Warrick built the Sportsman Hotel on Nantasket Avenue, the very first hotel in the town. The magnificent beaches of the town, easy access to Boston, and sea air brought hordes of visitors and by 1840 steamers were making three trips a day between Boston and Hull. Boardinghouses and elaborate hotels catered to visitors while Hull fishermen and farmers still pulled nets and farmed in its rural acreage. When the amusement park closed in 1985, an era ended for the town and the millions of visitors. But another era began as Hull acquired a suburban character with a growing number of professionals moving into town, and today there are over 11,050 year round residents.

The town maintains a website at www.town.hull.ma.us

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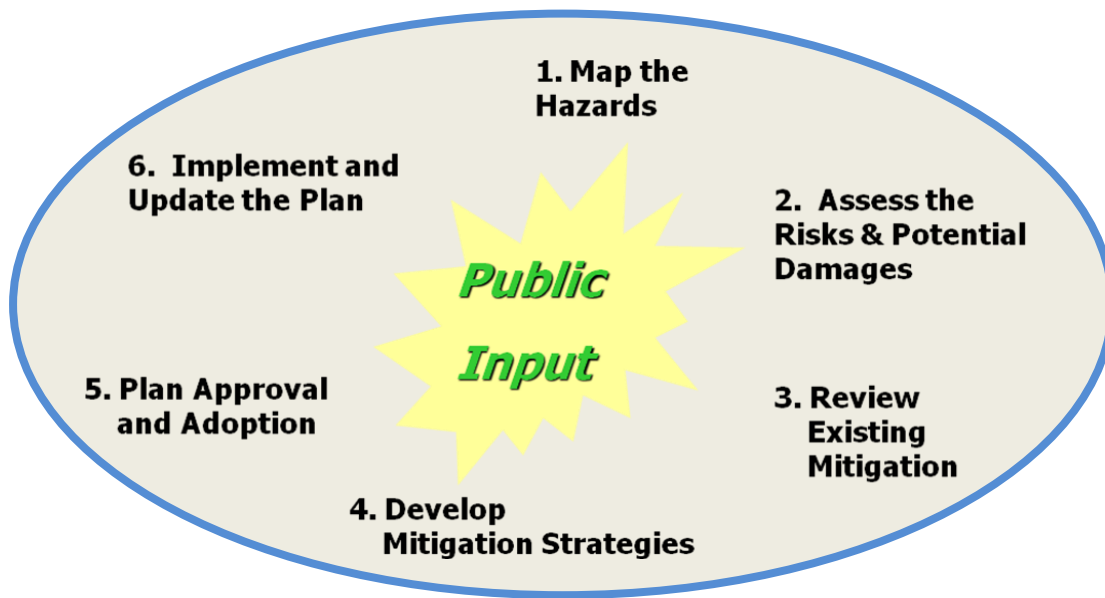
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III. PLANNING PROCESS AND PUBLIC PARTICIPATION

MAPC employs a six step planning process based on FEMA's hazard mitigation planning guidance focusing on local needs and priorities but maintaining a regional perspective matched to the scale and nature of natural hazard events. Public participation is a central component of this process, providing critical information about the local occurrence of hazards while also serving as a means to build a base of support for hazard mitigation activities. MAPC supports participation by the general public and other plan stakeholders through Regional and Local Hazard Mitigation Planning Committees, two public meetings hosted by the local Planning Board and Board of Selectmen, posting of the plan to the Town's website, and invitations sent to neighboring communities, Town boards and commissions, the local chamber of commerce, and other local or regional entities to review the plan and provide comment.

Planning Process Summary

The six-step planning process outlined below is based on the guidance provided by FEMA in the Local Multi-Hazard Mitigation Planning Guidance, July 1, 2008. Public participation is a central element of this process, which attempts to focus on local problem areas and identify needed mitigation measures based on where gaps occur in the existing mitigation efforts of the municipality. By working on municipal hazard mitigation plans in groups of neighboring cities and towns, MAPC is able to identify regional opportunities for collaboration and facilitate communication between communities. In plan updates, the process described below allows staff to bring the most recent hazard information into the plan, including new hazard occurrence data, changes to a municipality's existing mitigation measures, and progress made on actions identified in previous plans.



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1. Map the Hazards – MAPC relies on data from a number of different federal, state, and local sources in order to map the areas with the potential to experience natural hazards. This mapping represents a multi-hazard assessment of the municipality and is used as a set of base maps for the remainder of the planning process. A particularly important source of information is the knowledge drawn from local municipal staff on where natural hazard impacts have occurred, which is collected. These maps can be found in Appendix B.
2. Assess the Risks & Potential Damages – Working with local staff, critical facilities, infrastructure, vulnerable populations, and other features are mapped and contrasted with the hazard data from the first step to identify those that might represent particular vulnerabilities to these hazards. Land use data and development trends are also incorporated into this analysis. In addition, MAPC develops estimates of the potential impacts of certain hazard events on the community.
3. Review Existing Mitigation – Municipalities in the Boston Metropolitan Region have an active history in hazard mitigation as many have adopted flood plain zoning districts, wetlands protection programs, and other measures as well as enforcing the State building code, which has strong provisions related to hazard resistant building requirements. All current municipal mitigation measures must be documented.
4. Develop Mitigation Strategies – MAPC works with the local municipal staff to identify new mitigation measures, utilizing information gathered from the hazard identification, vulnerability assessments, and the community's existing mitigation efforts to determine where additional work is necessary to reduce the potential damages from hazard events. Additional information on the development of hazard mitigation strategies can be found in Chapter VII.
5. Plan Approval & Adoption – Once a final draft of the plan is complete it is sent to MEMA for the state level review and, following that, to FEMA for approval. Typically, once FEMA has approved the plan the agency issues a conditional approval with the condition being adoption of the plan by the municipality. More information on plan adoption can be found in Chapter IX and documentation of plan adoption can be found in Appendix D.
6. Implement & Update the Plan – Implementation is the final and most important part of any planning process. Hazard Mitigation Plans must also be updated on a five year basis making preparation for the next plan update an important on-going activity. Chapter IX includes more detailed information on plan implementation.

Hull'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

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community. The following individuals were appointed to represent Hull on the regional committee:

Anne Herbst	Conservation Administrator
Janice Lichtenberger	Assistant Emergency Manager
Christopher Russo	Deputy Fire Chief

The regional committee serves as an opportunity for neighboring communities to discuss hazard mitigation issues of shared concern. In addition, as the same group of MAPC staff is working on each community's plan, these issues of shared concern, and other issues that may arise between neighboring communities, are discussed in greater detail in local committee meetings and resulting actions are reflected in the identified mitigation measures, as noted in Chapter VIII. The South Shore Regional Committee met on February 9, 2010 and was attended by representatives from the neighboring cities and towns of Milton, Randolph, Quincy, Braintree, 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 Hull (local committee). James Freas, AICP, MAPC Regional Planner, led the planning process. Anne Herbst, MCP, Hull Conservation Administrator was the local lead for the planning process.

The Local Multiple Hazard Community Planning Team Meetings

On September 28, 2010 and December 9, 2010 MAPC conducted the meetings of the Hull Local Committee. The meetings were organized by Janice Lichtenberger, Assistant Emergency Manager and Anne Herbst, Conservation Administrator. 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 Hull Local Committee Meetings**

Name	Representing
<i>September 28, 2010</i>	
Rick Billings	Police Department
Dan Evans	Fire Department
Bob Fultz	Planning & Community Development
Anne Herbst	Conservation Commission
Janice Lichtenberger	Emergency Management
Phil Lemnios	Town Manager
Peter Lombardo	Building Commissioner
Robert Sawtelle	Police Department
Joe Stigliani	Public Works
Joyce Sullivan	Board of Health
<i>December 21, 2010</i>	
Kurt Bornheim	Harbor Master
Dan Evans	Fire Department
Bob Fultz	Planning & Community Development
Anne Herbst	Conservation Commission
Bob Hollingshead	Fire Chief, Emergency Mgmt
Phil Lemnios	Town Manager
Peter Lombardo	Building Commissioner
Dick Miller	Municipal Light Plant
Ed Petrilak	Sewer
Chris Russo	Deputy Fire Chief
Dale Shea	Police Department
Joe Stigliani	Public Works
Joyce Sullivan	Board of Health

Outreach to State and Regional Agencies

On November 2, 2010 James Freas and Anne Herbst met with representatives of state and regional agencies to discuss potential strategies to address flooding and, in particular, strategies to address the future impacts of sea level rise and other associated impacts of climate change. Table 5 lists the attendees at the meeting.

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**Table 5
Attendance at State and Regional Agencies Meeting**

Name	Representing
Anne Herbst	Town of Hull, Conservation Administrator
James Freas	MAPC, Regional Planner
Martin Pillsbury	MAPC, Environmental Division Manager
Sam Cleaves	MAPC, Senior Regional Planner
Jason Burtner	MA CZM, South Shore Regional Coordinator
Rebecca Haney	MA CZM, Coastal Geologist
Julia Knisel	MA CZM, Coastal Resilience Specialist
Richard Zingarelli	MA Hazard Mitigation Officer, NFIP Coordinator
Sarah White	MA MEMA, Hazard Mitigation Planner

Public Meetings

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

Natural hazard mitigation plans unfortunately rarely attract much public involvement in the Boston region, unless there has been a recent hazard event. One of the best strategies for overcoming this challenge is to include discussion of the hazard mitigation plan on the agenda of an existing board or commission. With this strategy, the meeting receives widespread advertising and a guaranteed audience of the board or commission members plus those who attend the meeting. These board and commission members represent an engaged audience that is informed and up to date on many of the issues that relate to hazard mitigation planning in the locality and will likely be involved in plan implementation, making them an important audience with which to build support for hazard mitigation measures. In addition, these meetings frequently receive press coverage and are televised, expanding the audience that has the opportunity to hear the presentation and provide comment by phoning or emailing local staff.

The plan was introduced to the public at two public meetings, once at the beginning of 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 Planning Board on November 10, 2010 held in the Hull Town Hall. This meeting was also televised on the Hull Community Television channel. A draft of the plan was presented for public comment at a meeting of the Board of Selectmen March 29, 2011 at the Hull Town Hall and televised on the Hull Community Television channel.

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The first meeting was publicized as a regular meeting of the Hull Planning Board, though the Board of Zoning Appeals was also invited to attend and additional notification was given to the public in the Hull Times. The presentation of the final draft was publicized in the local paper. The attendance list for each meeting can be found in Table 6.

Table 6
Attendance at Public Meetings

Name	Representing
<u>First Public Meeting</u>	
Jeanne M. Paquin	Hull Planning Board
J. Timothy Reynolds	Hull Planning Board
Frank Parker	Hull Planning Board
Sarah P. White	Hull Planning Board
Joseph L. Duffy, Jr.	Hull Planning Board
Vernon L. Wood	Hull Planning Board
Alana Swiec, Chair	Zoning Board of Appeals
Roger Atherton, Clerk	Zoning Board of Appeals
Eric Hipp	Zoning Board of Appeals
Bob Fultz	Planning/Community Development Director
Anne Herbst	Administrator Conservation Department
Paul Paquin	Conservation Commission
Peter Lombardo	Building Commssioner
James Freas	MAPC
Seven additional attendees	Local Citizens
<u>Second Public Meeting*</u>	
John D. Reilly, Jr.	Hull Board of Selectmen
Christopher Olivieri	Hull Board of Selectmen
John C. Brannan	Hull Board of Selectmen
Domenico L. Sestito	Hull Board of Selectmen
Dennis R. Blackall	Hull Board of Selectmen
Philip E. Lemnios	Town Manager
Jim Lampke	Town Council
Anne Herbst	Conservation Administrator
Bob Hollingshead	Fire Chief, Emergency Mgmt
James Freas	MAPC
15 additional attendees	Local Citizens

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Other Opportunities for Public Involvement

A draft of the plan was posted on the Town's website. A notice inviting comment on the plan was posted on the front page of the Town of Hull website. In addition, notice requesting comment was sent to local groups and agencies including the Chamber of Commerce, Aquarion Water Company, the local Coast Guard, area environmental groups, neighboring towns, and regional representatives who had provided earlier input to the plan.

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IV. RISK ASSESSMENT

The risk assessment analyzes the potential natural hazards that could occur within the Town of Hull 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 Hull'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. 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 (described below) and assessed the potential impacts of flooding using the latest data.

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 7 summarizes the hazard risks for Hull. 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 Hull using the definitions for hazard frequency and severity listed below Table 7.

**Table 7
Hazard Risks Summary**

Hazard	Frequency	Severity
Flood		
<i>Inland/Riverine</i>	High	Minor
<i>Coastal Storms</i>	High	Extensive
<i>Dam Failure</i>	Low	Serious
<i>Ice Jam</i>	Low	Minor
Wind		
<i>Hurricanes</i>	Medium	Extensive

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<i>Tornadoes</i>	Low	Serious
<i>Nor'easter</i>	High	Extensive
<i>Severe Thunderstorm</i>	High	Minor
Winter storms		
<i>Heavy Snow</i>	High	Minor
<i>Ice Storm</i>	High	Minor
<i>Blizzard</i>	High	Serious
Geologic		
<i>Earthquakes</i>	Low	Extensive
<i>Landslides</i>	Low	Minor
Other Natural Hazards		
<i>Brush Fire</i>	Medium	Minor

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 to public infrastructure (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and fatalities.

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

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Flood Related Hazards

Flooding was the most prevalent serious natural hazard identified by local officials in Hull. Flooding is generally the rising or overflowing of water onto normally dry land and can be caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms amongst other causes. Sea level rise brought on by global climate change has the potential to exacerbate these issues over time.

Regionally Significant Floods

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 Hull have included:

- March 1968
- The blizzard of 1978
- January 1979
- April 1987
- October 1991 ("The Perfect Storm")
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007
- March 2010
- December 2010

Overview of Town-Wide Flooding

The Town of Hull is subject to two kinds of flooding; coastal flooding where wind and tide leads to flooding along the shore and 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.

The frequency and locations of flood hazard events in Hull can be estimated based on the reported loss occurrences for repetitive loss properties and from local knowledge captured through discussion with local staff and the public during identification of local flood hazard areas. Based on these factors flooding occurs most often along the ocean shoreline, where even a relatively small storm can lead to very high tides and overwash of seawalls and dunes, and in a number of low-lying neighborhoods throughout the town. Reported losses on repetitive loss properties indicate that a flood event resulting in property damage occurs on average a little more frequently than once a year, though there

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have been stretches of time over the last 30 years of up to a couple years during which flooding of this extent did not occur. In particular, winter storms in 1978, 1979, 1982, 1991, 1992, 2001, 2003 (twice), 2005, 2006, and 2007 all led to extensive flood insurance claims in Hull's low lying, flood prone areas.

Inland/Riverine Flooding

Given Hull's largely peninsular geography, riverine flooding is less of a prominent issue compared to the hazards presented by coastal flood events. The Weir River and its tributaries, located at the southern end of the Town, is the only real river system. Flooding is relatively limited in this area and active land conservation and wetland protection measures in this area have limited the exposure of homes and businesses to this type of flooding.

Another type of inland flooding that is a greater issue for the Town is flooding driven by inadequate storm water drainage. Particularly an issue in those parts of the Town with greater levels of imperviousness, this flooding occurs in areas where the storm drain pipes are inadequately sized compared to the level of storm water run-off. Exceptionally high tides can also effectively block these storm drain systems, given Hull's generally low-lying geography.

Coastal Flooding

Coastal flooding is associated with severe coastal storms that, through the combination of winds and tides, drive tidal waters to higher levels than normally experienced, leading to the inundation of low lying land areas and the overtopping of sea walls. Hull has extensive exposure to coastal flooding and flooding along large stretches of its coastline can be a relatively frequent occurrence. The greatest amount of coastal storm related flooding is along the eastern coastline, which faces the greatest exposure to wind driven waves.

Sea Wall Failure and Coastal Erosion

Sea wall failure and coastal erosion are related issues increasingly impacting towns along the Massachusetts coast. Rising sea levels have led to increased rates of erosion along beaches and coastlines and the undermining of sea walls, some of which in the Boston region are many decades old. Sea walls protect the buildings behind them from storm damage and their failure can lead to increased property damage. Similarly, intact beaches with dunes dissipate wave energy, protecting buildings behind them. As the beaches erode away, this protection is lost. In some cases, sea walls can accelerate beach erosion. In April of 2010, 500 feet of sea wall in Marshfield collapsed due to undermining of its foundation from erosion.

FEMA has indicated in their latest rules that post hazard event reconstruction or repair funding for coastal protection structures will only be made available where the damage can be directly attributed to the storm event. Therefore, in order to receive

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this funding, the Town must maintain records of maintenance and repair activities that demonstrate the status of each structure.

Dams and Dam Failure

The Department of Conservation and Recreation (DCR) Office of Dam Safety lists one dam in Hull, which is ranked as a significant hazard.

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

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

The Massachusetts DCR has three hazard classifications for dams:

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

In general, DCR requires that dams that are rated as low hazard be inspected every ten years while dams that are rated as significant hazards must be inspected every five years.

Straits Pond Dam – The Straits Pond Dam in fact refers to the tide gate of the same name, which was recently replaced and is monitored frequently. This structure is listed by DCR as a Significant Hazard.

Ice Jam

Ice jams occur in cold weather when normally flowing water begins to freeze effectively damming the waterway and causing localized flooding in the area. There is no recent history of ice jams leading to flooding in Hull and Town staff did not identify this hazard

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as an issue for the Town. As coastal Massachusetts experiences somewhat warmer winters than the western part of the State and tidal waters are less subject to freezing, this hazard is unlikely to be an issue in the Town.

Potential Flood Hazard Areas

Information on potential flood hazard areas was taken from two sources. The first was the National Flood Insurance Rate Maps. The FIRM flood zones (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) Atlantic Avenue – Overwash of the sea wall here leads to flooding, especially during Nor'easters.
- 2) Atlantic Avenue @ Cohasset Border – Overwash leads to flooding.
- 3) Nantasket Beach (DCR) – Waves during storm events top the sea wall in this area.
- 4) Hampton Circle – Floods in the low area between Hampton and Sagamore Hills.
- 5) Beach Avenue to Nantasket Avenue, (Phipps to A Streets) – Coastal flooding overtops the sand dunes. Flooding is compounded by lack of adequate drainage.
- 6) Sunset/Cadish Avenue, Bayside – Coastal flooding overtops seawalls and revetments.
- 7) Alphabet Streets, Oceanside – Coastal flooding overtops the sand dunes.
- 8) Stoney Beach– Coastal flooding overtops seawalls and revetments. Flooding is compounded by lack of adequate drainage.
- 9) Ocean Avenue Marsh– Coastal flooding overtops seawalls and revetments. Flooding is compounded by lack of adequate drainage.
- 10) Channel Street – Sea wall– Coastal flooding overtops seawalls and revetments. Flooding is compounded by lack of adequate drainage.
- 11) Point Allerton - Coastal flooding overtops the revetment.
- 12) James Avenue– Coastal flooding overtops seawalls and revetments.

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- 13) DPW Building – adjacent to Weir River
- 14) Gun Rock Beach Coastal flooding overtops seawalls and revetments.
- 15) Dighton Street adjacent to Hull Bay
- 16) Gun Rock Coastal flooding overtops seawalls and revetments.

Repetitive Loss Structures

There are 235 repetitive loss structures in Hull. 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>.

**Table 8
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, AO	157	20	4	181
FEMA Zone VE	37	0	1	38
FEMA .2% annual chance	0	0	0	0
Total: FEMA Flood Zones*	194	20	5	219
Atlantic Avenue	20	2	0	22
Atlantic Avenue @ Cohasset Border	0	0	0	0
Nantasket Beach (DCR)	6	4	1	11
Hampton Circle	8	1	0	9
Beach Avenue to Nantasket Avenue, (Phipps to A Streets)	57	12	1	70
Sunset / Cadish Avenue, Bayside	4	0	1	5
Alphabet Streets,	13	0	0	13

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Oceanside				
Stoney Beach	15	0	1	4
Ocean Avenue	6	0	0	6
Channel Street – Sea Wall	16	0	0	16
Point Allerton	2	0	0	2
James Avenue	2	0	0	2
DPW Building	0	0	0	0
Gun Rock Beach	4	0	0	4
Dighton Street	0	0	0	0
Gun Rock	14	2	0	16
Total: Locally Identified Areas of Flooding*	165	19	4	171

* 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.

The repetitive loss sites include both residential and non-residential properties. The Town has conducted an analysis of Repetitive Loss Structures as part of its application to the Community Rating System program of FEMA. Approximately 85% of the claims are concentrated in ten areas subject to coastal flooding. The areas of greatest concentration include the Gun Rock area, the Kenberma/Samoset area and locations nearest to Nantasket Beach. Other locations include Pemberton Point, the Stony Beach area between Telegraph and Allerton Hill, in the vicinity of the marsh behind Ocean Avenue, in the vicinity of Sunset Avenue, in the low elevations between Sagamore and Hampton Hills, and off Nantasket Avenue in the vicinity of Park, Berkley and Atherton Streets.

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

Hurricanes

Since 1900, 39 tropical storms have impacted New England (NESEC). Massachusetts has experienced approximately 32 tropical storms, nine Category 1 hurricanes, five Category 2 hurricanes and one Category 3 hurricane. 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. In 1923 a tropical storm track passed through Hull near Stoney Beach. The Town experiences the impacts from 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.

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Some of the hurricanes that have passed through the region include:

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

*Category 3

Given its coastal location on a narrow peninsula, Hull 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.

Tornados

On average, there are six tornadoes that touchdown somewhere in the northeast region every year. Tornadoes are most common in the summer, June through August and most form in the afternoon or evening. Tornadoes are associated with strong thunderstorms. The strongest tornado in Massachusetts history was the Worcester Tornado in 1953 (NESEC). The most recent tornado event in Massachusetts caused significant damage in the Springfield area and resulted in 4 deaths in June of 2011. There has been no recorded tornado within the Town limits.

Nor'easters

Featuring strong northeasterly winds blowing in from the ocean over coastal areas, nor'easters are relatively common in the winter months in New England occurring one to two times a year and frequently lead to coastal flooding and erosion. The storm radius of a nor'easter can be as much as 1,000 miles and these storms feature sustained winds of 10 to 40 mph with gusts of up to 70 mph. These storms are accompanied by heavy rains or snows, depending on temperatures.

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

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Severe Thunderstorms

While less severe than the other types of storms discussed, thunderstorms can lead to localized damage and represent a hazard risk for communities. Generally defined as a storm that includes thunder, which always accompanies lightning, a thunderstorm is a storm event featuring lightning, strong winds, and rain and/or hail. Thunderstorms sometime give rise to tornados. On average, these storms are only around 15 miles in diameter and last for about 30 minutes. A severe thunderstorm can include winds of close to 60 mph and rain sufficient to produce flooding.

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. 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 36.1 - 48 inches.

Heavy Snows

Severe snow accumulation can have a number of different impacts on a community. Hazardous driving conditions can impact emergency response and vulnerable citizens in need of services, heavy snow on tree branches can cause them to fall and damage electric lines, and, in extreme situations, heavy snow can collapse or cave-in building roofs.

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
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

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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.

Ice Storm

The ice storm category covers a range of different weather phenomena that collectively involve rain or snow being converted to ice in the lower atmosphere leading to potentially hazardous conditions on the ground. While ice pellets and sleet are examples of these, the greatest hazard is created by freezing rain conditions, which is rain that freezes on contact with hard surfaces leading to a layer of ice on roads, walkways, trees, and other surfaces. The conditions created by freezing rain can make driving particularly dangerous and emergency response more difficult. The weight of ice on tree branches can also lead to falling branches damaging electric lines.

Blizzards

Blizzards include all of the hazards associated with heavy snows but also accompanied by winds of at least 35 mph and temperatures below 20 degrees Fahrenheit. Historical occurrences of blizzards are included in the above winter storm listing.

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

Damage in an earthquake stems from ground motion, surface faulting, and ground failure in which weak or unstable soils, such as those composed primarily of saturated sand or silts, liquefy. The effects of an earthquake are mitigated by distance and ground materials between the epicenter and a given location. An earthquake in New England affects a much wider area than a similar earthquake in California due to New England's solid bedrock geology (NESEC). According to the Boston College Weston Observatory, in most parts of New England, there is a one in ten chance that, a potentially damaging earthquake will occur in a 50 year time period.

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According to the State Hazard Mitigation Plan, New England experiences an average of five earthquakes per year. From 1668 to 2007, 355 earthquakes were recorded in Massachusetts (NESEC). The region has experienced larger earthquakes, including a magnitude 6.0 quake that struck in 1755 off the coast of Cape Anne. More recently, a pair of damaging earthquakes occurred near Ossipee, NH in 1940. The closest recorded earthquake epicenter was at the Braintree/Quincy border, south-west of the route three interchange with route 93. This quake occurred in 1979 and had a magnitude of 2.2, which is close to the smallest quake normally felt by people. There have been no recorded earthquake epicenters within Hull.

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.

The entire Town has been classified as having a low risk for landslides. There are no recorded instances of landslides having occurred in the Town of Hull.

Other Natural Hazards

Brush Fires

For the purposes of this plan, a brush fire is an uncontrolled fire occurring in a forested or grassland area. In the Boston region these fires rarely grow to the size of a wildfire as seen more typically in the western U.S. As their name implies, these fires typically burn no more than the underbrush of a forested area. These fires present a hazard where there is the potential for them to spread into developed or inhabited areas, particularly residential areas where sufficient fuel materials might exist to allow the fire the spread into homes.

Within the past year there were no wildfires that resulted in significant property damage. 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”:

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- 17) Ocean Avenue Marsh
- 18) Fort Revere
- 19) WBZ Marsh Area
- 20) Straights Pond Island
- 21) Shore Garden Road Area
- 22) Landfill
- 23) Weir River Woods

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 9 shows the acreage and percentage of land in 10 categories. If the three residential categories are aggregated, residential uses make up 29.13% of the area of the town (566.83 acres). The highest percentage is undeveloped wetland, which comprises 51.3% (977.93 acres).

**Table 9
2005 Land Use**

Land Use Type	Acres	Percent
High Density Residential	282.44	14.81
Medium Density Residential	272.76	14.31
Low Density Residential	11.63	.01
Non-Residential, Developed	83.91	4.4
Commercial	22.91	1.2
Industrial	3.22	.17
Transportation	.47	.02
Agriculture	0	0
Undeveloped	251.48	13.2
Undeveloped Wetland	977.93	51.3
<i>Total</i>	<i>1,906.73</i>	<i>100.00</i>

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Economic Elements

While Hull does not have a quantitative measure of the impact of specific businesses, industries, or areas on its local economic conditions, the local committee did describe two economic drivers within the Town that face potential damage during a coastal natural hazard event. The first was the Nantasket Focus Area, which includes a number of businesses related to the recreation and tourism at Nantasket Beach, historic buildings owned by DCR, and docks for a portion of Hulls commercial fishing fleet. The second was the Kenberma Business Block in the vicinity of Kenberma Street and Nantasket Avenue. This area includes the local supermarket, hardware store and numerous other local businesses.

Historic, Cultural, and Natural Resource Areas

The Local Committee identified four sites of cultural importance to the Town, the Boathouse, the Lifesaving Museum, the Carousel and Fort Revere. Several Town buildings were also noted to be of historic value including the library and Town Hall.

Development Trends

The entire peninsula occupied by the Town of Hull is built out with a relatively high density of homes. Historically, much of Hull's development has been driven by beach oriented development along the coast. Anticipated new development is limited to the occasional single residential lot redevelopment, with the exception of potential redevelopment in the Nantasket Beach area. Extensive wetlands and floodplains limit the land available for development.

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) Nantasket Focus Area
- B) Worrick Estates
- C) Waveland Area – Targeted for blight removal and redevelopment.
- D) R Street to Fitzpatrick Way - Targeted for blight removal and redevelopment.

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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.

Future Development in Hazard Areas

Table 10 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 10: Relationship of Potential Development to Hazard Areas		
Parcel	Landslide risk	Flood Zone
Nantasket Focus Area	Moderate Susceptibility	23.3139% in AE 29.5655% in AO 41.0415% in VE
Worrick Estates	Moderate Susceptibility	35.1879% in AE
Waveland Area	Moderate Susceptibility	87.4192% in AE 6.836% in VE
R Street to Fitzpatrick Way	Moderate Susceptibility	45.4311% in AE 25.7958% in AO 27.1398% in VE

Critical Infrastructure in Hazard Areas

Critical infrastructure includes facilities that are important for disaster response and evacuation (such as emergency operations centers, fire stations, water pump stations, etc.) and facilities where additional assistance might be needed during an emergency (such as nursing homes, elderly housing, day care centers, etc.). These facilities are listed in Table 11 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.

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Explanation of Columns in Table 11.

Column 1: ID #: The first column in Table 11 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:

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

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

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

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

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".

Column 7: Hurricane Surge Category: The seventh column indicates whether or not the site is located within a hurricane surge area and the category of hurricane estimated to be necessary to cause inundation of the area. The following explanation of hurricane surge areas was taken from the US Army Corps of Engineers web site:

"Hurricane storm surge is an abnormal rise in sea level accompanying a hurricane or other intense storm. Along a coastline a hurricane will cause waves on top of the surge. Hurricane Surge is estimated with the use of a computer model called SLOSH. SLOSH stands for Sea Lake and Overland Surge from Hurricanes. The SLOSH models are created and run by the National Hurricane Center.

The SLOSH model results are merged with ground elevation data to determine areas that will be subject to flooding from various categories of hurricanes. Hurricane categories are defined by the Saffir-Simpson Scale." See <http://www.sam.usace.army.mil/hesdata/General/heshtasks.htm>

According to the Saffir-Simpson Scale, the least damaging storm is a Category 1 (winds of 74-95 miles per hour) and the most damaging storm is a Category 5 (winds greater than 155 miles per hour).

Column 8: Brushfire Risk: The fourth column indicates whether the site falls within an area identified by municipal staff as posing a brushfire risk.

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Table 11: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Areas	Brushfire Risk
1	Lillian M Jacobs School	School	Moderate Susceptibility	No	No	0	No
2	Hull Wpcf - C/O P.S.G	Waste Water Treatment	Moderate Susceptibility	AE	Stoney Beach	2	No
3	Gould Hall	School	Moderate Susceptibility	No	No	0	Fort Revere
4	Hull High SCHOOL	School	Moderate Susceptibility	No	No	0	No
5	HULL MEMORIAL SCHOOL	School	Moderate Susceptibility	AE	No	1	No
6	A Street Fire Station	Fire Department	Moderate Susceptibility	AE	No	2	No
8	VFW	Meeting Place	Moderate Susceptibility	No	No	0	No
9	Police Dept	Police Department	Moderate Susceptibility	No	No	0	No
10	Hull Medical Center	Medical Facility	Moderate Susceptibility	AE	No	1	No
11	Hull Teen & Woman's Clinic	Medical Facility	Moderate Susceptibility	No	No	2	Landfill
12	Town Hall Fire Dept	Fire Department	Moderate Susceptibility	No	No	0	No
14	McTighe Manor	Elderly Housing	Moderate Susceptibility	No	No	0	No
16	HULL TOWN HALL	Town Hall	Moderate Susceptibility	No	No	0	No
17	VILLAGE FIRE STATION	Fire Department	Moderate Susceptibility	No	No	0	Fort Revere
18	WIND MILL at High School	Electric Power Plant	Moderate Susceptibility	AE	Channel Street - Sea Wall	1	No

TOWN OF HULL HAZARD MITIGATION PLAN

Table 11: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Areas	Brushfire Risk
19	STATION 9	Waste Water Pump Station	Moderate Susceptibility	VE	No	0	No
20	PEMBERTON PIER	Marina	Moderate Susceptibility	VE	No	1	No
21	LIFE SAVING BOAT HOUSE	Marina	Moderate Susceptibility	AE	No	1	No
22	FAA BEACON SHED	Beacon Shed	Moderate Susceptibility	AE	No	1	No
23	PT ALLERTON COAST GUARD STA	Coast Guard Station	Moderate Susceptibility	VE	No	2	No
24	COAST GUARD BOAT HOUSE	Beach Head	No	VE	No	0	No
25	WASTE WTR PUMP STA	Waste Water Pump Sta	Moderate Susceptibility	AE	No	1	No
27	STORM WATER PUMP STA	Storm Water Pump Sta	Moderate Susceptibility	VE	Sunset / Cadish, Bayside	1	No
28	A STREET PIER	Marina	No	VE	No	0	No
29	DONAHUE 'S WAVE LAND MARINA	Marina	Moderate Susceptibility	No	No	4	No
30	DONAHUE 'S WAVE LAND PIER	Pier	No	VE	No	0	No
31	TRI TOWN BAPTISTE CHURCH	Church	Moderate Susceptibility	No	No	0	No
33	ST ANN'S CHURCH	Church	Moderate Susceptibility	AE	Beach to Nantasket Ave	1	No
34	ANNE SCULLY'S SENIOR CENTER	Elderly Housing	Moderate Susceptibility	AE	Beach to Nantasket Ave	1	No

TOWN OF HULL HAZARD MITIGATION PLAN

Table 11: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Areas	Brushfire Risk
35	MEMORIAL SCHOOL SHELTER	Shelter	Moderate Susceptibility	AE	No	1	No
36	FUEL DEPOT	Fuel Depot	Moderate Susceptibility	No	No	0	No
37	MUNICIPAL LIGHT DEPT	Electric Power Plant	Moderate Susceptibility	No	No	2	No
38	KNIGHT'S OF COLUMBUS	Alt Shelter	Moderate Susceptibility	No	Beach to Nantasket Ave	2	No
39	DPW BARN	DPW Barn	Moderate Susceptibility	AE	DPW Building	1	No
40	DPW SALT SHACK	DPW Salt Shack	Moderate Susceptibility	AE	DPW Building	1	No
41	PUBLIC SAFETY DISPATCH CENTER	Dispatch Center	Moderate Susceptibility	No	No	0	No
42	WASTE WATER PUMP STATION A	Waste Water Pump Station	Moderate Susceptibility	VE	No	0	No
43	WASTE WATER PUMP STATION 1	Waste Water Pump Station	Moderate Susceptibility	AE	No	2	No
44	WASTE WATER PUMP STATION 3	Waste Water Pump Station	Moderate Susceptibility	AE	No	1	No
45	WASTE WATER PUMP STATION 4	Waste Water Pump Station	Moderate Susceptibility	AE	Hampton Circle	1	No
46	WASTE WATER PUMP STATION 5	Waste Water Pump Station	Moderate Susceptibility	AE	No	1	No
47	DRAPER AVE STORM WATER PUMP STATION	Waste Water Pump Station	Moderate Susceptibility	AE	No	1	No
48	NANTASKET PIER	Pier	Moderate Susceptibility	AE	No	1	No

TOWN OF HULL HAZARD MITIGATION PLAN

Table 11: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Areas	Brushfire Risk
49	HULL LAND FILL	Land Fill	Moderate Susceptibility	No	No	0	Landfill
50	TOWN POWER LINE	Power Line	No	AE	No	0	No
51	SPINNAKER ISLAND MARINA	Marina	No	VE	No	0	No
52	SPINNAKER ISLAND BRIDGE (PRIVATE)	Bridge	No	VE	No	0	No
53	DRINKING WATER BOOSTER PUMP STA 9ug0	Water Booster	Moderate Susceptibility	No	No	0	No
54	WEST CORNER BRIDGE	Bridge	No	AE	DPW Building	2	No
55	WEST CORNER CULVERT	Culvert	Moderate Susceptibility	AE	DPW Building	2	No
56	HULL PUBLIC LIBRARY	Library	Moderate Susceptibility	No	James Avenue	0	No
57	BORLAND BRIDGE	Bridge	No	AE	No	0	No
58	MLK BRIDGE	Bridge	Moderate Susceptibility	AE	No	2	No
59	TOWN PIER (PUBLIC)	Pier	No	VE	No	0	No
60	HULL YACHT CLUB	Marina	No	VE	No	0	No
61	HULL SALT WATER CLUB	Marina	No	VE	No	0	No
62	NEWPORT ROAD DIKE	Dam	Moderate Susceptibility	AE	No	0	WBZ

TOWN OF HULL HAZARD MITIGATION PLAN

Table 11: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Areas	Brushfire Risk
63	WBZ TV TOWERS	Communication Towers	Moderate Susceptibility	AE	No	1	WBZ
64	WBZ TV TOWERS	Communication Tower	Moderate Susceptibility	AE	No	1	WBZ
65	NANTASKET BEACH RES SEAWALL	Seawall	Moderate Susceptibility	VE	No	1	No
66	SUMMIT HILL SEAWALL	Seawall	Moderate Susceptibility	VE	No	0	No
67	CRESCENT/GUN ROCK BEACH SEAWALL	Seawall	Moderate Susceptibility	VE	No	1	No
68	GUN ROCK BEACH BREAKWATER	Break Water	No	VE	No	1	No
69	BEACH AVE BARRIER DUNES	Dune	Moderate Susceptibility	VE	Beach to Nantasket Ave	2	No
70	ALLERTON HILL BLUFF	Bluff	Moderate Susceptibility	VE	No	1	No
71	POINT ALLERTON SEAWALL	Seawall	Moderate Susceptibility	VE	Stoney Beach	0	No
72	STONEY BEACH/FORT HILL RIP-RAP SEAWALL	Seawall	No	VE	No	0	No
73	CHANNEL STREET SEAWALL	Seawall	No	VE	No	0	No
74	WINDMILL POINT BREAKWATER RIP-RAP	Seawall	No	VE	No	0	No
75	MAIN ST SEAWALL	Seawall	No	VE	No	0	No

TOWN OF HULL HAZARD MITIGATION PLAN

Table 11: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Areas	Brushfire Risk
76	HULL HILL SEAWALL	Seawall	Moderate Susceptibility	VE	No	0	No
77	JAMES AVE LANDING SEAWALL RIP-RAP	Seawall	Moderate Susceptibility	VE	James Avenue	1	No
78	SPRING ST SEAWALL	Seawall	No	VE	No	0	No
79	CADISH AVE SEAWALL	Seawall	No	VE	No	0	No
80	STRAWBERRY HILL SEAWALL	Seawall	Moderate Susceptibility	VE	No	0	No
81	NEWPORT RD SEAWALL	Seawall	Moderate Susceptibility	VE	No	0	No
82	SUNSET PIER SEAWALL	Seawall	Moderate Susceptibility	VE	No	0	No
83	HAMPTON CIRCLE SEAWALL	Seawall	Moderate Susceptibility	AE	No	0	No
84	BAY STREET SEAWALL	Seawall	No	AE	No	0	No
85	GEO WASHINGTON BLVD SEAWALL	Seawall	No	AE	No	0	No
86	FITZPATRICK WAY LAGOON SEAWALL	Seawall	No	AE	No	1	No
87	SUNSET MARINA	Marina	Moderate Susceptibility	VE	Sunset / Cadish Bayside	0	No
88	NANTASKET PRESCHOOL	Day Care	Moderate Susceptibility	AO	Alphabet Streets, Oceanside	2	No
89	NORTH RIVER BUS COMPANY	Bus Garage	Moderate Susceptibility	AE	Beach to Nantasket Ave	1	No

TOWN OF HULL HAZARD MITIGATION PLAN

Table 11: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Areas	Brushfire Risk
90	HADASSAH WAY TEMPLE	Church	Moderate Susceptibility	AE	Beach to Nantasket Ave	2	No
91	HULL SCHOOL DEPT	School Department	Moderate Susceptibility	AE	Beach to Nantasket Ave	2	No
92	HULL COMMUNITY NURSERY SCHOOL	Day Care	Moderate Susceptibility	No	Beach to Nantasket Ave	2	No
93	BOY SCOUT BLDG	Municipal Building	Moderate Susceptibility	No	No	2	No
94	HULL PUBLIC HOUSING	Public Housing	Moderate Susceptibility	AE	No	1	No
95	HULL PUBLIC HOUSING	Public Housing	Moderate Susceptibility	AE	No	1	No
96	HULL PUBLIC HOUSING	Public Housing	Moderate Susceptibility	AE	No	1	No
97	HULL PUBLIC HOUSING	Public Housing	Moderate Susceptibility	AE	No	1	No
98	HULL PUBLIC HOUSING	Public Housing	Moderate Susceptibility	AE	No	1	No
99	HULL PUBLIC HOUSING	Public Housing	Moderate Susceptibility	AE	No	1	No
100	HULL PUBLIC HOUSING	Public Housing	Moderate Susceptibility	AE	No	1	No
101	HULL LIFESAVING MUSEUM	Museum	Moderate Susceptibility	AE	Stoney Beach	2	No
103	Nantasket Pharmacy	Pharmacy	Moderate Susceptibility	No	Beach to Nantasket Ave	2	No
104	Riddles Grocery Store	Food	Moderate Susceptibility	No	No	2	No

TOWN OF HULL HAZARD MITIGATION PLAN

Table 11: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Areas	Brushfire Risk
105	US Post Office	Post Office	Moderate Susceptibility	AE	No	2	No
106	Cumberlands Farms	Food	Moderate Susceptibility	No	No	4	No
107	Tedeschi	Food	Moderate Susceptibility	AE	Beach to Nantasket Ave	1	No
108	Daley and Wanzer Moving & Storage	Moving/storage	Moderate Susceptibility	AO	No	2	No
109	Cumberland Farms	Food	Moderate Susceptibility	AE	No	1	No
110	Allerton Post Office	Post Office	Moderate Susceptibility	AE	No	1	No
111	Wellspring	Food	Moderate Susceptibility	AO	Alphabet Streets, Oceanside	2	No
112	Hull Cemetery	Cemetery	Moderate Susceptibility	No	No	0	No
113	Pemberton Boat Ramp	Boat Ramp	Moderate Susceptibility	VE	No	0	No
114	A Street Boat Ramp	Boat Ramp	Moderate Susceptibility	VE	Sunset / Cadish Bayside	0	No
115	8th Street Boat Ramp	Boat Ramp	Moderate Susceptibility	AE	No	0	No
116	Gun Rock Boat Ramp	Boat Ramp	Moderate Susceptibility	VE	Gun Rock Beach	1	No
117	Roller Hockey Park Heliport	Heliport	Moderate Susceptibility	AE	No	2	No
118	State Police/ Nantasket Pier Heliport	Heliport	Moderate Susceptibility	AE	No	1	No
119	Burgins Parking Lot Heliport	Heliport	Moderate Susceptibility	AO	No	4	No

TOWN OF HULL HAZARD MITIGATION PLAN

Table 11: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Areas	Brushfire Risk
120	Kenberma Playground Heliport	Heliport	Moderate Susceptibility	AE	No	2	No
121	L Street Playground Heliport	Heliport	Moderate Susceptibility	AE	No	1	No
122	Mariners Park Heliport	Heliport	Moderate Susceptibility	VE	No	1	No
123	Jacobs School Heliport	Heliport	Moderate Susceptibility	No	No	0	No
124	Dust Bowl Heliport	Heliport	Moderate Susceptibility	AE	No	2	No
125	Main Street Beach	Beach	No	VE	No	0	No
126	Channel Street Beach	Beach	Moderate Susceptibility	VE	No	0	No
127	Stoney Beach	Beach	Moderate Susceptibility	VE	No	1	No
128	Point Allerton Beach	Beach	Moderate Susceptibility	VE	Stoney Beach	1	No
129	Allerton Hill Bluff Beach	Beach	No	VE	No	0	No
130	Nantasket Beach	Beach	Moderate Susceptibility	VE	No	0	No
131	Gun Rock Beach	Beach	Moderate Susceptibility	VE	Gun Rock Beach	1	No
132	Stoney Beach	Beach	Moderate Susceptibility	VE	Gun Rock Beach	1	No
133	Crescent Beach	Beach	No	VE	No	0	No
134	Crescent beach Breakwater	Breakwater	Moderate Susceptibility	VE	No	0	No

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Table 11: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Areas	Brushfire Risk
135	Crescent beach Seawall	Seawall	Moderate Susceptibility	VE	Atlantic Ave	1	No
136	Summit Ave Beach	Beach	Moderate Susceptibility	VE	No	0	No
139	George Washington Blvd Beach	Beach	No	AE	No	0	No
140	Bay street Beach	Beach	Moderate Susceptibility	AE	No	0	No
141	Hampton Circle Beach	Beach	Moderate Susceptibility	AE	No	0	No
142	Bay Street 2 Beach	Beach	Moderate Susceptibility	AE	No	1	No
143	Topics Beach	Beach	Moderate Susceptibility	AE	No	0	No
144	Edgewater Beach	Beach	Moderate Susceptibility	AE	No	0	No
145	Sunset Point Beach	Beach	Moderate Susceptibility	VE	No	0	No
146	Newport Road Beach	Beach	Moderate Susceptibility	VE	No	0	No
147	Strawberry Hill Beach	Beach	No	VE	No	0	No
148	Cadish Ave Beach	Beach	Moderate Susceptibility	VE	Sunset / Cadish Bayside	0	No
149	Spring Street Beach	Beach	Moderate Susceptibility	VE	No	0	No
150	Fitzpatrick Way Beach	Beach	Moderate Susceptibility	VE	No	0	No
151	Fitzpatrick Way Seawall	Seawall	Moderate Susceptibility	VE	No	0	No

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Table 11: Relationship of Critical Infrastructure to Hazard Areas							
ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Areas	Brushfire Risk
152	James Ave Beach	Beach	Moderate Susceptibility	VE	James Avenue	1	No
153	Hull Hill Beach	Beach	Moderate Susceptibility	VE	No	0	No
154	Spinnaker Island Breakwater	Wave Attenuator	No	VE	No	0	No
155	A Street Breakwater	Breakwater	No	VE	No	0	No
156	Water Pump	Water Pump	Moderate Susceptibility	No	No	0	No
157	Bus Company Garage	Garage	Moderate Susceptibility	AE	Beach to Nantasket Ave	1	No
158	Windmill at Landfill	Windmill	Moderate Susceptibility	No	No	0	Landfill
159	Communications Shed	Communications Shed	Moderate Susceptibility	AO	Nantasket Beach (DCR)	2	No
160	Communications Tower	Communications Tower	Moderate Susceptibility	AO	Nantasket Beach (DCR)	2	No
161	Verizon Communications Tower	Communications Tower	Moderate Susceptibility	AE	No	1	No
162	Gun Rock Breakwater	Breakwater	No	VE	No	0	No
163	Water Pipe - 6" Main	Water Pipe	No	VE	No	0	No
164	Gas Line	Gas Line	No	VE	No	0	No
165	3 Water Tanks in Bunker	Water Tank	Moderate Susceptibility	VE	No	0	No

TOWN OF HULL HAZARD MITIGATION PLAN

Damage Assessments

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

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

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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 12
Estimated Damages from Hurricanes

	100 Year	500 Year
Building Characteristics		
Estimated total number of buildings	4,373	4,373
Estimated total building replacement value (Year 2002 \$) (Millions of Dollars)	\$1,074	\$1,074
Building Damages		
# of buildings sustaining minor damage	760	1,614
# of buildings sustaining moderate damage	134	860
# of buildings sustaining severe damage	7	233
# of buildings destroyed	8	196
Population Needs		
# of households displaced	23	375
# of people seeking public shelter	6	82
Debris		
Building debris generated (tons)	3,672	22,518
Tree debris generated (tons)	2,460.24	4,953.96
# of truckloads to clear building debris	99	708
Value of Damages (Thousands of dollars)		
Total property damage	\$17,837.29	\$170,088.15
Total losses due to business interruption	\$2,010.19	\$23,171.61

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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 13
Estimated Damages from Earthquakes

	Magnitude 5.0	Magnitude 7.0
Building Characteristics		
Estimated total number of buildings	4,373	4,373
Estimated total building replacement value (Year 2002 \$)(Millions of dollars)	\$1,074	\$1,074
Building Damages		
# of buildings sustaining slight damage	695	590
# of buildings sustaining moderate damage	187	1,673
# of buildings sustaining extensive damage	23	1,244
# of buildings completely damaged	3	769
Population Needs		
# of households displaced	21	1,257
# of people seeking public shelter	4	276
Debris		
Building debris generated (tons)	Not available	Not available
Value of Damages (Millions of dollars)		
Total property damage	\$48.76	\$618.92
Total losses due to business interruption	\$2.23	\$59.90

Estimated Damages from Flooding

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

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Hull is 2.98 square miles or 1,906.73 acres. Approximately 406 acres have been identified by local officials as areas highly susceptible to flooding. This amounts to 21% of the land area in Hull. Over 60% of Hull's total land area is located in a flood zone. The number of structures in each flood area was estimated by applying the percentage of the total land area to the number of structures (4,373) in Hull; the same number of structures used by HAZUS for the hurricane and earthquake calculations. HAZUS uses a value of \$245,648.30 per structure for the building replacement value in Hull. 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 \$24,463,928.17- \$122,319,640.86. 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 14
Estimated Damages from Flooding

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area in Hull	Estimated Number of Structures	Replacement Value	Low Estimate of Damages	High Estimate of Damages
1	Atlantic Avenue	11.34	.59	25.8007	\$6,779,576.15	\$677,957.61	\$3,389,788.07
2	Atlantic Avenue @ Cohasset border	4.45	.23	10.0579	\$2,642,885.62	\$264,288.56	\$1,321,442.81
3	Nantasket Beach (DCR)	52.72	2.76	120.6948	\$31,714,627.41	\$3,171,462.74	\$15,857,313.70
4	Hampton Circle	12.9	.68	29.7364	\$7,813,748.78	\$781,374.88	\$3,906,874.39
5	Beach Avenue to Nantasket Avenue, (Phipps to A Streets)	127.77	6.69	292.5537	\$76,873,499.05	\$7,687,349.90	\$38,436,749.52
6	Sunset / Cadish Avenue, Bayside	29.06	1.52	66.4696	\$17,466,026.69	\$1,746,602.67	\$8,733,013.34

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Table 14
Estimated Damages from Flooding

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area in Hull	Estimated Number of Structures	Replacement Value	Low Estimate of Damages	High Estimate of Damages
7	Alphabet Streets, Oceanside	58.93	3.09	135.1257	\$35,506,593.73	\$3,550,659.37	\$17,753,296.86
8	Stoney Beach	27.7	1.45	63.4085	\$16,661,670.20	\$1,666,167.02	\$8,330,835.10
9	Ocean Avenue	12.1	.63	27.5499	\$7,239,208.43	\$723,920.84	\$3,619,604.22
10	Channel Street – Sea Wall	20.05	1.05	45.9165	\$12,065,347.38	\$1,206,534.74	\$6,032,673.69
11	Point Allerton	13.79	.72	31.4856	\$8,273,381.06	\$827,338.11	\$4,136,690.53
12	James Avenue	6.55	.34	14.8682	\$3,906,874.39	\$390,687.44	\$1,953,437.20

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Table 14
Estimated Damages from Flooding

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area in Hull	Estimated Number of Structures	Replacement Value	Low Estimate of Damages	High Estimate of Damages
13	DPW Building	9.17	.48	20.9904	\$5,515,587.38	\$551,558.74	\$2,757,793.69
14	Gun Rock Beach	12.03	.63	27.5499	\$7,239,208.43	\$723,920.84	\$3,619,604.22
15	Dighton Street	2.94	.15	6.5595	\$1,723,621.05	\$172,362.11	\$861,810.53
23	Gun Rock	4.9	.26	11.3698	\$2,987,609.83	\$298,760.98	\$1,493,804.91
<i>Totals</i>		<i>406.38</i>	<i>21.29</i>	<i>931.0117</i>	<i>\$244,639,281.72</i>	<i>\$24,463,928.17</i>	<i>\$122,319,640.86</i>

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V. HAZARD MITIGATION GOALS

The Hull Local Multiple Hazard Community Planning Team met on September 28, 2010. At that meeting, the team reviewed and discussed the goals from the 2005 Hazard Mitigation Plan for the Town of Hull. Reflective of Town staff's increasing knowledge and familiarity with hazard mitigation planning and the potential impacts on Hull of natural hazard events and sea level rise associated with global climate change, the local committee modified Goals 7 and 8.

The following nine goals were endorsed by the Committee for the 2010 update of the Hull 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, 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 such as coastal erosion.
7. Encourage future development that addresses hazard mitigation including measures that reflect mitigation and adaptation to climate change and the risk of sea level rise.
8. Educate the public about natural hazards and mitigation measures including the potential impacts of climate change.
9. Make efficient use of public funds for hazard mitigation.

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VI. HAZARD MITIGATION STRATEGY

The central component of a hazard mitigation plan is the strategy for reducing the community's vulnerabilities to natural hazard events. Responding to the analysis of risk, vulnerabilities, potential impacts, and anticipated future development, the process for developing this strategy is one of setting goals, understanding what actions the community is already taking that contribute to mitigating the effects of natural hazards and assessing where more action is needed to complement or modify existing measures. The following sections include descriptions of existing mitigation measures, a status update on mitigation measures identified in previous plans, and descriptions of proposed new mitigation measures. All mitigation measures are evaluated by their benefits and potential costs to arrive at a prioritized list of action items.

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/hmgrp/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.

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- **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls (e.g., culverts), floodwalls, seawalls, retaining walls, and safe rooms.
- **Emergency Services Protection:** Actions that will protect emergency services before, during, and immediately after an occurrence. Examples of these actions include protection of warning system capability, protection of critical facilities, protection of emergency response infrastructure.

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

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 – Hull has full coverage of the Town with emergency services radio. The Town is addressing compatibility issues that will allow for regional dispatch during emergency events. Incident command units are available through Plymouth County and MEMA.

Emergency Power Generators – The Town maintains emergency power generators in several important public facilities and emergency shelters.

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

Regional and Local Emergency Management Planning Committees – Locally, the Town engages department heads in emergency management planning. On a regional level, the Town participates in regional emergency management groups, including emergency management cooperation across five neighboring communities and the Massachusetts Emergency Preparedness Region 4b, a health emergency preparation group operating across a large part of the metropolitan region and organized by Cambridge Health Alliance.

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Public Information & Outreach – The Town provides information to residents and business owners relating to a range of potential natural hazards, most especially with regard to flooding, hurricanes, and northeasters. The Town maintains a section of its webpage devoted specifically to flooding issue awareness, located at http://www.town.hull.ma.us/Public_Documents/HullMA_conservation/flood. In addition, the Town has comprehensive flood information and mitigation materials in the town library and sends an annual mailing with flood information to all residents in a flood zone.

Existing Flood Hazard Mitigation Measures

National Flood Insurance Program (NFIP) – Hull participates in the NFIP with 2,105 policies in force as of the May 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 Hull:

Flood insurance policies in force (as of November 30, 2010)	2,102
Coverage amount of flood insurance policies	\$442,078,000
Premiums paid	\$2,753,173
Total losses (all losses submitted regardless of the status)	2,102
Closed losses (Losses that have been paid)	1,765
Open losses (Losses that have not been paid in full)	1
CWOP losses (Losses that have been closed without payment)	336
Total payments (Total amount paid on losses)	\$12,260,280.84

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 29 and the total losses have increased by 177. The total payments, as of December 21, 2004, were \$10,872,341.80, approximately \$1.3 million less than the most recent figure.

CRS Program Participation – The Town of Hull 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 Hull currently has a rating of Class 8 with 1301 points, resulting in a 10% 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

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to maintain the capability of the drainage system through the reduction of sediment and litter build up and proper maintenance and repair.

- *Street sweeping* – Conducted annually, more frequently in environmentally sensitive areas and business districts.
- *Catch basin cleaning* – Conducted annually, more frequently in low lying areas.
- *Roadway treatments* – Mixture of sand and salt.
- *Other* – Continued repair and rehabilitation of check valves and back-flow preventers.

Stormwater Drainage System – Hull has an extensive stormwater drainage system that features a lagoon system with pumps as well as check valves and back-flow preventers.

Hull Community Development Plan, 2004 – The Community Development Plan includes an analysis of challenges and opportunities in the Town and proposes a vision for the Town's future and a general strategy for achieving it. The plan focuses on the potential for development in the Nantasket Beach area.

Conservation/Recreation Open Space Plan – The 2000 Open Space and Recreation Plan identifies current open space areas, as well as properties that could be acquired for open space, which serve a number of different purposes including mitigation of flooding and storm damage.

Weir River Estuary Land Protection Plan – The 2006 Weir River Estuary Land Protection Plan, covering an area that includes portions of Hull, Hingham, and Cohasset includes land protection goals for shoreline lands and wetlands that could also serve as flood and storm damage mitigation. The efforts to date have protected 368 acres of estuary land and there are approximately 150 acres of key parcels that have been identified as a priority for protection.

Harbor Management Plan - The Harbor Management Plan addresses the need for maintenance and repair of foreshore structures that prevent against flooding.

Floodplain Zoning District – Zoning is intended to protect the public health and safety through the regulation of land use. The Hull Zoning Bylaw includes a Floodplain District (Section 37 and 42). The purposes of this district are to protect the public health, safety and general welfare, to protect human life and property from the hazards of periodic flooding, to preserve the natural flood control characteristics, and the flood storage capacity of the floodplains.

The Floodplain District is an overlay district, defined by the 100-year floodplain as designated by FEMA. Within the District, all development must conform with the

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requirements of the State Building Code pertaining to the flood resistant construction and meet requirements related to anchorage, flood design considerations for enclosed spaces below base flood elevation, and water resistant construction. In High Hazard Zones (V Zones), buildings must be elevated two feet above base flood elevation, spaces below flood elevation levels should be free of obstruction or have “break-away walls”, and be anchored to pilings.

Site Plan Review – The Hull Zoning Bylaw includes Site Plan Review Design Guidelines (Section 40) with provisions that relate to improving stormwater management.

1. Protection and enhancement of important existing site features
2. Protection of adjoining premises against detrimental uses by provision of surface water drainage, sound, sight and wind barriers and preservation of views, light and air quality.
3. Convenience and safety of vehicular and pedestrian movement within the site, the location of driveway openings in relation to traffic or to adjacent streets.
4. Adequacy of the arrangement of parking and loading spaces.
5. Adequacy of the methods of disposal of refuse and other wastes.
6. Relationship of buildings, structures and open space to the natural landscape and existing buildings and structures.
7. Prevention of pollution of surface and groundwater, soil erosion, increased runoff and flooding.

Subdivision Control – “Town of Hull, Rules and Regulations Governing the Subdivision of Land” was adopted in 1988 to regulate land subdivision in the Town. These regulations include provisions that serve to address stormwater run-off associated flooding and land development within the floodplain.

Cluster Zoning - Section 43 Flexible Plan Development allows for cluster zoning. Properties of at least ten acres may receive a density bonus if a minimum of 25% of the property is reserved as open space, including passive or active recreation areas. Open space areas could be designated for the protection of natural drainage areas and streams.

Wetlands Protection Act – Hull enforces the State Wetlands Protection Act through the permitting authority of the Conservation Commission. Enforcement of the Act serves to protect the Town’s shores, ponds, rivers, and wetlands for, among other reasons, flood control, erosion and sedimentation control, and storm damage prevention.

Resource Area Setbacks – Section 31-3.e and f of the Zoning Bylaw require building setbacks from sea walls and cliffs. Specifically, these sections require that no building be constructed within ten feet of a publicly owned seawall and that no structure be built closer than twenty five feet from the top edge of a cliff that is greater than twenty feet in height unless said cliff is certified as stable by a registered geologist or registered engineer.

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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.

Identification of Repetitive Loss Areas – The Town has identified and mapped areas where there are significant concentrations of repetitive loss properties.

Elevating Repetitive Loss Properties - The Town has received two FEMA Hazard Mitigation Grants for a total of more than \$600,000 to elevate homes, or utilities within homes, for ten residential properties. The ten property owners are proceeding with their projects. The Town has applied for an additional FEMA Hazard Mitigation elevation grant for two homeowners.

Freeboard Incentive - For residential and commercial building elevation, or new construction projects, building department permit fees are reduced by \$500 if an elevation certificate is provided to verify the building is elevated a minimum of two feet above the highest federal or state requirement for the flood zone.

Tide-Gates – The Town has three major tide-gates used to control incoming tide levels. The tide-gate at Strait Pond was recently repaired.

Seawalls, Jetties, and Dikes - There are 22.6 miles of coastal frontage in Hull, 5.9 miles of this coastal frontage is publicly owned. Hull has a significant number of seawalls and armoring treatments on this frontage. The town has a Seawall Maintenance and Monitoring plan to ensure Town seawalls are inspected on a regular basis, and corrective action taken when required. Recent work includes emergency repairs to the James Street seawall. In February 2006 the Town updated a comprehensive study of these facilities to determine which ones were in need of repair or replacement and what the likely impacts of a seawall failure would be. The Town completed an inventory, condition and ownership study for all in-town seawalls in the fall of 1996. A US Army Corp of Engineers (USACOE) feasibility study to mitigate flooding of north Nantasket Beach was completed in February 1996. The Town appropriates funding annually to support seawall maintenance and repair and actively inspects and monitors their condition.

Beach and Dune Protection - The Town plants beach grass each spring. In March 2010, as in the past several years, the Town planted 15,000 beach grass plants. The Town has continued to repair breaches in the dune and improve sand fencing to protect the dune from damage.

Existing Wind Hazard Mitigation Measures

Communication Tower Zoning Regulations – Regulations of communication towers were created to (a) protect the general public from hazards associated with wireless communication facilities; (b) minimize visual impacts from wireless communication facilities on districts in Hull and to preserve scenic views to and from roadways, open space, recreation areas, and waterways; (c) allow the provisions of necessary wireless communication services and (d) promote shared use of facilities to minimize the need for

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additional facilities. The zoning ordinance contains regulations that limit tower height and ensure that design and construction is done safely. A special permit from the Board of Appeals is required in order to construct a communications tower and it must meet the following conditions:

- Towers must be 500' from buildings
- Towers can not be more than 50' above natural grade
- Allowed on public lands or commercial recreation by special permit
- Only mono-poles are allowed
- Not closer than 2 miles to nearest wireless facility
- No lighting allowed

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

Tree-trimming program – The Town Light Department conducts tree trimming in coordination with the Department of Public Works.

Existing Winter Storm Hazard Mitigation Measures

Snow disposal –The town conducts general snow removal operations with its own equipment.

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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Existing Other Hazard Mitigation Measures

Burn Permits – The Town fire department requires a written permit for outdoor burning, which includes explanation of the related regulations and precautions for the permit-holder to take. The permit-holder must call the fire department on the proposed burn day to confirm weather conditions are suitable for outdoor burning.

Subdivision/Development Review – The Fire Department participates in the review of new subdivisions and development projects.

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Table 15- Hull 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	Further funding needed. Critical elements being upgraded.
Massachusetts State Building Code	Town-wide	Effective for new construction.	None.
Emergency Power Generators	Town-wide	Effective.	Upgrade generators or purchase additional as needed; provide generators at additional locations; provide alternative fuel sources and generator power source flexibility.
Participation in the Regional and Local Emergency Planning Committees	Town-wide	Forums for cooperation on natural and manmade disasters.	None.
Public Information & Outreach	Town-wide	Effective	More funding.
FLOOD HAZARDS			
Participation in the National Flood Insurance Program (NFIP)	Areas identified on the FIRM maps.	There are 2,102 policies in force.	
CRS Program Participation	Town-wide	Class 8	Seek more CRS points.
Public Works Operations/Maintenance Activities	Town-wide	Effective	More funding.
Stormwater Drainage System	Town-wide	Somewhat Effective	Upgrade and improve as funding allows.
Community Development Plan, 2004	Town-wide	Effective	Needs Updating.

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Table 15- Hull Existing Mitigation Measures			
Type of Existing Mitigation Measures	Area Covered	Effectiveness/ Enforcement	Improvements/ Changes Needed
Open Space Plan	Town-wide	Effective	Needs Updating
Weir River Estuary Land Protection Plan	Weir River	Effective	Needs Updating
Harbor Management Plan	Harbor Area	Effective	Update in progress
Zoning – Floodplain District	Town-wide	Effective	Updating based on new FEMA maps / code
Site Plan Review	Town-wide	Effective	Amend to address flooding and sea level rise.
Subdivision Control Law	Town-wide	Effective	None
Cluster Zoning	Town-wide	Effective	None
Wetlands Protection Act	Resource Areas	Effective	None
Resource Area Setbacks	Town coastlines	Effective	None
DCR Dam Safety Regulations	Dams	Effective	None
Identification of Repetitive Loss Areas	Town-wide	Effective	Keep up to date.
Elevating Repetitive Loss Properties	Repetitive Loss Properties	Grant applications submitted	Continue to seek funding.
Freeboard Incentive	Flood Zones	Effective	Address zoning height limitation issue.
Flood Control Pump Stations	Town-wide	Effective	Investigate for potential for failure.
Tide Gates	Town-wide	Effective	Inspect, maintain and repair as necessary.
Seawalls, Jetties, and Dikes	Coastline	Effective	Inspect, maintain and repair as necessary.
Beach Dune Protection	Coastline	Effective	Inspect, maintain and repair as necessary.
WIND HAZARDS			
Communication Tower Zoning Regulations	Town-wide	Effective	None
The Massachusetts State Building Code	Town-wide	Effective for most situations except severe	None.

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Table 15- Hull Existing Mitigation Measures			
Type of Existing Mitigation Measures	Area Covered	Effectiveness/ Enforcement	Improvements/ Changes Needed
		storms	
Tree trimming program	Town-wide	Effective	None
WINTER HAZARDS			
Snow Disposal Site	Town-wide	Effective	Seek additional appropriate disposal locations.
GEOLOGIC HAZARDS			
The Massachusetts State Building Code	Town-wide	Effective	None.
OTHER HAZARDS			
Burn Permit	Town-wide	Effective.	None.
Development Review	Town-wide	Effective.	None.

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Implementation Progress on Previous Plans

At a meeting of the Hull Hazard Mitigation Committee, Town staff reviewed the mitigation measures identified in the 2005 South Shore Regional Pre-Disaster Mitigation Plan Hull Annex and subsequent plan updates in 2008, 2009, 2010 and determined whether each measure had been implemented or deferred. For implemented projects, they were categorized as either complete or in-process, with the latter referring to projects begun but not yet completed. In-process measures are carried forward into the 2011 Hull Hazard Mitigation Plan. Of those measures that had been deferred, the committee evaluated whether the measure should be deleted or carried forward into the 2010 Hull 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 16 Mitigation Measures from the 2005 Plan			
Mitigation Measures	Priority	Implementation Responsibility	2011 Status
Stormwater drainage system improvements, including increasing capacity; mapping the drainage system using GIS	High (Years 1-3)	DPW	In-process (Mapping is done, and several projects have been completed or are currently underway. This project represents a continuous improvement effort)
Check valves and back flow preventers	High (Years 1-3)	DPW	In-process (Several projects have been completed. This project represents a continuous improvement effort)
Repair Nantasket sea wall (DCR owned facilities)	High (Years 1-3)	DCR	In-process (DCR installed a new wall and revetments along the northern third of the beach. Hull is active on advisory committee to continue improvements)
Straits Pond at Nantasket Ave culvert, Atlantic Ave bridge and tidegate repairs	High (Years 1-3)	MHD and DPW	Complete

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Table 16 Mitigation Measures from the 2005 Plan			
Mitigation Measures	Priority	Implementation Responsibility	2011 Status
House elevating	High (Years 1-3)	Conservation	In-process (Ten completed to date, with an application to fund two more)
Repair of Town seawall, dikes, and jetties based on updated analysis of needs	High to Low – varies by project (Years 1-5)	Town of Hull	In-process (Numerous repairs completed. This project represents a continuous improvement effort)
Seismic Study for earthquake hazards	Medium (Years 3-5)	Town of Hull	Deferred (Not prioritized for funding and dedication of staff time)
Public education for residents in flood hazard zones; flood materials in library	High (Years 1-5)	CRS Coordinator	In-process (This project is a continuous effort by the Town to provide flood related information through many different outlets)
Repair and protect dunes along Nantasket Beach	High (Years 1-5)	Conservation Commission, DPW	In-process (The Town completes annual beach grass plantings and dune repairs. This project represents a continuous improvement effort)
Update FEMA flood maps	Medium (Years 1-3)	FEMA with input from the Town of Hull	In-process (FEMA released draft maps in 2008 and Hull continues to participate in map review)
Mitigation Measures Added 2008			
Flood protection for the A Street fire station. Elevate boiler and install hurricane doors.	High	Fire Department	In-process (Boiler elevated, seeking grant for hurricane doors)
Mitigation Measures Added 2009			

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Table 16 Mitigation Measures from the 2005 Plan			
Mitigation Measures	Priority	Implementation Responsibility	2011 Status
Examine need to elevate generator and mechanical systems at the Memorial School, which serves as the Town's emergency shelter.	High	Emergency Management	Complete
Mitigation Measures Added 2010			
Reinforce and protect electric transmission lines from weather and trees damage	Medium	Hull Light Plant	In-process (Some work completed. This project represents a continuous improvement effort)

The Town of Hull is very active in pursuing implementation of hazard mitigation efforts and annually reviews progress on all identified mitigation measures. Many of those identified measures are not discrete projects but are instead on-going efforts to maintain and improve Town infrastructure so as to reduce vulnerability to natural hazards events, focused primarily on the potential risks from flooding and wind.

Further information on the status of several of the projects listed above can be found in the mitigation measure descriptions in the next chapter.

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 in a local area. There is a third level of mitigation which is regional; involving a state, regional, or federal agency or an issue that involves numerous municipalities across a wide area of the metropolitan region.

Inter-Community Considerations

Shoreline Environment – The coastal shoreline of the South Shore area is a dynamic environment where forces of erosion and deposition of sand are constantly at work changing the beach profile. This process disregards municipal boundaries as sand and other materials are moved along the coast. Shoreline protection measures such as sea walls, jetties, and others have an impact on this process with the potential of building up

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sand in some areas while striping it away from others. Municipalities along the South Shore should work to understand how these processes are at work locally and consider mutually beneficial means of protecting their shore side communities from the impacts of storm damage.

Weir River Estuary Land Protection – Amongst the numerous benefits that can be attributed to protecting land in the Weir River Estuary, covering an area that includes portions of Hull, Hingham, and Cohasset, protection of coastal land and wetland areas can serve to mitigate flooding and potential storm damage. These protected areas directly serve to absorb storm water and act as flood water retention areas. Indirectly, land along the water that is protected will not be developed with homes and buildings that would later be subject to storm and flood damage.

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.

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 Hull, 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

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where cooperation with these other agencies may be necessary. Implementation of these recommendations will require that all parties work together to develop solutions.

Proposed Hazard Mitigation Measures

Flood Hazard Mitigation Measures

- A) **Alphabet Streets Drainage:** The Alphabet Streets area, up to Bay Avenue East, periodically experience flooding caused by insufficient drainage. A portion of this area has been identified for revitalization and redevelopment. The entire area needs to be studied for necessary drainage system upgrades and a plan developed to implement those upgrades in conjunction with other area infrastructure improvements.
- B) **Aquarion Water Pipes:** Aquarion Water Company is the public water supply company serving the Town of Hull. One of their water pipes runs directly under the primary dune along Nantasket Beach, creating the potential for the destruction of the dune in the event of a pipe break. The dune is an important part of the Town's storm protection system. The Town will propose that the water company abandon and replace the current pipe in a less dangerous location.
- C) **Encourage Building Elevation:** Hull has created a freeboard incentive program that encourages property owners constructing a new home to exceed the minimum required building elevation. In some cases this incentive conflicts with height restrictions in the base zoning district. A proposed change to the zoning bylaw allowing existing homes in the flood district to exceed the height restrictions to provide flood proofing by a maximum of four feet by special permit will be voted on in May. Town staff will monitor the effectiveness of this change in encouraging home elevations to exceed minimum requirements.
- D) **Stormwater Drainage System Improvements:** The drainage system is an important part of Hull's overall flood mitigation efforts and the Town is continuously engaged in repair and improvements to this system. The Town has completed drainage improvements along Main Street and at James Avenue, Moreland Avenue, and Fitzpatrick Way. The Town completed GIS mapping of the entire drainage system and all DPW infrastructure has been incorporated into GIS. The Town received state grant funds to improve drainage at Pond Street and Richard Road. The town experimented with new catch basin design at S Street. The new design is beneficial in sandy soils and will be implemented in additional locations.
- E) **Check Valves and Back-Flow Preventers:** Within the stormwater drainage system, check valves and back-flow preventers are important for ensuring that lines meant to drain water away do not become conduits for bringing additional flood waters into streets and homes. As with the overall system, repair and improvement is an on-going task. The Town added and/or repaired flapper valves at James Avenue,

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Moreland Avenue, Main Street, and Fitzpatrick Way. Work in this past year includes repair and rehabilitation of the flapper valve at Main Street and repair of the Spinnaker Island flapper valve.

- F) Flood Control Pump Stations: Hull's topography and location as a peninsula require the use of pump stations in a number of areas that are intended to remove flood waters. These pumps require on-going repair and improvement in order to maintain their effectiveness. Given the current age of these pumps, they should be investigated for failure potential. The Draper Avenue pump station (also referred to as the Lagoon Pond pump station) needs to be upgraded.
- G) Repair Nantasket Seawall: This Department of Conservation and Recreation (DCR) owned facility protects adjacent commercial areas and parking that are an important part of Hull's tourism and visitor based economy. The DCR has installed a new wall and revetment along the northern third of the DCR-owned beach. The Town of Hull is active in a DCR Citizens Advisory Committee to address additional measures to protect against flooding.
- H) Home Elevation Program: Programs to elevate homes and utilities located in floodplain areas can be a very effective measure to reduce the loss of life and property associated with flooding events. Hull is continuing to seek funding to support home elevation in the community. Work is proceeding on the two home elevation grants received in 2009 for ten homes. One home has completely finished elevating utilities. The Town is currently in the process of applying for another Hazard Mitigation grant to elevate for an additional two homes.
- I) Repair of Town Seawalls, Dikes, and Jetties: Seawalls, dikes, and jetties form an important line of protection from storm surges in Hull. The Town has a Seawall Maintenance and Monitoring plan to ensure Town seawalls are inspected on a regular basis, and corrective action taken when required. The Town should continue its efforts to fund seawall repair and replacement. Recently, the Town funded, and received grant support, to rebuild the Green Hill revetment and that project is substantially complete. The Town has received permit approval to repair the seawall at James Avenue. The DCR has received permit approval to repair seawalls at Pt. Allerton and Stony Beach. The DCR has done initial work to consider options for repair of the seawall in the Gun Rock area. The James Avenue wall was re-pointed. Areas of the Newport Avenue wall were repaired. Cracks in the seawall along Nantasket Avenue at Stoney Beach were repaired.
- J) Dune Repair and Protection: Dunes are an important storm protection feature, not only serving to reduce flooding of adjacent properties but also naturally re-nourishing the beach. The Town should continue to actively maintain the dunes, including the existing program of planting beach grass each spring. In March 2008, 2009 and 2010, the Town planted 15,000 beach grass plants. The Town should continue to repair breaches in the dune and improve sand fencing to protect the dune from damage. The Town restored and planted 50 feet of dune at A Street in spring 2010.

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- K) A Street Fire Station Flood Protection: The A Street Fire Station is an important emergency services facility and is located in a floodplain area. Improvements should be made to provide flood protection to this building. While the boiler was elevated in 2008, the Fire Department has applied for grant funding to install hurricane doors.
- L) Paving Reduction Program: The Town will consider creating a program to reduce the amount of impervious paving in order to allow for greater absorption of stormwater before it enters the storm drain system. As proposed, this program would target both new construction and existing developed areas through a combination of regulation, education, and incentives. Successful efforts in Somerville, MA and Portland, OR can serve as potential models.
- M) Open Space Plan Update: In identifying potential open space and recreation areas in the next update to the Hull Open Space Plan, consider the positive role open space has in mitigating flood hazards and incorporate that into the criteria for selecting parcels for the protection or creation of public open space areas.
- N) Harbor Management Plan Update: Complete update and adoption of the plan.
- O) Acquisition of Repetitive Loss Properties: Consider pursuing grant funding for acquisition of repetitive loss properties.

Measures to Ensure Compliance with NFIP

- P) Floodplain Management: Continue to enforce the Floodplain Zoning District (Article XV) and associated building regulations for floodplain areas. Update this district to remain consistent with the building code, FEMA guidelines and floodplain mapping. In May Town Meeting will consider bylaw change proposals that update the floodplain district language to include the latest version of the building code and give the Planning Board authority to review proposed measures by a developer to address flooding and sea level rise during the site plan review process.
- Q) 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.
- R) Floodplain Mapping: Maintain up to date maps of local FEMA identified floodplains.

Wind Hazard Mitigation Measures

- S) Protect Electric Lines: Reinforce and protect electric transmission lines from weather and trees damage. The Light Plant completed work on transmission lines on Nantasket Avenue from Point Allerton to the Hull Yacht Club.

TOWN OF HULL HAZARD MITIGATION PLAN

Winter Storm Hazard Mitigation Measures

The Local Hazard Mitigation Committee did not identify any additional hazard mitigation measures in this category beyond existing mitigation measures, which were deemed to be adequate given the risks and vulnerabilities presented.

Geologic Hazard Mitigation Measures

T) Public Building Seismic Assessments: Assess the earthquake vulnerability of all public buildings.

Other Natural Hazards

The Local Hazard Mitigation Committee did not identify any additional hazard mitigation measures in this category beyond existing mitigation measures, which were deemed to be adequate given the risks and vulnerabilities presented.

Multi-Hazard Mitigation Measures

- U) Emergency Power Generators: Upgrade or purchase additional emergency power generators in emergency shelters and critical facilities as needed; provide alternative fuel sources and generator power source flexibility.
- V) Public Education: Continue efforts at public education addressing all potential natural hazards in Hull. Take advantage of existing State and Federal public information materials that can be made available to residents and businesses in the Town. Continue to reach out specifically to residents and businesses in areas particularly prone to flooding and provide them with information on steps they can take to reduce their vulnerabilities to property damage during flood events. Use public education efforts around hazard preparedness to build support for efforts to implement hazard mitigation measures.
- W) Communications Equipment at Jacobs School: Assess the necessity of upgrading emergency communication capabilities at the Jacobs School in the event that this facility becomes used as an alternate emergency shelter.
- X) Community Development Plan Update: Ensure the incorporation of Hazard Mitigation issues into the next update to the Hull Community Development Plan, with emphasis on the potential impacts of flooding and the effects of climate change on future development in the Town.

TOWN OF HULL HAZARD MITIGATION PLAN

Prioritization of Mitigation Activities

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

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. This cost approximation takes into account the estimated project costs, as well as other political, social, or environmental aspects as appropriate such as whether the town currently had the technical and administrative capability to carry out the mitigation measures or whether any environmental constraints exist. These cost and benefit designations reflect discussion and general consensus developed over the course of a meeting and is subject to change as conditions in the community change.

The table below demonstrates the prioritization analysis. For each mitigation measure, municipal staff identified the geographic extent of the potential benefiting area, estimated an overall benefit in terms of High, Medium or Low, a cost as outlined above in terms of High (greater than \$50,000), Medium (\$10,000 to \$49,000), or Low (less than \$10,000 or staff time), and based on these factors, prioritized each mitigation measure as High, Medium or Low. The level of benefit created by a project was based on an estimate of the number of homes, businesses, or people served by the mitigation action and an estimate of the costs or damages avoided via implementation of the mitigation measure. Where a more exact estimate of cost was known, this number was used instead. With this assessment, the Committee was able to identify an approximate timeframe in which the municipality would attempt to complete the mitigation measure.

TOWN OF HULL HAZARD MITIGATION PLAN

Table 17 Mitigation Measure Prioritization					
Mitigation Action	Geographic Area	Benefit	Estimated Cost	Priority	Time Frame
Flood Hazard Mitigation Measures					
A) Alphabet Streets Drainage	Project Area	High	High	High	2012-2017
B) Relocate Aquarion Water Pipes	Project Area	High	High	High	2012-2015
C) Encourage Building Elevation	Floodplains	High	Low	High	2012
D) Stormwater Drainage System Improvements*	Town wide	High	High	High	2012-2017
E) Check Valves and Back-Flow Preventers*	Town wide	High	High	High	2012-2017
F) Flood Control Pump Stations	Pump Stations	High	High	High	2012-2017
G) Repair Nantasket Seawall*	Nantasket Beach Area	High	High	High	2012-2017
H) Home Elevation Program*	Floodplains	High	High	High	2012-2017
I) Repair of Town Seawalls, Dikes, and Jetties*	Coastline	High	High	High	2012-2017
J) Dune Repair and Protection*	Coastline	High	Medium	High	2012-2017
K) A Street Fire Station Flood Protection	Fire Station	High	High	High	2012-2015
L) Paving Reduction	Town wide	Medium	Low	Medium	2012-

TOWN OF HULL HAZARD MITIGATION PLAN

Table 17 Mitigation Measure Prioritization					
Mitigation Action	Geographic Area	Benefit	Estimated Cost	Priority	Time Frame
Program					2017
M) Open Space Plan Update	Town wide	Medium	Medium	Medium	2012-2014
N) Harbor Management Plan Update	Harbor	Medium	Medium	Medium	2012-2014
O) Acquisition of Repetitive Loss Properties	Flood plains	Medium	High	Medium	2012-2017
P) Floodplain Management	Flood plains	High	Low	High	2012-2017
Q) Acquisition of Vacant Flood Prone Lands	Flood Plains	High	High	High	2012-2017
R) Floodplain Mapping*	Town wide	Medium	Low	Medium	2012-2017
Wind Hazard Mitigation Measures					
S) Protect Electric Lines	Town wide	Medium	Medium	Medium	2012-2017
Geologic Hazard Mitigation Measures					
T) Public Building Seismic Assessments	Public Buildings	Low	Medium	Medium	2012-2017
Multi-Hazard Mitigation Measures					
U) Emergency Power Generators	Shelters and Critical Facilities	Medium	High	High	2012-2017
V) Public Education*	Town wide	Medium	Low	High	2012-2017

TOWN OF HULL HAZARD MITIGATION PLAN

Table 17 Mitigation Measure Prioritization					
Mitigation Action	Geographic Area	Benefit	Estimated Cost	Priority	Time Frame
W) Communications Equipment at Jacobs School	School	Medium	Medium	Medium	2012-2014
X) Community Development Plan Update	Town wide	Low	Medium	Medium	2012-2015

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

TOWN OF HULL HAZARD MITIGATION PLAN

Introduction to Mitigation Measures Table (Table 18)

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.

Hazard Area – Each mitigation measure is intended to address one or more of the natural hazard potentially impacting Hull, such as Flooding, Wind, Fire, and Earthquake. Where the proposed measure is intended to address a specific locally identified area of concern, this area is identified as well.

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.

Measure Type – There are six different types of pre-disaster mitigation measures identified by FEMA for which a community may apply for Hazard Mitigation funding.

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, even though many of these represent continuous efforts over a much longer period. The identification of a likely time frame is not meant to constrain a community from taking advantage of funding opportunities as they arise.

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

TOWN OF HULL HAZARD MITIGATION PLAN

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 18

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

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Table 18
Hull Potential Mitigation Measures

Mitigation Measure	Measure Type	Implementation Responsibility	Priority	Time Frame	Potential Funding Sources
Flood Hazard Mitigation Measures					
A) Alphabet Streets Drainage	Structural Projects	Public Works/Planning	High	2011-2016	FEMA/DHCD/Town
B) Relocate Aquarion Water Pipes	Natural Resource Protection	Conservation/Public Works	High	2011-2014	Private
C) Encourage Building Elevation	Prevention	Building/Conservation	High	2011	Town Staff Time
D) Stormwater Drainage System Improvements*	Structural Projects	Public Works	High	2011-2016	FEMA/Town
E) Check Valves and Back-Flow Preventers*	Structural Projects	Public Works	High	2011-2016	FEMA/Town
F) Flood Control Pump Stations	Structural Projects	Public Works	High	2011-2016	FEMA/Town
G) Repair Nantasket Seawall*	Structural Projects	DCR	High	2011-2016	ACOE/State
H) Home Elevation Program*	Property Protection	Conservation	High	2011-2016	FEMA
I) Repair of Town Seawalls, Dikes, and Jetties*	Structural Projects	Public Works	High	2011-2016	ACOE/State/Town
J) Dune Repair and Protection*	Natural Resource Protection	Conservation/Public Works	High	2011-2016	Town
K) A Street Fire Station Flood Protection	Emergency Services Protection	Fire	High	2011-2014	FEMA/Town

TOWN OF HULL HAZARD MITIGATION PLAN

Table 18
Hull Potential Mitigation Measures

Mitigation Measure	Measure Type	Implementation Responsibility	Priority	Time Frame	Potential Funding Sources
L) Paving Reduction Program	Prevention/ Property Protection	Conservation/ Planning/ Building/ Sewer	Medium	2011-2016	Town
M) Open Space Plan Update	Prevention	Planning	Medium	2011-2013	State/Town
N) Harbor Management Plan Update	Prevention	Planning	Medium	2011-2013	Town
O) Acquisition of Repetitive Loss Properties	Property Protection	Conservation	Medium	2011-2016	FEMA/Private
P) Floodplain Management	Prevention	Building/ Conservation	High	2011-2016	Town
Q) Acquisition of Vacant Flood Prone Lands	Natural Resource Protection	Conservation	High	2011-2016	Town/ DCR/ Private
R) Floodplain Mapping*	Public Education	Conservation/ Building	Medium	2011-2016	Town
Wind Hazard Mitigation Measures					
S) Protect Electric Lines	Property Protection	Light Plant	Medium	2011-2016	Town
Geologic Hazard Mitigation Measures					
T) Public Building Seismic Assessments	Property Protection/ Emergency Services Protection	Building	Medium	2011-2016	Town
Multi-Hazard Mitigation Measures					
U) Emergency Power	Emergency Services	Emergency Management	High	2011-2016	FEMA/Town

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Table 18
Hull Potential Mitigation Measures

Mitigation Measure	Measure Type	Implementation Responsibility	Priority	Time Frame	Potential Funding Sources
Generators	Protection				
V) Public Education*	Public Education	Conservation	High	2011-2016	Town
W) Communications Equipment at Jacobs School	Emergency Services	Emergency Management	Medium	2011-2013	Town
X) Community Development Plan Update	Prevention	Planning	Medium	2011-2014	DHCD/ Town

*Mitigation measures carried forward from the 2005 Hull Hazard Mitigation Plan

TOWN OF HULL HAZARD MITIGATION PLAN

VII. PLAN ADOPTION AND MAINTENANCE

Plan Adoption

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

Plan Maintenance

MAPC worked with the Hull 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

Annual Update to the Plan

The Local Hazard Mitigation Implementation group will meet and update the plan on an annual basis. An updated plan will be completed and made available to the public by October 1 of each year.

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 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 Hull Hazard Mitigation Plan will be forwarded to MEMA and DCR for review and to FEMA for approval.

TOWN OF HULL HAZARD MITIGATION PLAN

Integration of the Plans with Other Planning Initiatives

Upon approval of the Hull 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
- Planning and Community Development
- Conservation
- Health
- Building
- Light
- Sewer

The plan will 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 HULL HAZARD MITIGATION PLAN

VIII. 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 Hull, General By-laws.

Town of Hull, Zoning Bylaw

Town of Hull, Repetitive Loss Properties Analysis, November 2006

Preparing for Climate Change Impacts on Hull, Anne Herbst, (powerpoint) 4/29/10

Weir River Estuary Land Protection Plan, 2006

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

Massachusetts Hazard Mitigation Plan 2007

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

FEMA, Flood Insurance Rate Maps for Hull, MA, May 2, 1983

FEMA, Revised Preliminary Flood Insurance Rate Maps for Hull, MA, November, 2008

FEMA Flood Insurance Study, Town of Hull, MA, November 2, 1982

FEMA Flood Insurance Study, Plymouth County, MA, Preliminary May, 2008

FEMA flood insurance claims data for the Town of Hull

Metropolitan Area Planning Council, Geographic Information Systems Lab

Metropolitan Area Planning Council, Regional Plans and Data

Massachusetts StormSmart Coasts, website: <http://ma.stormsmartcoasts.org/>

New England Seismic Network, Boston College Weston Observatory, website: <http://aki.bc.edu/index.htm>

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

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**APPENDIX A
MEETING AGENDAS**

TOWN OF HULL HAZARD MITIGATION PLAN

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TOWN OF HULL HAZARD MITIGATION PLAN



Don Boyce
DIRECTOR



Richard Sullivan
COMMISSIONER



Marc D. Draisen
EXECUTIVE DIRECTOR

SOUTH SHORE HAZARD MITIGATION PLANNING TEAM

Braintree
Cohasset
Hingham
Hull
Marshfield
Milton
Quincy
Randolph
Scituate
Weymouth

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)

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 HULL HAZARD MITIGATION PLAN

Meeting Agenda Local Multiple Hazard Community Planning Team Hull, MA

September 28, 2010 10:00 AM - 11:30 AM
Hull Town Hall, 253 Atlantic Ave

1. Overview of Project Scope and Status.
2. Introduce Hull 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 HULL HAZARD MITIGATION PLAN

Public Participation Options

1. Public web-based survey
2. Series of presentations by Town/City staff to local groups.
3. MAPC presents at a public meeting – existing board or commission*
4. Post on Town/City website with a set public review period.
5. Distribute to specified organizations or boards/commissions for their review.
6. Create a summary document and distribute in community

2005 Goals

1. Ensure that critical infrastructure sites are protected from natural hazards.
2. Protect existing residential and business areas from flooding by controlling, regulating, and desynchronizing stormwater flows.
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.

TOWN OF HULL HAZARD MITIGATION PLAN

Meeting Agenda Local Multiple Hazard Community Planning Team Hull, MA

December 9, 2010 2:30 PM - 4:00 PM
Hull Town Hall, 253 Atlantic Ave

1. Confirm Goals
2. Review Existing Mitigation Measures
3. Review Mitigation Measures from the 2005 Plan and the 2009 Annual Update
4. Discuss Potential Mitigation Measures
5. Prioritize Mitigation Measures
6. Assign Final Review Team
7. Prepare for final public meeting

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 HULL HAZARD MITIGATION PLAN

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 Hull 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 HULL 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/pp1183/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.

TOWN OF HULL HAZARD MITIGATION PLAN

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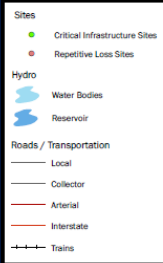
TOWN OF HULL HAZARD MITIGATION PLAN

FEMA Pre-Disaster Mitigation Planning Grant

HULL, MA

Natural Hazards Map

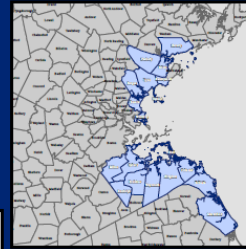
Flood Zones and Earthquake / Landslides



The information depicted on this map is for planning purposes only. It is not intended for legal, regulatory, or other purposes. Repetitive Loss Sites are shown in yellow.

Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-0770

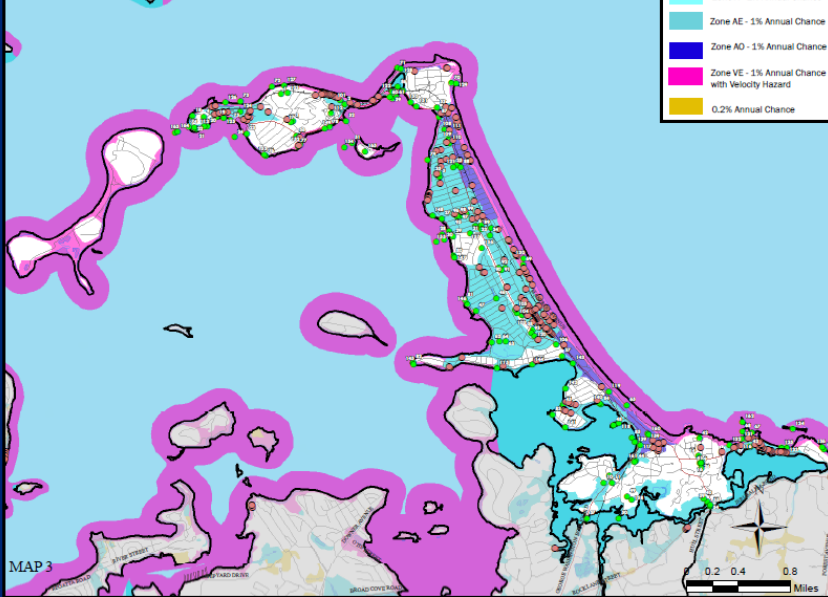
Date: 10/1/2010
Map: 10/1/2010
Project: 10/1/2010
Version: 1.0



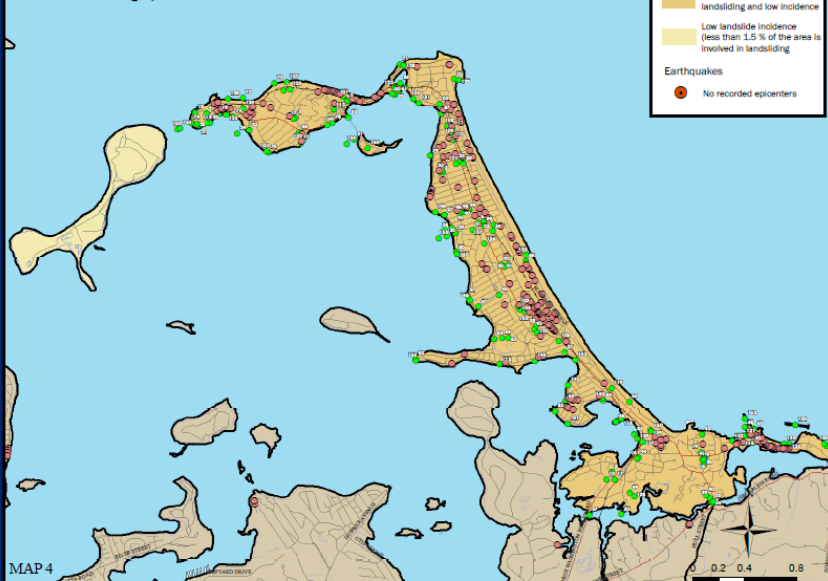
CRITICAL INFRASTRUCTURE SITES

ID	NAME	TYPE
1	100th Ave. Junior School	School
2	101st Ave. C/O P.S.D.	Water Wren Treatment
3	102nd Ave.	Fire Station
4	103rd Ave.	School
5	104th Ave.	School
6	105th Ave.	Fire Department
7	106th Ave.	Water Wren Pump Sta.
8	107th Ave.	Water Wren Pump Sta.
9	108th Ave.	Water Wren Pump Sta.
10	109th Ave.	Water Wren Pump Sta.
11	110th Ave.	Water Wren Pump Sta.
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201	300th Ave.	Water Wren Pump Sta.

FLOOD ZONES



EARTHQUAKES AND LANDSLIDES



TOWN OF HULL HAZARD MITIGATION PLAN

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TOWN OF HULL HAZARD MITIGATION PLAN

FEMA Pre-Disaster Mitigation Planning Grant

HULL, MA

Natural Hazards Map

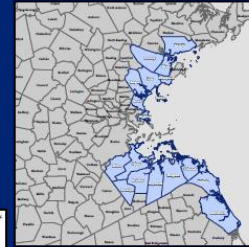
Hurricanes / Tornadoes and Average Snowfall



The information depicted on this map is for planning purposes only. It is not adequate for legal, regulatory, engineering, or other purposes.

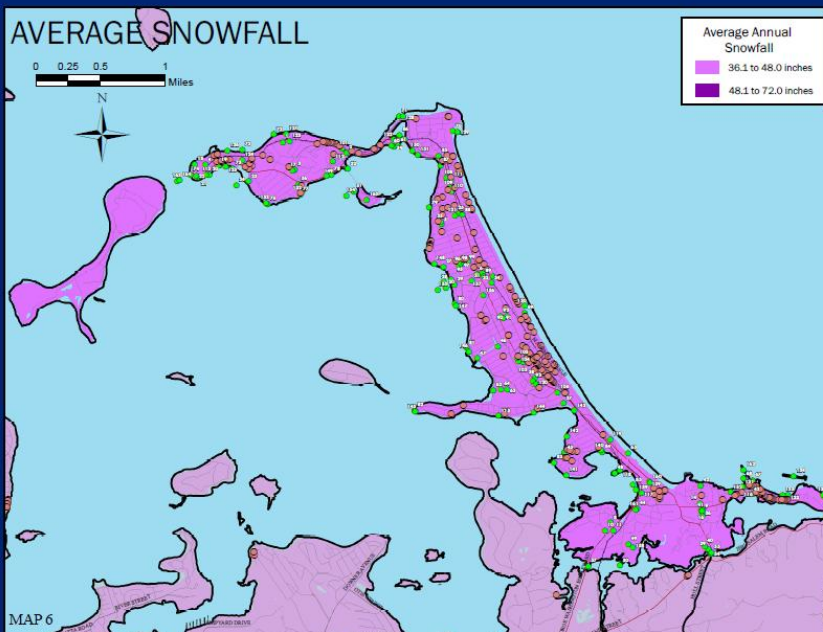
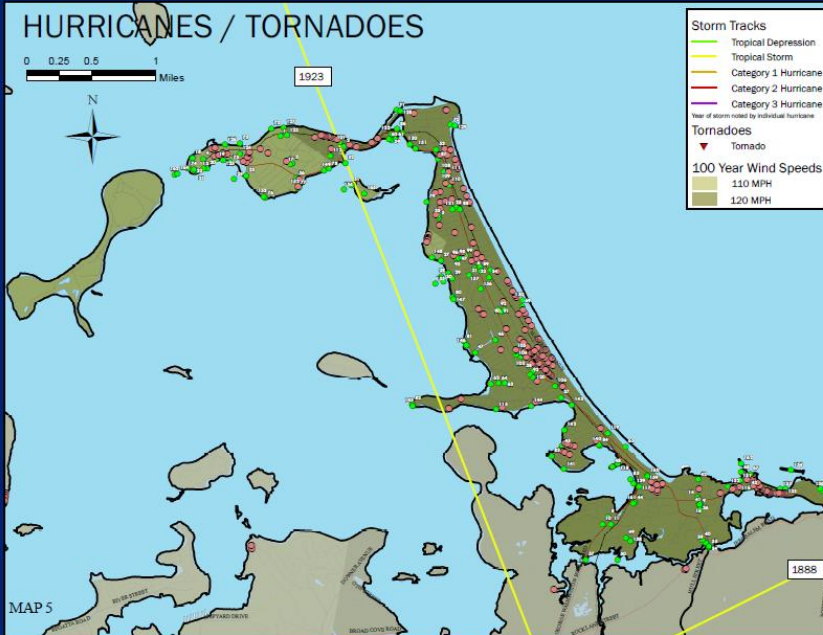
Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770

Date: December 2010
Map: Hurricane / Tornadoes and Average Snowfall
Project: FEMA Pre-Disaster Mitigation Planning Grant
Client: Town of Hull



CRITICAL INFRASTRUCTURE SITES

SITE #	NAME	TYPE
1	Office of Justice School	School
2	Hull Wast. C/O P.S.D.	Waste Water Treatment
3	Coast Road	Fire Station
4	Hull High School	School
5	Hull Middle School	School
6	A Street Fire Station	Fire Department
7	South Shore Charter School	School
8	W.R.	Meeting Place
9	Trinity Day	Police Department
10	Hull Medical Center	Medical Facility
11	Hull Town & Municipal Club	Medical Facility
12	Town Hall Fire Dept	Fire Department
13	South Shore Primary Charter School	School
14	St. John's Church	Religious Building
15	South Shore Charter School	School
16	Hull Town Hall	Town Hall
17	Village Fire Station	Fire Department
18	Ward Hill	Public Power Plant
19	STATION 3	Waste Water Pump Sta.
20	FRANKLIN ST.	Waste Water Pump Sta.
21	UPR SAVING ROAD HOUSE	Waste Water Pump Sta.
22	COAST GUARD HOUSE	Waste Water Pump Sta.
23	PT ALBERTON COAST GUARD STA.	Waste Water Pump Sta.
24	WASTE WTR PUMP STA.	Waste Water Pump Sta.
25	LIGHT HOUSE ASSEMBLY CHURCH	Church
26	STORM WATER PUMP STA.	Waste Water Pump Sta.
27	A STREET PIER	Waste Water Pump Sta.
28	SCHWAB'S WAREHOUSE	Waste Water Pump Sta.
29	SCHWAB'S WAREHOUSE	Waste Water Pump Sta.
30	ST. JOHN'S LUTHERAN CHURCH	Church
31	WATER TOWER	Waste Water Pump Sta.
32	ST. ANNE'S CHURCH	Church
33	WINE SOCIETY SENIOR CENTER	Senior Housing
34	WINE SOCIETY SENIOR CENTER	Senior Housing
35	PUB. DEPOT	Public Power Plant
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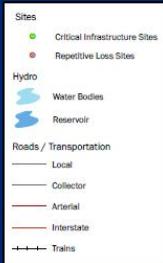
TOWN OF HULL HAZARD MITIGATION PLAN

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TOWN OF HULL HAZARD MITIGATION PLAN

FEMA Pre-Disaster Mitigation Planning Grant HULL, MA

Natural Hazards Map Composite Natural Hazards and Hazard Areas



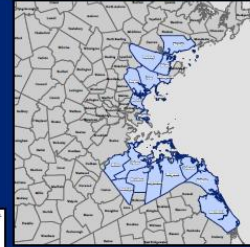
The information described on this map is for planning purposes only. It is not intended for legal, regulatory, or other purposes. Repetitive Loss Sites are shown in red.

Produced by MAPC Data Services
60 Temple Place, Boston, MA 02111 (617) 451-2770

Data Sources:
Massachusetts Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast State Emergency Coordination Center (NSEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
Hull, MA

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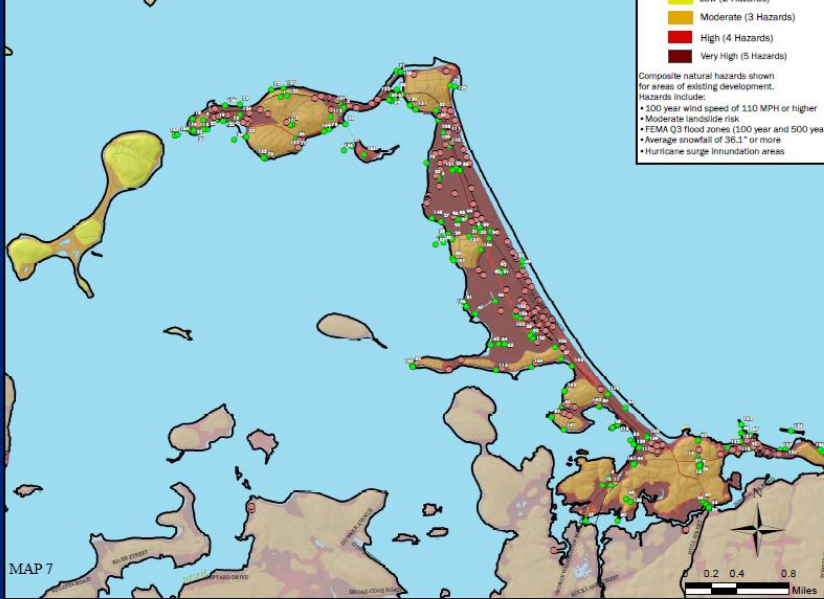
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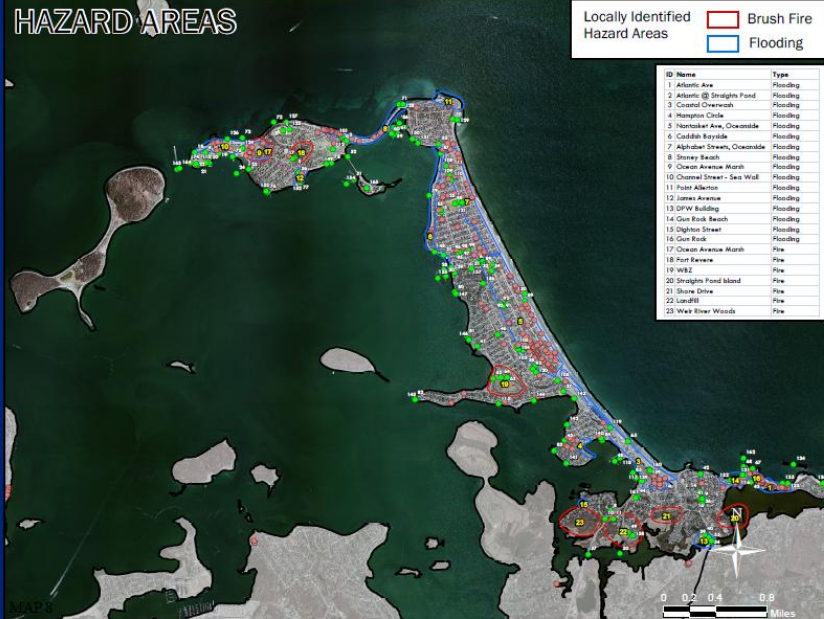
CRITICAL INFRASTRUCTURE SITES

SITE ID	NAME	TYPE
1	William W. Jacoby School	School
2	Hull High School	High School
3	Quincy Hall	Fire Station
4	Hull High School	School
5	Hull Memorial School	School
6	A Street Fire Station	Fire Department
7	South Shore Charter School	School
8	Fire	Fire
9	Public Dept	Public Department
10	Hull Harbor Center	Harbor Center
11	Hull Town & Veterans Club	Harbor Center
12	Town Hall Fire Dept	Fire Department
13	South Shore Primary Charter School	School
14	AC TROIE MARCH	Public Housing
15	South Shore Charter School	School
16	HULL TOWN HALL	Town Hall
17	WALSH FIRE STATION	Fire Department
18	WINDMILL	Public Power Plant
19	STATION 1	Public Power Plant
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148	STATION 130	Public Power Plant
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150	STATION 132	Public Power Plant
151	STATION 133	Public Power Plant
152	STATION 134	Public Power Plant
153	STATION 135	Public Power Plant
154	STATION 136	Public Power Plant
155	STATION 137	Public Power Plant
156	STATION 138	Public Power Plant
157	STATION 139	Public Power Plant
158	STATION 140	Public Power Plant

COMPOSITE NATURAL HAZARDS



HAZARD AREAS



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APPENDIX C
DOCUMENTATION OF PUBLIC PARTICIPATION

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The following ad ran in the November 5, 2010 Hull Times.

Planning Board to update Disaster Mitigation Plan. The Hull Planning Board will meet on Wednesday, Nov. 10 at 7 p.m. in the selectmen's meeting room to hear two presentations. The Town of Hull is beginning the process of revising its Pre-Disaster Mitigation Plan to review Hull's exposure to natural hazards (flood, hurricane, etc.) and identify actions that can be taken to reduce risk. James Freas of the Metropolitan Area Planning Commission will present information on the planning process. The public is invited to provide input into revisions to Hull's PDM.

In addition, Conservation Administrator Anne Herbst will give a presentation on Hull's vulnerability to the impacts of rising sea levels. The presentation will include discussion of potential bylaw changes or other policy initiatives the town may want to consider to be better prepared for future coastal storms.

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MINUTES

Hull Planning Board

November 10, 2010

Agenda

The Hull Planning Board held a joint meeting with the Hull Board of Appeals on November 10, 2010 at 7:10 pm at the Hull Municipal Building, 253 Atlantic Avenue, Hull, Massachusetts.

Present for the Planning Board were: Jeanne Paquin, Chairman; Joseph Duffy, Vice Chairman; Timothy Reynolds, Clerk; Sarah White, Vernon Wood and Frank Parker, Members; Also present was Robert Fultz, Planning Board Director. Not present was Stephen Flynn, Member.

Present for the Board of Appeals were: Alana Swiec, Chairman; Roger Atherton, Member; and Eric Hipp, Associate Member.

The Planning Board Chairman opened the meeting at 7:10 pm and announced that the meeting is being taped and televised and introduced Anne Herbst, Hull's Conservation Administrator, to the full audience. Herbst presented a power point. She opened with preparing for climate impacts on Hull and explained that the Massachusetts CZM (Coastal Zone Management) provided a technical assistance grant to prepare for the effects of climate change for Hull with a focus on the sea level rise (slr) aspect. Herbst said she is seeking zoning to protect the town as a rising of 1 ft. per century would be significant.

Herbst also said that she wanted to acknowledge from the beginning, for those who hold different opinions on climate change, and speak about what is happening and what may happen, and that she is hoping that we can agree to disagree as she does have data that shows sea levels in our area are currently rising at the rate of nearly one foot per century. Herbst added that our land is dropping and the rate of the water rise is 7" per century and could reach 12".

Green House Effect – on the concept of climate warming. Solar energy comes in, some heat is radiated back to space and keeps our planet temp regulated. Additional Green House gas traps some of the heat that is radiated out and the planet warms.

The focus of the grant is preparing for the sea level rise but there are other impacts such as precipitation changes like the big flooding event in Hull this past March. Ocean water changes increase acidification that will impact shellfish and Hull's economy.

Sea Level Rise is caused by three factors and Hull is experiencing a relative sea-level rise: Global Sea Level Rise; the slide shows the rate of increase has grown in recent years. However, Herbst said, the reason the slide states "may" be rising could be

continued

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just a natural variation and not a long enough time span to know for certain. Boston Tide Station; this slide is the data gathered and based on its records from 1921 – 2005 the increase rate is 10.3 inches per century. Sea Level Rise Trend and Projections; future projections show the actual Boston tide gauge and the projections of rates of increase using various models such as the intergovernmental panel on climate change and the state is using 2 ½ to 4 ft SLR for planning purposes.

Northeast Storms in Hull – Ten Highest Flood Insurance Claims and the slide is based upon an analysis of FEMA flood insurance claims that may under estimate the damage as not everyone files a claim,. Herbst presented pictures of the Patriots Day Storm and Blizzard of 1978; the first had 20 damage claims, the highest tide was 13.7'; the latter had 278 damage claims with a tide that was 15'. She added that you can get an idea of what a difference 1.3 feet in sea level rise can make.

Location of Flood Insurance Claims: Slide shows all of the losses from 23 storms that she analyzed in the map (blurred so as not to identify individual properties.) Cost of flood damage has been very high and with more big storms, big mounting damages.

Photo-realistic 3D models-CZM paid from a grant the development of critical facilities at various Hull locations. They surveyed actual locations and based on draft flood maps that depict how high flood waters would be in a 100-year storm with three different sea level rise scenarios, but not future slr just current conditions. Herbst listed the properties and conditions: Scully Senior Center, including a picture, and pointed out that in that area other houses would not be under water; Hull High School is in a flood zone; Sewer Treatment Plant has done flood-proofing; Allerton Post Office at R Street and Nantasket Avenue; Memorial School the flood maps show worst 100-year risk on the bayside that is a hurricane; Draper Avenue as pump station is at the corner of Draper and Newport; Municipal Light Plant did not build close to the water, therefore it would not be completely under water.

Adaptive Responses to Sea Level Rise: Herbst said that having discussed the risks she would like to talk about what we have been doing as the Town has done a lot, All of our preparations for flooding are also preparations for Sea Level Rise, and there are 3 Categories: Protection is being well-prepared prior to any storms, and accommodation is accepting that there will be flooding. The town has done a lot of work and has received ½ million in FEMA grants to help homeowners elevate their homes. It also granted a Freeboard incentive of \$500.00 off on building permit fees for elevations of 2 feet higher than the flood map requires; (Town has been cited by FEMA as a best practice Town and won an award from NOAA for excellence in local government).

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Retreat: It is necessary to accept that some areas are not appropriate for habitation due to flood vulnerability and FEMA buy-out of some properties, as they did in the Blizzard of '78, are probable, and no rebuilding would be allowed. Education and Outreach: The town joined the Community Rating Program (CPR) and as a member of CPR we are eligible for a 10% discount for flood protection; and there is a lot of outreach to the community.

In closing the Power Point Herbst reiterated the need for some new zoning. Perhaps under Site Plan Review; have specific language on drainage and explicitly on flooding language. Address the 35ft height limit restriction by having some process to support the Freeboard elevations. She said that her hope is the Zoning Bylaw Committee will look at the suggestions, and she would be happy to work with them.

Members of the Zoning Bylaw Committee present agreed to look at the zoning. Anne Herbst then introduced James Fraes, Planner for the Metropolitan Area Planning Council (MAPC) to explain the process and what Hull should be doing.

Fraes explained that Hull must update its Hazard Mitigation Plan and said the problem is not man-made but nature made, the required plan is not an emergency response plan, it is a pre-disaster mitigation plan integrating state and local government and must be approved by FEMA. He added that the must be updated every five years and adopted to receive funds; planning and zoning are also required. He mentioned building elevations, public information, resource protection, dune protection, seawalls & culverts, and anything to drain water away, and protection of infra-structures. Fraes spoke about 8 steps: Map the Hazards; assess the risks, using FEMA flood map and putting out brush fires (so to speak); identify mitigation steps for unprotected areas. He said to prioritize short term and long term 1 get plan approved; 2 FEMA reviews; 3 conditions adopted.

Fraes explained that this meeting is one of two that is required for review and comments are welcome. He suggested that for any new development the town should get back to us through Anne Herbst.

Several persons in the audience offered support as did Members of town boards who were present and some made suggestion such as newspaper columns for public awareness. Robert Fultz, Community Development Director commented that Plymouth has a workshop for Storm-smart Zoning, and in closing Herbst said there is enough money in the grant for 10 homes and she will send the information to the newspapers.

TOWN OF HULL HAZARD MITIGATION PLAN

TOWN OF HULL, MASSACHUSETTS *-Memorandum-*

DATE: March 24, 2011
TO: Board of Selectmen
FROM: Philip E. Lemnios, Town Manager
SUBJECT: Agenda for March 29, 2011 Meeting

APPOINTMENTS

7:30 pm – Mike Jackman – Congressman Keating's Aide – re: Update
7:45 pm – Anne Herbst – re: Hazard Mitigation Plan
8:15 pm – Proclamation
8:30 pm – Bob Fultz – re: Ferry Service
8:45 pm – Bradley Swartz – Applicant for Livery Badge

OLD BUSINESS

1. Budget Approval

NEW BUSINESS

1. Town Meeting Warrant Signing

CORRESPONDENCE

1. Kat von Tungeln – re: Permission to have a 5K Road Race
2. Joseph F. Mahoney, Jr. – re: Requesting appointment to the Government Study Committee

LICENSES

1. Knights of Columbus, 440 Nantasket Ave – One day all alcohol for April 16, 2011 from 1 – 5 pm

THE LISTING OF MATTERS ARE THOSE REASONABLY ANTICIPATED BY THE CHAIR WHICH MAY BE DISCUSSED AT THE MEETING. NOT ALL ITEMS LISTED MAY IN FACT BE DISCUSSED AND OTHER ITEMS NOT LISTED MAY ALSO BE BROUGHT UP FOR DISCUSSION TO THE EXTENT PERMITTED BY LAW.

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TOWN OF HULL HAZARD MITIGATION PLAN

**APPENDIX D
DOCUMENTATION OF PLAN ADOPTION**

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TOWN OF HULL HAZARD MITIGATION PLAN

DOCUMENTATION OF PLAN ADOPTION

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

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APPENDIX E
HULL REPETITIVE LOSS PROPERTIES ANALYSIS

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TOWN OF HULL HAZARD MITIGATION PLAN

Town of Hull Repetitive Loss Properties Analysis November 2006

The Town of Hull conducted an analysis of the Repetitive Loss Properties (RLPs) within its borders. There are currently 211 unmitigated properties; claimants for these properties have filed 638 claims. Claims have been filed for twenty-two separate storm events from the Blizzard of 1978 (February 1978) through a May 2005 northeaster. Virtually all of the flood claims in Hull result from the effects of coastal storms. Significant wave heights combined with high tides result in overtopping of coastal banks and dunes, as well as sea walls and revetments. In many areas flood claims may also result from poor drainage conditions that keep floodwaters from immediately receding.

An analysis of weather data for the twenty-two storm events shows that flood insurance claims rise with high tide levels and wave heights. New England Weather Science provided storm data for the twelve storms that resulted in five or more flood insurance claims. The Town also has tide data for all storm events and wave height data for storms from 1987 to the present. All but one of the storm events with five or more claims, featured high tides of 12 feet or greater. Only one claim has been filed for a storm with a maximum 10-foot tide, and a very small number of claims have been filed for storms with maximum 11-foot tides. The effect of wave height is evident when comparing the 2000 and 2001 storms. Each storm featured successive high tides of 13, 12, and 13 feet. The 2000 storm had wave heights of up to 11 feet and resulted in two claims. The 2001 storm had wave heights of 16 to 24 feet and resulted in 26 claims. See Figure 1 "Summary of flood events and claims" for an overview of storm conditions and flood insurance claims.

Ten geographic areas with highly concentrated numbers of claims are identified in this report. (See Repetitive Loss Claims map.) 170 properties, or 81% of the total properties, and 535 claims, or 84% of total claims, are located within the ten areas identified in this report. See Figure 2 "Analysis of Repetitive Loss Properties" for a summary of flood insurance claims categorized by area and storm event. Three quarters of the remaining RLPs that lie outside of the ten areas with concentrated claims are located east and west of Nantasket Avenue between Phipps and X Streets. A small number of additional claims have been filed in various locations throughout the town.

Ten areas of concentrated claims:

Area One: This area is protected by a seawall on its northern boundary. Flooding is caused by overtopping of the seawall. Many of the homes in this area do not directly abut the ocean; rather they are at lower elevation and tend to be affected by poor drainage. It is hoped that recent drainage improvements

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associated with a road project for Main Street will result in reduced drainage related flood damage in this area.

Area Two: This area is also protected by a seawall on its northern boundary. There have been no flood claims since December 1992. Flooding is a result of overtopping of the seawall and limited drainage capacity of an adjacent salt marsh.

Area Three: This area is protected by a revetment on its northern boundary. Flooding is caused by overtopping of the revetment.

Area Four: This area is adjacent to the northern portion of Nantasket Beach. Flooding is caused by overtopping of the beach and of small individual seawalls. There is a small dune at the southern end of this area. Although dune grass planting and dune protection efforts have resulted in some northward development of the dune, the narrow width of the beach and significant wave action limit the capacity for dune development in this area.

Area Five: This area is one of two concentrated flood claim areas on the bay side of Hull. Flooding is caused by overtopping of a revetment/sea wall. There has been only one claim since 1992.

Area Six: This area is adjacent to the middle portion of Nantasket Beach. Flooding is caused by overwash from the ocean. Flood protection is provided by a sand dune. The Town has devoted significant resources to repairing and planting the dune where illegal openings had been created. In addition, Town maintained openings have been reconfigured to provide improved storm protection. There are remaining gaps in the dune and the Town is continuing its efforts to maintain a continuous dune along Nantasket Beach. This area has had only one claim since 1992.

Area Seven: This area is adjacent to, and landward of, the southern portion of Nantasket Beach. Flooding is caused by overwash from the ocean. A significant component of the overwash originates just south of Area Seven along the state-owned portion of Nantasket Beach. Flood protection is provided by a sand dune. As is true for Area Six, the Town has devoted significant resources to repairing, recreating and planting the dune, and improving Town maintained openings. A dozen repetitive loss properties in this area are located in "B" and "C" flood zones.

Area Eight: This bayside area is a low isthmus between two hills. Floodwaters enter from the north at a small beach, and the south, where there is a sea wall. The Town has just completed drainage improvements designed to improve the capacity of floodwaters to recede within one tidal cycle.

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Area Nine: This area is adjacent to Nantasket Avenue at the southernmost portion of the state owned Nantasket Beach. The area is affected by overwash from the beach. It is protected by a seawall.

Area Ten: This area is affected by overwash from the ocean. The area is protected by a revetment and seawall. This area has had the greatest number and frequency of claims since 1992.

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Figure 1: Summary of flood events and claims

Date	Tide levels (ft)	Wave maximum (meters)	Duration of waves above four meters (hours)	Conditions at highest tide			# of claims*
				Tide (ft)	Wave (meters)	Wind Speed (m/s)	
1978	12,15,15,13,13,12,12,12,12			15			55
1979	14,11,13,11,13,12,13,12,13			14			39
1981	11, 11,11,11,10,11			11			2
1982	11,10,11,10,11			11			4
1983/Mar	11,11,11			11			3
1983/Nov	11,10,12			12			1
1984	12,12,11			12			8
1986	10			10			1
1987	14, 10, 12	4.7	9	14	4.6	17.0	52
1991	12, 14	9.1	38	14	5.2	17.6	147
1992	14, 12, 14	7.3	73	14	6.2	21.0	125
1993/Mar	12, 12	6.0	9	12	6.0	15.8	1
1993/Dec	12, 11, 13, 11, 12	4.8	19	13	3.7	13.5	1
1994	11, 11	6.7	25	11	4.9	20.2	2
1996	12, 11, 12	5.83	31	12	5.3	14.8	1
1997	12	7.38	31	12	6.17	17.4	14
1998	12	6.05	22	12	5.6	14.0	1
2000	13, 12, 13	3.4	0	13	3.4	15.4	2
2001	13, 12, 13	7.3	49	13	6.06	15.7	26
2002	14, 12, 13	4.93	9	14	2.03	9.1	4
2003/Jan.	12, 12, 14	6.09	23	14	6.09	14	13
2003/Dec	12, 12, 12	8.04	46	12	7.3	18.2	15
2005/Jan.	11	8.48	30	11	6.8	20.3	5
2005/May	12, 14, 12, 14, 12	5.3	41	14	5.2	16.7	17

* claims data is for the 10 areas of concentrated repetitive loss claims

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Figure 2: Analysis of Repetitive Loss Properties in the 10 areas of concentrated claims

ID	<i>Claim- ants</i>	Claims	Dates																					
			1/ 05	5/ 05	1/ 03	12/ 03	02	01	00	98	97	96	94	93	92	91	87	86	84	83	82	81	79	78
1	15	50		2				1			1				12	14	1		1				7	11
2	7	19													4	6	1						4	5
3	15	60			7			7							8	11	7	1	1		1		9	8
4	13	33	1	1	2			2							9	11	2						2	3
5	4	15		1											3	4	3			1				3
6	13	34				1									12	13	1		1				3	3
7	49	142		8								1		1	42	47	17			3	2		7	14
8	9	30		4			3				1				4	5	7				1		2	3
9	11	38			5			1	1		1			1	9	9	5					1	4	1
10	34	117	4	1	1	12	1	15	1	1	11		2		22	27	8		5			1	1	4
Total 1-10	170	538	5	17	15	13	4	26	2	1	14	1	2	2	125	147	52	1	8	4	4	2	39	55
Total Hull	211	638																						

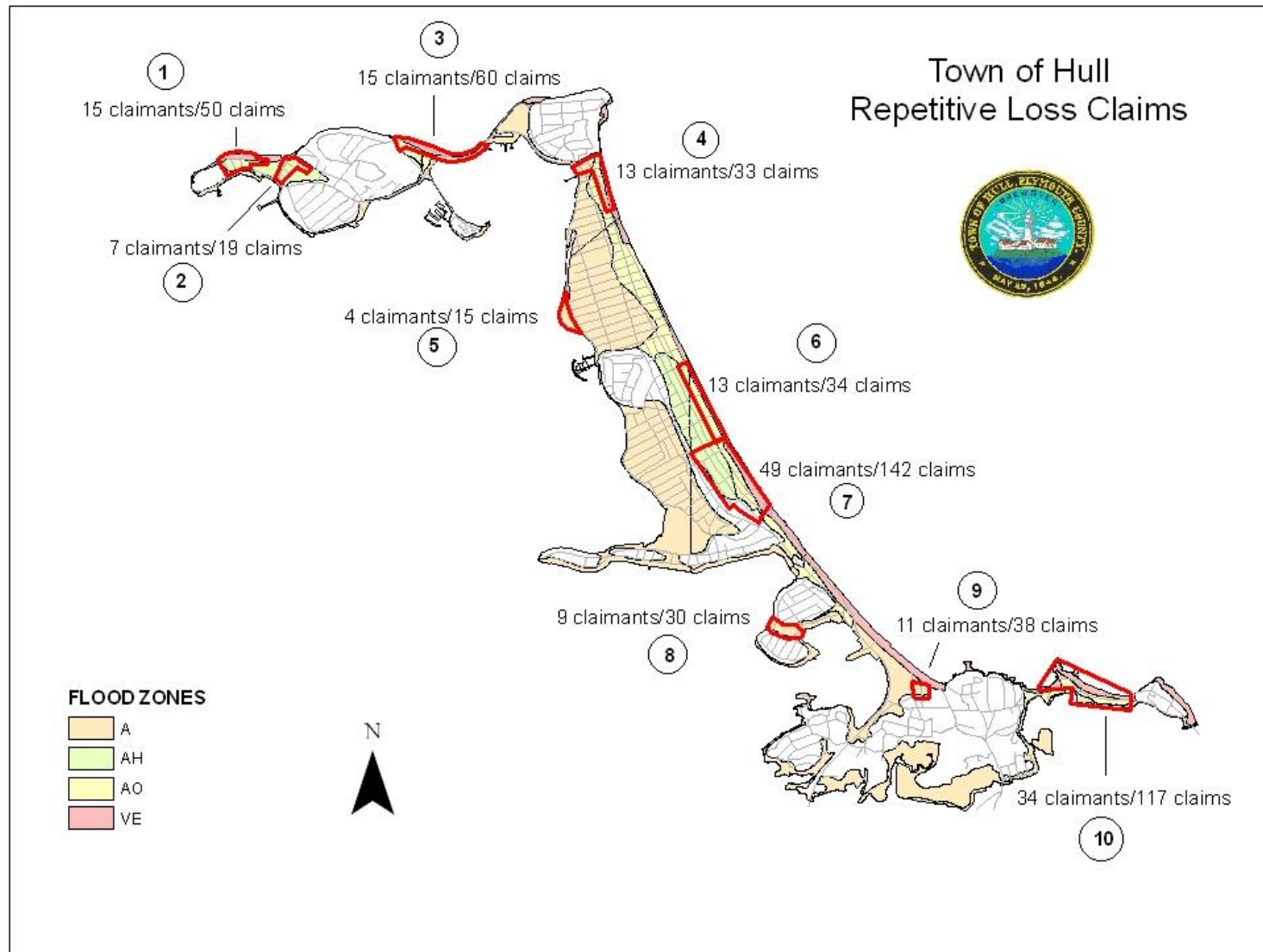
Major Storms (more than 5 claims)

1978: 2/6 to 2/9
 1979: 1/21 to 1/27
 1984: 3/29
 1987: 1/2 to 1/4
 1991: 10/26 to 10/31
 1992: 12/11
 1997: 3/31 to 4/2
 2001: 3/5 to 3/8
 2003: 1/4
 2003: 12/6
 2005: 1/23
 2005: 5/24 to 5/26

Other dates:

1981: 8/20
 1982: 6/6
 1983: 3/20 (3), 11/25/ (1)
 1986: 1/19
 1993: 3/13, 12/13
 1994: 12/23
 1996: 10/21
 1998: 3/21
 2000: 1/21
 2002: 11/6

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