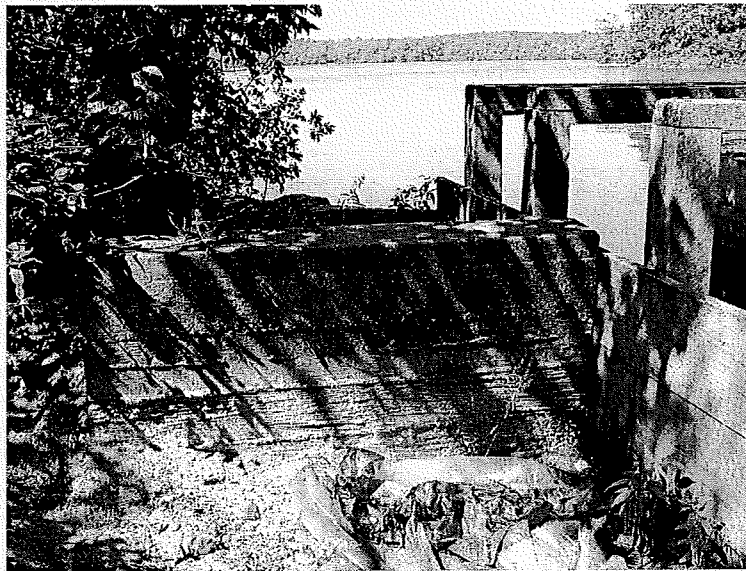
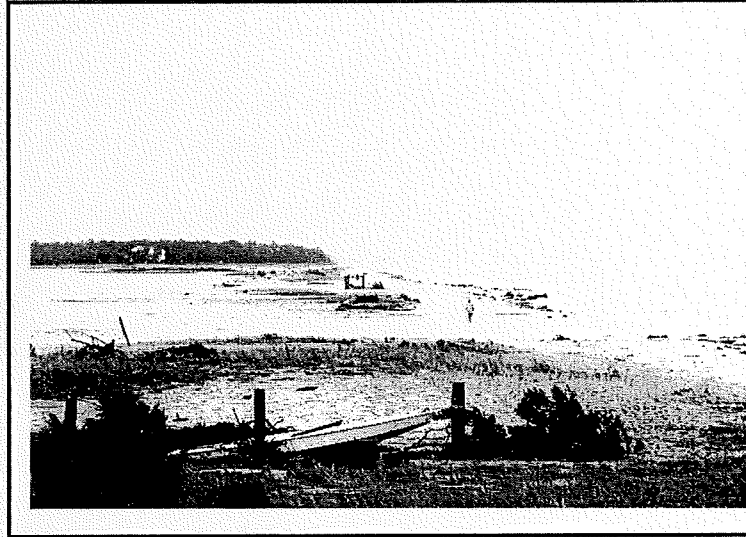


Town of Mashpee Pre-Disaster Mitigation Plan



FINAL DRAFT: September 2004

Prepared for the Federal Emergency Management Agency to comply with the Disaster Mitigation Act of 2000

Coordinated and written by the Mashpee Local Multiple-Hazard Community Planning Team

THE HISTORY OF THE

REPUBLIC OF THE UNITED STATES OF AMERICA



BY

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NEW YORK

THE CENTURY COMPANY

Executive Summary

The Multiple-Hazard Mitigation Plan is required to be in place by November 1, 2004 under the federal Disaster Mitigation Act of 2000. This Mitigation Plan will be required in order to qualify for future federal post-disaster mitigation grant funding under the FEMA's Hazard Mitigation Grant Program (HMGP). Hazard Mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to life and property resulting from natural hazards (flooding, storms, high winds, hurricanes, wildfires, earthquakes, etc.) This plan allows for the better identification of existing mitigation measures and for the Town to have a proactive response to natural hazard-related emergencies and be better prepared for natural hazards.

In July 2003, the Town of Mashpee began the local multiple-hazard mitigation planning process by establishing the Local Multiple-Hazard Community Planning Team. The team has been meeting generally once a month to complete this Plan.

Using an established Hazard Analysis and Risk Assessment methodology, the local team identified the various natural hazards that impact the Town of Mashpee:

- Flood (from coastal storm surge, storm tides & wave action, erosion, and sea level rise, as well as infrastructure failure such as dam failure, stormdrain failure or dike failure caused by coastal storms, winter storm, nor'easters or hurricanes)
- Wind (from hurricanes, nor'easters, tornadoes)
- Wildfire (from drought, lightning strikes)
- Geologic (from shoreline change, shoreline erosion, landslides, earthquakes)
- Snow and ice accumulations (severe winter storms, prolonged sub-freezing periods)

The next step was to identify the Town's "Critical Facilities," which include schools, public safety facilities, other Town/public facilities, marinas, day care centers, and wastewater treatment plants. Subsequently, each critical facility was mapped to see what natural hazard areas they were located in. The plan describes such facilities.

A 'vulnerability analysis' was then conducted. This analysis revealed that certain portions of the Town, such as Monomoscoy Island, for which access is frequently threatened due to high water. In the event of a truly large storm, such as the 500-year flood or a Hurricane, large portions of the coast, including all of our islands (Seconset, Monomoscoy, Popponesset and Daniel's), all of the South Cape Beach and Little Neck Bay area, and large portions of Popponesset Beach and Brights Cove portion of New Seabury would be inundated, and all of South Mashpee would have its access roads blocked by flooding.

The population in the above-identified vulnerable areas, which is in the southern part of Mashpee, is where more of the senior citizens are located, given the fact that it is retirement/resort area. In the 2000 Census, 736 persons over 65 were living south of Red Brook Road (on a year-round basis). These were 30.9% of all the persons over 65 living year-round in the Town of Mashpee. The median age of this geographic area is about twenty years higher than

the remaining portions. For this area the median age is 54.9 years, whereas the median age for the rest of the community is around 38 years.

Building continues in hazard areas. A review of the Town's building permit records indicates that the Mashpee Building Department has issued 787 buildings permits for construction of new single-family homes over the 5-year period between 1999-2003. Of these 68 are located in a FEMA FIRM flood zone. This amount to just over 8.5% of the single-family building permits being for dwellings located within a flood zone. In addition, New Seabury has plans in the works for additional development, some of which is located in FEMA A Zones and SLOSH hurricane inundation zones.

Another vulnerability in Mashpee is the hazard from the dam structures located here. The 2004 Massachusetts State Hazard Mitigation Plan has inventoried dam locations across the State and has ranked them for their potential to cause loss of life or damage should they fail. Based on a hazard ranking provided by Massachusetts Department of Conservation and Recreation (MDCR), there is one identified high hazard dam is the Mashpee Pond Dam and two significant hazard dams are in Mashpee. These are the Quashnet River dam (at Route 28) and the Santuit Pond dam at the Santuit River.

Of particular concern at this time is the condition of the Santuit Pond dam. A consultant of the Conservation Commission, Haley & Aldrich, has assessed this dam structure to be in poor condition. For example, they found seepage and significant erosion of embankment soils adjacent to the wooden outlet structure and large trees located along the crest being uprooted. Failure of the structure could result in over 500 acre-feet of water being released, which would have the potential to adversely affect the culverts at Rtes 28 and 130, a major regional intersection located in the Town of Barnstable just across the Mashpee town line.

The Town has submitted a Letter of Intent to MEMA to apply for funds through the Pre-Disaster Hazard Mitigation Program. The Town is requesting \$300,000 in hazard mitigation funds to, at a minimum, get emergency mitigation work done on this structure. An Implementation Measure calls for preparing a detailed engineering assessment on each of the Town's dam structures. Interestingly, the Town's Comprehensive Emergency Management Plan states that there are no dam structures in Mashpee. Thus, there seems to be some differences in the definitions of the structures in Mashpee's waterways.

Mashpee has been fortunate in not having any 'repetitive loss' properties, defined by FEMA as 'one that has had 2 or more flood insurance claim payments of more than \$1,000 in any ten-year period'. Since Mashpee joined the flood insurance program in the late 1970's there have been a total of 20 claims paid for a total of \$94,000. Meanwhile, there are currently 448 policies in force in Mashpee covering a total of \$92 million (or about 20% of assessed value of property containing buildings within the flood zones).

According to Richard Zingarelli, with the MA DCR Flood Hazard Management Program, based on the above information stated that "this tells me that either the current policies have not been in force very long or that the town has been lucky that it has not been hit hard by a storm."

Given the amount of recent development within flood zones, the potential for more and the statement by Mr. Zingarelli “that the town has been lucky that it has not been hit by a storm” the potential for one or more repetitive loss properties exists, especially if two major storms hit Mashpee within a ten-year period. Hurricane forecasters had predicted 2004 to be a busy hurricane season. And given Florida’s experience they were accurate.

Also in 2004 insurance companies that had been providing homeowner’s insurance to Cape Cod property owners began not renewing, or even canceling policies. This was due to a wind model utilized by the insurance agencies. The Committee did want to get an idea of how many homeowners in Mashpee have switched to FAIR plan since the beginning of 2004, but as of the *date of this draft*, FAIR has not returned the phone call to the Planning Department.

An analysis was conducted by the Mashpee Assistant Planner using the Town’s Geographic Information System (GIS) to determine the value of developed properties within the Town’s A & V flood zones. This analysis was done with Assessor’s data from FY 2003. The total assessed value of residential and commercial properties containing buildings within floodzones is \$449,902,420. Given that waterfront property is the Town’s most valued property, it is no surprise that developed lands in flood zones makes up 22.4% of the \$2,639,417,760 total building and land assessed value, as of FY 2003. Meanwhile just 6.1% percent, or about 846 acres, of the Town, is situated in either an A or V FEMA FIRM Flood-Hazard Zone.

Mashpee’s ‘Existing Protection Measures’ were then identified. Existing Town bylaws and regulations include the Floodplain Zoning Bylaw provisions, relevant building codes protecting structures from flood and wind, the Conservation Commission’s Wetlands Protection Bylaw, and the Board of Health Regulations on locating new sewer and water facilities in a Floodplain District.

Mashpee’s flood zones were delineated in the late 1970’s and the Flood Insurance Administration first produced Flood Hazard and Boundary Maps for the Town in 1979, updated in 1985 with the latest update in 1992. The Town is in the Regular Program of the National Flood Insurance Program. The Town has not yet applied for the NFIP’s Community Rating System (CRS), but a Mitigation Measure calls for such application. The Town gets 210 points towards the CRS by completing this plan and having it approved by FEMA. The maximum floodplain insurance at this time is \$250,000 per home.

Finally, the Town has preserved a number of parcels that are located within flood zones and/or Hurricane SLOSH zones. The Town acquired these parcels either through Town Meeting purchases or via tax-taking.

A mitigation strategy has been developed to reduce the community’s vulnerability to the effects of natural hazards. Fifteen (15) objectives and twenty-three (23) actions have been developed for the Town to accomplish this strategy. After developing the comprehensive list of 23 action items, the Mashpee Multi-Hazard Mitigation Planning Team recognized that there are generally six (6) categories into which the actions fall including general actions, continued or additional planning actions, continuation or development of programs or initiatives, regulatory actions, educational actions or infrastructure-related projects.

The next step was to prioritize the action items. These items have been prioritized based on their 'feasibility' for implementation. Feasibility and prioritization were based on the STAPLEE criteria as suggested in the Natural Hazards Mitigation Planning: A Community Guide, prepared by Massachusetts Department of Environment Management and the Massachusetts Emergency Management Agency. STAPLEE is an acronym for a general set of criteria used to make decisions regarding community initiatives, standing for social, technical, administrative, political, legal, economic, and environmental decision-making criteria.

This hazard-weighted STAPLEE mitigation strategy resulted in three levels of priority based on equally distributing the scores. Table 5: STAPLEE Feasibility Analysis of Potential Natural Hazard Mitigation Measures presents the results: High (32–30 points) = 12 actions; Medium (28-26 points) = 10 actions; and Low (25 points and less) = 1 action.

Lack of dedicated staff and limited financial resources are two key factors limiting full implementing this Plan. The Cape Cod Commission, who prepared the Regional Pre-Disaster Mitigation Plan, have included a request to get a full-time dedicated individual to work on hazard mitigation planning. Such an individual would help the Town in identifying grant opportunities. Still, the Town is going to have to dedicate and commit more of its own resources towards the hazard mitigation projects identified in this plan, in order to adequately implement this Plan. Each of the Action Items has an associated responsible party(ies) along with a short-term or long-term implementation, based on the STAPLEE Feasibility Analysis.

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**Town of Mashpee
Pre-Disaster Hazard Mitigation Plan**

Section 1: Introduction

Hazard Mitigation Definitions

• What is *Hazard Mitigation Planning*¹:

In the context of natural disasters, *hazard mitigation* is commonly defined as any sustained action that permanently reduces or eliminates long-term risk to people, property, and resources from natural hazards and their effects.

In the context of this Local Pre-Disaster Mitigation (PDM) Plan *hazard* refers to an extreme natural event that poses a risk to people, infrastructure, or resources. *Risk* can be defined as “hazard; danger; peril; exposure to loss, injury, or destruction” or “the possibility of suffering harm or loss.” The Town’s hazard risk assessment determines which areas of Town may be affected by a natural hazard, how likely it is that a given hazard may occur, and how intense that hazard might be.

Vulnerability can be defined as “susceptibility to injury or attack.” Vulnerability indicates what is likely to be damaged by the identified hazards and how severe the damage might be. For example, if an area is determined to be at risk of flooding, vulnerability estimates could include potential residential property losses, impacts to the tax base and damages to public infrastructure in that area.

Hazard mitigation planning is the process that the Local Multi-Hazard Community Planning Team underwent to analyze our Town’s risk from natural hazards, to coordinate available resources, and to develop a strategy to implement actions to eliminate risk.

Benefits of Creating a Hazard Mitigation Plan

The chief benefits of this plan are maintaining eligibility for the Federal Emergency Management Agency’s (FEMA) Hazard Mitigation Grant funds (available after a disaster is declared) and to be eligible for other federal hazard mitigation funds. In addition there are other mitigation benefits by developing this plan. Mitigation actions help safeguard personal and public safety. For instance, retrofitting bridges (raising roads/bridges located below the 100-year flood zone) can help keep them from being washed out, which means they will be available to fire trucks and ambulances in the event of a storm. Another important benefit of hazard mitigation is that money spent on preventative measures today can significantly reduce the impact of disasters in the future, including the cost of post-disaster cleanup. This local hazard

¹ Definitions and text adapted from “ Strategy for Reducing Risks from Natural Hazards in Narragansett, Rhode Island: A Multi-Hazard Mitigation Strategy, June 1999” and the Barnstable County PDM Plan.

mitigation strategy will minimize the economic and social disruption that can result from multiple natural hazards.

This plan allows for the better identification of existing mitigation measures and for the Town to have a proactive response to natural hazard-related emergencies and be better prepared for natural hazards. Approval of this plan also provides the Town with points towards the FEMA Community Rating System (CRS). Once the Town completes the CRS application and becomes certified, there would be a subsequent lowering of flood insurances rates.

Planning Process Documentation

In July 2003, the Town of Mashpee began the local multiple-hazard mitigation planning process by establishing the Local Multiple-Hazard Community Planning Team. The Town Administrator appointed the following members:

- David Bailey, Town Assessor
- George Baker, Fire Chief
- Perry Ellis, Harbormaster and Mashpee Water District
- Glen Harrington, Board of Health
- Tim Leedham, Waterways Commission
- Lewis Mantel, Monomoscoy Island resident
- Jim Marr, Assistant Town Administrator
- Scott Nickerson, New Seabury representative
- Jon Read, Mashpee Police Department
- Robert Sherman, Conservation Agent
- Eric R. Smith, Assistant Town Planner
- Greg Taylor, Public Works Director
- Wayne Taylor, Board of Selectmen
- Ernie Virgilio, Civil Defense Director
- Russ Wheeler, Building Inspector

In August 2003 the first team meeting was held. Monthly meetings were convened on the 3rd Tuesday of each month. These meetings were posted with the Town Clerk's office. *A presentation of the Draft Pre-Disaster Hazard Mitigation Plan was held before the Planning Board on October 6, 2004. Notice for this meeting was provided in the Mashpee Enterprise on September 17, 2004. In addition, the Local Multiple-Hazard Community Planning Team on October 21, 2004 conducted an official team-sponsored Public Hearing. Notice of this hearing was provided in the Mashpee Enterprise on _____. Comments were received from the Team and _____ members of the general public. Subsequently, the Final Hazard Mitigation Plan was presented before and adopted by the Mashpee Board of Selectmen on November ____, 2004.*

Coordination with Other Towns, Agencies

In addition, the Assistant Town Planner was a team member of the Regional Pre-Disaster Mitigation (PDM) Planning Team, which was charged with assisting in the development of the Regional PDM Plan. This planning effort assisted the Town of Mashpee in coordinating with neighboring communities in the identification of regional mitigation efforts/projects/items.

One area where further coordination has been identified is in regards to planning for water-system vulnerabilities. The Mashpee Water District is an independent entity from the Town of Mashpee. The Water District has prepared a Vulnerability Assessment, which was required by the United States Environmental Protection Agency (EPA). This Vulnerability Assessment identified man-made threats, such as terrorism, however. The Water District is working on a Emergency Response Plan, scheduled for completion in late 2004, which will be dealing with natural hazards.

A Water District Commissioner, Perry Ellis, was part of the Town's Hazard Mitigation Community Planning Team and during this planning process a meeting was held between a few of the Committee members and Andy Marks, Assistant Operations Manager. Some areas identified for coordination in hazard mitigation between the Water District and the Town are: generators for pumps in the New Seabury wells, the ability to super chlorinate the water, and provide for alternative water sources (especially drinking water) if a natural hazard renders the water supply unavailable due to lack of power or an issue with its potability. An Implementation Measure has been included to have the Town and Water District coordinate these and other hazard mitigation efforts.

Description of Town – Location

The Town of Mashpee is located on Cape Cod, Massachusetts at 41 degrees 37 minutes latitude north and 70 degrees 29 minutes longitude west. Specifically on Cape Cod, the Town is geographically located on the Upper Cape. Mashpee is surrounded by the Town of Sandwich to the north, the Town of Falmouth to the west, the Town of Barnstable to the east, and Nantucket and Vineyard Sounds to the south.

Based on the Town Assessor's Maps and Geographic Information System (GIS), Mashpee has a total area of 18,469.66 acres, or 28.86 square miles, excluding the portion of Vineyard / Nantucket Sounds which lies within our legal boundaries. Of that area, approximately 1513.5 acres lies in the Waquoit Bay estuarine system (Waquoit Bay proper, Jehu Pond, Sedge Lot Pond, Hamblin's Pond and Great and Little Rivers) and 558.9 acres is in the Popponesset Creek estuary (Popponesset Bay proper, Ockway Bay, Shoestring Bay, Popponesset Creek and the Mashpee River below Route 28) for a total of 2072.4 salt water acres, or 11.22% of the town. An additional 1503.3 acres of the Town's remaining 16,397.26 acres (25.62 square miles) is made up of fresh water bodies.

Mashpee's two estuarine systems are shared with the bordering communities: to the west Waquoit Bay is shared with Falmouth while to the east Popponesset Bay is shared with Barnstable. As described above, off of each bay, there are a number of inlets, bays and rivers that are the cause of concern as it relates to natural hazards. These are areas of concern due to the potential impact from hurricanes, nor'easters as well as erosion in certain areas. Ice accumulation is also a concern.

Further inland within the Town of Mashpee, wildfires are a hazard of concern, especially given that the primary forest cover here is Pitch Pine/Scrub Oak, which is the second most flammable vegetative environment, outside the chaparral environment in California. Areas of particular concern are found within the "Wildland/Urban Interface" where development meets the forested

area. This plan will identify the various natural hazards that pose various threats to the Town of Mashpee and offer a series of mitigating actions.

Mashpee Population Characteristics

The Mashpee Town Clerk, as of December 2003, shows the year-round population at 14,230, based on an annual Town census. The 2000 U.S. Census listed the Town of Mashpee, Massachusetts, population of 12,948, thus in the past 3+ years, Mashpee has added an additional 1,282 persons. From 1970 to 2000, Mashpee's population rose an astounding 905% during the past 30 years. During the 1980's, Mashpee was the fastest-growing town in Massachusetts. During the 1990's, its growth was the second only to Aquinnah (whose population grew by just 143 people). Mashpee is both a fast growing, year-round community and a prime resort, seasonal home, and retirement community. The Town's population because of the seasonal nature of Cape Cod, doubles during the summer to an estimated summer population for the Summer of 2004 is 30,073 (source: Mashpee Town Planner). It is also unique as one of the remaining homes of the Wampanoag Nation. Although now a minority population within the community, the Wampanoag continue to play a significant role in shaping the character of Mashpee.

The Town's under 17 population increased 65% from 1990 to 2000. School enrollment increased 48% since 1993. Mashpee's over 60 population doubled from 1,536 in 1990 to 3,053 in 2000. In 1990, senior population comprised 19.5% of Mashpee's total population compared to 24% of the population in 2000. The actual number of Mashpee seniors in 2000 has already greatly exceeded the 1998 Executive Office of Elder Affairs (EOEA) projections for the year 2010. With 3,053 Mashpee residents aged over 60 in 2000, Mashpee surpassed EOEA projections of 1,770 residents in 2000 and 2,262 in 2010.

Type of Development Patterns and Expected Future Development

The southern part of Mashpee is where traditionally most of the seasonal population has located, because of its proximity to the waterfront. However, over the past 10-14 years, there has been a shift towards conversion of the seasonal housing units to year-round status. According to the U.S. Census in 1990, 45% of the Town's housing units were occupied on a year-round basis. By the 2000 Census the year-round occupancy rate had risen to 63.1%. This trend is expected to continue in the years to come, as more property owners retire to their second homes in Mashpee and it develops more as a bedroom community for people working in the metro Boston or Providence, RI areas and other towns on Cape Cod. More teardowns and rebuilds are expected to occur within the southern part of Town, particularly on lots that have been used as seasonal cottages.

In addition to the redevelopment discussed above, new development is in the permitting stages within New Seabury planned resort community. A review of their proposals indicates that there is a subdivision and other development plans in the planning stages that are either located in or within the vicinity of A & V zones. Overall, the Town of Mashpee continues to be one of the fastest growing towns in Massachusetts. As an indication, as of December 2003 there are 894,931 square footage of commercial and industrial space either under construction or that has been permitted with another 722,090 square feet that have been proposed. Also, the Town has 8 various projects with potentially up to 1,249 housing units either recently approved, pending or

proposed, under the State's Anti-Snob Zoning Act, Chapter 40B, which allows a developer to override local zoning as long as 25% of the housing units are affordable, that is, made available to 80% of the area's median income.

Existing Hazard Mitigation-Related Town Goals

The Town of Mashpee Comprehensive Plan has two elements with goals that supported hazard mitigation: Public Safety and Coastal Resources. The Mashpee Comprehensive Plan was approved by the Town in the Spring of 1998.

Goal #1 from the Public Safety element: To minimize loss and suffering in our community due to fire, storms and other man-made and natural disasters.

Goal # 3 from the Coastal Resources element: To minimize or prevent loss of life, property damage and environmental damage due to a coastal storm.

The Comprehensive Plan also specifies nine (9) objectives in the Public Safety element and (5) objectives in the Coastal Resource element. A number of these objectives are relevant for this Plan, thus they have been incorporated into the Mitigation Strategy (Section 5) of this Hazard Mitigation Plan.

Town of Mashpee Goals for Hazard Mitigation

Goal 1: To reduce the loss of life, property, infrastructure, and environmental and cultural resources in Mashpee from natural disasters.

Goal 2: To coordinate Mashpee's hazard mitigation planning and activities with those of our neighboring towns, the Massachusetts Military Reserve and Barnstable County as well as the appropriate State and Federal agencies.

Goal 3: To seek for and take advantage of non-property tax based funding opportunities to implement this Pre-Disaster Hazard Mitigation Plan.

Section 2: Hazard Analysis and Risk Assessment

Summary of historical damage and damage-causing natural events

As a coastal community, Mashpee is subject to flooding and storm damage from hurricanes, nor'easters and winter storms. During the great storm events of the past Mashpee's coast was relatively undeveloped and damage was not significant in comparison with other more developed coastal communities on Cape Cod. There has been a tremendous increase, however, in the last few decades in both the number of persons living in flood-prone areas along our coast and in the value of property as it is developed or redeveloped.

Hurricanes/Nor'easters

The earliest known recorded storm that may have affected Mashpee was an 1841 storm that impacted the Outer Cape Towns' fisheries. Though Mashpee did not have a developed waterfront in those days, it still may have indirectly felt the brunt of this storm.

"The Hurricane in 1938 was a major catastrophic hurricane event in New England. For example, it caused almost 700 deaths and cost \$4.7 billion in today's dollars property damage in today's dollars. In Massachusetts the shore of Buzzards Bay was little more than wreckage. One complete house was still standing in ritzy Westport Harbor. At Mattapoisett's Crescent Beach, of 107 cottages, a dozen remained. Horseneck Beach, Fairhaven, and Woods Hole were swept clean."²

Mashpee was fortunate as it was not very populated at the time with only about 400 year-round residents. Most of this population was concentrated in the north part of Town at that time, though there was a small settlement in South Mashpee with fewer than a dozen homes located in the area around Great Neck Road South, Red Brook Road and Wading Place Road. Popponesset Beach area had an active summer cottage community, developed around 1920. Also just before and after World War I, a number of waterfront areas on Monomoscoy and Seconsett Islands and Johns Pond were subdivided into small lots for summer homes. It is known that this Hurricane leveled all the trees in the Little Neck Area portion of South Mashpee.

Records from the Town Archives indicate that "Oral tradition has it that during the 1944 hurricane, the water reached all the way north from Nantucket Sound to Red Brook Road."

Hurricane Bob followed by the "no-name" nor'easter that hit the Town in 1991 causing major power outages and structure damages due to fallen trees and wind. There was damage done to Popponesset Spit, as was noted in the Coastal Resources element of the Comprehensive Plan: "Popponesset Spit, a barrier beach that runs parallel to Nantucket Sound and separates the Sound from Popponesset Bay, has varied greatly in shape over the years...During recent major storms, including Hurricane Bob and the no-name Nor'easter of Halloween in 1991, the Spit has been submerged. Wave driven water has flowed over much of the length of the spit even at low tide. In the 1990's other strong nor'easters have brought strong northeast winds, moving the sand back towards Nantucket Sound...(see Figure 2 for a picture of the Spit after Hurricane Bob)"

² "Sudden Sea: The Great Hurricane of 1938," R.A. Scott, pg. 227, Little, Brown and Company.

Popponeset Spit

At one time Popponeset Spit extended much farther to the east along the Cotuit shoreline in Barnstable. When the boundary line between Mashpee and Barnstable was established and marked in 1894, the spit was approximately 6450 feet in length, extending along the Cotuit shore almost to Rushy Marsh Pond (the Shoreline Change Maps produced by Mass CZM show the original this location and map out the changes in the Spit land area). Big and Little Thatch Islands were clearly separate from the spit with Popponeset Bay, while there was a shallow break in the spit next to Big Thatch Island. The spit was also farther south, being a direct continuation of the Popponeset Beach mainland shoreline.

At the time of the writing of the Mashpee Comprehensive Plan in the mid-1990's the Spit was about 3,700 feet. In addition, it had moved about 400-700 feet inland and the height had dropped as well. Meanwhile, the tip of Popponeset Island has receded back about 300'; the Spit is now where the Big Thatch Island was located in 1938.

At various time there have been openings in the spit: in 1938 one opening was at the tip near mainland, in 1947 an entrance was 1/2 way out and in 1951 about 1/3 of the way.

In the early 1950's in front of Popponeset Beach a series of 9 groins were installed. The last groin substantially impeded the lateral flow of sand and causes the scouring inwards near the end of Wading Place Road that is noticeable today compared to the location before these groins (see Picture 2). Today the elevation of spit is lower, even minimal at high tide, with there being 4-5 places where the water flows out, in areas which were once 12 feet high (see Figure 1 of the Spit in 1962). This migration, which continues today, has greatly reduced the width of the channel between the spit and Popponeset Island at the "Wading Place." It is probably due to the presence of those nine groins at Popponeset Beach, which intercept and deflect sand migrating along the coast from its source at the eroding Succonesset Point bluffs which used to continue on to Popponeset Spit (see Figure 3, which shows these groins identified on the 1974 U.S.G.S Cotuit Quadrangle map).

Figure 1: Popponeset Spit in 1962 with Beach Club

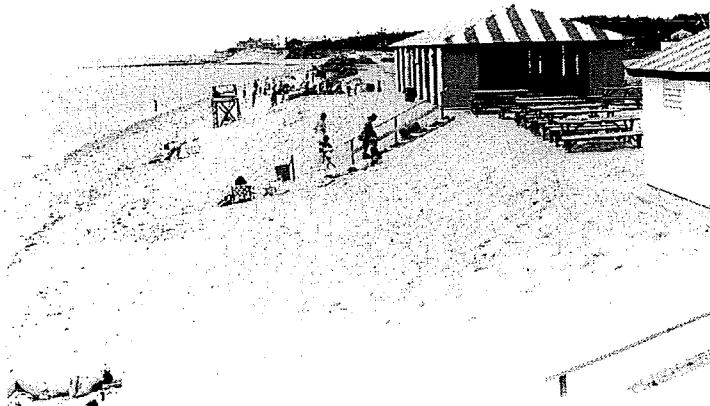
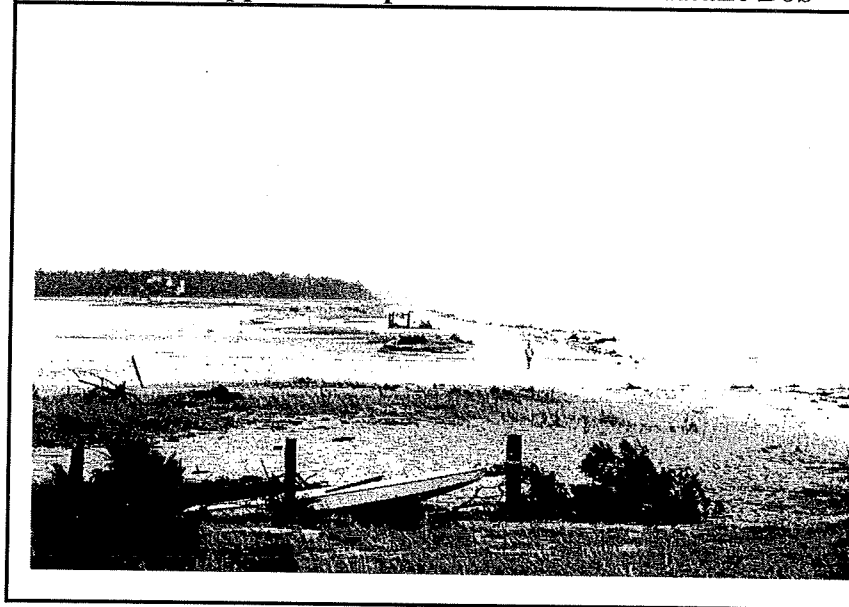


Figure 2: Popponeset Spit in 1991 after Hurricane Bob



Eroding Coastal Banks

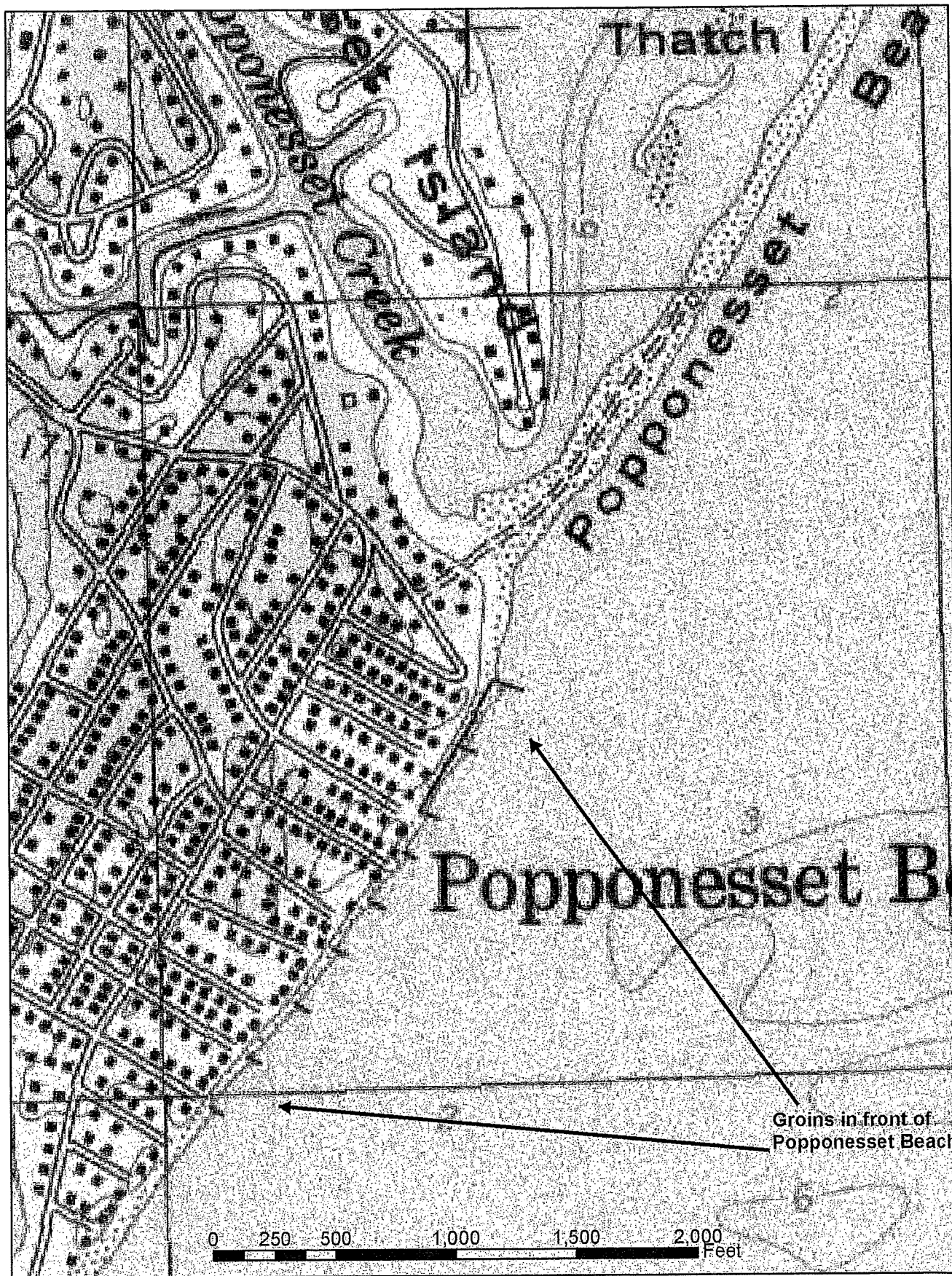
Significant eroding coastal banks in Mashpee are found on the southern coastline from Lily Pond through to the Tidewatch Condos and in an area between the Maushop Village Condos and set of houses by the Triton Sound Rotary (shown on Map 1: Town of Mashpee Risk and Vulnerability Assessment and Map 2: The Regional Hazard Risk Map I, Long Term Shoreline Change Susceptibility). The coastal eroding banks fronting on Nantucket Sound are losing up to 1 foot per year in some areas. Other less significant coastal erosion is occurring in Mashpee, one example being bay front parcels in Pirates Cove.

Wildfires

Wildfires have been identified as Hazard within the Town of Mashpee and have occurred in the past. As noted the Pitch Pine/Scrub Oak forest is one of the most flammable vegetative environments, second only the chaparral environment in California. Research of Mashpee district records indicate that in April 1841: “by-laws not to take effect on the Burnt Lot in the southern part of District of Mashpee until after May 1, 1841 and elsan (sp?) coal may be dried and wood coaled on said Burnt Lot provided sufficient brickworks placed for that purpose.” Possible reference to a lot that experience wildfire (source: Town of Mashpee Archives).

Later in March 1861 a “Report to the Governor and Council concerning the Indians of the Commonwealth” published by John Milton Earle, Commissioner, refers to “The new growth of wood, which was coming up on most of the allotments, as well as that on the parsonage lot, which had attained considerable size, has, to a great extent, **been destroyed by fires that have, within two or three years, burnt over about five thousand acres of woodland (about 7 ¾ square miles!) in the District...**(page 50)”. Former Mashpee Historical Commission member and Mashpee fire fighter Gordon Peters also told of a “Great Fire” in the 1930’s to Assistant

Figure 3: USGS Topo Map of Popponesset Groins



Map Source: U.S.G.S. Cotuit Quadrangle Topographical Map, 1974
Prepared by the Mashpee Planning Department, September 2004



Planner during the development of the Comprehensive Plan Heritage Preservation and Community Character element.

Fires also are a risk from storms. Risks include hazards of downed electrical powerlines, home fires from lightning strikes and also from ruptured gas main breaks (that have the potential to occur when there is structural damage from a hurricane). Droughts, which occurred on Cape Cod as recently as the summer of 2002, increase the wildfire potential.

Hazard Identification and Ranking Matrix (see Table 1)

Historically, the Town of Mashpee has sustained damage from flooding, storm surge, and high winds associated with hurricanes, nor'easters, and heavy rains, in addition to wildfires. However, this plan and its mitigation strategy addresses multiple natural hazards, even those assessed with low probability. Risks to our town (as identified in Table 1: Town of Mashpee Pre-Disaster Mitigation Planning Hazard Identification Ranking Matrix include:

- Flood (from coastal storm surge, storm tides & wave action, erosion, and sea level rise, as well as infrastructure failure such as dam failure, stormdrain failure or dike failure caused by coastal storms, winter storm, nor'easters or hurricanes)
- Wind (from hurricanes, nor'easters, tornadoes)
- Wildfire (from drought, lightning strikes)
- Geologic (from shoreline change, shoreline erosion, landslides, earthquakes)
- Snow and ice accumulations (severe winter storms, prolonged sub-freezing periods)

For the identification and ranking of the various hazards, a subcommittee was formed. This subcommittee consisted of members of the Local Multiple-Hazard Community Planning Team plus three (3) members of the Town's Waterways Commission (James Hanks, Bill Taylor and Tim Leedham). These Waterways Commission members provided excellent insight on identifying and ranking the flooding hazards. In order to better identify the Town's hazard areas, it was determined that they should be broken down by neighborhood. Map 5 shows the flood zones by neighborhoods.

Table 1: Town of Mashpee			1 = small	0 = unlikely	1 = limited	
Pre-Disaster Mitigation Planning			2 = medium	1 = possible	2 = significant	
Hazard Identification and Ranking Matrix			3 = large	2 = likely	3 = critical	
				3 - highly likely	4 = catastrophic	
Hazard	Cause/Effect	Location	Location Rank	Frequency Rank	Magnitude Severity Rank	Total Score
FLOOD	Natural inundation in the floodplain caused by coastal storms, winter storms, nor'easters, hurricanes - by neighborhood storm surge 100-year event flood.	Popponeset Island	3	2	3	8
		Daniels Island	3	2	3	8
		Monomoscoy Island	3	2	2	7
		Seconsett Island	3	2	2	7
		Little Neck Bay	2	2	2	6
		South Cape Beach Estates	2	2	2	6
		Quail Hollow	2	2	2	6
		Bayview Condos	2	1	3	6
		Bright Coves	2	2	2	6
		The Bluffs	2	1	2	5
		Stendahl Condos	2	1	2	5
		Summersea	2	1	2	5
		Pirates Cove	2	1	2	5
		Great Flat Pond	1	2	1	4
		Seabrook Shores	1	1	2	4
		Amy Brown Road Area	1	1	2	4
		Punkhorn Point	1	1	2	4
		Frog Pond Close area	1	1	2	4
		Popponeset neighborhood	1	1	2	4
		The Mews	1	1	1	3
		Greensward	1	1	1	3
		Sea Quarters	1	1	1	3
		Promontory Point Condos	1	1	1	3
		Seaside	1	1	1	3
		Tidewatch Villas	1	1	1	3
		Colony Villas	1	1	1	3
		Triton Sound Village	1	1	1	3
		Maushop Village	1	1	1	3
		Rock Landing	1	1	1	3
		Harbor Ridge Estates	1	1	1	3
		Seabrook Pines	1	1	1	3
		Seabrook Village	1	1	1	3
		Seabrook Meadows	1	1	1	3
		Ockway Bay Road	1	1	1	3
		Riverbend	1	1	1	3
		Trout Pond Area	1	1	1	3
		Shoestring Bay Estates	1	1	1	3
		Willow Bend	1	1	1	3
		Highwood	1	0	1	2
		Red Brook Road Area	1	0	1	2
		Baybury	1	0	1	2
		Sandalwood	1	0	1	2
Windchime	1	0	1	2		
Parkside	1	0	1	2		
Cotuit Park	1	0	1	2		
Maushop Stables	1	0	1	2		
Cotuit Bay Condos	1	0	1	2		
FLOOD	Specific Locations:	Popponeset Spit Breach	2	2	3	7
		Seconsett Island Causeway	3	2	1	6
		Monomoscoy Rd. Causeway	3	2	1	6
		Mashpee Neck Marina	1	2	3	6
		Little River Boat Yard	1	2	3	6
		Waquoit & Tributaries Mooring Fields	2	2	2	6
		Poppon. & Tributaries Mooring Fields	2	2	2	6
		Great Oak Road @ Jehu Pond Marsh	1	2	3	6
		Popponeset Island Bridge	3	1	1	5
		New Seabury Marina	1	1	3	5
		New Seabury Golf Course	1	2	2	5
		South Cape Beach Parking lot	1	2	2	5
		State Beach Area	1	2	2	5
		Red Brook Rd @ Mashpee/Falmouth TL	1	2	1	4
		Red Brook Rd @ Dutchmen's Brook	1	1	1	3
Great Oak Road @ Abigail's Brook	1	1	1	3		
FLOOD	Infrastructure failure such as dam failure, stormdrain failure or dike failure caused by coastal storms, winter storm, nor'easters, hurricanes	John's Pond Culvert - Child's River	2	1	3	6
		Santuit Pond "Dam" @ Townline Rts 130/28	1	1	3	5
		John's Pond Flume - Quashnet River	1	1	1	3
		Mashpee River Flume Area	1	1	1	3
WIND	Hurricane Neighborhoods	Mashpee Commons Buildings	2	1	4	7
		Roofs Blowing off - Roof Damage	Town Buildings off of Frank Hicks Dr	2	1	4

Hazard	Cause/Effect	Location	Location Rank	Frequency Rank	Magnitude Severity Rank	Total Score		
WIND (con't)	Hurricane Neighborhoods Roofs Blowing off - Roof Damage	Monomoscoy Island	3	2	1	6		
		Seconsett Island	3	2	1	6		
		South Cape Estates	3	2	1	6		
		Tidewatch Villas	2	1	3	6		
		Colony Villas	2	1	3	6		
		Maushop Village	2	1	3	6		
		The Bluffs	2	1	3	6		
		Popponeset Island	2.5	1	-2.5	6		
		Christ the King Church - Steeple	1	1	4	6		
		Rock Landing	2	1	2.5	5.5		
		Little Neck Bay	2	2	1	5		
		Seaside	2	1	2	5		
		Triton Sound Village	2	1	2	5		
		Popponeset	2	1	2	5		
		Seabrook Shores	2	1	2	5		
		Amy Brown Road Area	2	1	2	5		
		Punkhorn Point	2	1	2	5		
		Pirates Cove	2	1	2	5		
		Promontory Point Condos	1	1	2	4		
		Stendahl Condos	1	1	2	4		
		Seabrook Village	1	1	2	4		
		Frog Pond Close area	1	1	2	4		
		Neighborhoods north of Wakeby Pond	2	1	1	4		
		Quail Hollow	1	1	1	3		
		Bayview Condos	1	1	1	3		
		The Mews	1	1	1	3		
		Greensward	1	1	1	3		
		Sea Quarters	1	1	1	3		
		Great Flat Pond	1	1	1	3		
		New Seabury Golf Course	1	1	1	3		
		Highwood	1	1	1	3		
		Bright Coves	1	1	1	3		
		Daniels Island	1	1	1	3		
		Summersea	1	1	1	3		
		Cape Cod Holiday Timeshare Estates	1	1	1	3		
		Harbor Ridge Estates	1	1	1	3		
		Seabrook Pines	1	1	1	3		
		Seabrook Meadows	1	1	1	3		
		Red Brook Road Area	1	1	1	3		
		Ockway Bay Road	1	1	1	3		
		Baybury	1	1	1	3		
		Riverbend	1	1	1	3		
		Sandalwood	1	1	1	3		
		Windchime	1	1	1	3		
		Trout Pond Area	1	1	1	3		
		Shoestring Bay Estates	1	1	1	3		
		Willow Bend (esp Country Club)	1	1	1	3		
		WIND	Infrastructure failure caused by hurricanes	Waquoit Mooring Fields	2	1	3	6
				Poppon. Mooring Fields	2	1	3	6
				Seconsett Island Causeway	3	1	1	5
				Monomoscoy Rd. Causeway	3	1	1	5
				Mashpee Neck Marina	1	1	3	5
				Little River Boat Yard	1	1	3	5
				New Seabury Marina	1	1	3	5
				Water Tower - Back Road	1	1	3	5
				Water Tower - Meetinghouse Road	1	1	3	5
Cell Tower - 154 Industrial Park Dr	1			1	3	5		
Comm Tower - 47 Industrial Park Dr	1			1	3	5		
Cell Tower - 43 Bowdoin Road	1			1	3	5		
Popponeset Spit Erosion	1			1	2	4		
South Cape Beach Parking lot	1			1	2	4		
State Beach Area	1			1	2	4		
Popponeset Island Bridge	1			1	1	3		
New Seabury Golf Course	1			1	1	3		
WIND	Electrical and phone service interruption or failure - Due to Hurricane			Townwide - areas without Town H20	1	3	3	7
				Townwide - tree damage	1	3	1	5
WIND	Nor'easter - by Neighborhood Roofs Blowing off - Roof Damage	Town Buildings off of Frank Hicks Dr	2	2	3	7		
		Monomoscoy Island	3	2	1	6		
		Seconsett Island	3	2	1	6		
		South Cape Estates	3	2	1	6		
		Mashpee Commons Buildings	2	2	2	6		
		Little Neck Bay	2	2	1	5		
		Bright Coves	1	2	2	5		
		Popponeset Island	1	2	2	5		
		Harbor Ridge Estates	1	2	2	5		
		Ockway Bay Estates	1	2	2	5		
		Ockway Bay Road	1	2	2	5		
		Punkhorn Point	1	2	2	5		
		Shoestring Bay Estates	1	2	2	5		
Neighborhoods South of Mashpee Pond	1	2	2	5				
John's Pond Estates	1	2	2	5				

Hazard	Cause/Effect	Location	Location Rank	Frequency Rank	Magnitude Severity Rank	Total Score
		Neighborhoods north of Wakeby Pond	2	2	1	5
Wind (continued)	Nor'easter	Christ the King Church - Steeple	1	2	2	5
	Nor'easter - by Neighborhood	Quail Hollow	1	2	1	4
	Roofs Blowing off - Roof Damage	Bayview Condos	1	2	1	4
		The Mews	1	2	1	4
		Greensward	1	2	1	4
		Sea Quarters	1	2	1	4
		Great Flat Pond	1	2	1	4
		New Seabury Golf Course	1	2	1	4
		Promontory Point Condos	1	2	1	4
		Seaside	1	2	1	4
		Tidewatch Villas	1	2	1	4
		Colony Villas	1	2	1	4
		Triton Sound Village	1	2	1	4
		Maushop Village	1	2	1	4
		Rock Landing	1	2	1	4
		The Bluffs	1	2	1	4
		Stendahl Condos	1	2	1	4
		Highwood	1	2	1	4
		Daniels Island	1	2	1	4
		Summersea	1	2	1	4
		Cape Cod Holiday Timeshare Estates	1	2	1	4
		Seabrook Pines	1	2	1	4
		Seabrook Village	1	2	1	4
		Seabrook Meadows	1	2	1	4
		Seabrook Shores	1	2	1	4
		Amy Brown Road Area	1	2	1	4
		Red Brook Road Area	1	2	1	4
		Baybury	1	2	1	4
		Pirates Cove	1	2	1	4
		Riverbend	1	2	1	4
		Sandalwood	1	2	1	4
		Windchime	1	2	1	4
		Trout Pond Area	1	2	1	4
		Frog Pond Close area	1	2	1	4
		Parkside	1	2	1	4
		Willow Bend	1	2	1	4
		Neighborhoods South of Santuit Pond	1	2	1	4
WIND	Infrastructure failure caused by Nor'easter	Seconssett Island Causeway	3	2	1	6
		Monomoscoy Rd. Causeway	3	2	1	6
		Water Tower - Back Road	1	2	3	6
		Water Tower - Meetinghouse Road	1	2	3	6
		Cell Tower - 154 Industrial Park Dr	1	2	3	6
		Comm Tower - 47 Industrial Park Dr	1	2	3	6
		Cell Tower - 43 Bowdoin Road	1	2	3	6
		Popponesset Spit Erosion	1	2	2	5
		Mashpee Neck Marina	1	2	2	5
		Waquoit Mooring Fields	2	2	1	5
		Poppon. Mooring Fields	2	2	1	5
		South Cape Beach Parking lot	1	2	2	5
		State Beach Area	1	2	2	5
		Popponesset Island Bridge	1	2	1	4
		Little River Boat Yard	1	2	1	4
		New Seabury Marina	1	2	1	4
		New Seabury Golf Course	1	2	1	4
WIND	Nor'easter	Electrical and phone service interruption or failure - Townwide	1	3	3	7
WIND	Tornados	Electrical and phone service interruption or failure - Townwide	1	1	1	3
WIND	Infrastructure failure caused by Tornados	Town-wide	1	1	2	4
FIRE	Drought - wildfires	Contiguous Forested Areas Over 40 Acres	3	3	4	10
	Lightening Strikes - wildfires	Contiguous Forested Areas Over 40 Acres	1	1	4	6
	Lightening Strikes - structures	Town-wide	2	2	4	8
GEOLOGIC	Erosion Note: Seaside and Tidewatch are nourished by New Seabury	Seaside	1	3	4	8
		Tide Watch	1	3	4	8
		Maushop Village	1	3	4	8
		Colony Villas	1	1	1	3
		Triton Sound	1	1	1	3
		Rock Landing	1	1	1	3
GEOLOGIC	Landslide	Seaside				0
	at our 02/17 meeting the Team gave me direction to separate erosion from landslide but did not give me values for landslides	Tide Watch				0
		Colony Villas				0
		Triton Sound				0

Hazard	Cause/Effect	Location	Location Rank	Frequency Rank	Magnitude Severity Rank	Total Score
	<i>in these locations!</i>	<i>Maushop Village</i>				0
GEOLOGIC	Landslide (con't)	Rock Landing				0
GEOLOGIC	Earthquake	Townwide	3	1	1	5
OTHER	Ice sheets/accumulation	Waquoit Bay (incl. Mooring Fields)	2	2	3	7
OTHER	Ice sheets/accumulation (con't)	Popponeset Bay (incl. Mooring Flds)	2	2	1	5
		Access Blockage for Monomoscoy Is.	3	1	1	5
		Access Blockage for Seconsett Island	3	1	1	5
		Access Blockage for Daniel's Island	2	1	1	4
OTHER	Snow accumulation: roof cave in, especially flat structures	Townwide	3	1	2	6
<i>Note: Speak with Greg Taylor on Geologic "Liquidfaction" issues near the shoreline.</i>						

Section 3: Community's Vulnerability to these Hazards / Vulnerability Assessment

Introduction

Mashpee's **Critical Facilities & Infrastructure** has been identified on the Town of Mashpee **Risk and Vulnerability Assessment Map (Map 1)**. The Mashpee Multiple-Hazard Community Planning Team used this map to determine what critical facilities are in the hazards that were identified in Table 1. Table 2: Inventory of Critical Facilities and Infrastructure, provides a listing of the identified critical facilities and infrastructure located within the Town of Mashpee.

Identification of Critical Facilities in Flood Hazard Areas

The following identified Critical Facilities are in Flood-related Hazard Areas: the Town's Harbormaster shed and all three of the privately owned Marinas located within the Town. These same facilities are also located in SLOSH zones (see Map 1A for the Town of Mashpee Risk and Vulnerability Assessment Map overlaid with the SLOSH Zones). In addition, the New Seabury Wastewater Treatment Plant is located in a Hurricane Category 4 with forward speed greater than 40 MPH SLOSH Zone.

Identification of Critical Facilities in SLOSH Hazard Areas

A number of identified evacuation route have crossings over SLOSH zones (see Map 1 and Map 1A). Map 1 identifies these crossings as red stop signs. Route 28 where the Mashpee River goes under the roadway is the first identified 'stop sign'. The next two are on Quinaquisset Avenue. The first is where Quaker Run crosses under Quinaquisset; the second is where Quinaquisset fronts onto Shoestring Bay just before the Barnstable town line. The forth 'stop sign' is along Red Brook Road, where Dutchmen's Brook goes under the roadway. About a half-mile away Red Brook Road is also in a SLOSH-zone, although it was not designated with a 'stop-sign' under the Cape Cod Commission's "Risk and Vulnerability Assessment" mapping effort. This location is where Red Brook Road crosses over Red Brook at the Falmouth town line.

It should be pointed out that there are roadways that would not be accessible due to storm surges. More discussion on these roads and the parts of Mashpee they impact is found below. There are about 215 acres, or 1.5% of the Town, located in an identified SLOSH zone. Meanwhile about 846 acres, or 6.1% percent of the Town, is located in either an A or V FEMA FIRM Flood-Hazard Zone.

Identification of Critical Facilities in Wildfire Hazard Areas

The following identified Critical Facilities are in a high-risk area for wildfires (these are areas as identified as being in the Wildland/Urban Interface, which include areas adjacent to residential and commercial development, electrical transmission lines and major transportation infrastructure, and have been shown on Map 4: Regional Hazard Risk III, Cape Cod, Massachusetts – Wildlife Hazard Areas): Town Hall, The Town Archives Building, Rainbows and Rhymes Nursery School, Mashpee Center for Optimum Care (Harborside), the Stratford Ponds Wastewater Treatment Plant, the Willowbend Wastewater Treatment Plant, Mashpee Vet, Christ the King Church, Mashpee Commons Wastewater Treatment Plant, the Windchime Point Wastewater Treatment Plant and the New Seabury Wastewater Treatment Plant .

Table 2: Inventory of Critical Facilities and Infrastructure - Located within the Town of Mashpee

Parcel ID	Critical Facilities and Infrastructure, Mashpee, MA		Address	Facility Type	Map Location	SLOSH (Y/N)	FIRM (Y/N)	Capacity	Notes	Multi Fac
	Critical Facility or Infrastructure	Address								
1	Police Station (EOC)/Fire Station	99 Rte. 151	B	G5	no	no				1,2
1	Boys and Girls Club	31 Frank Hicks Dr.	J	G5	no	no				
2	Quashnet Middle School/Kids Klub After School Program	150 Old Barnstable Rd.	A, G, I	G5	no	no		500		1,7
2	Kenneth C. Coombs Elementary	152 Old Barnstable Rd.	G	G5	no	no				
3	Mashpee High School	500 Old Barnstable Rd.	A, E, G	F6	no	no		1000		1,5,7
4	Christ The King Church	7 Jobs Fishing Rd.	A	G5	no	no		500		1,4
4	Housing Authority	7 Job's Fishing Rd.	D	G5	no	no				1,4
5	Town Hall	16 Great Neck Rd. North	D	H3	no	no				
6	DPW, Shellfish Dept.	350 Meetinghouse Rd.	D	H5	no	no				
7	Public Library	100 Rte. 151	D	G5	no	no				
8	Human Services	800 Falmouth Rd.	D	G6	no	no				
9	Mashpee Senior Center/Council On Aging/Senior Citizens Center	500 Great Neck Rd. North	D, J	G5	no	no				
10	Town Archives Building	13 Great Neck Rd. North	D	H3	no	no				
11	Harbormaster's Department Shed.	88 Seconset Island Rd.	D	F9	Yes	Yes				
42	Mashpee Commons	Great Neck Rd. South	E	H5	no	no		Building itself not in flood plain		
13	Southport	443 Old Barnstable Rd.	E	F5	no	no				
14	New Seabury	138 Fairway Ln.	E	G9	Yes	Yes				
15	Straford Ponds	44 Main St.	E	L4	no	no				
46	Winehome Point	90 Great Neck Rd. South	E	H6	no	no				
17	Willowbend	Quippish Rd.	E	L5	no	no		Building itself not in flood plain		
18	Center For Optimum Care	161 Falmouth Rd.	H	L4	no	no				
19	Kids Klub Preschool	Rte. 130 (Recreational Bldg)	I	G3	no	no				
20	Mashpee Creative Children's Center	133 Shelback Place, Suite D	I	G6	no	no				
21	Rainbows & Rhymes Nursery School	47 Wampanoag Ave.	I	E5	no	no				
22	Mashpee Veterinary Hospital	430 Great Neck Rd. North	K	G5	no	no				
23	Little River Boat Yard	15 Riverside Rd.	L	F9	Yes	Yes				
24	New Seabury Marina	135 Daniels Island Rd.	L	L8	Yes	Yes				
25	Half-Tide Marina	21 Frog Pond	L	L6	Yes	Yes				

In addition, there are some other sites that were questionable as to being in the high-risk area, perhaps are in a medium-risk area: the Mashpee D.P.W. offices and storage facility, the Mashpee High School and the Mashpee Creative Children's Center.

Other Identified Critical Facilities in Hazard Areas

In addition, there are some other facilities, not included in the Cape Cod Commission inventory, that have been identified as Critical Infrastructure in the Town of Mashpee's Comprehensive Emergency Management Plan (CEMP) that are in identified hazard areas. For example, almost all of the Town's wells are located in identified unfragmented forested areas (defined as forested area that is over 40 acres), except for the well located in New Seabury that is the 'Section 5' portion of New Seabury. Although there is a large forested area (though it is not 40 acres and has not been classified as 'unfragmented' forest) in to the southwest portion of this well area.

The Mashpee Water District office, located in the Mashpee Industrial Park, is within a high-risk area for wildfires. There are two communication towers in the Industrial Park, with one being in a high-risk wildfire area (154 Industrial Drive) and the second being only a couple hundred feet from the high-risk zone (47 Industrial Drive). The Water District Water Tower off of Back Road, which abuts the Otis Air National Guard Base, is within a high-risk area for wildfires. The newest Water District Water Tower, constructed in 2003 at 50 Meetinghouse Road, is also within a high-risk wildfire area.

Vulnerability Analysis

Access and Roadways Threatened By Flooding

There are certain portions of the Town, such as Monomoscoy Island, for which access is frequently threatened due to high water. In the event of a truly large storm, such as the 500-year flood or a hurricane (see Map 1A for identification of land areas that are affected by hurricane storm surges, which are defined as SLOSH: Sea, Lake, and Overland Surges from Hurricanes), large portions of the coast, including all of our islands (Seconset, Monomoscoy, Popponesset and Daniel's), all of the South Cape Beach and Little Neck Bay area, and large portions of Popponesset Beach and Brights Cove portion of New Seabury would be inundated, and all of South Mashpee would have its access roads blocked by flooding. There are two responses (Mitigation Measures) to this potential situation which must be pursued. The first (and least expensive) is the development of an emergency evacuation plan that recognizes all of the threatened evacuation routes. The second (more capital intensive) is the relocation or elevation of the major roads which provides access to the coastal areas to above either the 500-year or 100-year flood levels. More discussion on these mitigation measures is found in Section 5 (Mitigation Strategy).

Population Vulnerable to Identified Threatened Areas

The population in the above-identified vulnerable areas, which is in the southern part of Mashpee is where more of the seniors citizens are located, given the fact that it is retirement/resort area. In the 2000 Census, 736 persons over 65 were living south of Red Brook Road (on a year-round basis). These were 30.9% of all the persons over 65 living year-round in the Town of Mashpee. The median age of this geographic area is about twenty years higher than the remaining portions.

For this area the median age is 54.9, whereas the median age for the rest of the community is around 38.

Analysis of Recent Construction in Flood Zones

A review of the Town’s building permit records indicates that the Mashpee Building Department has issued 787 buildings permits for construction of new single-family homes over the 5-year period between 1999-2003. Of these 68 are located in a FEMA FIRM flood zone (see Table 3 below). This amount to just over 8.5% of the single-family building permits being for dwellings located within a flood zone.

Table 3: Building Permits in Flood Zones 1999-2003

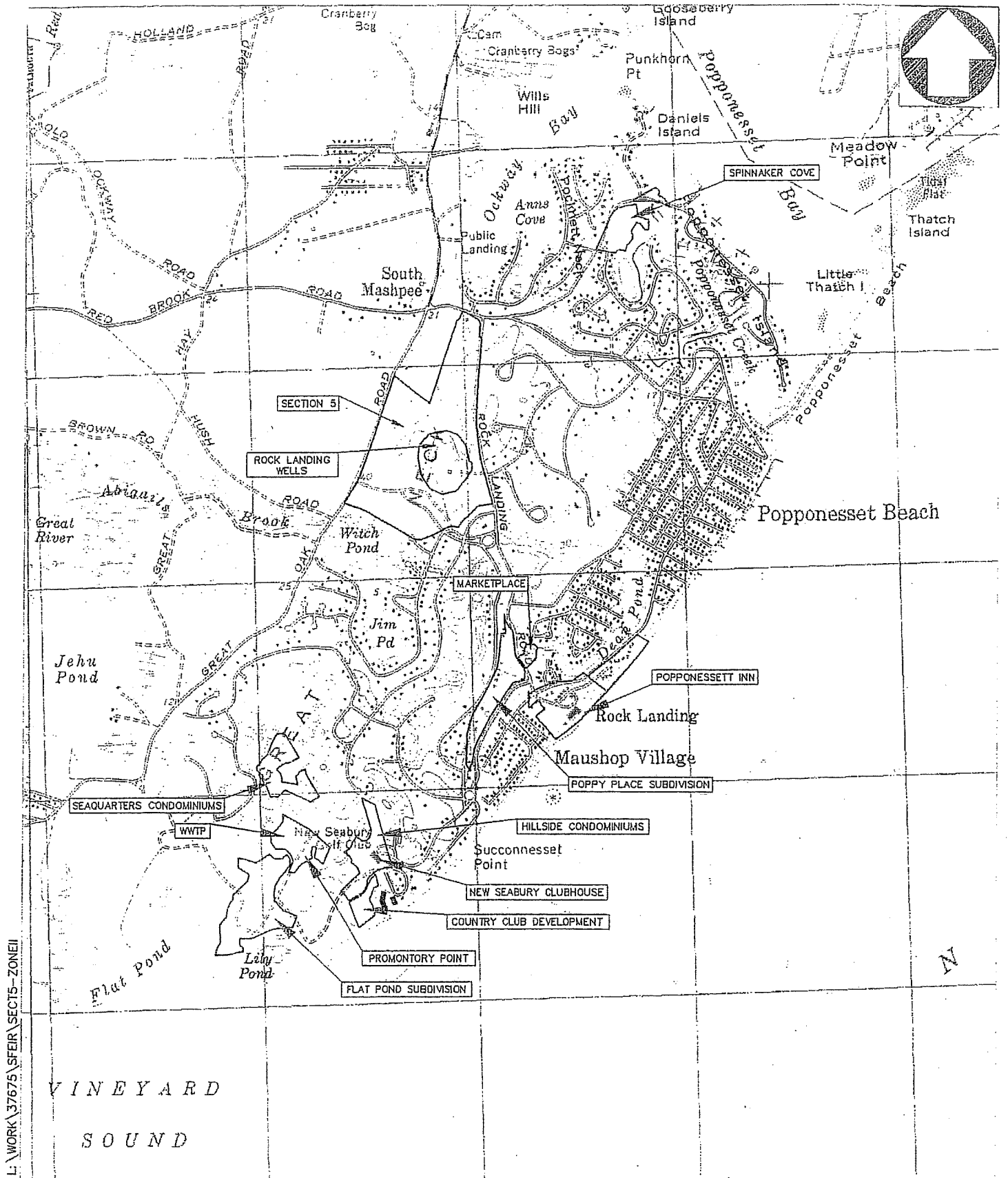
Year	New Building Permits in Flood Zones*	Total New Permits	% in Flood Zones
1999	11	236	4.66%
2000	21	179	11.73%
2001	16	151	10.60%
2002	13	107	12.15%
2003	7	114	6.14%
5-year Total	68	787	8.64%

Analysis of Future Construction in Flood and SLOSH Areas

The New Seabury development in the southern portion of Mashpee, permitted by the Zoning Board of Appeals under a Special Permit in 1964, still has a number of permitted projects to be constructed. A MEPA filing in October 2001 by Earth Tech, Inc. on behalf of the New Seabury Properties, LLC, with a subsequent Notice of Project Change on January 2, 2003, shows these pending development areas (see Figure 4: Development Areas in New Seabury). A review of the latest New Seabury development proposals show that a number of them are in Flood Zones and/or SLOSH zones (comparing Figure 4 with Map 1A).

In the area of the existing Popponesset Inn, 51 new housing units are proposed along with a new swimming pool. This area is in a SLOSH Zone (ranging from the Zone where a Hurricane 1 or 2 category between 0 and 20 MPH of forward speed would impact the south and east portion, going to the Hurricane Category 4 with forward speed greater than 40 MPH SLOSH Zone as you move north and west). To the west of the Popponesset Inn are a number of vacant residential lots. These fourteen vacant lots make up the Poppy Place Subdivision. The lot furthest to the north is located in a Category 4, 40MPH forward speed SLOSH Zone.

Further southwest in New Seabury is a development proposed south of the existing New Seabury Clubhouse. Eighty (80) residential units are proposed in the area called the Country Club Development. Analyzing the New Seabury Development Areas map with the SLOSH map indicates that the southern portion of this area is located in a Category 4, 40MPH forward speed SLOSH Zone down to the Category 1, <20MPH forward speed SLOSH Zone the closer to the shore one gets. A preliminary review indicates that most of this development area is situated on a bluff. More detailed analysis of this area will have to occur during the site plan review for the actual construction.



L:\WORK\37675\SFER\SECTS-ZONEI

SOURCE: USGS COTUIT QUAD

SCALE: 1"=2083'

FIGURE A
DEVELOPMENT AREAS AT NEW SEABURY
NEW SEABURY - MASHPEE, MA

The Great Flat Pond Definitive Plan Subdivision is still to come before the Mashpee Planning Board. This Subdivision, which contains 27 single-family house lots, also contains land in hazard areas. It appears that most of the easterly portion of the Great Flat Subdivision is within a Category 4, 40MPH forward speed SLOSH Zone, and that the western portion is within the 100-year Flood Zone.

Finally, the last of the proposed development that appears to be within a SLOSH zone is the Promontory Point, which is to consist of 24 residential condo units. Although no designated flood zone has been mapped in this area, a Category 4, 40MPH forward speed SLOSH zone covers the western half of this parcel.

As was identified in Section 2 of this Plan, also found along the southern coastline located within the New Seabury coastline are eroding coastal banks (See Map 1 and Table 2 for identification and assessment of these areas). Within the past 5 years, one homes has been constructed in the Seaside neighborhood and there are two remaining vacant residential lots in this neighborhood, which fronts onto the eroding coastal bank.

Dam Hazards

The Massachusetts Department of Conservation and Recreation (MDCR) maintains inventories of dams across the state. The 2004 Massachusetts State Hazard Mitigation Plan includes a map of these dam locations and a ranking for their potential to cause loss of life or damage should they fail. Based on this hazard ranking provided by MDCR, there are ten (10) dams ranked as significant hazards and one (1) as a high hazard on Cape Cod.

Dam hazard rankings are defined as follows:

Significant hazard = dams that are located where failure or mis-operation may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways or railroads, or cause interruption of use or service of relatively important facilities.

High hazard = dams that are located where failure or mis-operation will likely cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways or railroads.

The one identified high hazard dam is the Mashpee Pond Dam and two (2) of the ten (10) identified significant hazard dams are in Mashpee. These are the Quashnet River dam (at Route 28) and the Santuit Pond dam at the Santuit River. Of particular concern at this time is the condition of the Santuit Pond dam. A consultant of the Conservation Commission, Haley & Aldrich, has assessed this dam structure to be in poor condition. For example, they found seepage and significant erosion of embankment soils adjacent to the wooden outlet structure and large trees located along the crest being uprooted (Figures 5 and 6 show this dam). Failure of the structure could result in over 500 acre-feet of water being released, which would have the potential to adversely affect the culverts at Rtes 28 and 130, a major regional intersection located in the Town of Barnstable just across the Mashpee town line.

The Town has submitted a Letter of Intent to MEMA to apply for funds through the Pre-Disaster Hazard Mitigation Program. The Town is requesting \$300,000 in hazard mitigation funds to, at a

minimum, get emergency mitigation work done on this structure. An Implementation Measure calls for preparing a detailed engineering assessment on each of the Town's dam structures.

It should be noted that the Town's Comprehensive Emergency Management Plan (CEMP) states that there are no dams in Mashpee. Thus, there seems to be some differences in the definitions of the structures in Mashpee's waterways.

Figure 5: Eastern Edge of Existing Santuit Pond Dam

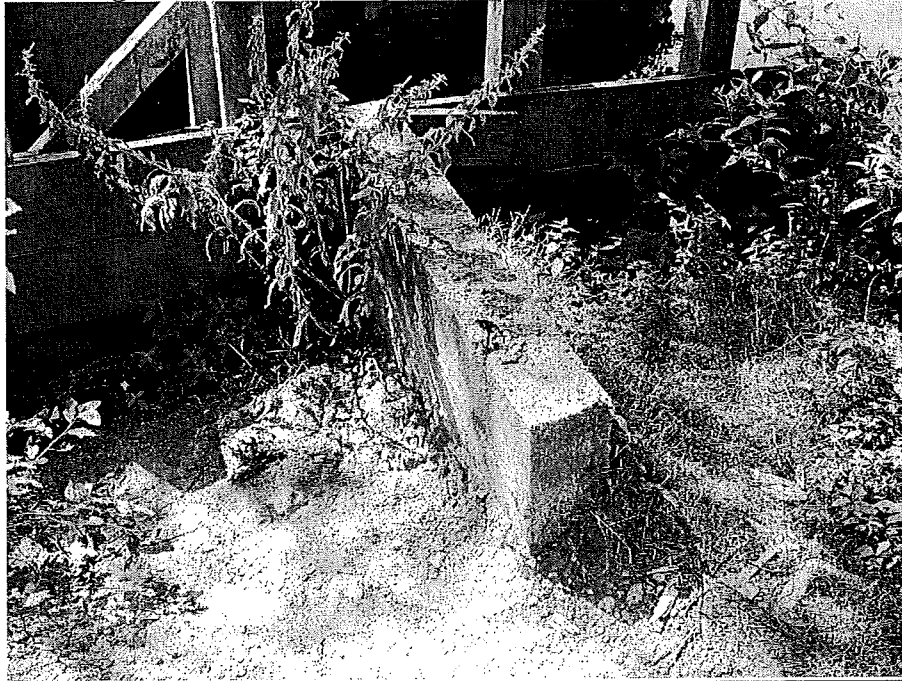
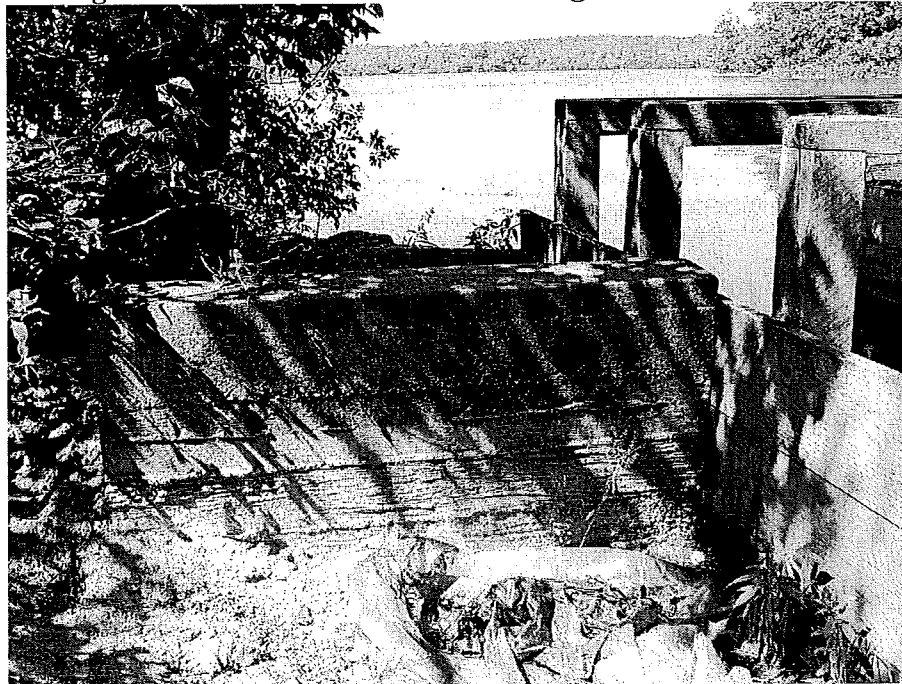


Figure 6: Western Portion of Existing Santuit River Dam



FEMA Flood Insurance Policies in the Town

Regarding repetitive loss properties, as of October 2003, Mashpee did not have any such properties, according to FEMA. FEMA defines a repetitive loss property as one that has had 2 or more flood insurance claim payments of more than \$1,000 in any ten-year period. Since Mashpee joined the flood insurance program in the late 1970's there have been a total of 20 claims paid for a total of \$94,000. Meanwhile, there are currently 448 policies in force in Mashpee covering a total of \$92 million (or about 20% of assessed value of property containing buildings within the flood zones). According to Richard Zingarelli, with the MA DCR Flood Hazard Management Program, based on the above information "this tells me that either the current policies have not been in force very long or that the town has been lucky that it has not been hit hard by a storm."

Given the amount of recent development within flood zones, and the strong potential for more, the statement by Mr. Zingarelli "that the town has been lucky that it has not been hit by a storm" the potential for one or more repetitive loss properties exists, especially if two major storms hit Mashpee within a ten-year period. Hurricane forecasters had predicted 2004 to be a busy hurricane season.

Also in 2004 insurance companies that had been providing homeowner's insurance to Cape Cod property owners began not renewing, or even canceling policies. This was due to a wind model utilized by the insurance agencies. The Committee did want to get an idea of how many homeowners in Mashpee have switched to FAIR plan since the beginning of 2004, but has of the *date of this draft*, FAIR has not returned the phone call to the Planning Department. (*left message with FAIR on 8/10/04, no call back to date*).

Analysis of an Estimation of Potential Loss of Property in Flood Zones

An analysis was conducted by the Mashpee Assistant Planner using the Town's Geographic Information System (GIS) to determine the value of developed properties within the Town's A & V flood zones. This analysis was done with Assessor's data from FY 2003. The total assessed value of residential and commercial properties containing buildings within floodzones is \$449,902,420. Map 6 shows those properties with structures located in Mashpee's flood zones. Given that waterfront property is the Town's most valued property, it is no surprise that developed lands in flood zones makes up 22.4% of the \$2,639,417,760 total building and land assessed value, as of FY 2003. Meanwhile just 6.1% percent, or about 846 acres, of the Town, is situated in either an A or V FEMA FIRM Flood-Hazard Zone.

Section 4: Existing Local Hazard Mitigation Programs, Projects and Activities

See Table 4: Town of Mashpee Existing Protection Matrix

Mashpee Participation in the National Flood Insurance Program (NFIP)

Mashpee's flood zones were delineated in the late 1970's and the Flood Insurance Administration first produced Flood Hazard and Boundary Maps for the Town in 1979, updated in 1985 with the latest update in 1992. The Town is in the Regular Program of the National Flood Insurance Program and has adopted a number of zoning by-laws regarding the elevation of new construction and substantial improvements, the certification of floodproofing methods, the regulation of development in Velocity (V) Zones and the regulation manufactured (mobile) homes. The Town has not yet applied for the NFIP's Community Rating System, but a Mitigation Measure calls for such application. The Town gets 210 points towards the CRS by completing this plan and having it approved by FEMA. The maximum floodplain insurance that is offered by FEMA at this time is \$250,000 per home.

Wildfire Assessment and Preparedness Program

Mashpee currently is not an active participant in the Barnstable County Cooperative's Extension's Wildfire Assessment & Preparedness Program. However, as of the drafting of this plan, the Town has applied for this Program. A total of 6 parcels have been identified by the Fire Chief and Conservation Agent as part of this application. Map 7 shows these parcels.

Repetitive Loss Properties

Mashpee does not have any repetitive loss properties as of the writing this Plan.

Town Purchases of Property Within Identified Flood Zones

The following properties have been either purchased by the Town for conservation purposes or taken for back taxes. (See Map 8, Town of Mashpee Environmental Infrastructure map).

- a) The Town has made some purchases along the Santuit River. About 2/3 of the purchases were made from the Peck family and 1/3 was from the Willowbend Development Corporation.
- b) In 1985 and 1987, the Town purchased the Mashpee River Woodland a total of three parcels: a large one eastern side of River and two parcels on the west side of River. Other protected properties within this river corridor are the Stenberg parcel (donated to the Town), open space dedicated from the Windchime Point Condominiums and also open space owned by the private-land trust, the Trustees of Reservations.
- c) The Jehu Pond Conservation Area is a series of parcels that are now under ownership of the USF&WS (majority of), the Town, and the State. Land parallel to Abigail's Creek falls within the floodzone, as well as a significant portion of the land between Great Hay Road, Amy Brown Road and Jehu Pond.
- d) South Cape Beach: the State purchased the land in 1983 and 1995 from New Seabury, otherwise it would have been developed with housing units and a marina. All of this land in the floodzone.

Table 4: Mashpee Existing Protection Measures

<u>Column 1</u>	<u>Column 2</u>	<u>Column 3</u>	<u>Column 4</u>	<u>Column 5</u>
Type of Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
<p>Mashpee Floodplain Zoning Bylaw, Article XI of the Mashpee Zoning Bylaws</p>	<p>Mashpee's flood zones were delineated in the late 1970's and the Flood Insurance Administration first produced Flood Hazard and Boundary Maps for the Town in 1979, updated in 1985 with the latest update in 1992. The Town is in the Regular Program of the National Flood Insurance Program and has adopted a number of zoning by-laws regarding the elevation of new construction and substantial improvements, certification of floodproofing methods, regulation of development in Velocity (V) Zones and regulations regarding manufactured (mobile) homes. New construction or substantial improvement to have lowest floor, including basement, elevated to not less than base floor elevation (BFE); No land areas within V Zones shall be dev. unless such development is located landward of the reach of mean high tide. All new const & substantial const within V Zones shall be elevated on adequately anchored pilings and securely anchored to such pilings or columns so that lowest portion of structural members of the lowest floor, excluding the pilings, is elevated to or above BFE; Provides some prohibitions.</p>	<p>A & V Zones</p>	<p>Enforced by zoning official; variances are rarely granted the ZBA. Better Code Enforcement is required if Town's Flood Rating is not be compromised. The Town needs to adopt provisions of 44 CFR 60.3, relating to underground utilities.</p>	<p>The Multi-Hazard Mitigation Team had a subcommittee help prepare the Hazard Identification and Ranking Matrix. During this process this subcommittee identified what it believed to be errors in the existing flood maps e.g. misidentification of V zones, etc. As further noted below these flood maps have become outdated. Current and more accurate maps are needed to enforce the existing regulations. The Town has not yet applied for the NFIP's Community Rating System, but a Mitigation Measure calls for such application. The Town gets 210 points towards the CRS by completing this plan and having it approved by FEMA. Also, have better enforcement of Town's existing Floodplain Regulations</p>
<p>Mashpee Wetlands Protection Bylaw</p>	<p>For Description of this Bylaw see text.</p>	<p>Land Subject to Coastal Storm Flowage</p>	<p>See Text</p>	<p>See Text</p>

Table 4: Mashpee Existing Protection Measures

Column 1	Column 2	Column 3	Column 4	Column 5
Type of Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
<p>Mashpee Department Regulations enforced through the 780 CMR Mass State Building Code - (Section 1611.0 Wind Load)</p>	<p>Wind Load Zone 3; Structures of all types are designed to withstand wind forces of 90 mph</p>	<p>South East Region, including Cape Cod (Mashpee) & the Islands</p>	<p>Building Officials will retain an engineer analysis for conformance</p>	<p>The ICC, if adopted, has updated the ASCE 7-95 to 7-98. The reference to the 50-year mean recurrence interval from the previous maps has been removed, reflecting the fact that the MRI is greater than 50 years along the hurricane coastline.</p>
<p>Mashpee Department Regulations enforced through the 780 CMR Mass State Building Code - (Section 1612.0 Earthquake Loads)</p>	<p>Designed and constructed to resist the effects of earthquake motions utilizing an approved analysis. Separated into three (3) categories, Groups I, II and III, depending on the nature of occupancy.</p>	<p>Map prepared by the U.S. Geological Survey (USGS), broken up by contour intervals throughout the U.S. IBC has yet to be adopted.</p>	<p>Building Officials will retain an engineer analysis for conformance</p>	<p>None at this time for this particular area. <i>What about adoption of IBC?</i></p>
<p>Mashpee Department Regulations enforced through the 780 CMR Mass State Building Code - (Section 3107.0 Flood-Resistant Construction)</p>	<p>Any new or substantial improvements of a structure exceeding 50% of the market value of the structure will comply with the provisions of Sections 3107.</p>	<p>Any area with the Town that falls within the jurisdiction of the Flood Insurance Rate Map (FIRM) Zone A, A1-A30, AO, AH, V and V1-30.</p>	<p>Building Official will require elevation certificates at the beginning and before the issuance of the certificate of occupancy. A registered engineer or architect will inscribe on the plan elevations, i.e., first floor, crawl spaces, flood panels, etc.</p>	<p>FIRM maps for the Town of Mashpee are outdated. The last time the maps were revised was in 1992. We rely on engineers to accurately define the flood zones.</p>

Table 4: Mashpee Existing Protection Measures

<u>Column 1</u>	<u>Column 2</u>	<u>Column 3</u>	<u>Column 4</u>	<u>Column 5</u>
Type of Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
Mashpee Board of Health Regulations	The Board of Health in reviewing all proposed sewer and water facilities to be located in Floodplain District under the Zoning Bylaw shall require: 1) New and replacement water supply systems to be designed to minimize or eliminate infiltration of flood waters into the systems. 2) New and replacement sanitary sewage systems to be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters.	All areas as identified under the Town of Mashpee Flood Plain Zoning District...	<i>Health Agent and the Board of Health have good relationship and work together to ensure this Regulation is enforced. Variances can be give at the Board of Health's discretion</i>	?
Mashpee Board of Health Regulations	No newly constructed septic systems, nor expansion of existing septic systems shall be permitted within 150 feet of any area where there is active shifting of sands or earth. The delineation of such area shall be shown on a plan drawn by a Professional Registered Engineer and verified by the Conservation Commission or its act. These areas shall include: a) Coastal beaches, b) Coastal dunes, c) Barrier beaches and d) Coastal Banks composed of unconsolidated sediment.	Any area within 150 feet of any area where there is active shifting of sands or earth.	<i>Health Agent and the Board of Health have good relationship and work together to ensure this Regulation is enforced. Variances can be give at the Board of Health's discretion</i>	?

- e) Dutchmen's Brook, which is located on the western portion of the Jehu Pond Conservation Area the USFWS parcel, a 6.2 acre Town tax taking parcel and on the northside of Red Brook Road a 8+ acre Town-owned parcel, obtained in a land trade.
- f) Red Brook: Two Town-owned tax taking parcels: (one north and one southside of Polaris Drive); the third one borders that southside Polaris one to the south, surrounded by the Town of Falmouth to the west, a State-owned parcel to the east.
- g) Quashnet River: within the Town of Mashpee, near the border with Falmouth, a portion of the Quashnet River falls within the 100-year flood zone, this land is preserved by State purchases back in the 1950s.
- h) Monomoscoy Island, a number of tax-taking parcels by the Town of Mashpee.

Section 5: Mitigation Strategy

This section outlines Mashpee's overall strategy to reduce the community's vulnerability to the effects of natural hazards. It has been separated into the following sections:

- **Mitigation Objectives** – These are designed to directly support the Town's hazard mitigation goals, outlined earlier. If all the objectives are met, the goal will be met.
- **Mitigation Actions** – These are specific measures to be undertaken in order to achieve the identified objectives. These actions should guide future funding decisions for both pre- and post-disaster mitigation projects throughout the Town.

The Town's hazard mitigation strategy is to be an evolving plan that will change over time as circumstances warrant, as new studies are conducted, and as technology for understanding, predicting and locating risk improves. This strategy will be updated over time so that it will meet the needs of the Mashpee should it confront a natural hazard. Part of what this strategy does is to identify gaps in data, planning, and policies that should be addressed and completed over time.

A. Mitigation Objectives – these are designed to support and correspond directly with the Community Goals (see Section 1).

Objective 1: Preserve the natural and beneficial functions of the town's floodplain, wetlands, beaches and dunes through continued support of natural resource protection policies and by the careful review of growth in environmentally sensitive areas.

Objective 2: Enhance the Town's capability to conduct hazard risk assessments, demonstrate funding needs, and track mitigation activities throughout town (whether directly as part of this plan, or indirectly through the normal course of business).

Objective 3: Ensure that current emergency services and plans are adequate to protect public health and safety.

Objective 4: Ensure coordination with neighboring towns, the Massachusetts Military Reservation, and County emergency services, as well as other state and federal agencies.

Objective 5: Ensure that all new construction is completed using wind-resistant design techniques and materials that will limit damage caused by high winds and reduce the amount of wind-borne debris.

Objective 6: Ensure that new development, buildings and other facilities are properly located, accessed, designed, and constructed so as to minimize life and property loss due to storms, flooding, wildfires and other natural disasters.

Objective 7: Maximize the use, as available, of hazard mitigation grant programs and other non-property tax sources of funding for the protection of the Mashpee's most vulnerable populations and structures.

Objective 8: Ensure that all critical facilities are protected from the effects of natural hazards to the maximum extent possible.

Objective 9: Increase the level of knowledge and awareness for Mashpee residents on the hazards that are potential threats to the area.

Objective 10: Educate property owners on the affordable, individual mitigation and preparedness measures that can be taken before the next hazard event (e.g., elevation of mechanicals outside buildings in flood zones above the base flood elevation).

Objective 11: Ensure that loss of life and serious injuries are minimized during storms or other natural disasters.

Objective 12: Minimize property and other insurance rates which may be influenced by the Town's public safety programs or other Town activities.

Objective 13: Ensure that fire safety and response, storm damage prevention, emergency evacuation and other hazard-related issues are incorporated in the Town's emergency-related planning, regulations, policies and review practices related to construction, development and redevelopment.

Objective 14: Ensure that development on or landward of a coastal bank or dune is designed and located so as to have no significant adverse effect on the height, stability or the functioning of the bank or dune as a natural sediment source and in storm damage prevention/flood control and that the average annual erosion rate of the bank or dune is considered in locating such development or redevelopment.

Objective 15: Ensure that new or expanded public infrastructure does not promote new growth or development in coastal A or V zones, on coastal banks, dunes or barrier beaches which could result in damage to the coastal environment, increased storm damage or loss of public recreation resources unless developed in accordance with the Town's Comprehensive Plan.

Objective 16: Balance mitigation needs against conservation requirements, e.g. clearing/pruning of trees and vegetation for wildfire protection and berms for floodwaters.

B. Available Mitigation Techniques

In considering the appropriate mitigation techniques for Mashpee to undertake, the Mashpee Pre-Disaster Mitigation Team reviewed the hazard identification and analysis, the Town's vulnerability assessment, and the existing protection measures. An assessment of these earlier planning steps was the foundation for generating mitigation actions to lessen Mashpee's vulnerability to natural hazards. Six (6) categories of available mitigation types and techniques

(as discussed in Appendix 10) were assessed as they relate to the hazards face by the Town of Mashpee.

Mitigation Technique	Possible Hazard:							
	Flood	Wind	Wildfire	Erosion	Earthquake	Tornado	Snow & Ice	Drought
Prevention	√		√	√			√	√
Property Protection	√	√	√	√		√	√	
Natural Resource Protection	√		√	√			√	√
Structural Projects	√			√				
Emergency Services	√	√	√		√	√	√	
Public Information and Awareness	√	√	√	√	√	√	√	√

C. Mitigation Actions and Projects – After developing a comprehensive list of action items, the Mashpee Multi-Hazard Mitigation Planning Team recognized that there are generally six (6) categories into which the actions fall including general actions, continued or additional planning actions, continuation or development of programs or initiatives, regulatory actions, educational actions or infrastructure-related projects. The laundry list of action items is divided into these six categories and presented below.

General Actions

Action Item #1	Seek funding under the FEMA Hazard Mitigation Grant Program to implement the structural and capital measures in this Plan.
Hazard to mitigate:	All
Responsible for implementation:	Various
Potential funding source:	FEMA PDM Grants, with Town budget matching funds
Feasibility / Implementation:	Medium / Ongoing over 5 years

Continued or Additional Planning

Action Item #2	Become a participant in the NFIPs Community Rating System program by the year 2006 through enhanced floodplain management activities. Explore opportunities to join with Barnstable County as a whole.
Hazard to mitigate:	Flood
Responsible for implementation:	Planning and Building Departments
Potential funding source:	Town budget, PDM grants, County Assistance
Feasibility / Implementation:	Medium / Within 2 years

Action Item #3	Work with FEMA to update the Town's Flood Insurance Rate Maps (FIRM) to correct inaccuracies identified by the Town's Local Hazard Mitigation Planning Team and to take advantage of improvements in mapping technology.
Hazard to mitigate:	Flood
Responsible for implementation:	Planning and Building Departments, Waterways Commission
Potential funding source:	Town budget, PDM Grants, County Assistance
Feasibility / Implementation:	High / Within 2 years

Action Item #4	Develop an emergency evacuation plan that includes specific procedures for evacuation areas where evacuation routes may be inaccessible due to flooding or wave action.
Hazard to mitigate:	Flood, Wind
Responsible for implementation:	Public Works, Fire and Police
Potential funding source:	Town budget, PDM Grants, County Assistance
Feasibility / Implementation:	High / Within 2 years

Action Item #5	Conduct a detailed, geologic study of the Popponeset Spit to determine the action necessary to prevent further deterioration or erosion.
Hazard to mitigate:	Erosion/Shoreline Change
Responsible for implementation:	Conservation Commission
Potential funding source:	Town budget, PDM Grants, County Assistance

Feasibility / Implementation:	High / Within 2 years
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Action Item #6	Engage in the National Fire Prevention Association's (NFPA) planning process to minimize wildfire hazards.
Hazard to mitigate:	Wildfire
Responsible for implementation:	Fire and Planning Departments
Potential funding source:	Town budget, PDM Grants, County Assistance
Feasibility / Implementation:	Medium / complete within 5 years

Action Item #7	Develop a plan, in conjunction with the Mashpee National Wildlife Refuge Management Committee, for the maintenance of the unpaved roads within the Mashpee National Wildlife Refuge (MNWR) to ensure adequate access for response to wildfires or other disasters and so that these roads can also function as fire breaks.
Hazard to mitigate:	Wildfire
Responsible for implementation:	Fire, Public Works, Police and Conservation with MNWR Management Committee
Potential funding source:	Town budget, PDM Grants, County Assistance
Feasibility / Implementation:	Medium / complete within 5 years

Action Item #8	Develop a Stormwater Runoff Management Plan, which identifies and prioritizes in the Town of Mashpee needed stormwater runoff projects.
Hazard to mitigate:	Flood
Responsible for implementation:	Public Works
Potential funding source:	Town budget; State and Federal Grants
Feasibility / Implementation:	High / complete within 2 years

Action Item #9	Establish and Implement the Town's Wastewater Facilities Plan
Hazard to mitigate:	Flood
Responsible for implementation:	Planning, Public Works
Potential funding source:	Town budget, State Revolving Fund
Feasibility / Implementation:	Medium / on-going over multi-year period

Action Item #10	Evaluate feasibility of burying utilities in identified hazardous areas.
Hazard to mitigate:	Wind

Responsible for implementation:	Planning, Public Works; NSTAR
Potential funding source:	Grant funding; private sector
Feasibility / Implementation:	Low / complete within 5 years

Action Item #11	Study the appropriate placement for Fire, Police and DPW facilities.
Hazard to mitigate:	Flood, Wind, Fire, Snow/Ice
Responsible for implementation:	<i>Local ERC; Town Manager, Fire, Police and DPW, Planning</i>
Potential funding source:	Grant funding, including FEMA PDM Grants, with Town budget matching funds
Feasibility / Implementation:	High / complete within 5 years

Action Item #12	Coordinate the Town's mitigation planning efforts with the Mashpee Water District.
Hazard to mitigate:	All
Responsible for implementation:	Mashpee Water District; Board of Health, Public Works and Fire Department, other Town Departments as designated by the Town Manager.
Potential funding source:	FEMA PDM Grants with Town budget matching funds; Water District
Feasibility / Implementation:	Medium / on-going over 5-years

Continuation or Development of Programs & Initiatives

Action Item #13	Complete Application and submit to Barnstable County Cooperative Extension's Wildfire Assessment & Preparedness Program for the six (6) identified Town-owned parcels.
Hazard to mitigate:	Wildfire
Responsible for implementation:	Fire and Conservation Commission
Potential funding source:	Grants from County budget; PDM project grants
Feasibility / Implementation:	High / Within the next year

Action Item #14	Provide that identified hazard mitigation programs and measures are adequately addressed in updates of the Town's Comprehensive Emergency Management Plan (CEMP).
Hazard to mitigate:	All
Responsible for implementation:	Police, Fire, Town Manager, <i>Local ERC</i>
Potential funding source:	Town budget, <i>Homeland Security and/or</i>

	<i>MEMA grants</i>
Feasibility / Implementation:	High / complete as needed in CEMP update

Action Item #15	Investigate the possibility of tax credits for property owners who voluntarily implement mitigation measures.
Hazard to mitigate:	All
Responsible for implementation:	Town Manager to designate (perhaps Town Assessor?).
Potential funding source:	Town budget
Feasibility / Implementation:	Medium / complete within 5 years

Regulatory Actions

Action Item #16	Increase protection of the floodplain by enhancing floodplain management activities (zoning, building) within the Town of Mashpee.
Hazard to mitigate:	Flood
Responsible for implementation:	Planning and Building Departments
Potential funding source:	Town budget, PDM grants, County Assistance
Feasibility / Implementation:	High / Within 2 years

Action Item #17	Incorporate Part 44 of the Code of Federal Regulations, Section 60.3, which regards the placement of utility structures, into the Town's Floodplain Zoning Bylaw.
Hazard to mitigate:	Flood
Responsible for implementation:	Planning and Building Departments
Potential funding source:	Town budget
Feasibility / Implementation:	High / Within 2 years

Education-related Projects

Action Item #18

Work with Barnstable County to develop a multifaceted hazard mitigation education program to:

- Raise public awareness and support for mitigation.
- Assist the Town in implementation of community based hazard mitigation through education of Town officials and employees, residents, visitors, and businesses (including resorts and seasonal residents); on-going risk assessment and vulnerability analysis; floodplain management, land use and community planning; and through participation in other state and federal programs intended to reduce risk.
- Reduce duplication of effort of Countywide work.

Elements of the educational program may include the following as well as additional action items/elements that will be developed or specified as additional needs are identified:

- Production and distribution of hazard mitigation materials targeted specifically to diverse sectors of the Cape's population (i.e. seniors, visitors, realtors, homeowners, second home owners, contractors and builders, realtors, children, Chambers of Commerce, business owners, boat owners, marina managers, etc.).
- Educate town officials to the available, proper mitigation techniques.
- Develop education programs to inform Town residents about prevention techniques to minimize storm damage to their own property.
- Develop seasonal visitor evacuation education (specifically hurricanes or other disaster that may require evacuation or sheltering in place).
- Encourage participation in the National Fire Protection Association's *National Firewise Communities Program*.
- Assist in annual updates to the Cape Cod Emergency Preparedness Handbook: A Guide to Natural Disasters, which was produced by

	<p>the Cape Cod Commission in 2004, by providing updated Town of Mashpee information and distribute at various locations within the Town.</p> <ul style="list-style-type: none"> · Work with the Commission in providing the relevant Mashpee information for inclusion in all Cape Cod phone books a section on hazard mitigation, emergency preparedness, and hazardous event response (contact, shelter and evacuation information) intended as a quick reference guide for the public. · Coordinate with the Commission on utilization and adoption to Cape Cod and Mashpee of the State's public information, materials, workshops, and videos, and the utilization of the State Hazard Mitigation Training Program to train Mashpee officials. · Get local officials and permitting board to participate in an annual hazard mitigation training program that the Commission has proposed to organize as part of its Regional Hazard Mitigation Plan. · Have links from the Town's redesigned web page to the County and State's hazard mitigation web information in order to provide local officials and the general public the latest information on hazard mitigation measures, programs and funding in Massachusetts.
Hazard to mitigate:	All
Responsible for implementation:	To be determined.
Potential funding source:	Grant funding
Feasibility / Implementation:	High / ongoing actions

Infrastructure-related Projects

Action Item #19	Conduct a feasible study of the roadways within the Town of Mashpee subject to flooding or wave action, as identified in the <i>Hazard Identification and Ranking Matrix</i> , to determine the ability and cost to elevate or relocate these roads to above the applicable 100-year flood level and the hurricane inundation level, as identified by the <i>SLOSH</i> maps.
Hazard to mitigate:	Flood, Wind
Responsible for implementation:	Public Works
Potential funding source:	Town budget, PDM Grants, County Assistance
Feasibility / Implementation:	Medium / 2-5 years

Action Item #20	Prepare an engineering assessment of the various dam/flume structures controlled by the Town, including those at Santuit Pond, Mill Pond (Mashpee River), Quashnet River, in order to develop a long-term plan for the improvement and/or replacement of these structures as necessary.
Hazard to mitigate:	Flood
Responsible for implementation:	Conservation Commission
Potential funding source:	Town budget, PDM Grants, County Assistance
Feasibility / Implementation:	High / Within 2 years

Action Item #21	Prepare design plans for the improvement of the culvert situation for the Child's River at John's Pond.
Hazard to mitigate:	Flood
Responsible for implementation:	Conservation Commission
Potential funding source:	Town budget, PDM Grants, County Assistance
Feasibility / Implementation:	Medium / Within 2 years

Action Item #22	Implement and operate a fully, functional Emergency Operations Center.
Hazard to mitigate:	All
Responsible for implementation:	Police, Fire, Town Manager, <i>Local ERC</i>
Potential funding source:	Town budget, Homeland Security and/or MEMA grants

Feasibility / Implementation:	High / complete within 2 years
Action Item #23	Assess the condition of the culvert between Hamblin and Jehu Ponds under Monomoscoy Road (ideally raise the roadway).
Hazard to mitigate:	Flood
Responsible for implementation:	Public Works
Potential funding source:	Grant funding, including FEMA PDM Grants, with Town budget matching funds
Feasibility / Implementation:	Medium / complete within 5 years

Prioritization and Implementation of Action Items

The activities listed above represent all those that provide the best method of mitigating future damages and/or loss of life based on the hazard analysis. In order to effectively implement the above action items some priority must be determined, as there are naturally restrictions on implementation. The Mashpee Multiple-Hazard Community Planning Team discussed each suggested action item and worked to determine its feasibility and priority. Feasibility and prioritization were based on the STAPLEE criteria as suggested in the Natural Hazards Mitigation Planning: A Community Guide, prepared by Massachusetts Department of Environment Management and the Massachusetts Emergency Management Agency (see Appendix 11 for a description of the STAPLEE criteria). STAPLEE is an acronym for a general set of criteria used to make decisions regarding community initiatives, standing for social, technical, administrative, political, legal, economic, and environmental decision-making criteria. Using these criteria the team determined the overall feasibility of the twenty-three (23) action items.

The use of STAPLEE would rank all action items against each other, without regard to impact on reducing the Town’s vulnerability to natural hazards. Consideration had to be given to actions intended to address the greatest hazard risk(s). Therefore, the team weighted the ranking of the STAPLEE by adding in the hazard ranking values assigned to the hazards the Cape faces (see Table 1: Hazard Identification and Ranking Matrix, Section 2). If an action item would address multiple hazards it was given a value of eleven (11), which is one number higher than the highest hazard ranking assigned. This hazard-weighted STAPLEE mitigation strategy resulted in three levels of priority based on equally distributing the scores. Table 5: STAPLEE Feasibility Analysis of Potential Natural Hazard Mitigation Measures, presents the results:

- High (32–30 points) = 12 actions
- Medium (28-26 points) = 10 actions
- Low (25 points and less) = 1 action

It is important to discuss the criterion of “Administratively Possible” and to explain how the question was answered. Regarding this criterion STAPLEE asks: *Can the community implement the action? Is there someone to coordinate and lead the effort? Is there sufficient funding, staff and technical support available? Are there ongoing administrative requirements that need to be*

Table 5: STAPLEE Feasibility Analysis of Potential Natural Hazard Mitigation Measures

Town of Mashpee Hazard Mitigation Measures	Action Item #	Hazard Index	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Priority Score
High Feasibility: Provide that identified hazard mitigation programs and measures are adequately addressed in updates of the Town's Comprehensive Emergency Management Plan increase protection of the floodplain by enhancing floodplain management activities (zoning, building) incorporate 44 CFR 60.3, regarding the placement of utility structures, into the Floodplain Zoning Bylaw Implement and operate a fully, functional Emergency Operations Center Work with FEMA to update Town's FIRM maps Develop an emergency evacuation plan that includes specific procedures for evacuation areas where evacuation routes may be inaccessible due to flooding or wave action Conduct detailed, geologic study of Popponneset Spit to determine necessary action to prevent further deterioration or erosion. Develop a Stormwater Runoff Management Plan, which identifies and prioritizes needed stormwater projects Study the placement for Fire, Police and DPW Facilities	#14 #16 #17 #22 #3	11 10 10 11 10	3 3 3 3 3	3 3 3 3 3	3 3 2 2 2	3 3 3 3 3	3 3 3 3 3	3 3 3 3 3	3 3 3 3 3	32 31 31 31 30
Submit application to Barnstable Co. Cooperative Extension's Wildfire Assessment & Preparedness Program for the six (6) identified Town-owned parcels. Develop a multi-faceted education program Prepare an engineering assessment of the various dam structures controlled by the Town, including those at Santuit Pond, Mashpee River, Quashnet River, in order to develop a long-term plan for the improvement and/or replacement of these structures as necessary	#13 #18 #20	10 11 10	3 3 3	3 3 3	3 3 2	3 3 3	3 3 3	3 3 3	3 3 3	30 30 30
Medium Feasibility: Coordinate the Town's mitigation planning efforts with the Mashpee Water District Conduct a feasible study of roadways within the Town subject to flooding or wave action to determine the ability and cost to elevate or relocate roadways these roads above applicable 100-year flood level, and the SLOSH hurricane inundation level Prepare design plans for the improvement of the culvert situation for the Child's River at John's Pond Assess the condition of the culvert between Hamblin and Jehu Ponds under Monomoscoy Road (ideally raise roadway)	#12 #19 #21 #23	11 11 10 10	3 3 3 3	3 2 3 2	3 2 3 2	2 3 3 3	2 3 3 3	2 3 3 3	2 3 3 3	29 29 29 29
Seek funding under the FEMA Hazard Mitigation Grant Program to implement the structural and capital measures in this Plan. Become participant in CRS program by 2006 Engage in the NFPA Planning process to minimize wildfire hazards Develop a plan for the maintenance of unpaved roads within the MNWR to ensure adequate access for response to wildfires or other disasters and so that these roads can also function as fire breaks. Establish and implement Wastewater Facilities Plan Investigate possibility of tax credits for property owners who voluntarily implement mitigation measures	#1 #2 #6 #7 #9 #15	11 10 10 10 10 11	3 3 3 3 3 2	3 3 3 3 3 2	2 3 3 2 2 3	3 2 3 2 2 2	3 2 3 3 3 2	3 3 3 3 3 2	3 3 3 3 3 2	28 28 28 28 27 27
Low Feasibility: Evaluate feasibility of burying utilities in identified hazard areas Key: 1 = not acceptable, no; 2 = somewhat acceptable, maybe; 3 = desirable, yes	#10	10	3	3	2	3	2	2	3	26

met? At the time this Local Pre-Disaster Mitigation Plan was prepared there is neither Town nor County staff available or designated to either continue hazard mitigation planning or implement the strategy that this Plan develops beyond the tasks of existing Town employees that happen to directly accomplish the specified action items and which is beyond the scope of the County grant received to prepare the Regional Pre-Disaster Mitigation Plan and provide technical assistance as needed in writing this Plan.

The County in the Regional Plan has included an Action Item to “Identify or create County personnel to...Assist towns with a certified Local PDM Plan with the implementation of that Plan by identifying and seeking grant opportunities for local hazard mitigation projects...” This item if implemented will identify staff to assist the Town in the implementation of this Plan. Also, by making residents aware of the hazard identified in this plan and the required actions to mitigate them, greater budgetary support may be possible both for staff and capital projects. Therefore, six (6) of the Action Items received a low ranking when “Administratively Possible?” was asked about them, with another thirteen (13) receiving a medium ranking in this category. If the Commission is able to get Staff assistance and the Town makes greater resources available for hazard-mitigation planning, the STAPLEE chart will be affected as follows:

- Actions #2, #6, #10, #18, #19 will each receive a score of 3 (rather than 1); This would move Action Items #2, #6, #10 and #19 from medium to high feasibility (#18 is already high feasibility).
- Actions #1, #3, #4, #5, #7, #9, #11, #13, #15, #20, #22, and #23 will each receive a score of 3 (rather than 2); This would move Action Item #23 from medium to high feasibility (Items #3, #4, #5, #11, #13, #20 and #22 are already high feasibility).

Although all of the identified mitigation techniques will likely reduce costs by avoiding losses, many projects are too costly to implement. The Town, working with Barnstable County, will continue to seek outside funding assistance for projects in both the pre- and post-disaster environment. Indeed the Town, as identified in Action Item #1, will be seeking funding to implement the structural and capital measures in this Plan. In addition, it is the role of the County to help the Towns find the resources to conduct our identified projects. Action Item #4 of the County Plan calls for continuing to identify potential funding sources and passing this information on to the Town officials.

Section 6: Implementation and Adoption of this Plan

Explain how your town will implement this plan. If you use the chart above you may want to summarize the last row into a short-term, long-term type implementation chart.

The Town of Mashpee will be implementing this plan by following through on the Action Items identified and prioritized by feasibility in Section 5. These action items have been divided into short-term and longer-term projects and presented in the following chart:

Short-Term/High Priority, Feasibility (0-2 years)

Action Item #1 (seeking funding under the FEMA Hazard Mitigation Grant Program)

Action Item #2 (become participant in CRS program)

Action Item #3 (update of Town's FEMA FIRM maps)

Action Item #4 (Emergency evacuation plan for areas where evacuation routes subject to flooding)

Action Item #5 (detailed, geologic study of Popponeset Spit)

Action Item #8 (Develop a Stormwater Runoff Management Plan)

Action Item #11 (Study the appropriate placement for Fire, Police and DPW Facilities)

Action Item #13 (Submit Application to Barnstable County Cooperative Extension's Wildfire Assessment & Preparedness Program for the six identified Town-owned parcels)

Action Item #14

Action Item #16 (Increase protection of floodplain by enhancing floodplain management activities, e.g. zoning and building regulations, within the Town)

Action Item #17 (Incorporate 44 CFR 60.3, which regards the placement of utility structures, into the Town's Floodplain Zoning Bylaw)

Action Item #18 (Develop a multi-faceted education program)

Action Item #20 (Prepare engineering assessment of various dam/flume structures controlled by Town, with first priority on Santuit Pond)

Action Item #21 (Prepare design plans for the improvement of the culvert situation for the Child's River at John's Pond)

Action Item #22 (Implement a fully functional Emergency Operations Center)

Long-Term/Low to Medium Priority, Feasibility (Greater than 2-years)

Action Item #6 (Engage in NFPA planning process to minimize wildfire hazards)

Action Item #7 (Develop a plan for maintenance of unpaved roads within the MNWR for fire protection)

Action Item #9 (Establish and Implement the Town's Wastewater Facilities Plan)

Action Item #10 (Evaluate feasibility of burying utilities in identified hazard areas)

Action Item #12 (Coordinate the Town's mitigation planning efforts with the Mashpee Water District)

Action Item #15 (Investigation of tax credits for property owners who voluntarily implement mitigation measures)

Action Item #19 (Feasibility Study of roadways subject to flooding or wave action to determine ability and cost to elevate roads above 100-year flood level and hurricane inundation level)

Action Item #23 (Assess the condition of the culvert between Hamblin and Jehu Ponds under Monomoscoy Road, including need to raise the roadway)

Explain the town adopted this plan (to show FEMA that your community and officials are committed to it)

The Assistant Planner presented the final draft plan, on behalf of the Local Multiple-Hazard Community Planning Team, to the Mashpee Planning Board at a public hearing on October 6, 2004, which was advertised in the *Mashpee Enterprise* greater than 14 days before the hearing. Public comment was taken from this hearing *and other comments that were received before and after the hearing and incorporated into this final plan. This plan was brought before the Mashpee Board of Selectmen on for their approval on _____, 2004. The Mashpee Board of Selectmen voted to approve this plan on _____, 2004. include motion language here, with their signatures.*



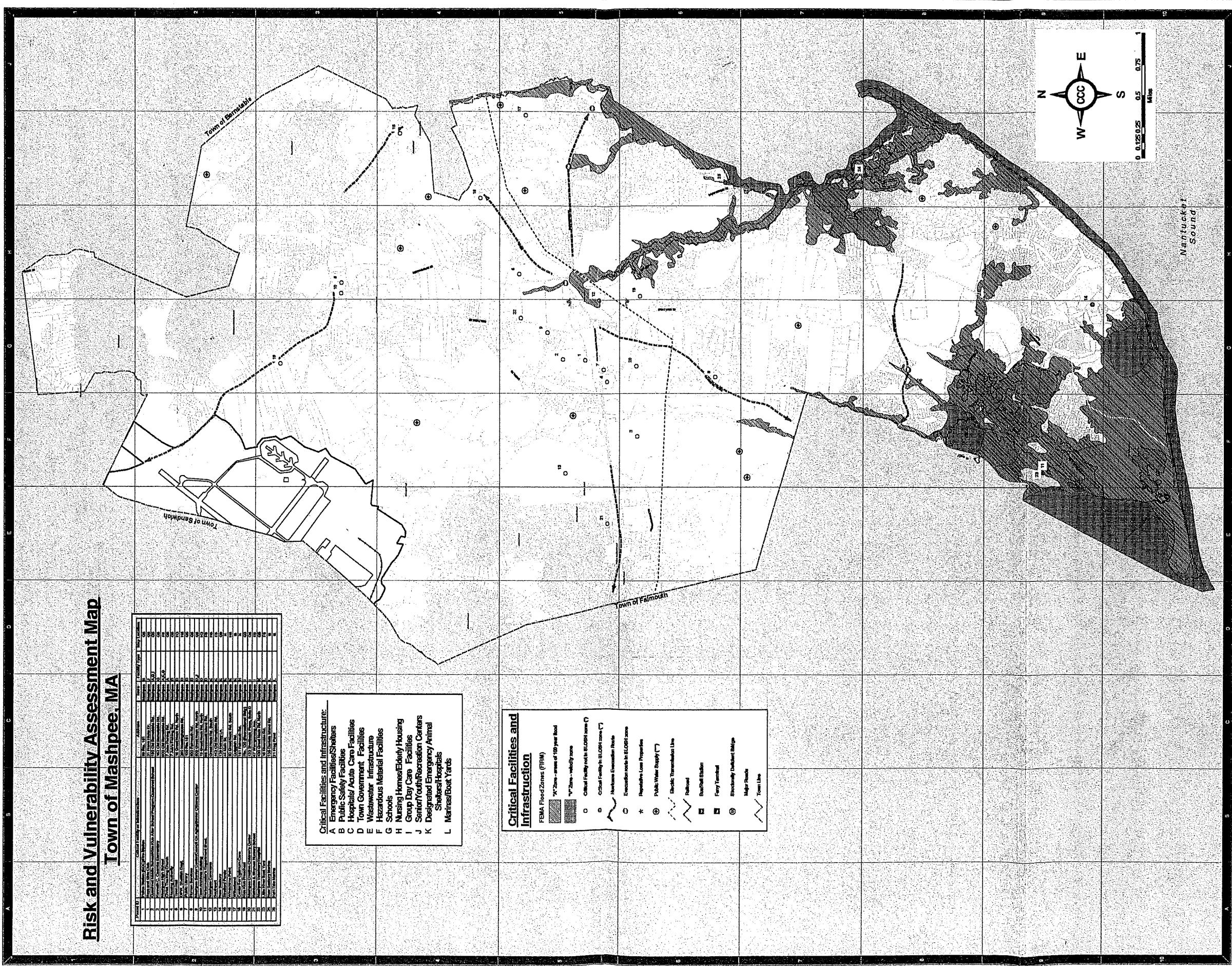
Appendix 1:
Map 1: Risk and Vulnerability
Assessment/Local Critical Facilities Map

Risk and Vulnerability Assessment Map Town of Mashpee, MA

Parcel ID	Address	Facility Type	Notes
1	100 Main St	A	
2	102 Main St	A	
3	104 Main St	A	
4	106 Main St	A	
5	108 Main St	A	
6	110 Main St	A	
7	112 Main St	A	
8	114 Main St	A	
9	116 Main St	A	
10	118 Main St	A	
11	120 Main St	A	
12	122 Main St	A	
13	124 Main St	A	
14	126 Main St	A	
15	128 Main St	A	
16	130 Main St	A	
17	132 Main St	A	
18	134 Main St	A	
19	136 Main St	A	
20	138 Main St	A	
21	140 Main St	A	
22	142 Main St	A	
23	144 Main St	A	
24	146 Main St	A	
25	148 Main St	A	
26	150 Main St	A	
27	152 Main St	A	
28	154 Main St	A	
29	156 Main St	A	
30	158 Main St	A	
31	160 Main St	A	
32	162 Main St	A	
33	164 Main St	A	
34	166 Main St	A	
35	168 Main St	A	
36	170 Main St	A	
37	172 Main St	A	
38	174 Main St	A	
39	176 Main St	A	
40	178 Main St	A	
41	180 Main St	A	
42	182 Main St	A	
43	184 Main St	A	
44	186 Main St	A	
45	188 Main St	A	
46	190 Main St	A	
47	192 Main St	A	
48	194 Main St	A	
49	196 Main St	A	
50	198 Main St	A	
51	200 Main St	A	
52	202 Main St	A	
53	204 Main St	A	
54	206 Main St	A	
55	208 Main St	A	
56	210 Main St	A	
57	212 Main St	A	
58	214 Main St	A	
59	216 Main St	A	
60	218 Main St	A	
61	220 Main St	A	
62	222 Main St	A	
63	224 Main St	A	
64	226 Main St	A	
65	228 Main St	A	
66	230 Main St	A	
67	232 Main St	A	
68	234 Main St	A	
69	236 Main St	A	
70	238 Main St	A	
71	240 Main St	A	
72	242 Main St	A	
73	244 Main St	A	
74	246 Main St	A	
75	248 Main St	A	
76	250 Main St	A	
77	252 Main St	A	
78	254 Main St	A	
79	256 Main St	A	
80	258 Main St	A	
81	260 Main St	A	
82	262 Main St	A	
83	264 Main St	A	
84	266 Main St	A	
85	268 Main St	A	
86	270 Main St	A	
87	272 Main St	A	
88	274 Main St	A	
89	276 Main St	A	
90	278 Main St	A	
91	280 Main St	A	
92	282 Main St	A	
93	284 Main St	A	
94	286 Main St	A	
95	288 Main St	A	
96	290 Main St	A	
97	292 Main St	A	
98	294 Main St	A	
99	296 Main St	A	
100	298 Main St	A	

- Critical Facilities and Infrastructure:**
- A Emergency Facilities/Shelters
 - B Public Safety Facilities
 - C Hospitals/Acute Care Facilities
 - D Town Government Facilities
 - E Water/Water Infrastructure
 - F Hazardous Material Facilities
 - G Schools
 - H Nursing Homes/Elderly Housing
 - I Group Day Care Facilities
 - J Senior/Youth/Recreation Centers
 - K Designated Emergency Animal Shelters/Hospitals
 - L Marine/Boat Yards

- Critical Facilities and Infrastructure**
- FEMA Flood Zone (FIRM)
 - 1/4" Zone - areas of 100-year flood
 - 1/2" Zone - velocity zone
 - Critical Facility not in SLOSH zone (F)
 - Critical Facility in SLOSH zone (F)
 - Hurricane Evacuation Route
 - Evacuation route in SLOSH zone
 - * Repetitive Loss Properties
 - ⊙ Public Water Supply (P)
 - ⊙ Electric Transmission Line
 - ⊙ Railroad
 - ⊙ Bus/Tram Station
 - ⊙ Ferry Terminal
 - ⊙ Structurally Deficient Bridge
 - ⊙ Major Road
 - ⊙ Town Line



Data Source: (Note: not all features are present in each town.)
 FEMA Flood Hazard Area: Flood Insurance Rate Maps, 1-4500,
 Federal Emergency Management Agency, 1985. Data insufficient
 to map on a parcel level. The map shows digital data and
 adjusted to match the Massachusetts 1:25000
 Cape Cod Commission. Exact flood hazard boundaries may need to
 be determined by land survey methods as used by FEMA.

*SLOSH Zone: (Sea, Lake, and Overland Surges from Hurricanes)
 These are areas of inundation modeled to occur from wind and
 pressure forces of hurricanes. The SLOSH zones are not shown
 on this map. The determination was based on consultation of the
 Southern Massachusetts Hurricane Evacuation Study/Inundation
 Map Atlas, December 1994, US Army Corp of Engineers.
 - Critical Facilities in SLOSH Zones include properties where only
 part of the parcel is within the SLOSH Zone.
 - - - Public Water Supply symbol may designate multiple wellheads.

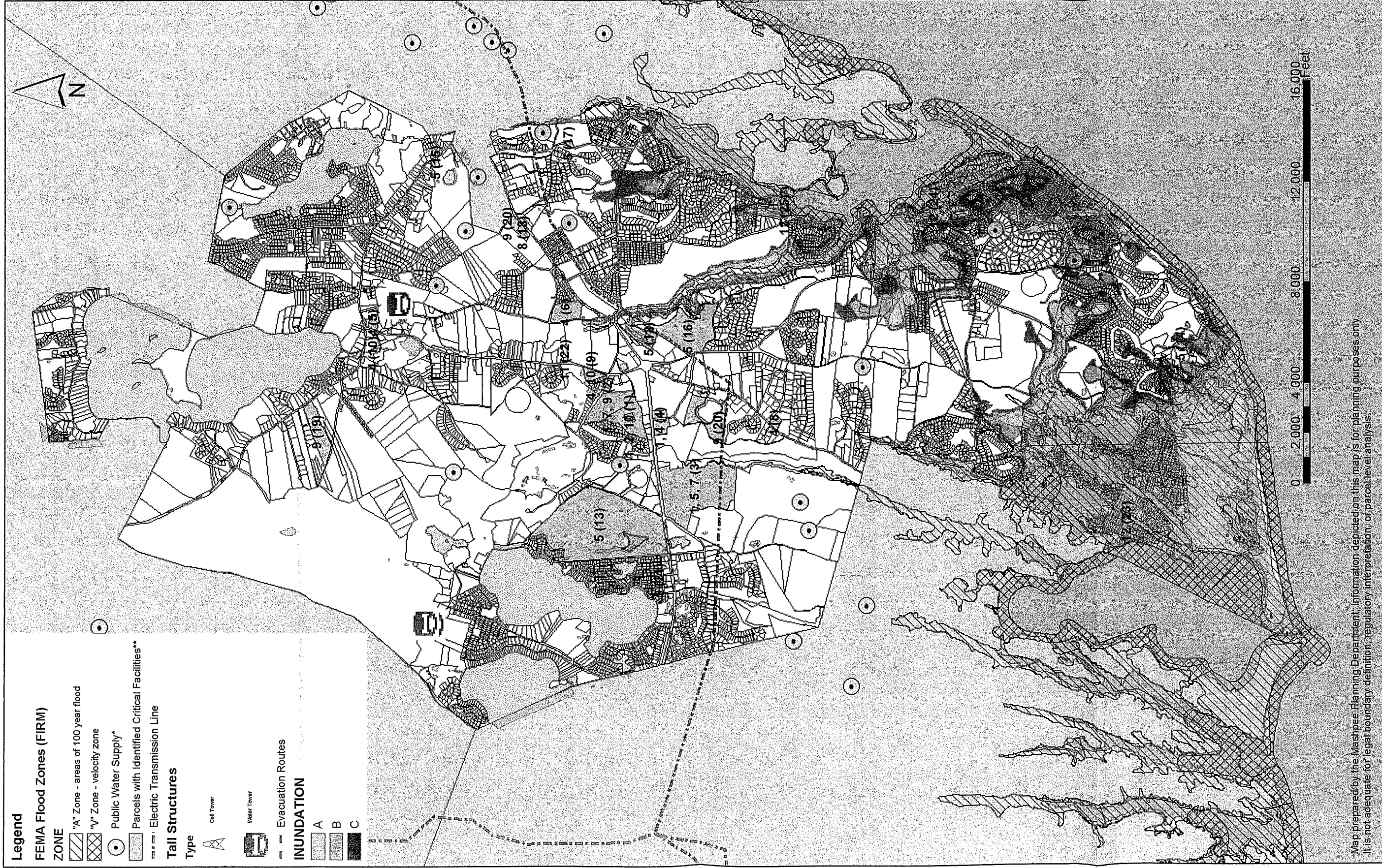
The Critical Facility labels on the map consist of a Parcel ID which
 corresponds to a label included on the map. The Facility Type can
 be identified from the key included on the map.
 Repetitive loss property: Known to be incomplete, but based upon
 best available information from FEMA.
 Evacuation Route: MEMA. Best available information from Local
 Comprehensive Emergency Management Plans on file with the
 Massachusetts Emergency Management Agency.



This map was produced by the Cape Cod Commission Geographic
 Information System Department for the Pre-Disaster Mitigation
 Project. Digital data used are from MassGIS and the Cape Cod
 Commission, 2003. Data bases associated with critical facilities were
 researched by AmeriCoops of Cape Cod.
 Information depicted on this map is for planning purposes only. It is
 not a warranty for legal boundary definition, regulatory interpretation,
 or parcel level analysis.

Appendix 2:
Map 1A: Risk and Vulnerability Assessment
Map with SLOSH Zones

Map 1A: Town of Mashpee Risk and Vulnerability Assessment Map (With SLOSH Zones)



Data Sources:

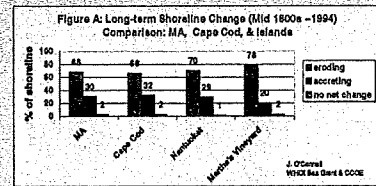
FEMA Q3 Flood - July 1997 (Flood Hazard Area: Flood Insurance Rate Maps). The Q3 flood data were developed to support floodplain management and planning activities but do not replace the official paper FIRMs. These data are not suitable for engineering applications or site work nor can the data be used to determine absolute delineations of flood boundaries. Instead the data should be used to portray zones of uncertainty and possible risks associated with flooding.

* Public Water Supply symbol may designate multiple wellheads.
 ** The Critical Facility labels on the map consist of a Parcel ID which corresponds to a table (see provided table: "Inventory of Critical Facilities and Infrastructure - Located within the Town of Mashpee")
 Evacuation Route: MEMA. Best available information from Local Comprehensive Emergency Management Plans on file with MEMA.
 Digital data used are from MassGIS, Cape Cod Commission and Town of Mashpee

Appendix 3:
Map 2: Hazard Risk Map I (Historical
Tornadoes, Historical Earthquakes, Landslides
& Shoreline Change)

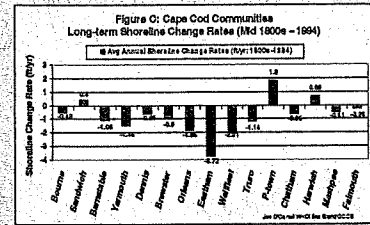
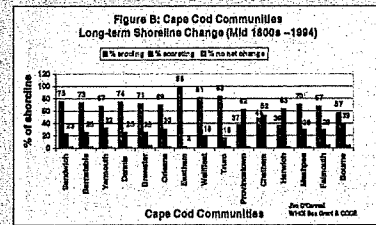
Regional Hazard Risk (Map I), Cape Cod, Massachusetts

- Landslide Susceptibility
- Long-Term Shoreline Change Susceptibility
- Historic Tornado Activity
- Historic Earthquake Activity



* Cape Cod has 886 miles of tidal shoreline of which 238 miles of primarily ocean-facing shore were analyzed for shoreline change trends (O'Connell, et al., 2002; Thaler et al., 2003). The long-term shoreline change rate for all Cape Cod communities combined is -0.58 ft/yr, slightly higher than the statewide average: 0.6% (167 miles) of the Cape Cod shoreline shows long-term erosion. Twelve of the 15 Cape communities exhibit a long-term erosion trend, while only 3 exhibit long-term accretion.

The shoreline change data on this map were generalized from 27 individual shoreline change maps covering Cape Cod. The original data were blocked and averaged in groups exhibiting similar shoreline change trends along the shore. Therefore, there may be small, localized areas that are opposite the shoreline change trend shown on this map. Refer to the original maps and data tables for more detail (Thaler, et al., 2002; O'Connell, et al., 2002). Data analysis for this map was conducted by Jim O'Connell, WHOI Sea Grant and Cape Cod Cooperative Extension.



Shoreline Erosion Susceptibility*

Shoreline Change Index

- Erosion > 2 feet per year
- Erosion 1 - 1.99 ft/yr
- Erosion .01 - .99 ft/yr
- Accretion .01 - .99 ft/yr
- Accretion 1 - 1.99 ft/yr
- Accretion > 2 feet per year
- No Data

BLOSH Inundation Zones (Maximum Extent)**

Landslide Susceptibility

- Combination - High
- Incidence - High
- Incidence - Low
- Susceptibility - High
- Susceptibility - Moderate

Tornadoes (Fujita Scale)

- F0, Gale Tornado (Light Damage)
- F1, Moderate Tornado (Moderate Damage)
- F2, Significant Tornado (Considerable Damage)
- F3, Severe Tornado (Severe Damage)
- F4, Devastating Tornado (Devastating Damage)

Tornado Density (# of Tornadoes/20 miles)

- 0 - 18
- 18 - 32
- 32 - 48
- 48 - 64
- 64 - 72

Earthquake Magnitudes (Richter Scale)

- 1+
- 2+
- 2+ Generally not felt, but recorded
- 4+ Often felt, but rarely causes damage
- 5+ Can be destructive in areas approx. 100 km where people live
- 6+ Major earthquake, can cause serious damage
- 7+ Major earthquake, can cause major damage

Fault Lines

- Fault
- Normal Fault
- Thrust Fault

Peak Ground Acceleration

- 1 - 3 % Light shaking, no damage
- 4 - 6 % Moderate shaking, no damage
- 6 - 7 % Moderate shaking, light damage
- 8 - 10% Strong shaking, light damage

Major Roads

Town Line

Notes:

- ** BLOSH Zones (Sea, Lake, and Overland Surges from Hurricanes) depicted here are areas of inundation modeled to occur from wind and pressure forces of hurricanes. Inundation areas reflect "Worst Case" combinations of hurricane direction, forward speed, landfall point, and high astronomical tide. The BLOSH zones shown here have been generalized for this project and are originally found in the publication "Southern Massachusetts Hurricane Evacuation Study Inundation Map Atlas, December 1994" by the US Army Corp of Engineers, "Worst Case" hurricane surge elevations are given in the surge file profiles provided on Plate II of that publication.
- ** Ocean-facing shores where data are not represented have extremely complex shoreline changes due to barrier beach breaching and migration. Historic shorelines are available. However, shoreline change data are not available for bay and estuarine areas (See references).

Landslide Susceptibility

Historic Tornado Activity

Historic Earthquake Activity

NOTE and CAUTION: The shoreline change data on this map were generalized from 27 individual shoreline change maps covering Cape Cod. The shoreline change data span approximately 150 years (mid-1800s to 1994), with an uncertainty range of +/- 0.4 feet per year. The original data were blocked and averaged in groups exhibiting similar shoreline change trends along the shore. Therefore, there may be small, localized areas that are opposite the shoreline change trend shown. Furthermore, caution should be used when interpreting any shoreline change data as recent trends, as shoreline movement may have changed as a result of natural causes, or irregularly human activities, such as coastal development, fill or dune construction. It is important to analyze the short-term shoreline change data that were used to calculate the long-term rates of change to identify recent changes in shoreline movement that may be more applicable for planning purposes. For case examples, see O'Connell, et al., 2002 & 2003, and Thaler, et al., 2002 listed in the references below. Data tables and maps can be viewed at www.stc.usg.gov/cemr/.

Data Sources:

Northeast States Emergency Consortium (NESEC) www.nsec.org, Massachusetts Executive Office of Environmental Affairs, "Coastal Erosion on Cape Cod: Status Quo and 'Worst Case'" (http://www.stc.usg.gov/cemr/), Federal Emergency Management Agency (FEMA), and the Cape Cod Commission's Geographic Information System Department.

References:

IPCC, 1995, Second Assessment - Climate Change 1995: A Report of the Intergovernmental Panel on Climate Change, IPCC, Geneva, Switzerland.

O'Connell, J.F., 2003, New Shoreline Change Data Reveal Mass Shoreline is Eroding, WHOI Sea Grant and Cape Cod Cooperative Extension, Marine Extension Bulletin, March, 2003.

O'Connell, J.F., Thaler, E.R., and Schupp, C., 2007, New Shoreline Change Data and Analysis for the Massachusetts Shore, with Emphasis on Cape Cod and the Islands: Mid-1800s - 1994, Environmental Cape Cod, Vol. 8, No. 1.

Thaler, E.R., O'Connell, J.F., and Schupp, C., 2002, The Massachusetts Shoreline Change Project: 1860s - 1994, Technical Report, U.S.G.S. Administration Report, Woods Hole, MA.

Funding for the Cape Cod Program through Mission Planning grant was provided by the Cape Cod Commission by the Federal Emergency Management Agency under the DMA 200 Initiative through the Massachusetts Emergency Management Agency. This map was produced through the Cape Cod Commission's Geographic Information System Department for the Pre-hurricane Mitigation Project. January, 2004. Based on data analysis, graphics and had provided by Jim O'Connell, Woods Hole Oceanographic Institution Sea Grant Program and Cape Cod Cooperative Extension. A description of the shoreline change data basis analyzed for this project can be found in Thaler, O'Connell and Schupp (2007) - see references above. Corrections and comments are welcome at the Cape Cod Commission's office or contact the geographic information system. This map is derivative and all depicted boundaries are approximate.

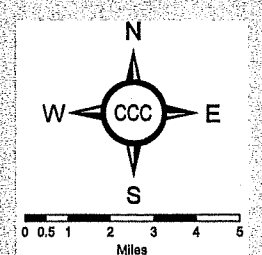
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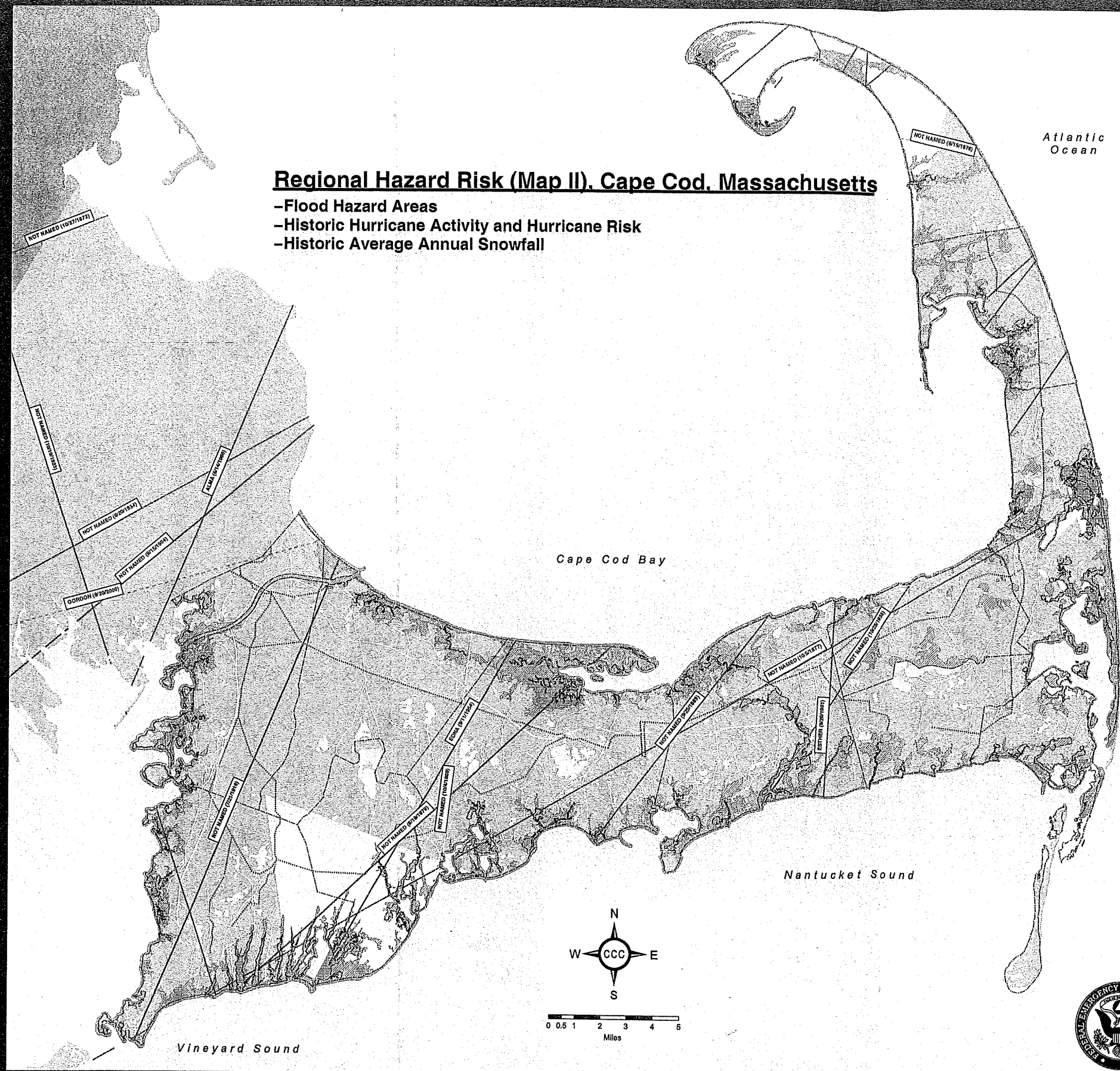
2.1, 1941SEP12



Appendix 4:
Map 3: Hazard Risk Map II (average annual
snowfall, historical hurricanes)

Regional Hazard Risk (Map II). Cape Cod, Massachusetts

- Flood Hazard Areas
- Historic Hurricane Activity and Hurricane Risk
- Historic Average Annual Snowfall



Hurricane Tracks

- Tropical Depression (< 39 MPH Sustained Winds)
- - - Tropical Storm (39 - 73 MPH Sustained Winds)
- Category 1 Hurricane (74 - 95 MPH Sustained Winds)
- Category 2 Hurricane (96 - 110 MPH Sustained Winds)
- Category 3 Hurricane (111 - 133 MPH Sustained Winds)

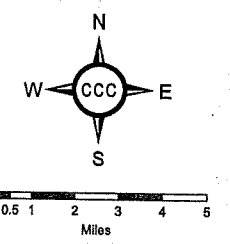
Average Annual Snowfall

- 12.1 - 24.0 Inches
- 24.1 - 36.0 Inches
- 36.1 - 48.0 Inches
- 48.1 - 72.0 Inches
- > 72.0 Inches

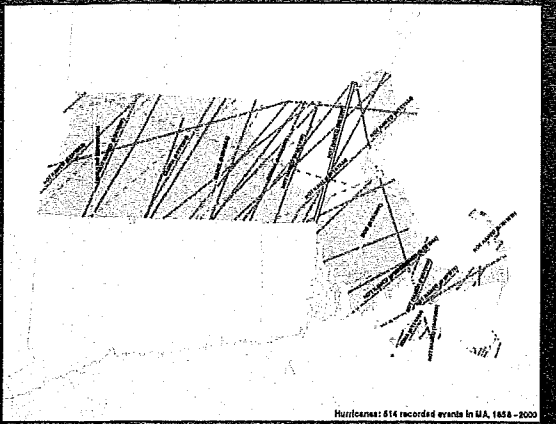
FEMA Flood Zones (FIRM)

- A* Zone - areas of 100 year flood
- V* Zone - velocity zone

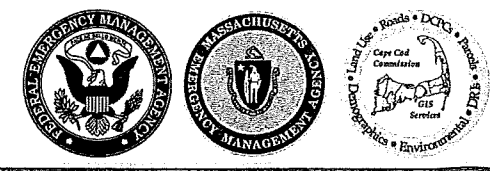
Electric Transmission Lines
Major Roads
Town Line



Hurricane Tracks and Hurricane Risk



Average Annual Snowfall

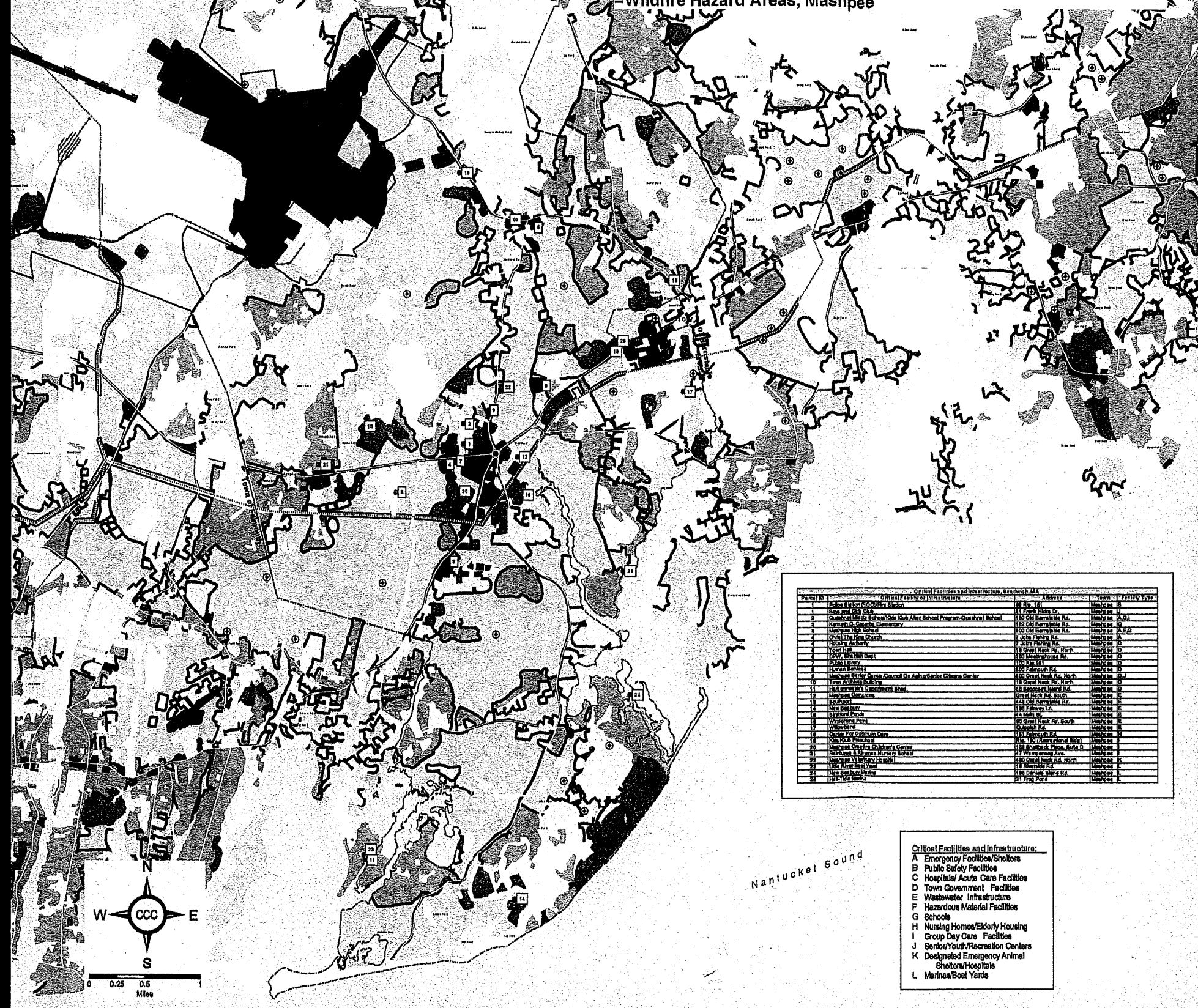


Data Sources:
 Northeast States Emergency Consortium (NESEC) www.nesec.org, MassGIS Executive Office of Environmental Affairs, Greg's Weather Center (http://homeown.aol.com/hurtrack/HurcTrackIndex.html), The United States Hurricane Page (http://www.geocities.com/hurricanes/), and the Cape Cod Commission's Geographic Information System Department.
 Funding for the Cape Cod Pre-Disaster Mitigation Planning grant was provided to the Cape Cod Commission by the Massachusetts Emergency Management Agency. Funding for statewide PDM planning was originally provided by the Federal Emergency Management Agency - Region I under the DMA 2000 Initiative.
 This map was produced by the Cape Cod Commission's Geographic Information System Department for the Pre-Disaster Mitigation Project May 30, 2003. Comments and corrections are welcome at the Cape Cod Commission office or contact gis@capecodcommission.org. This map is illustrative and all depicted boundaries are approximate.

Appendix 5:
Map 3: Hazard Risk Map III (local wildfire risk
areas)

Regional Hazard Risk III, Cape Cod, Massachusetts

Wildfire Hazard Areas, Mashpee



Wildfire Hazard Areas

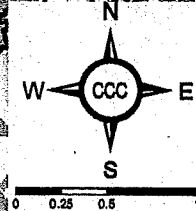
- Wildfire Risk*
- Wildland/Urban Interface**
- Residential and Commercial Development
 - High Density Residential
 - Medium Density Residential
 - Low Density Residential
 - Commercial/Industrial Development
- Critical Facilities and Infrastructure
- Public Water Supplies
- Electro Transmission Lines
- Rail Lines
- Major Roads
- Massachusetts Military Reservation
- Town Line (Mashpee)

*Wildfire Risk category includes unfragmented forest habitat MacConnell forest category greater than 40 acres and salt marsh areas greater than 3 acres.

**Wildland/Urban Interface includes areas adjacent to residential and commercial development, electrical transmission line and rail right-of-ways, and major transportation infrastructure that may represent an elevated risk.

Facility ID	Facility Name	Address	Year	Facility Type
1	Police Station	100 N. Main St.	1998	A
2	Fire Station	100 N. Main St.	1998	A
3	Elementary School	100 N. Main St.	1998	C
4	High School	100 N. Main St.	1998	C
5	Senior Center	100 N. Main St.	1998	I
6	Public Library	100 N. Main St.	1998	G
7	Post Office	100 N. Main St.	1998	F
8	Police Station	100 N. Main St.	1998	A
9	Fire Station	100 N. Main St.	1998	A
10	Elementary School	100 N. Main St.	1998	C
11	High School	100 N. Main St.	1998	C
12	Senior Center	100 N. Main St.	1998	I
13	Public Library	100 N. Main St.	1998	G
14	Post Office	100 N. Main St.	1998	F
15	Police Station	100 N. Main St.	1998	A
16	Fire Station	100 N. Main St.	1998	A
17	Elementary School	100 N. Main St.	1998	C
18	High School	100 N. Main St.	1998	C
19	Senior Center	100 N. Main St.	1998	I
20	Public Library	100 N. Main St.	1998	G
21	Post Office	100 N. Main St.	1998	F
22	Police Station	100 N. Main St.	1998	A
23	Fire Station	100 N. Main St.	1998	A
24	Elementary School	100 N. Main St.	1998	C
25	High School	100 N. Main St.	1998	C
26	Senior Center	100 N. Main St.	1998	I
27	Public Library	100 N. Main St.	1998	G
28	Post Office	100 N. Main St.	1998	F
29	Police Station	100 N. Main St.	1998	A
30	Fire Station	100 N. Main St.	1998	A
31	Elementary School	100 N. Main St.	1998	C
32	High School	100 N. Main St.	1998	C
33	Senior Center	100 N. Main St.	1998	I
34	Public Library	100 N. Main St.	1998	G
35	Post Office	100 N. Main St.	1998	F

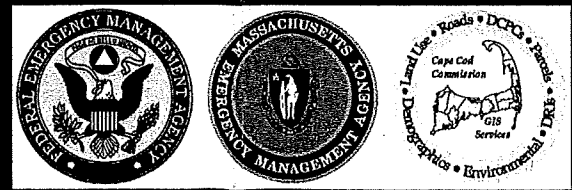
- Critical Facilities and Infrastructure:**
- A Emergency Facilities/Shelters
 - B Public Safety Facilities
 - C Hospitals/ Acute Care Facilities
 - D Town Government Facilities
 - E Wastewater Infrastructure
 - F Hazardous Material Facilities
 - G Schools
 - H Nursing Homes/Elderly Housing
 - I Group Day Care Facilities
 - J Senior/Youth/Recreation Centers
 - K Designated Emergency Animal Shelters/Hospitals
 - L Marine/Boat Yards



Data Sources:
 MacConnell Database (digital) 1999
 Northeast States Emergency Consortium (NESEC) www.nesec.org; MassGIS Executive Office of Environmental Affairs, Federal Emergency Management Agency (FEMA), Cape Cod Dutch Historical Society (http://www.capecod.com/), USGS 1:250,000 Scale Digital Data; USGS Forest Service (http://www.fed.us/forest/); and the Cape Cod Commission's Geographic Information System Department. Additional appreciation to Jeffrey Stenwick, Forest Fire Patrolman, Plymouth County, MA for his thoughtful input.

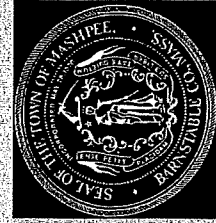
Funding for the Cape Cod Pro-Disaster Mitigation Planning grant was provided by the Cape Cod Commission by the Massachusetts Emergency Management Agency. Funding for statewide PDM planning was originally provided by the Federal Emergency Management Agency - Region I under the DMA 2000 Initiative.

This map was produced by the Cape Cod Commission's Geographic Information System Department for the Pro-Disaster Mitigation Project May 20, 2003. Comments and corrections are welcome at the Cape Cod Commission office or contact gis@capecodcommission.org. This map is illustrative and all depicted boundaries are approximate.



Appendix 6:
Map 5: Flood Zones by Neighborhood

Map 5: Flood Zones by Mashpee Neighborhoods



Map Prepared by the
Mashpee Planning Department
September 2004



BARNSTABLE

SANDWICH

Otis A.N.G.B.

John's Pond

Ashumet Pond

Moody Pond

Tri-Town Circle

Horseshoe Bend Way

Briarwood

John's Pond Estates

Winslow Farms

Lakeside Estates

Greggy Acres

Childs River West

Childs River East

Childs River Gun Club

Kristina Lane

Falmouth Park & Gun Club

FALMOUTH

Legend

- Neighborhoods
- Parcels
- Public Facilities

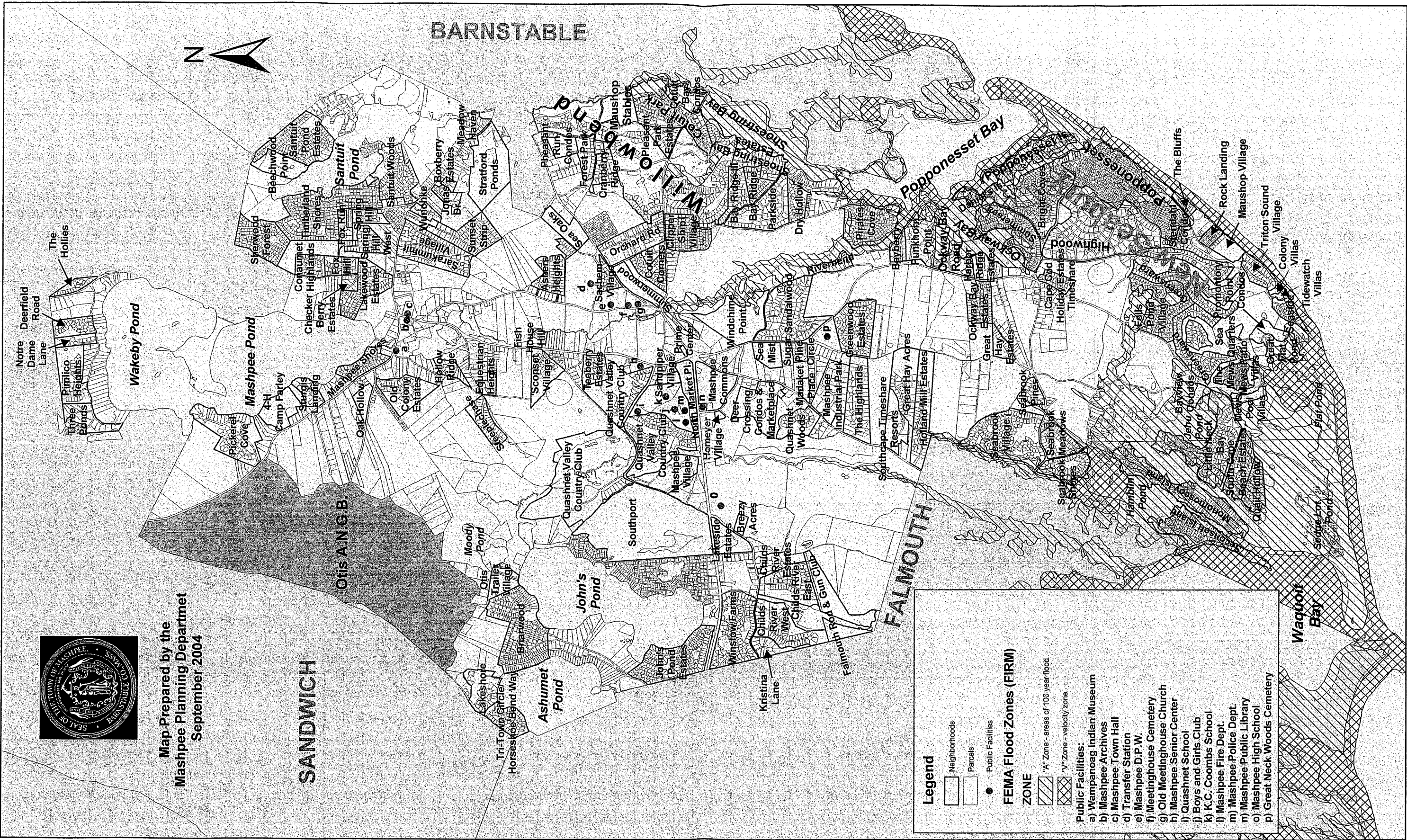
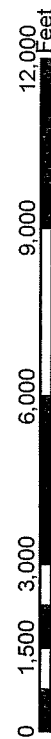
FEMA Flood Zones (FIRM)

ZONE

- "A" Zone - areas of 100 year flood
- "V" Zone - velocity zone

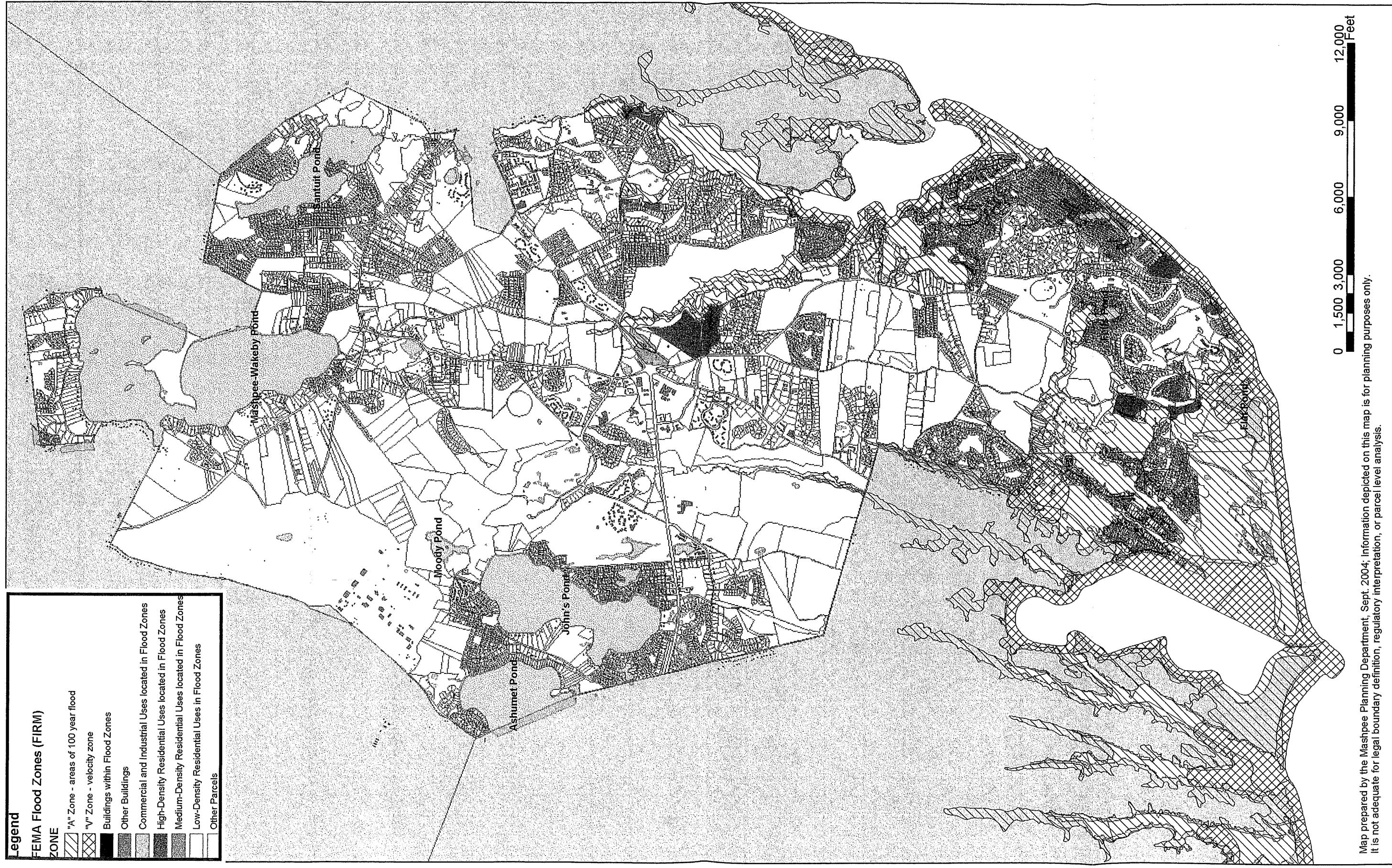
Public Facilities:

- a) Wampanoag Indian Museum
- b) Mashpee Archives
- c) Mashpee Town Hall
- d) Transfer Station
- e) Mashpee D.P.W.
- f) Meetinghouse Cemetery
- g) Old Meetinghouse Church
- h) Mashpee Senior Center
- i) Quashnet School
- j) Boys and Girls Club
- k) K.C. Coombs School
- l) Mashpee Fire Dept.
- m) Mashpee Police Dept.
- n) Mashpee Public Library
- o) Mashpee High School
- p) Great Neck Woods Cemetery



Appendix 7:
Map 6: Structures within Flood Zones

Map 6: Properties with Structures located within Flood Zones



Map prepared by the Mashpee Planning Department, Sept. 2004; information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel level analysis.



Data Source: FEMA Q3 Flood - July 1997 (Flood Hazard Area: Flood Insurance Rate Maps). The Q3 flood data were developed to support floodplain management and planning activities but do not replace the official paper FIRMs. These data are not suitable for engineering applications or site work nor can the data be used to determine absolute delineations of flood boundaries. Instead the data should be used to portray zones of uncertainty and possible risks associated with flooding.

Appendix 8:
Map 7: Parcels selected for Town of Mashpee
Application to the Barnstable County
Cooperative Extension Wildfire Assessment and
Preparedness Program

Map 7: Town of Mashpee-owned Parcels for grant submission to Barnstable County Wildfire Assessment and Preparedness Program



Legend

-  Parcels Identified in Wildfire Assessment and Preparedness Program Grant
-  Other Parcels

0 1,000 2,000 4,000 6,000 8,000 Feet

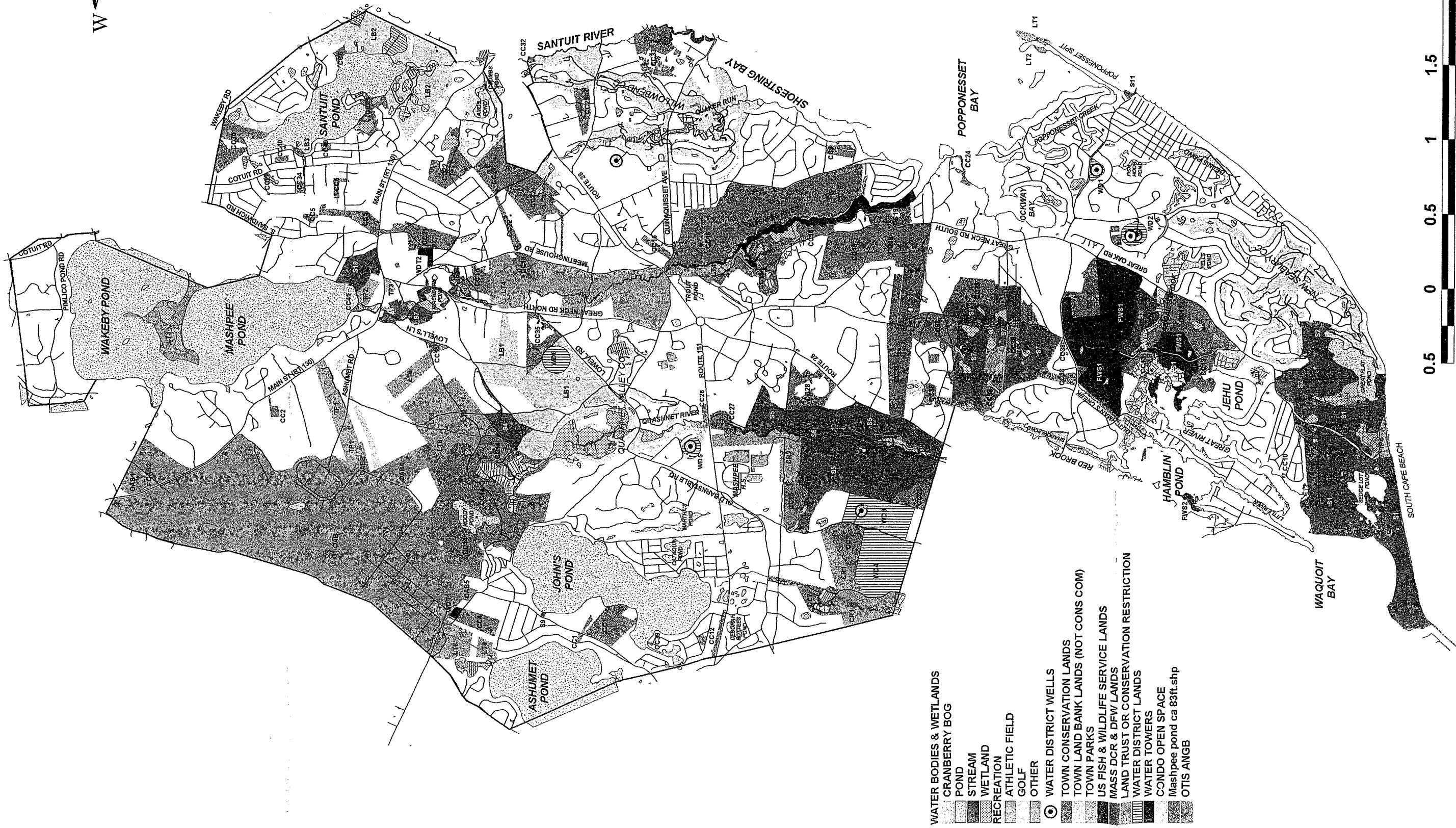
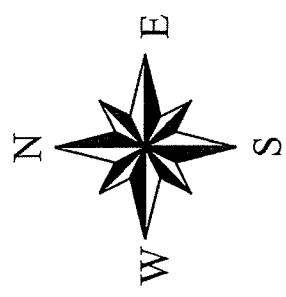
1 inch equals 2,000 feet

Prepared by Mashpee Planning Department, September 2004
Parcel information is from FY 2003 Assessor information.
See the Town's Barnstable County Cooperative's Extension's Wildfire Assessment & Preparedness Program for more information on the Identified Parcels.
Source: George Baker, Mashpee Fire Chief.



Appendix 9:
Map 8: Mashpee Environmental Infrastructure

MASHPEE ENVIRONMENTAL INFRASTRUCTURE



0.5 0 0.5 1 1.5 2 Miles

Appendix 10: Available Hazard Mitigation Action Types and Techniques

Appendix 10

Available Hazard Mitigation Action Types and Techniques

Prevention

Preventative activities are intended to keep hazard problems from getting worse. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:

- planning and zoning
- open space preservation
- floodplain regulations
- stormwater management
- drainage system maintenance
- capital improvement programming
- shoreline setbacks

Property Protection

Property protection measures protect existing structures by modifying the building to withstand hazardous events, or removing structures from hazardous locations. Examples include:

- acquisition
- relocation
- building elevation
- critical facilities protection
- retrofitting (i.e., windproofing, floodproofing, seismic design standards, etc.)
- insurance
- safe rooms

Natural Resource Protection

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their mitigative functions. Such areas include floodplains, wetlands and dunes. Parks, recreation or conservation agencies and organizations often implement these measures. Examples include:

- floodplain protection
- beach and dune preservation
- riparian buffers
- fire resistant landscaping
- fuel breaks
- erosion and sediment control
- wetland preservation and restoration
- habitat preservation

- slope stabilization

Structural Projects

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- reservoirs
- seawalls, floodwalls, levees, and dikes
- diversion, detention, and retention basins, ponds, or structures
- channel modification
- beach nourishment
- storm sewers

Emergency Services (Preparedness and Response Mitigation Activities)

Although not typically considered a “mitigation technique,” emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Sandbagging for flood protection
- Installing shutters for wind protection
- Evacuation route planning (designation and regional coordination of routes)
- Shelter designation and siting
- Retrofitting buildings
- Plans to distribute emergency food & water supplies to people following a disaster
- Food preservation
- Medical evacuations
- Developing & building hospital or local medical outposts
- Health training courses: CPR, first aid, etc.
- Communications and warning system development (Intelligent Transportation Systems designed for use in emergencies)
- Updating communications equipment for regular use (for medical and public safety info, etc.)
- Hazard drills
- Coordinating emergency provision needs and siting and maintaining storage facilities

Public Information and Awareness

Public information and awareness activities are used to advise residents, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- outreach projects
- speaker series / demonstration events

- hazard map information
- real estate disclosure
- library materials
- school children education
- hazard expositions

Appendix 11: STAPLE/E Criteria

STAPLE/E Criteria

(Social, Technical, Administrative, Political, Legal, Economic, and Environmental)

STAPLE/E is an acronym for a general set of criteria common to public administration officials and planners. It stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental criteria for making planning decisions. The STAPLE/E approach provides a series of questions to help make planning decisions and determine benefits and costs of various mitigation activities.

Social: *Community development staff, local non-profit organizations, or a local planning board can help answer these questions.* Is the proposed action socially acceptable to the community? Are there equity issues involved that would mean that one segment of the community is treated unfairly? Will the action cause social disruption?

Technical: *The community public works staff, and building department staff can help answer these questions.* Will the proposed action work? Will it create more problems than it solves? Does it solve a problem or only a symptom? Is it the most useful action in light of other community goals?

Administrative: *Elected officials or the city or town administrator can help answer these questions.* Can the community implement the action? Is there someone to coordinate and lead the effort? Is there sufficient funding, staff, and technical support available? Are there ongoing administrative requirements that need to be met?

Political: *Consult the mayor, city council or board of selectmen, city or town administrator, and regional planning agencies to help answer these questions.* Is the action politically acceptable? Is there public support both to implement and to maintain the project?

Legal: *Include legal counsel, land use planners, risk managers, and city council or town planning commission members, among others, in this discussion.* Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity? Are there legal side effects? Could the activity be construed as a taking? Is the proposed action allowed by the comprehensive plan, or must the comprehensive plan be amended to allow the proposed action? Will the community be liable for action or lack of action? Will the activity be challenged?

Economic: *Community economic development staff, civil engineers, building department staff, and the assessor's office can help answer these questions.* What are the costs and benefits of this action? Do the benefits exceed the costs? Are initial, maintenance, and administrative costs taken into account? Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)? How will this action affect the fiscal capability of the community? What burden will this action place on the tax base or local economy? What are the budget and revenue effects of this activity? Does the action contribute to other community goals, such as capital improvements or economic development? What benefits will the action provide? (This can include dollar amount of damages prevented, number of homes protected, credit under the CRS, potential for funding under the HMGP or the FMA program, etc.)

Environmental: *Watershed councils, watershed basin teams, environmental groups, land use planners and natural resource managers can help answer these questions.* How will the action impact the environment? Will the action need environmental regulatory approvals? Will it meet local and state regulatory requirements? Are endangered or threatened species likely to be affected? Do the actions comply with the state's Environmental Justice Policy?