

Truro, Massachusetts

Multi-Hazard Mitigation Plan



Draft Plan
November 1, 2010
Prepared by Truro MHMP Team

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Section 1: Introduction

1.1 What is Hazard Mitigation?

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 Multi-Hazard Mitigation 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 Mitigation Plan (MHMP) Team underwent to analyze risk from natural hazards, to coordinate available resources, and to develop a strategy to implement actions to eliminate risk.

Hazard mitigation is 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.). Mitigation assists in helping to minimize damages that occur as the result of a natural disaster to structures, infrastructure and other resources. Preparing a plan to lessen the impact of a disaster before it happens will provide:

- Reduction in public and private damage costs
- Reduction in social, emotional and economic disruption
- Increase in access to funding sources for hazard mitigation projects
- Improvement in ability to implement post-disaster recovery projects
- Educate year-round and summer residents and policy makers about natural hazard risk and vulnerability
- Provide regional coordination with other Cape communities

1.2 What are the benefits of creating this plan for the Town?

The Town of Truro has created this Multi-Hazard Mitigation Plan (hereinafter referred to as the Plan) as a means to identify and reduce future risks of damage from natural hazards, evaluate existing protection measures and develop a mitigation strategy designed to reduce future damage from these hazards. Development of a local plan will identify the unique problems and solutions in Truro, allow for a comprehensive approach to finding the best solutions and in some

cases, single solutions to multiple problems, involve the public in the planning and mitigation process, and improve the Town's eligibility for planning and implementation funds.

On a more practical level, completion and certification of the Plan will make Truro eligible for FEMA's Hazard Mitigation Grant Program funds and other federal hazard mitigation funds. A certified plan will enable the Town to meet the requirements under the federal Disaster Mitigation Act of 2000.

1.3 The Local Planning Process

The Local MHMP Team started with a group of seven Town staff following the second regional planning meeting organized by the Cape Cod Commission. Those staff members had an interest in emergency services and planning or had expertise and information that would be vital to a planning effort. The Planning Team is shown in Table 1.

Table 1
Truro MHMP Team

Name	Affiliation
Patricia Pajaron	Health and Conservation Agent
Thomas Wingard	Building Commissioner
Paul Morris	DPW Director
John Thomas	Police Chief
John Lundborn	Police Lieutenant
Brian Davis	Fire Chief
Charleen Greenhalgh	Assistant Town Administrator/Planner

The Local Team met monthly during the summer and fall of 2009. It worked on various assignments from the Community Guide including hazard identification, assessment and actions for mitigation. Assistant Town Administrator Charleen Greenhalgh prepared draft chapters for the plan that were reviewed and revised by the Local Team. The Team also reviewed and revised the maps provided by the Cape Cod Commission.

The Board of Selectmen approved the formation of the MHMP Team, but it was not a formal appointment. At the July 14, 2009 Selectmen Meeting, the Board voted unanimously to approve the formation of the Team and to support our effort. The Local Team met on six (6) occasions over the six months to work on the plan.

The draft of the Plan was posted on the Town website in mid-December 2009 for public review and comment. Copies of the draft plan were also made available to all Town boards and committees and departments and to the public at the Truro Library. The draft was presented to the Board of Selectmen on December 15, 2009 for their review and comment. A more formal hearing for the approval of the plan will take place in the early spring of 2011.

A number of existing studies and plans were used to prepare the Local MHMP. The Local Comprehensive Plan and Open Space and Recreation Plan all provided valuable background

information on past events. In addition, the Local Team reviewed the goals of the Plan for consistency with these already existing documents. We also used a number of data sources provided to us by the Cape Cod Commission and MEMA. We used the Draft 2009 Barnstable FEMA Flood Insurance Study for historical and case study information, and repetitive flood loss data from MEMA and FEMA. Finally, the best information that we had available was first hand knowledge of events from members of the teams who are also life long residents of the Town of Truro. Collectively their historic knowledge was invaluable. All of these sources help formulate goals and objectives to mitigate damages from coastal flooding and the resulting erosion, as well as other natural events.

1.4 Regional Planning Process

Assistant Town Administrator/Planner Charleen Greenhalgh served as the Team's representative to the Regional Planning Team. She attended the monthly meetings organized by the Cape Cod Commission and then organized meetings of the Local Planning Team to undertake various planning activities.

The regional planning meetings coordinated by the Cape Cod Commission followed the outline in the *Local Multi-Hazard Mitigation Planning Guidance*, FEMA, July (2008). Goals and homework assignments were established at each session to help the local planning teams make progress toward a completed plan. By breaking the process down into achievable goals and tasks, the planning remained focused and the series of smaller accomplishments motivated the local team to stay involved and active throughout.

1.5 Community Goals for Hazard Mitigation

1. Reduce the loss of life and injury resulting from all hazards.
2. Mitigate financial losses incurred by municipal, residential, industrial, agricultural and commercial establishments due to disasters.
3. Reduce the damage to public infrastructure resulting from all hazards.
4. Ensure that mitigation measures are sympathetic to the natural features of the shoreline, inlets and estuaries, rivers, streams, other surface waters; historic resources, character of neighborhoods; and the capacity of the Town and community to implement them.
5. Educate residents about potential hazards that threaten the community, including but not limited to flood and erosion hazards, extreme weather conditions and wild fires.

Section 2: Hazard Identification and Risk Assessment

2.1 Water and Sand

Truro is a rural town on the outer portion of Cape Cod, a 70-mile-long peninsula extending off southeastern Massachusetts, possessing outstanding and diverse natural beauty and historical significance. Although the Cape is a peninsula of the mainland, its geological genesis and current character are very different from adjacent New England.

Truro, part of Barnstable County and the least populated of the county's 15 towns, is situated approximately 115 miles southeast of Boston. It occupies 22 square miles of the Outer Cape land, with 67% of its area (14.64 square miles or 9,366.53 acres) included in the Cape Cod National Seashore. Truro is bounded on the northwest by Provincetown and on the south by Wellfleet. It is bordered by Cape Cod Bay on the west and on the east by the Atlantic Ocean. Parts of Truro are quite hilly, similar to the rolling hills of central Massachusetts, while other portions such as in the Beach Point area are very flat.

During the summer, the population swells from approximately 2,050 year-round residents to an estimated 25,000 persons enjoying the Town's miles of ocean and bay-side beaches; several beautiful, clear, spring-fed, ponds; resort and transient accommodations, small shops and restaurants; and the beautiful Pamet Harbor.

In addition to coastal floodplains, Truro has three tidal estuaries that are also subject to flooding – Bound Brook, Pamet and East Harbor. Bound Brook is part of the larger Herring River Estuary that is mainly within the town of Wellfleet. The Pamet River System is the largest wetland ecosystem in Truro. The Pamet River flows east to west from its headwaters immediately behind the ocean dunes at Ballston Beach to Cape Cod Bay, about 3 miles away. Starting as a freshwater stream, it meanders 1.6 miles through a bottomland meadow and then passes through a tide gate, or clapper valve, located under Town Center Road, to become a saltwater estuary with flow easterly into the Pamet Harbor. East Harbor, once a natural saltwater bay was closed in 1868 with a constructed dike and roadway to facilitate passage to Provincetown. In 1873, tracks were laid for railroad service. In 1958 a water-level control device was installed above the dike at the eastern end of the harbor to help effect mosquito control. The resulting restriction of tidal flushing caused the water to become degraded. In the past several years, the National Park Service has opened up the drainage culvert to tidal flushing and the water continues to show quality improvements.

The climate of Truro is moderate, with temperatures ranging from a monthly average of 32.1 degrees Fahrenheit in January to 71.8 degrees Fahrenheit in July. Average annual precipitation is 44.10 inches. The terrain of Truro is quite varying with elevations ranging from 150 feet above mean sea level (msl) in the areas of the Wellfleet Plain deposits, to 80 feet above msl for the Truro Plan deposits and down to 10 feet msl in the Dune deposits along Beach Point. In contrast to the generally level, high bluff topography along the ocean side of Truro, the bay coast is marked by kettle-hole topography in what was a gradually sloping outwash plan. The surface is very irregular with marked dips and hollows that make for rough topography, with high points

exceeded only by the ocean beach bluff mostly below 100 feet; although, in the northeastern section of Town, a few hills reach 120 feet. The soil is mostly Carver Coarse sand.¹

2.2 Flood and Erosion Hazards

Truro's close relationship to the sea has serious implications for hazard mitigation. Flooding and erosion are the most frequent and highest risks. Development along the shoreline is especially vulnerable to damage from water and high winds. However, a number of low-lying areas surrounding small inlets and estuaries may also be vulnerable during extreme weather events such as hurricanes and northeasters.

Truro, because of its coastal New England location, is highly susceptible to northeasters. A northeaster travels in a southwest to northeast direction along the Atlantic coast collecting moisture over the ocean and sending it inland via northeast winds. Northeasters differ from hurricanes in that they cover a larger area. Although they are not as intense, they move more slowly, having a longer duration. While a hurricane may last for several hours, a northeaster may last for several days; therefore, northeasters usually are accompanied by at least one high tide, increasing the severity of coastal flooding.

Areas particularly vulnerable to flooding are: Mill Pond Road, Old County Road, various location of Beach Point (Shore Road), Route 6 at Stott's Crossing and the Truro Central School, Balston Beach, Dyer Hollow and Fisher Road. Areas particularly vulnerable to erosion are: Balston Beach, Coastguard Beach, Long Nook Beach, Great Hollow Beach and other areas along the Atlantic Coastline and the Cape Cod Bay Coastline.

2.3 Hazard History – Case Studies

February 1978

The storm of February 1978 has been designated approximately a 100-year event though out the Cape Cod Bay area, and on the coastlines of eastern Massachusetts, New Hampshire and Southern Maine. The northeaster of February 1978 was not typical for Truro. During the time of the highest tidal flooding, the day was clear, warm and windless. The dikes at Old County Road, Fisher Road and Castle Road were washed out and repaired that spring. The reason for such calm was caused by Truro being near the center of the storm, an event comparable to being in the “eye” of a hurricane. No one can recall that any areas of town were evacuated.

Hurricane Bob – September 1991

Hurricane Bob was an interesting storm in that it brought little to no rain to the entire area. Wind was the biggest culprit, with numerous trees down throughout Truro. Power to the entire Cape was cut by Commonwealth Electric at the Bourne Power Plant. Although several areas of town were without power for over a week, the Town was very proactive in removing fallen trees and branches, thereby allowing power to be restored to some areas significantly sooner than some other towns on the Cape. Because of the time of year with the warm weather and the lack of rain and flooding, there were no evacuations that anyone can recall, nor was a shelter opened.

No Name Storm – October 1991

¹ Natural Resources Conservation Service, via MassGis, October 2008.

The No Name storm, also known as the Halloween Storm or the Perfect Storm hit Truro on October 30, 1991. Two huge storm systems collided creating this massive storm. The following is an excerpt from the National Climate Radar Center website <http://www.ncdc.noaa.gov>:

On October 28, 1991, an extratropical cyclone developed along a cold front which had moved off the Northeast coast of the U.S., this low was located a few hundred miles east of the coast of Nova Scotia. With strong upper air support, the low rapidly deepened and became the dominant weather feature in the Western Atlantic. Hurricane Grace, which had formed on October 27 from a pre-existing subtropical storm and was initially moving northwestward, made a hairpin turn to the east in response to the strong, westerly deep-layer mean flow on the southern flank of the developing extratropical low. Grace was a large system and it was already generating large swells ranging in size from about 15 feet offshore of North Carolina to about 10 feet near the Florida coastline. As the low pressure continued to deepen on October 29, Grace became only a secondary contributor to the phenomenal sea conditions which developed over the Western Atlantic during the next few days. On the 29th, the vigorous cold front from the extratropical low undercut and quickly destroyed Grace's low level circulation east of Bermuda. The remnant mid- and upper-level moisture from Grace became caught up in the outer part of the extratropical storm center's circulation, far from the storm's center. By the next day these remnants had become indistinguishable. The center of the extratropical low drifted southeastward and then southwestward, deepening all the time. It reached peak intensity of 972 mb and maximum sustained winds of 60 knots on October 30, when it was located about 340 n mi south of Halifax, Nova Scotia. After reaching peak intensity on October 30, the low retrograded southwestward on October 31 and then southward as the central pressure rose to about 998 mb by 0000 UTC on November 1.

The winds and tides were the most destructive parts of the storm for Truro. The dike at Mill Pond Road broke through completely washing out the culvert under the road. The road remained closed for months. With time the Town of Truro and the Cape Cod Mosquito Control installed a new culvert and the elevation of Mill Pond Road was raised. The dike itself was not repaired and the freshwater marsh that had been created with the construction of the original dike is slowly reverted back to a saltwater marsh.

Old County Road and Fisher Road were also inundated and they too were eventually raised in elevation to alleviate future flooding and watch over.

Ice and Windstorm – December 2005

On December 9, 2005 the Lower and Outer Cape was hit by a fast moving, very intense northeaster. Although Truro was spared the brunt of the storm, the town was still affected. Power was out and the emergency dispatch was down. A main communication tower in the Town of Orleans went out, thus cutting off E911 access. Cell phone service was also limited. Truro Police and Fire were able to stay on top of matters with the regular telephone service and limited cell phone service.

A shelter was not set up for this storm, but because of the very cold weather the Police Department did pick up a few people from town and housed them at the Police Station until power was returned to their homes.

2.4 Fire, Tornado, Earthquake

Although Truro has not suffered any major wild fires, tornadoes or earthquakes, these are not out of the realm of possibility. For additional information and more detailed summary please refer to the Regional Plan (Page 24.) In that nearly 70% of the Truro is located within Cape Cod National Seashore (CCNS) and much of this area is wooded, there is a distinct probability that a wildfire could take place. Fortunately, out of the entire town, there are only 178 single family dwellings located within the boundaries of the CCNS. Other uses, such as campgrounds also exist, but these are seasonal in nature and during times of drought and other occasions that might warrant a “no burn” warning, campfires are not allowed.

Water spouts have been spotted off the shores of Cape Cod and there have been uncorroborated tornadoes as close as Orleans; however no one can recall any such events occurring here in Truro. As to earthquakes, it is true that a fault line runs under Cape Cod and tremors have been felt in various locations throughout the Cape. The type of construction that we have here in Truro is primarily single family dwellings, cottage colonies and hotel/motels. Truro only allows two-story construction, up to 30 feet in height. Our tallest structure is the Highland Light, a lighthouse located in North Truro along the Atlantic coastline. Highland Light has been moved back away from the top of the bluff, due to erosion, but there is no none history of earthquake affects. It is anticipated that structural damage from a earthquake would be minimal.

2.5 Hazard Identification

Historically, the Town of Truro has sustained damage from flooding, storm surge, and high winds associated with hurricanes, northeasters, and heavy rains. However, this plan and its mitigation strategy addresses multiple natural hazards, even those assessed with low probability. Risks to our town are identified in Table 2 - Hazard ID & Ranking Matrix:

**Table 2
TRURO, MASSACHUSETTS – HAZARD ID & RANKING MATRIX**

<i>Natural Hazard:</i>	<i>Location RATE: 1=small 2=medium 3=large</i>	<i>Frequency of Occurrence RATE: 0=unlikely 1=possible 2=likely 3=highly likely</i>	<i>Magnitude/ Severity RATE: 1=limited 2=significant 3=critical 4=catastrophic</i>	<i>Hazard Ranking</i>
FLOOD	3	3	3	9
WIND	3	3	3	9
FIRE	2	1	2	5
SNOW & ICE ACCUMULATION	3	3	3	9
SHORELINE CHANGE	3	3	2	8
TORNADO	2	1	2	5
EARTHQUAKES	3	0	2	5

For a complete matrix of specific hazard locations within Truro, please refer to Appendix B – Table 6

2.6 Hazard Ranking

In order to establish the potential degree of impact of the identified hazards within Truro, the Local Planning Team applied a rating system to evaluate the location (geographic extent, frequency of occurrence and magnitude/severity) of each identified hazard. The resulting “score” is the *Hazard Ranking*.

Location

1 = small	Isolated to a specific parcel, building, intersection or neighborhood
2 = medium	Occurring in multiple locations across Town during one event
3 = large	Affecting a significant portion of Town during one event

Frequency of Occurrence

0 = unlikely	Less than 1% probability in the next 100 years
1 = possible	Between 1 – 10% probability in the next year, or at least one chance in the next 100 years
2 = likely	Between 10 – 100% probability in the next year; or at least one chance in next 10 years
3 = highly likely	Near 100% probability in the next year

Magnitude/Severity

1 = limited	Injuries and/or illness are treatable with first aid; minor “quality of life” loss, shutdown of critical facilities and services for 24 hours or less; property severely damaged <10%
2 = significant	Injuries and/or illness do not result in permanent disability, shutdown of several critical facilities for more than one week; property severely damaged <25% and >10%
3 = critical	Injuries and/or illness result in permanent disability, complete shutdown of critical facilities for at least two weeks; property severely damaged <50% and >25%
4 = catastrophic	Multiple deaths; complete shutdown of facilities for 30 days or more; property severely damaged >50%

2.7 Hazard Mapping

The following maps, shown as Appendix A, were prepared by the Cape Cod Commission in collaboration with the Local Planning:

- Regional Hazard Risk (Map I), Cape Cod, Massachusetts (Landslide Susceptibility; Long-Term Shoreline Change Susceptibility; Historic Tornado Activity; Historic Earthquake Activity).
- Regional Hazard Risk (Map II), Cape Cod, Massachusetts (Flood Hazard Areas; Historic Hurricane Activity and Hurricane Risk; Historic Average Annual Snowfall).
- Regional Hazard Risk (Map III), Cape Cod, Massachusetts (Wildfire Hazard Areas, Truro)
- Risk and Vulnerability Assessment Map, Town of Truro, MA.

Section 3: Vulnerability Assessment

3.1 Critical Facilities

To establish a planning baseline, The Local MHMP Team used the “Risk and Vulnerability Assessment Map” prepared in collaboration with the Cape Cod Commission. The map depicted locations of critical facilities and infrastructure in the context of Hazard Mitigation Planning. As its first step, the MHMP Team reviewed and revised the Risk And Vulnerability Assessment Map. Nine critical facilities were identified and located within Truro, and grouped into eight facility types as shown in Table 3.

**Table 3
Critical Facilities and Infrastructure**

Facility	Address	Type	Map Location	SLOSH	FIRM
Emergency Operations (Police/Fire Station)	344 Route 6	B	F5	No	No
Truro Central School	317 Route 6	A* G	F5	No	No
Truro Department of Pubic Works	17 Town Hall Road	D	G7	No	No
Truro Town Offices	24 Town Hall Road	D	G7	No	No
Pamet Harbor	75 Depot Road	L	F7	Yes	Yes
Truro Public Library	7 Standish Way (aka Library Lane)	D	E4	No	No
Truro Community Center – Council on Aging and Recreation	Standish Way (aka Library Lane)	A, J	E4	No	No
Knowles Heights Pump House	143 Shore Road	D	D4	No	No
South Hollow Pump House	9 South Hollow Road	D	F5	No	No

Facility Types

A	Emergency Facilities/Shelters	D	Town Government Facilities
A*	Secondary Red Cross Shelter	G	Schools
A**	Primary Red Cross Shelter	J	Senior/Youth/Recreation Centers
B	Public Safety Facilities	K	Emergency Animal Shelters
C	Hospitals/Acute Care Facilities	L	Marinas/Boat Yards

Identifying and mapping the critical facilities and infrastructure made the Team aware of several things. First and foremost, the town has been very proactive in it's planning of where to site critical facilities. With the exception of the Pamet Harbor and the boat ramp, all the facilities are located outside the Sea Lake and Overland Surge from Hurricanes (SLOSH) and Flood Insurance Rate Map (FIRM) zones. In 2009, the parking lot and ramp at Pamet Harbor were redone. The Harbormaster's office was then raised, so that the first floor elevation is at the base flood elevation. The office is only seasonal and all equipment is removed for the winter.

It was also clear that the Town Department of Public Works has an excellent year-round brush cutting program. Crews work throughout the year trimming trees and cutting back brush from all Town roads. This makes for better snow plowing, less trees falling into road ways and it provides for clearer paths for vehicular and pedestrian traffic; not to mention making it easier for emergency vehicles to maneuver.

3.2 Priority Project

Several projections came to mind while preparing this plan. The Local MHMP Team concluded that several locations within the community had been, and would continue to be, subject to damage and financial losses due to their proximity to flood zones. Fisher Road continues to be vulnerable, despite past efforts to raise the road. The road needs to be elevated further in order to properly ensure future protection of access to and from the area. A few locations along Shore Road are also vulnerable to flooding; however, there appears to be little that can be done in this area.

Another concern was the condition of the fire roads throughout Truro. As stated previously, 67% of the Town is within the boundaries of the Cape Cod National Seashore. There are numerous fire roads throughout that are poorly maintained if at all. In addition, there are many private roads in Truro and although there is a General By-law that requires that roads be cleared to a certain standard, the by-law as currently written is not enforceable.

Beach erosion continues to be a problem in several areas, namely Ballston Beach, Coast Guard Beach and Noons Beach. Beach renourishment has taken place at each of these areas within the last year.

3.3 Evacuation Routes and Shelter Facilities

The critical facilities mapping also drew attention to a number of potential problems with major evacuation routes, routes for emergency vehicles and access to emergency shelter facilities. Flooding of Route 6 in the areas of Bay Berry Gardens and Outer Reach Motel could conceivably prevent residents from either evacuating or reaching an emergency shelter. High Head Road, Great Hills Road and Highland Road also experience flooding that could cause major access problems.

The primary emergency shelter for the Town of Truro is located at the Truro Community Center. The Truro Central School can serve as a secondary shelter, as could the Christian Union Church, in a very limited capacity. The closest major primary regional Red Cross shelter is in Eastham at the Nauset Regional High School. Residents might not reach these facilities with flooding at the locations already identified along Route 6 in Truro, but also there are several points identified in Wellfleet along Route 6 that would also restrict access. Historically, these areas can flood with just heavy rain. A hurricane passing over Truro/Wellfleet could be followed by a storm surge that would make portions of Route 6 impassable. Because the nearest hospital (Cape Cod Hospital) is approximately 50 miles away from the furthest point in Truro, it is also important to look at alternate routes for emergency vehicles. Outer Cape Health Services, located in Wellfleet and Provincetown and Fontaine Medical Center in Harwich, are not equipped as an emergency facility and access to these facilities would also be hampered. Controlling access to alternative routes could also be necessary. This should also be incorporated into the Emergency Response plan.

3.4 Repetitive Loss Properties

A repetitive loss property is any property, which the NFIP has paid two or more flood claims of \$1,000 or more in any given 10 year period since 1978. Specific property information is confidential, but within the Town of Truro, no properties qualify as repetitive losses according to information provided by MEMA through December of 2008.

As of April 30, 2009 there were 223 flood insurance policies in effect in Truro, with a total value of \$41,500,300 and the written premium in-force amount was \$218,583. Through April 30, 2009, no new losses reported.

3.5 Quantification of Potential Losses

The Local MHMP Team will continue to work with the Truro MIS Director and the GIS team at the Cape Cod Commission to conduct a quantification of potential losses and estimation of potential losses for planning purposes.

3.6 Land Uses and Development Trends

Truro is primarily made up of single family residences; however the Beach Point area of town, a coastal barrier beach, also includes cottage/cabin colonies, hotels/motels, and associated restaurants and small retail stores. The Beach Point area is seasonal and tourist oriented in nature. The zoning for residential lots is $\frac{3}{4}$ acres; however within the Beach Point zoning district, density is allowed to be much greater. This area is, or could be, vulnerable to flooding, wind, fire, snow and ice events and shoreline change. Low lying areas, which are not necessary adjacent to the shoreline, but perhaps to an estuary, are also subject to flooding, wind, snow and ice events. Other areas in Town, away from the shorelines, are vulnerable to wind and snow and ice events. It is important to note that there are a few small commercially zoned areas within the town, but there are no major commercial developments (ie: no malls or big box stores). These areas are subject to some flooding, wind, snow and ice events.

Within the boundaries of the Cape Cod National Seashore (CCNS), the zoning is 3 acres. Residential uses are allowable and existing commercial uses, of which there are few, are grandfathered for there existing uses. Changes of commercial uses in the CCNS are not allowable. Much of the area is wooded, making these areas vulnerable to wild fires. But like most of the town, areas are subject to flooding, wind, snow and ice events and coastal changes.

3.7 Climate Change

It is apparent from global, national, and regional studies that climate change will have an affect on the Town of Truro, as well as the rest of the world. The Cape Cod Commission in the Regional plan, has provided information for the Cape as a whole.

Section 4: Existing Resources, Programs, Projects and Activities

As part of the development of the Plan, the Local MHMP Team created a matrix assessing existing plans, programs and policies that Truro already has in place that incorporate hazard mitigation or other protective measures. These can be found in Table 4.

Table 4
Truro – Hazard Protection Matrix

Existing Protection	Description	Area Covered	Enforcement and/or Effectiveness
§30.5 Flood Plain District	Defines 100 Year Floodplain/Compliance Requirements	100 Year Floodplain (Zones A1-30, A, AE, V and V1-30)	Building Commissioner
Wetlands Protection Act	MGL Ch. 131 §40 310 CMR 10.00	Land area within 100' of water resources and wetlands. 50' buffer requirement.	Conservation Commission
Rivers Protection Act	301 CMR 10.00	Land area within 200' of river	Conservation Commission
Priority and Estimated Habitats - MESA	321 CMR 10.00	Town Wide	Natural Heritage, Massachusetts Division of Fisheries & Wildlife
Building Permits	Enforcement of State Building Code to ensure compliance	Buildings and Structures Town Wide	Building Commissioner
Dredge Program and Beach Nourishment	Annual maintenance dredging of Pamet Harbor, beach renourishment of adjacent beaches	Pamet Harbor area	Pamet Harbor Committee, Harbormaster, DPW Director
Dune restoration	Sand Renourishment and installation of sand fencing. Beach grass planting for dune stabilization	Ryder Beach Town Landing Town Landing – Noons	Conservation Commission
Comprehensive Emergency Management Plan	Establishes public safety response framework	Town Wide	Emergency Management Director
Subdivision Regulations	Requires underground utilities and drainage accommodating 50 year storm	Town Wide	Planning Board
§70 Site Plan Review	Stormwater Drainage and Drainage Basin Study Requirements	Commercial Developments	Planning Board
National Flood Insurance Program (NFIP)	Federally backed flood insurance available to homeowners, renters, and business owners	100 Year Floodplain (Zones A, AO, AH, A1-A30, A-99, V and V1-30)	FEMA/Building Commissioner
Restoration Projects	Restoration of salt marshes	Herring River and East Harbor	Various local, regional, state, and federal agencies

Section 5: Mitigation Strategy

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

Mitigation Objectives – these are designed to support and correspond directly with the Community Goals outlined in Section 1.

Mitigation Techniques – these are specific measures to be undertaken by the Town in order to achieve identified objectives. Each technique identifies the objective and vulnerability it is intended to address.

Implementation of Mitigation Measures – a detailed action plan describing how the actions identified will be prioritized, implemented, and administered by The Town.

5.1 Mitigation Objectives

The following section contains the five Community Mitigation Goals from Section 1. Each goal is followed by objectives to support the goal. The objectives have been developed to provide Truro with measurable short-term milestone (within a five year planning horizon).

Goal 1 - Reduce the loss of life and injury resulting from all hazards.

Objectives:

- 1.1 Increase the Town's capability to conduct hazard risk assessments, demonstrate funding needs and track mitigation activities.
- 1.2 Ensure that current emergency response plans and emergency services are adequate to protect public health and safety.
- 1.3 Coordinate local hazard mitigation planning and activities with those of Barnstable County and neighboring towns.
- 1.4 Evaluate and improve evacuation plans and routes.

Goal 2 - Mitigate financial losses incurred by municipal, residential, industrial, agricultural and commercial establishments due to disasters.

Objectives:

- 2.1 Ensure that all new construction is completed using wind-resistant design techniques that will limit damage caused by high winds and reduce the amount of wind-borne debris.
- 2.2 Increase the Town's control over development in the floodplain to ensure lives and property are not at risk to future flood conditions.
- 2.3 Decrease the number of FEMA-identified repetitive loss properties.

Goal 3 - Reduce the damage to public infrastructure resulting from all hazards.

Objectives:

- 3.1 Recognize the connections between land use, storm-water road design and maintenance and effects from disasters.
- 3.2 Maximize efforts to limit flooding in developed areas and along roadways and loss or disruption of utility services.
- 3.3 Ensure that all vital/critical facilities are protected from the effects of natural hazards to the maximum extent possible.
- 3.4 Apply for funding from hazard mitigation grant programs to improve vulnerable properties and facilities.

Goal 4 - Ensure that mitigation measures are sympathetic to the natural features of the shoreline, inlets and estuaries, rivers, streams, other surface waters; historic resources, character of neighborhoods; and the capacity of the Town and community to implement them.

Objective:

- 4.1 Preserve the natural and beneficial function of the Town's floodplain, wetlands, beaches and dunes through continued support of natural resource protection polices, open space acquisition and by discouraging growth in environmentally-sensitive areas.

Goal 5 - Educate residents about potential hazards that threaten the community, including but not limited to flood and erosion hazards, extreme weather conditions and wild fires.

Objectives:

- 5.1 Encourage hazard mitigation planning as part of the municipal planning process including but not limited to the Local Comprehensive Plan, Open Space and Recreation Plan, and Harbor Plan.
- 5.2 Increase the level of knowledge and awareness for Truro residents on the hazards that routinely threaten the area, and hazards that are specific to the part of Town where they live.
- 5.3 Increase the number of Truro residents that maintain an active NFIP flood insurance policy.
- 5.4 Educate property owners on the affordable, individual mitigation and preparedness measures that can be taken before the next hazard event.
- 5.5 Publicize the documents and plans associated with emergency response and hazard mitigation

5.2 Mitigation Techniques

In formulating this mitigation strategy, a wide range of activities were considered in order to help achieve the goals of the community and to lessen the vulnerability of our Town to the effects of natural hazards. In general, all of these activities fall into one of the following broad categories

of mitigation techniques (see the Regional Plan for an explanation of these Techniques; we did not replicate that information here):

1. Prevention – Proactive actions are intended to keep problems resulting from hazards getting worse. They are 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
- Storm water management
- Drainage system maintenance
- Capital improvements programming
- Shoreline setbacks

2. 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., wind proofing, flood proofing, etc.)
- Insurance

3. Natural Resource Protection – Natural resource protection activities reduce the potential for impact from natural hazards by preserving or restoring natural areas and their defensive functions. Such areas include floodplains, wetland and dunes. Examples include:

- Floodplain protection
- Beach and dune preservation
- Wetland Resource Area buffers
- Fire resistant landscaping
- Erosion and sediment control
- Wetland preservation and restoration
- Habitat preservation
- Slope stabilization

4. Structural Projects – Structural mitigation projects are intended to lessen the impact of 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:

- Levees, dikes, floodwalls, seawalls
- Diversion, detention, retention
- Channel modification
- Beach nourishment
- Storm drainage

5. Emergency Services – 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:

- Warning systems
- Evacuation planning and management
- Sandbagging for flood protection
- Installing shutters for wind protection

6. 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

5.3 Mitigation Actions

Mitigation actions, shown in Table 5, were prioritized using FEMA's *Developing the Mitigation Plan* (FEMA 386-3) STAPLEE Method. The STAPLEE method is a technique for identifying, evaluating, and prioritizing mitigation actions based on existing local conditions (Social, Technical, Administrative, Political, Legal, Economic and Environmental). The priority of “High”, “Medium”, or “Low” was based on the “Priority Score” calculated in the STAPLEE Table (Table 7 in Appendix B). Any actions that could be implemented with minimal effort and minimal cost to the Town were given a high priority. Any actions that involved an imminent threat to public safety or property were also given a high priority. High priority was also given to actions that would advance analysis of existing emergency response systems to identify shortfalls so that additional actions can be taken to eliminate gaps.

Medium priority was given to actions involving new regulations or bylaws due to the time involved in drafting regulations, holding public hearings and seeking Town Meeting approval. Medium priority was also given to actions requiring reorganization of Town staff and reassignment of responsibilities. Again, time was a factor for approval of organizational structural changes and also for training staff in areas like grant writing. Public education activities also received a moderate priority because of the time needed to develop programs and materials.

Table 5 – Mitigation Action Items

Action Item #1	Assign staff to conduct in-depth risk assessments, including a Quantification of Potential Losses, to apply for mitigation funding and to track the results.
Hazard it's designed to mitigate:	All
Objective it's intended to help achieve:	1.1
General background of item:	This action should help identify shortfalls and the most vulnerable areas and facilities. Plans and protocols should be developed to address identified needs.
Responsibility for implementation assigned to:	Assistant Town Administrator, DPW Director, Health/Conservation Agent, Building Commissioner, Emergency Management Director
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High. Initial assessments completed by 2011 Ongoing funding applications and tracking

Action Item #2	Monitor the Town's emergency response services to identify needs or shortfalls in terms of protocol, personnel, equipment or resources.
Hazard it's designed to mitigate:	All
Objective it's intended to help achieve:	1.2
General background of item:	Any identified needs or shortfalls become documented and result in specific recommendations to the Selectmen for emergency service enhancements.
Responsibility for implementation assigned to:	Emergency Management Director, Police Chief, Fire Chief, Health/Conservation Agent
Potential funding source:	Operating budget, grants.
Priority/ time frame for implementation (or target completion date if possible):	High. Ongoing.

Action Item #3	Continue regional and sub-regional meetings and planning efforts.
Hazard it's designed to mitigate:	All
Objective it's intended to help achieve:	1.3
General background of item:	Coordination with other Outer Cape towns and the County can avoid duplication of services and equipment and a coordinated overall effort
Responsibility for implementation assigned to:	Emergency Management Director, Police Chief, Fire Chief, Assistant Town Administrator, Health & Conservation Agent,
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High. Ongoing

Action Item #4	Revise the Town's Flood Plain Zoning to incorporate cumulative substantial damage or improvement requirements.
Hazard it's designed to mitigate:	Flood, Erosion, Sea level rise

Objective it's intended to help achieve:	2.2
General background of item:	Truro's Zoning by-laws do not include a definition of "substantial improvement." The by-law should require buildings to be brought into compliance with flood protection standards earlier in their life cycle. The Town should maintain permit history so when cumulative repairs and improvements equal 50% of the building value, the building must be brought up to current codes for floodplain development.
Responsibility for implementation assigned to:	Assistant Town Administrator, Building Commissioner, Planning Board, Conservation Commission
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High. Work on a revised by-law should be completed by 2011.

Action Item #5	Identify developed areas and roadways subject to repeated flooding. Work with Mass Highway, DPW and owners of private roads to improve drainage and to limit flooding.
Hazard it's designed to mitigate:	Flooding
Objective it's intended to help achieve:	3.2
General background of item:	Areas subject to repeated flooding should be identified and analyzed. Improvements for drainage and other mitigation techniques should be prioritized and implemented.
Responsibility for implementation assigned to:	DPW Director, Conservation Agent, Building Commissioner, Assistant Town Administrator
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	Medium. Complete inventory by 2012, begin improvement program by 2013.

Action Item #6	Develop protocols for relocation of vulnerable equipment and for provision of emergency utilities for emergency centers. Retrofit critical Town facilities located in the SLOSH and FIRM zones.
Hazard it's designed to mitigate:	All
Objective it's intended to help achieve:	3.3
General background of item:	Existing emergency response plans do not address relocation of computer and other electronic equipment in Town facilities, such as Provincetown Pump Houses. In addition, none of these facilities has undergone retrofitting to improve their ability to withstand high winds or flooding.
Responsibility for implementation assigned to:	Assistant Town Administrator, DPW Director, Town of Provincetown
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High. Complete relocation plan by 2013. Retrofitting will be ongoing.

Action Item #7	Preserve, enhance and restore natural mitigation measures within the floodplain, wetlands, beaches and dunes.
Hazard it's designed to mitigate:	All
Objective it's intended to help achieve:	4.1
General background of item:	In addition to man-made mitigation, we must preserve and enhance the natural barriers to property damage and loss provided by nature. This can be achieved through regulation and also by ensuring that all mitigation measures are sympathetic to and supportive of existing natural features.

Responsibility for implementation assigned to:	Building Commissioner, Conservation Agent, Conservation Commission, ZBA, Assistant Town Administrator
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High. Ongoing

Action Item #8	Develop early notification program and protocol for areas subject to flooding and difficult to evacuate.
Hazard it's designed to mitigate:	Flooding, high wind.
Objective it's intended to help achieve:	1.2, 1.4
General background of item:	A program for early notification and public education should be targeted toward areas that repeatedly flood and have limited vehicle access.
Responsibility for implementation assigned to:	Emergency Management Director, Police, Fire.
Potential funding source:	Operating budget
Priority/ time frame for implementation (or target completion date if possible):	High. Target most vulnerable areas by 2011. Ongoing education.

Action Item #9	Work with the CCNS in developing a plan and protocol for clearing and maintenance of fire roads
Hazard it's designed to mitigate:	Wildfire, wind, winter hazards
Objective it's intended to help achieve:	1.3, 3.2
General background of item:	Analyze the fire road network, determine the critical roads.
Responsibility for implementation assigned to:	Fire Chief, DPW Director, Assistant Town Administrator and CCNS
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	Low. Target most vulnerable areas by 2011.

Action Item #10	Develop policies that would provide for incentives for building above the floodplain.
Hazard it's designed to mitigate:	Flood
Objective it's intended to help achieve:	2.2, 2.3, 3.2, 5.2
General background of item:	Develop policies that would allow for a waiver of application fees, provided construction is 1 or more feet above base flood elevations.
Responsibility for implementation assigned to:	Building Commissioner, Assistant Town Administrator, Town Administrator, Selectmen
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High. Draft language by 2011.

Action Item #11	Augment the enforcement of the State Building Code and related Town By-laws by encouraging wind resistant design techniques for new residential construction during the Town's permitting process.
Hazard it's designed to mitigate:	Wind.
Objective it's intended to help achieve:	2.1
General background of item:	Although the State Building Code requires certain building practices for wind loss reduction, experts agree that structures built to exceed high wind provisions have a much greater chance of surviving violent windstorms. These additional techniques should be promoted for all new residential construction.

Responsibility for implementation assigned to:	Building Commissioner
Potential funding source:	Operating budget
Priority/ time frame for implementation (or target completion date if possible):	Medium. Implement by 2012.

Action Item #12	Review Subdivision Rules and Regulations regarding road construction requirements and development within areas prone to flooding or subject to erosion. Review General By-laws regarding requirements to retain all drainage on site.
Hazard it's designed to mitigate:	Flooding, Erosion.
Objective it's intended to help achieve:	3.1
General background of item:	Subdivision Rules and Regulations should be reviewed and updated to include more detailed requirements for road drainage design and to facilitate review of drainage design and calculations by an engineer. Enforcement of existing requirements for property owners to retain runoff on their own property should be stepped up.
Responsibility for implementation assigned to:	Assistant Town Administrator, Building Commissioner, DPW Director, Planning Board
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High. Complete review and propose revisions by 2012.

Action Item #13	Educate Town staff, boards and committees about the importance of hazard mitigation and the techniques and programs available.
Hazard it's designed to mitigate:	All
Objective it's intended to help achieve:	5.1
General background of item:	Hazard mitigation and emergency response are not seen as high planning priorities. They should be included in all long-range planning efforts.
Responsibility for implementation assigned to:	Assistant Town Administrator, Health & Conservation Agent, Harbormaster
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High. Ongoing.

Action Item #14	Develop educational materials, displays and events to inform residents about hazards that threaten the Town and mitigation measures they can take to lessen the impact and be better prepared.
Hazard it's designed to mitigate:	All
Objective it's intended to help achieve:	5.2, 5.4
General background of item:	Materials could be available at various locations such as the Library, Building Department and Community Center. Other outlets might include local newspapers and public access television. Events could be coordinated with other Town activities.
Responsibility for implementation assigned to:	Local MHMP Team, Police, Fire
Potential funding source:	Grants
Priority/ time frame for implementation (or target completion date if possible):	High. Have first educational material prepared by 2011. Ongoing activity.

Action Item #15	Make the local MHMP and other emergency planning and emergency response documents easily accessible to the public.
Hazard it's designed to mitigate:	All
Objective it's intended to help achieve:	5.5
General background of item:	Accessibility to these documents could be improved by posting them on the Town website and by establishing a special area at the Library for written materials.
Responsibility for implementation assigned to:	Local MHMP Team
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High. Complete initial awareness and postings by 2011. Ongoing updates.

Action Item #16	Participate in the Community Rating System Program
Hazard it's designed to mitigate:	Flood
Objective it's intended to help achieve:	5.1 – 5.5
General background of item:	Participation and certification in the Community Rating System would provide flood insurance policy owners a decrease in their rates
Responsibility for implementation assigned to:	Assistant Town Administrator, Building Commissioner
Potential funding source:	Operating budget,
Priority/ time frame for implementation (or target completion date if possible):	High. Preparation of application by 2012. Certification by 2013.

Action Item #17	Continue education programs and materials specific to specialized situations and groups, i.e., campgrounds, boat owners, etc.
Hazard it's designed to mitigate:	All
Objective it's intended to help achieve:	5.2
General background of item:	Specialized information needs to be disseminated to campgrounds, hotels/motels, seasonal rentals and boat owners about preparing for and responding to a disaster.
Responsibility for implementation assigned to:	Local MHMP Team
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	High. Ongoing.

Action Item #18	Work with Mass Highway to control flooding on Route 6 and with the CCNS to provide alternate routes for evacuation and emergency vehicles.
Hazard it's designed to mitigate:	Flooding
Objective it's intended to help achieve:	1.4
General background of item:	Flooding even during routine rainstorms can make area of Route 6 hazardous. In the event of a hurricane or other disaster, alternate routes should be available. A plan should also be developed to control access to these alternative routes.
Responsibility for implementation assigned to:	Police Chief, Fire Chief, DPW Director, Emergency Management Director.
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	Low. Complete initial evaluation and recommendations by 2015. Ongoing effort to make improvements.

Action Item #19	On an annual basis, contact all owners of FEMA-identified repetitive loss properties and inform them of the assistance available through the federal Flood Mitigation Assistance (FMA) program, in addition to other flood protection measures.
Hazard it's designed to mitigate:	Flood
Objective it's intended to help achieve:	2.3, 5.3
General background of item:	Eligible property owners should be contacted every year to promote the availability of the FMA funding through MEMA and to determine their interest in applying for funding.
Responsibility for implementation assigned to:	Assistant Town Administrator, Building Commissioner, Assessor
Potential funding source:	Operating budget.
Priority/ time frame for implementation (or target completion date if possible):	High. Implement the notification program by 2013.

Action Item #20	Identify existing facilities eligible for upgrading through grant programs and new mitigation measures that would qualify for grant funding. Assign responsibility for identifying and applying for grant funding.
Hazard it's designed to mitigate:	All
Objective it's intended to help achieve:	3.4
General background of item:	Currently, there is no organized effort to apply for grant funding. This action item would call for identifying what needs to be done, and then assigning responsibility for seeking the funding to appropriate Town staff and committees.
Responsibility for implementation assigned to:	Assistant Town Administrator, Local MHMP Team
Potential funding source:	Operating budget, grants
Priority/ time frame for implementation (or target completion date if possible):	Medium. Complete inventory by 2013, apply for grant funding by 2014.

Section 6: Implementation and Adoption of this Plan

6.1 Adoption

The Local MHMP Team adopted that plan at their final meeting held December 2, 2009. The Truro Board of Selectmen were presented that plan on December 15, 2009. The Board accepted the plan with several minor typographical corrections. The Town anticipates holding a public hearing in March 2010 to adopt the plan.

6.2 Implementation

The Plan will be implemented through the delegation of assignments by the Town Administrator and Assistant Town Administrator. Mitigation Action Items will be assigned to a responsible department and the individual department heads will be charged with overseeing the specific tasks assigned to them. Items assigned to boards and committees will be the responsibility of the staff liaison to that specific group. For example, the Conservation Commission and the Conservation Agent would be tasked with the preparation of a wetlands protection bylaw.

It shall be the responsibility of the Town Administrator and Assistant Town Administrator to ensure that the action items set forth in this plan are carried out in accordance with the time frame assigned to each action item. The Town Administrator and Assistant Town Administrator may also amend these action items with regard to departmental responsibilities, time frame, and funding source in consultation with the Local Team.

6.3 Annual Reporting and Monitoring

Periodic monitoring and reporting is required to ensure that local mitigation efforts are being carried out. The Plan shall be reviewed annually by the Local MHMP Team or as situations dictate, such as following a disaster declaration. Each year, the Town Administrator will assign responsibility for conducting this annual review to an appropriate individual or department, who will ensure the following:

1. The Board of Selectman and the Town Administrator will receive an annual report and/or presentation on the implementation status of the Plan. This will include at a minimum, a printed version of the Mitigation Action Plan indicating the implementation status of each identified action item.
 - The Report will also include an evaluation of the effectiveness and appropriateness of the actions proposed in the Plan.
 - The Report will recommend any required changes or amendments to the Plan.
 - If an amendment, change, or update (based on Section 6.4 below) is needed the Board of Selectman shall vote to adopt the change and to amend the Plan.

Appropriate notice shall be given to the public of the meeting at which an annual report will be given to the Board of Selectmen or at which proposed changes or revisions to the Plan will be discussed and approved. The public shall be invited to participate in all meetings, and will also have access to the report or proposed changes or revisions in advance at the Truro Library and on the Town's website and will be invited to submit written comments and suggestions.

6.4 Revisions and Updates

Periodic revision and updates may be required to ensure that the hazard mitigation goals, objectives, and activities for Truro are kept current. More importantly, revisions may be necessary to ensure the Plan is in full compliance with Federal regulations and State statutes.

Five-year Plan Review

The Plan should be reviewed every five years at the authorization of the Board of Selectmen to determine if there have been any significant changes in Town that would affect the Action Plan. Increased development, increased exposure to certain hazards, the development of new mitigation capabilities or techniques, and changes to Federal, State or County legislation are examples of changes that may affect the condition of the Plan.

Disaster Declaration

Following a disaster declaration, this Plan will need to be reviewed to reflect on lessons learned or to address specific circumstances arising out of the disaster.

6.5 Local Planning Integration

As stated previously in Goal 5 of Section 5.1 Mitigation Objectives, the Local MHMP Team, through the Assistant Town Administrator/Planner will work closely with the various planning processes to encourage hazard mitigation planning and encourage consistency with other planning efforts. These would include, but are not limited to: Local Comprehensive Plan, Open Space and Recreation Plan, Harbor Plan, Emergency Management Plan, etc.

Appendix A

- Regional Hazard Risk (Map I), Cape Cod, Massachusetts (Landslide Susceptibility; Long-Term Shoreline Change Susceptibility; Historic Tornado Activity; Historic Earthquake Activity).
- Regional Hazard Risk (Map II), Cape Cod, Massachusetts (Flood Hazard Areas; Historic Hurricane Activity and Hurricane Risk; Historic Average Annual Snowfall).
- Regional Hazard Risk (Map III), Cape Cod, Massachusetts (Wildfire Hazard Areas, Truro)
- Risk and Vulnerability Assessment Map, Town of Truro, MA.

Appendix B

Table 6: Complete Hazard ID & Ranking Matrix – Truro, Massachusetts

Table 7: STAPLEE Feasibility Analysis of Potential Hazard Mitigation Measures

Table 6
COMPLETE HAZARD ID & RANKING MATRIX - TRURO, MASSACHUSETTS

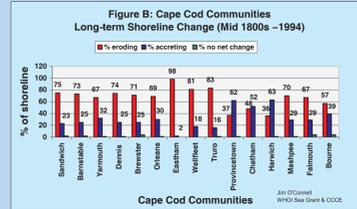
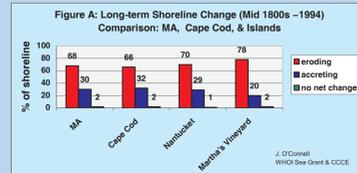
<i>Natural Hazard:</i>	<i>Location RATE: 1=small 2=medium 3=large</i>	<i>Frequency of Occurrence RATE: 0=unlikely 1=possible 2=likely 3=highly likely</i>	<i>Magnitude/ Severity RATE: 1=limited 2=significant 3=critical 4=catastrophic</i>	<i>Hazard Ranking</i>
FLOOD				
Mill Pond Road	1	1	2	4
Old County Road	2	1	1	4
Highland Road at Dutra's	1	3	2	6
Beach Point – Shore Road	2	2	2	6
Sutton Place	2	2	2	6
Top Mast	2	2	2	6
Bay Beach Town House	2	2	2	6
Route 6 – Stott's Crossing & High Head Road	2	2	3	7
Route 6 – Near Truro Central School	1	1	1	3
Snow's Park – Clapper Valve	1	1	1	3
Ballston Beach	2	3	2	7
Head of the Meadow	1	2	2	5
Dyer Hollow	1	1	1	3
Fisher Road & Great Hills Road	2	3	2	7
WIND				
Hurricanes	3	2	3	8
Beach Point	2	2	2	6
Pamet Harbor	3	2	2	7
FAA Tower	1	1	1	3
North Easters	3	2	3	8
High tide & gale winds	3	3	3	9

<i>Natural Hazard:</i>	<i>Location RATE: 1=small 2=medium 3=large</i>	<i>Frequency of Occurrence RATE: 0=unlikely 1=possible 2=likely 3=highly likely</i>	<i>Magnitude/ Severity RATE: 1=limited 2=significant 3=critical 4=catastrophic</i>	<i>Hazard Ranking</i>
Electrical service interruption	3	2	3	8
Heat	3	2	3	8
Water	3	2	3	8
Phone	3	2	3	8
FIRE				
Cape Cod National Seashore				
Large forested area	2	1	2	5
Dead trees and underbrush	2	2	2	6
Residences within the CCNS	2	1	2	5
Fire Road System	3	2	3	7
Water Supply	3	2	3	7
Beach Point	3	2	3	7
Dense development pattern	3	1	3	7
Wooden structures	3	1	3	7
SNOW & ICE ACCUMULATION				
Winter Storms	3	2	3	8
Snow drift across Rt 6	2	2	2	6
Seasonal Homes	3	1	2	6
Frozen water pipes	3	2	2	7
Frozen fuel lines	2	1	2	5
Loss of electrical power	3	2	2	7
Heat	3	2	2	7
Water	3	2	2	7
Phone	3	2	2	7

<i>Natural Hazard:</i>	<i>Location RATE: 1=small 2=medium 3=large</i>	<i>Frequency of Occurrence RATE: 0=unlikely 1=possible 2=likely 3=highly likely</i>	<i>Magnitude/ Severity RATE: 1=limited 2=significant 3=critical 4=catastrophic</i>	<i>Hazard Ranking</i>
SHORELINE CHANGE				
Erosion				
Ballston Beach	2	3	2	7
Noons Beach	1	3	2	6
CCBay Shoreline	3	2	2	7
Atlantic Shoreline	3	3	3	9
TORNADO	2	1	2	5
EARTHQUAKES	3	0	2	5
Prone to earthquakes, statistically overdue	3	0	2	5
Complicated fault system	3	0	2	5
Areas with clay deposits (from Highland Light to Noons pit)	2	0	3	5

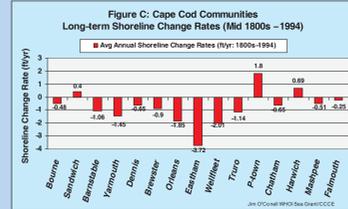
Regional Hazard Risk (Map I), Cape Cod, Massachusetts

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



* Cape Cod has 586 miles of tidal shoreline of which 238 miles of primarily ocean-facing shore were analyzed for shoreline change trends (O'Connell, et al., 2002; Thieler et al., 2001). The long-term shoreline change rate for all Cape Cod communities combined is -0.68 ft/yr, slightly higher than the statewide average: 66% (157 miles) of the Cape Cod shoreline shows long-term erosion. Twelve of the 15 Cape Cod 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 (Thieler 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/year
- Erosion .01 - .99 ft/year
- Accretion .01 - .99 ft/year
- Accretion 1 - 1.99 ft/year
- Accretion > 2 feet per year
- No Data

SLOSH 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 (Serious Damage)
- F4, Devastating Tornado (Devastating Damage)

Tornado Density (# of Tornadoes/20 miles)

- 0 - 16
- 16 - 32
- 32 - 48
- 48 - 64
- 64 - 72

Earthquake Magnitudes (Richter Scale)

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

Fault Lines

- Fault
- Normal Fault
- Thrust Fault

Peak Ground Acceleration

- 1 - 3 % Light shaking, no damage
- 4 - 5 % Moderate shaking, no damage
- 6 - 7 % Moderate shaking, light damage
- 8 - 10 % Strong shaking, light damage

Major Roads

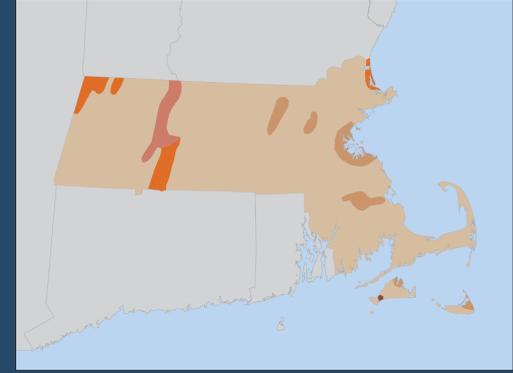
Town Line

Notes:

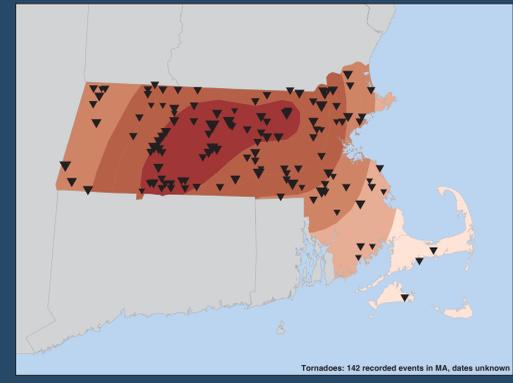
** SLOSH Zones (Sea, Lake, and Overland Surges from Hurricanes) depicted here are areas of inundation modeled to occur from wind and pressure forces of hurricanes. Inundation areas reflect "Worst Case" combinations of hurricane direction, forward speed, landfall point, and high astronomical tide. The SLOSH zones shown here have been georeferenced 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 tide 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).

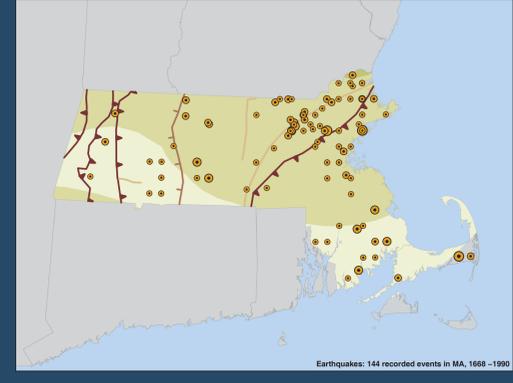
Landslide Susceptibility



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 +/- 1.4 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 in shoreline movement may have changed as a result of natural causes or, importantly, human activities, such as seawall/revetment, jetty or groin 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 Thieler, et al., 2002 listed in the references below. Data tables and maps can be viewed at www.state.ma.us/cvz/cm.htm.

Data Sources:
 Northeast States Emergency Consortium (NESEC) www.nesec.org; Massachusetts Executive Office of Environmental Affairs, "Coastal Erosion on Cape Cod: Some Questions and Answers" (<http://woodshole.er.usgs.gov/staffpages/boldale/capecod/>); Federal Emergency Management Agency (FEMA); and the Cape Cod Commission's Geographic Information System Database.

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 Massachusetts is Eroding. WHOI Sea Grant and Cape Cod Cooperative Extension, Marine Extension Bulletin, March, 2003.
 O'Connell, J.F., Thieler, E.R., and Schupp, C., 2002. New Shoreline Change Data and Analysis for the Massachusetts Shore, with Emphasis on Cape Cod and the Islands: Mid1800s - 1994. Environment Cape Cod, Vol. 5, No. 1.
 Thieler, E.R., O'Connell, J.F., and Schupp, C., 2002. The Massachusetts Shoreline Change Project: 1800s - 1994. Technical Report, U.S.G.S. Administrative Report, Woods Hole, MA.
 Funding for the Cape Cod Pre-disaster Mitigation Planning grant was provided to 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-disaster Mitigation Project, January, 2004, based on data analyses, graphs and text provided by Jim O'Connell, Woods Hole Oceanographic Institution Sea Grant Program and Cape Cod Cooperative Extension. A description of the shoreline change data base analyzed for this project can be found in Thieler, O'Connell and Schupp (2002) - see references above. Comments and corrections are welcome at the Cape Cod Commission office or contact capcodcommission.org. This map is illustrative and all depicted boundaries are approximate.

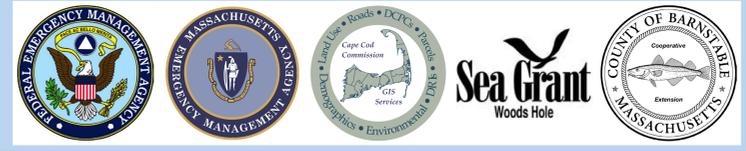
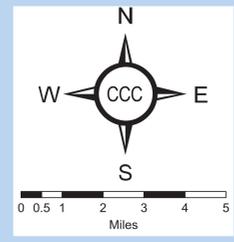
F0

3.1, 1977DEC20

4.2, 1947AUG08

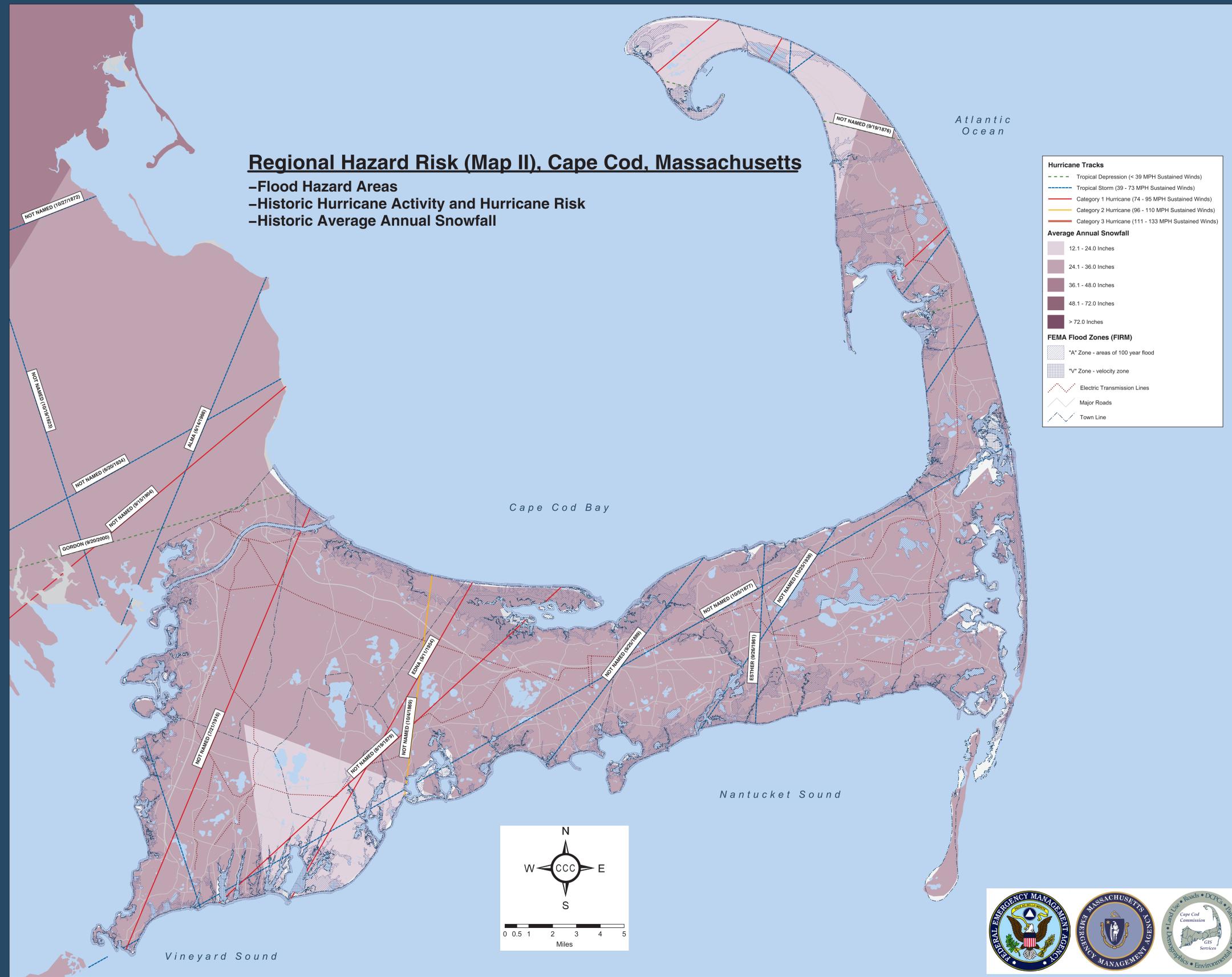
2.8, 1976MAR14

Vineyard Sound



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

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



Hurricane Tracks

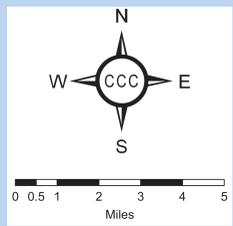
- Tropical Depression (< 39 MPH Sustained Winds)
- Tropical Storm (39 - 73 MPH Sustained Winds)
- Category 1 Hurricane (74 - 95 MPH Sustained Winds)
- Category 2 Hurricane (96 - 110 MPH Sustained Winds)
- Category 3 Hurricane (111 - 133 MPH Sustained Winds)

Average Annual Snowfall

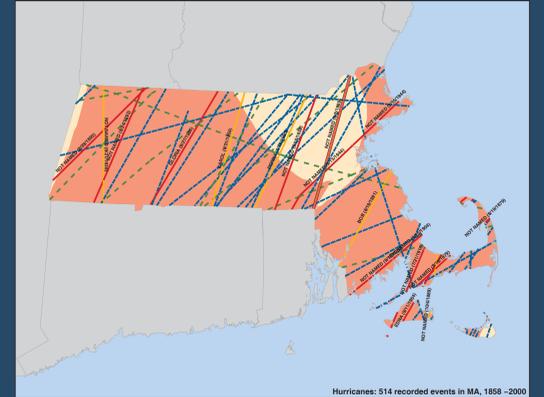
- 12.1 - 24.0 Inches
- 24.1 - 36.0 Inches
- 36.1 - 48.0 Inches
- 48.1 - 72.0 Inches
- > 72.0 Inches

FEMA Flood Zones (FIRM)

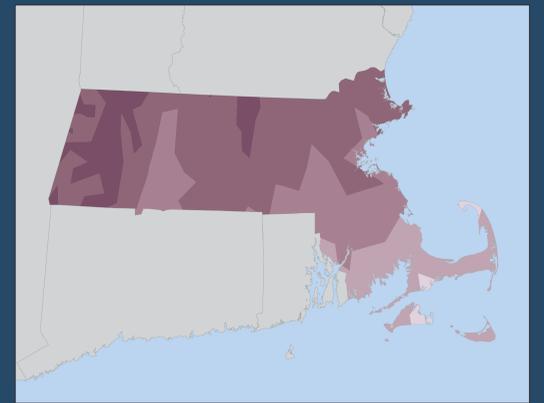
- *A* Zone - areas of 100 year flood
- *V* Zone - velocity zone
- Electric Transmission Lines
- Major Roads
- Town Line



Hurricane Tracks and Hurricane Risk



Average Annual Snowfall



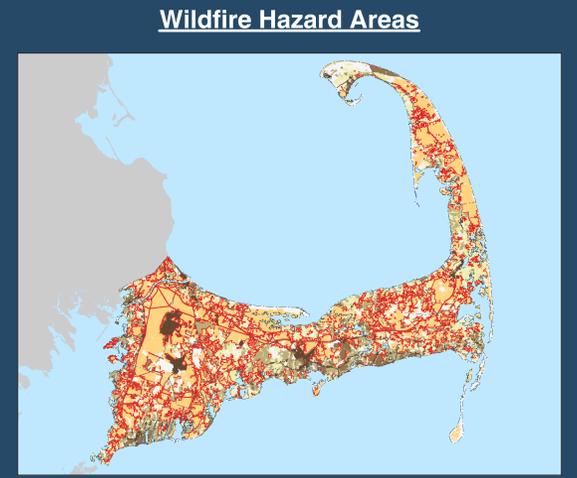
Data Sources:
 Northeast States Emergency Consortium (NESEC) www.nesec.org, MassGIS Executive Office of Environmental Affairs, Greg's Weather Center (http://hometown.aol.com/hurtrack/hurTrack.index.html), The United States Hurricane Page (http://www.geocities.com/hurricane1), and the Cape Cod Commission's 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.

Regional Hazard Risk III, Cape Cod, Massachusetts

-Wildfire Hazard Areas, Truro

Parcel ID	Critical Facility or Infrastructure	Address	Town	Facility Type
1	Emergency Operations Center (Police/Fire Station)	344 Rte. 6	Truro	A, B
2	Truro Central School	317 Rte. 6	Truro	A, G
4	South Truro Fire Station	Rte. 6A	Truro	B
5	Department of Public Works	17 Town Hall Rd.	Truro	D
5	Town Hall	24 Town Hall Rd.	Truro	D
6	Pilgrim Library (Bldg/Health/Rec. Depts.)	Rte. 6A	Truro	D
8	Panet Harbor Marina	75 Depot Rd.	Truro	L
9	Cobbs Library	5 Library Lane (off Standish Way)	Truro	D
9	Community Center	Library Lane (off Standish Way)	Truro	J
9	Council on Aging (new location)	Library Lane (off Standish Way)	Truro	J
10	Council on Aging	Rte. 6A	Truro	J

- 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 Marinas/Boat Yards



Wildfire Hazard Areas

- Wildfire Risk*
- Wildland/Urban Interface**

Residential and Commercial Development

- High Density Residential
- Medium Density Residential
- Low Density Residential
- Commercial/Industrial Development

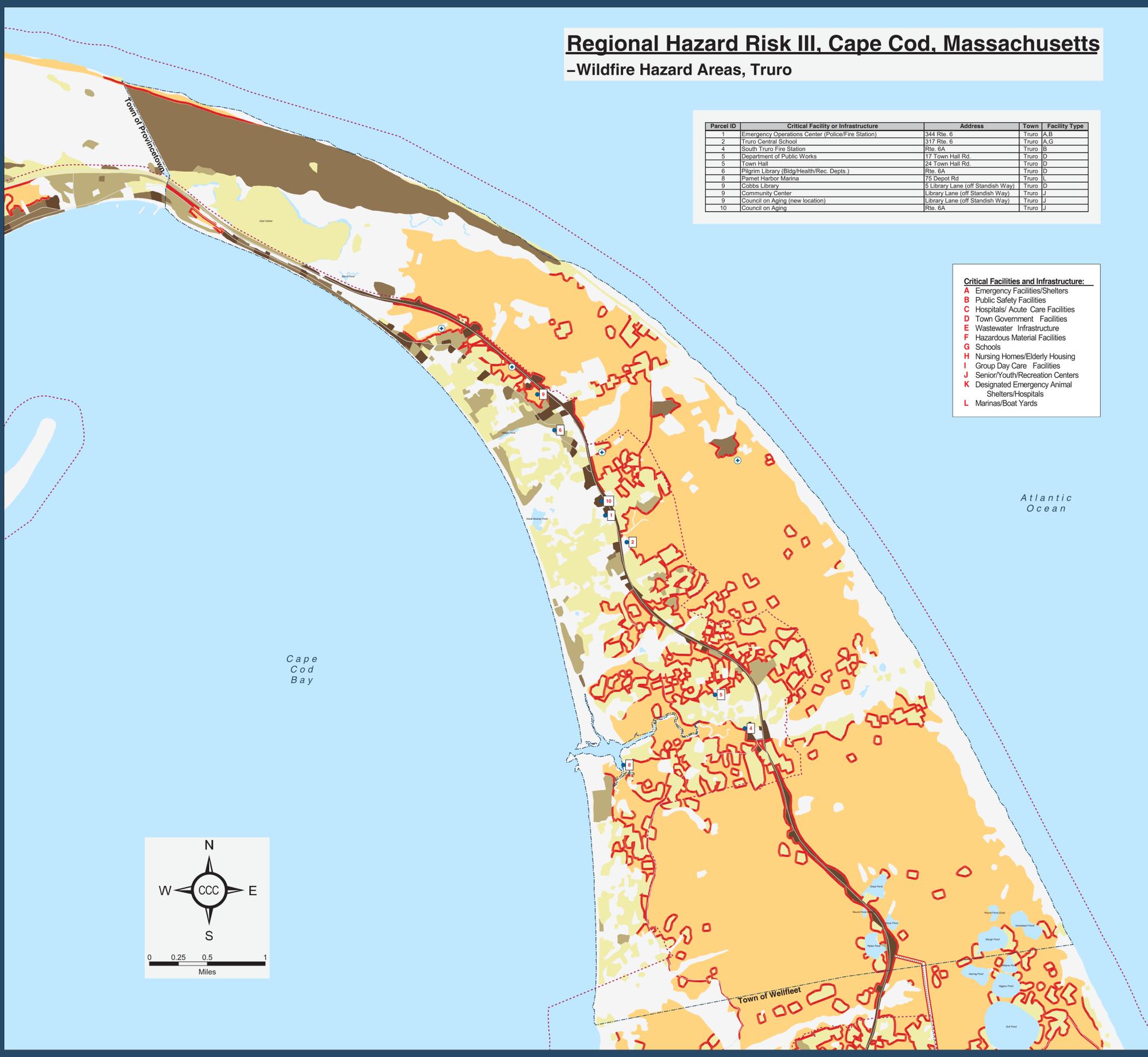
Critical Facilities and Infrastructure

- Electric Transmission Lines
- Rail Lines
- Major Roads
- Cape Cod National Seashore Boundary
- Town Line (Truro)

*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.

Data Sources:
 MacConnell landuse: (digital) 1999.
 Northeast States Emergency Consortium (NESEC) www.nesec.org, MassGIS Executive Office of Environmental Affairs, Federal Emergency Management Agency (FEMA), Cape Cod Brush Breakers Pictorial History (http://www.capecodff.com/PAGES%20Special/Breakers00.htm), USDA Forest Service (http://www.fs.fed.us/na/durham/), and the Cape Cod Commission's Geographic Information System Department. Additional appreciation to Jeffrey Stanovich, Forest Fire Patrolman, Plymouth County, MA for his thoughtful input.
 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 Commissions 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.



DRAFT 9.1.09



Critical Facilities and Infrastructure

FEMA Flood Zones (FIRM):

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

Hurricane Surge

- Category One Hurricane
- Category Two Hurricane
- Category Three Hurricane
- Category Four Hurricane

- Critical Facility not in SLOSH Zone (*)
- Critical Facility in SLOSH Zone (**)

Hurricane Evacuation Route

- Evacuation Route in SLOSH Zone

(See Note About Repetitive Loss Properties)

- Public Water Supply (*)
- Public Water Corrosion Control
- Public Water Zone 2
- Electric Transmission Line
- Railroad
- Bus/Rail Station
- Ferry Terminal
- Structurally Deficient Bridge
- Major Roads
- Town Line
- Shore
- Truro 2005 Parcels

Facility Type key to 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 Marinas/Boat Yards

**Risk and Vulnerability Assessment Map
Town of Truro, MA**

Parcel ID	Critical Facility or Infrastructure	Address	Town	Facility Type	Map Location
1	Emergency Operations Center (Police/Fire Station)	344 Rte. 6	Truro	B	F5
2	Truro Central School	317 Rte. 6	Truro	A,G	F5
3	Department of Public Works	17 Town Hall Rd.	Truro	D	G7
3	Town Hall	24 Town Hall Rd.	Truro	D	G7
4	Pamet Harbor	75 Depot Rd	Truro	L	F7
5	Truro Public Library	7 Library Lane (off Standish Way)	Truro	D	E4
5	Community Center - Council on Aging & Recreation Dept.	Library Lane (off Standish Way)	Truro	J	E4
6	Knowles Heights Pump House	143 Shore Road	Truro	D	D4
7	South Hollow Well Pump House	9 South Hollow Road	Truro	D	F5

An update of this Risk and Vulnerability Assessment Map to add "Tier 2 Reporters" from Mass. Department of Environmental Protection (DEP) (records up to Reporting Year 2008) was completed in May of 2009.
The Tier 2 reporters would have been classified as "Hazardous Material Facilities" (F) during the first round of mapping. The only one identified in Truro at this date is a public water system corrosion control facility which is also a Tier 2 reporter.

Repetitive Loss Properties: there are no Repetitive Loss Properties in the data obtained from FEMA in 2009 in the Town of Truro.

Data Sources: (Note: not all features are present in each town.)
FEMA Flood Hazard Area: Flood Insurance Rate Maps, 1:4800, Federal Emergency Management Agency, 1986. Due to insufficient accuracy of the source maps, areas shown have been digitized and adjusted to match the MassGIS 1:25000 road network by the Cape Cod Commission. Exact flood hazard boundaries may need to be determined by land survey methods as used by FEMA.

* Hurricane Surge data: Army Corps of Engineers. Updated areas of inundation based on severity of hurricanes. Completed 10/30/02 using the SLOSH (Sea Lake and Overland Surge from Hurricanes) model. These are areas of inundation modeled to occur from wind and pressure forces of hurricanes.
* 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 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 Multi-Hazard Mitigation Project. The Cape Cod Commission is a division of Barnstable County. Digital data used are from MassGIS 2008, the Army Corps of Engineers 2002, and the Cape Cod Commission, 2009. Data bases associated with critical facilities were researched by AmeriCorps of Cape Cod, 2003, the Barnstable County Department of Health and the Environment, 2007-2008, and by Town Staff, 2009.

Information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel level analysis.

Medium Feasibility										
Truro Natural Hazard Mitigation Measures	Action Item	Hazard Rank	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Priority Score
Identify developed areas and roadway subject to repeated flooding. Work with Mass Highway, DPW and owners of private roads to improve drainage and to limit flooding.	#5	9	3	2	2	2	3	2	3	26
Preserve, enhance and restore natural mitigation measures within the floodplain, wetlands, beaches and dunes.	#7	9	2	3	3	2	3	2	3	27
Augment the enforcement of the State Building Code and related Town By-laws by encouraging wind resistant design techniques for new residential construction during the Town's permitting process.	#11	9	2	3	3	2	3	2	3	27
Identify existing facilities eligible for upgrading through grant programs and new mitigation measures that would qualify for grant funding. Assign responsibility for identifying and applying for grant funding.	#20	9	3	2	2	2	3	2	3	26
Low Feasibility										
Work with the CCNS in developing a plan and protocol for clearing and maintenance of fire roads	#9	5	2	3	1	2	3	2	3	21
Work with Mass Highway to control flooding on Route 6 and with the CCNS to provide alternate routes for evacuation and emergency vehicles.	#18	9	2	1	1	2	3	2	2	22
Key: 1= not acceptable, no; 2 = somewhat acceptable, maybe; 3 = desirable, yes. As previously noted, the Hazard Ranking number corresponds to Table 2										