TOWN OF HAMPTON FALLS, NH

HAZARD MITIGATION PLAN 2006

Approved by the

HAMPTON FALLS BOARD OF SELECTMEN

And adopted as an official appendix to the
Hampton Falls Emergency Operations Plan

NOVEMBER 1ST, 2006

Rockingham Planning Commission

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NEW HAMPSHIRE BUREAU OF EMERGENCY MANAGEMENT

Hampton Falls Hazard Mitigation Plan

This Plan serves a dual role as a stand alone document approved by the Hampton Falls Board of Selectmen on November 1st, 2006. This document also will serve as an official annex to the Hampton Falls Emergency Operations Plan, upon its completion.

Approved by the Hampton Falls Board of Selectmen:

_____, Chair

_____

_____

TOWN OF HAMPTON FALLS NEW HAMPSHIRE INC. 1722

Date: November 1st, 2006

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EXECUTIVE SUMMARY

The Hampton Falls Hazard Mitigation Plan (herein after, the *Plan*) was compiled to assist the Town of Hampton Falls in reducing and mitigating future losses from natural hazard events. The *Plan* was developed by the Rockingham Planning Commission and participants from the Town of Hampton Falls and contains the tools necessary to identify specific hazards and aspects of existing and future mitigation efforts.

The following hazards are addressed:

- Flooding
- Hurricane – Extreme Weather Event
- Severe Winter Weather
- Wildfire
- Earthquake
- Coastal Storm

The Critical Facilities include:

- Emergency Response Facilities
- Critical Infrastructure
- Vulnerable Populations
- Historic Landmarks
- Transportation Infrastructure
- Possible Resources during a Hazard Event

The *Plan* is considered a work in progress and should be revisited frequently to assess whether the existing and suggested mitigation strategies are successful. Copies have been distributed to the Town of Hampton Falls, and a copy will remain on file at the Rockingham Planning Commission. A copy of this Plan is also on file at the New Hampshire Bureau of Emergency Management (NH BEM) and the Federal Emergency Management Agency (FEMA). This *Plan* was approved by both agencies prior its adoption at the local level.

CHAPTER 1 – INTRODUCTION

BACKGROUND

The New Hampshire Bureau of Emergency Management (NH BEM) has a goal for all communities within the State to establish local hazard mitigation plans as a means to reduce and mitigate future losses from natural hazard events. The NH BEM outlined a process whereby communities throughout the State may be eligible for grants and other assistance upon completion of a local hazard mitigation plan. A handbook entitled Hazard Mitigation Planning for New Hampshire Communities was created by NH BEM to assist communities in developing local plans. The State's Regional Planning Commissions are charged with providing assistance to selected communities to develop local plans.

The Plan was prepared by Rockingham Planning Commission (RPC) with the assistance of participants from the Town of Hampton Falls, under contract with the New Hampshire Bureau of Emergency Management (BEM) operating under the guidance of Section 206.405 of 44 CFR Chapter 1 (10-1-97 Edition). The Plan serves as a strategic planning tool for use by the Town of Hampton Falls in its efforts to identify and mitigate the future impacts of natural and/or man-made hazard events. Upon adoption of this Plan by the Hampton Falls Board of Selectmen, it will become an official appendix to the Hampton Falls Emergency Operations Plan.

METHODOLOGY

On March 2nd, 2005, the Rockingham Planning Commission (RPC) organized the first meeting with emergency management officials from the Town of Hampton Falls to begin the initial planning stages of the *Plan.* RPC staff and participants from the Town developed the content of the *Plan* using the nine-step process set forth in the *Hazard Mitigation Planning for New Hampshire Communities*. The following is a summary of the nine-step process conducted to compile the *Plan.*

Step 1 – Map the Hazards

Areas were identified where damage from historic natural disasters has occurred and areas where critical man-made facilities and other features may be at risk in the future for loss of life, property damage, environmental pollution and other risk factors. RPC generated a set of base maps with GIS (Geographic Information Systems) that were used in the process of identifying past and future hazards.

Step 2 – Identify the Critical Facilities

Critical Facilities were identified. These included buildings and areas that were considered to be important to the Town for emergency management purposes, were identified for provision of utilities and community services, evacuation routes, and for recreational and social value. Using a Global Positioning System, RPC plotted the exact location of these sites on a map.

Step 3 – Identify Existing Mitigation Actions or Strategies

After collecting information on each critical facility in Hampton Falls, RPC staff identified existing mitigation strategies relative to hazards that may affect the Town.

Step 4 – Identify Gaps in Existing Mitigation Actions or Strategies

The existing strategies were then reviewed by the RPC for coverage and effectiveness, as well as the need for improvement.

Step 5 – Identify Potential Mitigation Actions or Strategies

A list was developed of additional hazard mitigation actions and strategies for the Town of Hampton Falls. Potential actions include flood control gates on the dams near Route 1 and investigating local regulations to improve on wildfire protection.

Step 6 – Prioritize and Develop Action Plan

The proposed hazard mitigation actions and strategies were reviewed and each strategy was rated (good, average, or poor) for its effectiveness according to several factors (*e.g.*, technical and administrative applicability, political and social acceptability, legal authority, environmental impact, financial feasibility). Each factor was then scored and all scores were totaled for each strategy. Strategies were ranked by overall score for preliminary prioritization then reviewed again under Step 7.

Step 7 – Determine Priorities

The preliminary prioritization list was reviewed in order to make changes and determine a final prioritization for new hazard mitigation actions and existing protection strategy improvements identified in previous steps. RPC also presented recommendations to be reviewed and prioritized by emergency management officials.

Step 8 – Develop Implementation Strategy

An implementation strategy was developed for the Action Plan which included person(s) responsible for implementation (who), a timeline for completion (when), and a funding source and/or technical assistance source (how) for each identified hazard mitigation actions.

Step 9 – Adopt and Monitor the Plan

RPC staff compiled the results of Steps 1 to 8 in a draft document. This draft *Plan* was reviewed by members of the *Committee* and by staff members at the RPC. The draft *Plan* was also placed on the RPC website for review by the public, neighboring communities, agencies, businesses, and other interested parties to review and make comments via email. A letter was sent to the abutting New Hampshire communities of Hampton, Seabrook, Kensington, and Exeter to insure their opportunity to review the *Plan* prior to finalization (see Appendix F). A duly noticed public hearing was held by the Hampton Falls Board of Selectmen (November 1st, 2006). This meeting allowed the community to provide comments and suggestions for the *Plan* in person, prior to the document being finalized. A second public hearing was then held by the Hampton Falls Board of Selectmen on _____, 2006. At this public hearing the *Plan* was approved by the Board of Selectmen, and adopted as an appendix to the Hampton Falls Emergency Operations Plan.

HAZARD MITIGATION GOALS AND OBJECTIVES OF THE STATE OF NEW HAMPSHIRE

The *State of New Hampshire Natural Hazards Mitigation Plan*, which was prepared and is maintained by the New Hampshire Bureau of Emergency Management (NH BEM), sets forth the following related to overall hazard mitigation goals and objectives for the State of New Hampshire:

1. To improve upon the protection of the general population, the citizens of the State and guests, from all natural and man-made hazards.
2. To reduce the potential impact of natural and man-made disasters on the State's Critical Support Services.
3. To reduce the potential impact of natural and man-made disasters on Critical Facilities in the State.
4. To reduce the potential impact of natural and man-made disasters on the State's infrastructure.
5. To improve Emergency Preparedness.
6. Improve the State's Disaster Response and Recovery Capability.
7. To reduce the potential impact of natural and man-made disasters on private property.
8. To reduce the potential impact of natural and man-made disasters on the State's economy.
9. To reduce the potential impact of natural and man-made disasters on the State's natural environment.
10. To reduce the State's liability with respect to natural and man-made hazards generally.
11. To reduce the potential impact of natural and man-made disasters on the State's specific historic treasures and interests as well as other tangible and intangible characteristics which add to the quality of life of the citizens and guests of the State.
12. To identify, introduce and implement cost effective Hazard Mitigation measures so as to accomplish the State's Goals and Objectives and to raise the awareness of, and acceptance of Hazard Mitigation generally.

Through the adoption of this Plan the Town of Hampton Falls concurs and adopts these goals and objectives.

ACKNOWLEDGEMENTS

The Town of Hampton Falls offers thanks to the individuals that took part in the Hazard Mitigation Planning Committee:

Jay M. Lord, Fire Chief

Frank Ferreira, Selectmen

Eric Small, Town Administrator

Richard Merrill, Road Agent

Robbie Dirsa, Police Chief

Rod Vigneau, Building Inspector

The Town of Hampton Falls offers thanks to the **New Hampshire Bureau of Emergency Management** (www.nhBEM.state.nh.us), which provided the model and funding for this document.

In addition, thanks are extended to the staff of the Rockingham Planning Commission for professional services, process facilitation and preparation of this document.

CHAPTER II – COMMUNITY PROFILE

Hampton Falls is located in the Seacoast region of New Hampshire. It is a predominantly rural, coastal town, located within Rockingham County. The Town is connected to many major roads including State Routes 107, 84 and 88 and State Highway 1. Interstate 95 runs north-south through Hampton Falls, but does not have an exit. A land use map of the Town completed in 1998 by the University of New Hampshire (Map 1: Land Use), indicates that the Town is covered by 14% agricultural uses, 13.3% single family residences and approximately 65% undeveloped land area. This last number is deceiving due to the wet soil conditions underlying much of the forest and other open lands. The NH Soil Conservation Service indicates that 39% of Hampton Falls has hydric (or wetland) soils, and therefore undevelopable.

The Population of Hampton Falls was 1,880 according to the 2000 US Census, up from 1,503 in 1990. This represents a change of 377 residents, an increase of 25.1%. The average annual growth rate that this represents is 2.3% this is nearly twice that of the Rockingham County as a whole (1.2%), for the same time period. This high growth rate may be due to recent infill within the Town, because the growth rate between 1980 and 2000 is 1.6% for Hampton Falls and 1.9% for the County. The NH Office of Energy and Planning population projections for Hampton Falls show that the local population will grow to 2,121 by the year 2010 and 2,321 by the year 2020. The population density of Hampton Falls was 147.8 persons per square mile in 2000. This is up from 98.6 in 1970, but is still less than half the average for the County which is 386.5 persons per square mile.

NATURAL FEATURES

Hampton Falls is covered by diverse hydrologic features including many rivers, streams, creeks and brooks, as well as being affected by many tidal features. The Hampton River flows along the eastern boarder of Hampton Falls into Hampton and then into the Atlantic Ocean; this can be seen below in Figure 1. Several streams, brooks and rivers also run through or abut the Town including the Taylor River, Clay Brook, Grapevine Run, the Hampton Falls River, Swains Creek Ash Brook, and Kenny Brook. All of these waterways are tributaries of the Hampton River or flow directly into Hampton Harbor. Wetlands cover as much as 39% of Hampton Falls with a significant portion of these being tidal wetlands[1].

[1] Hampton Falls Master Plan

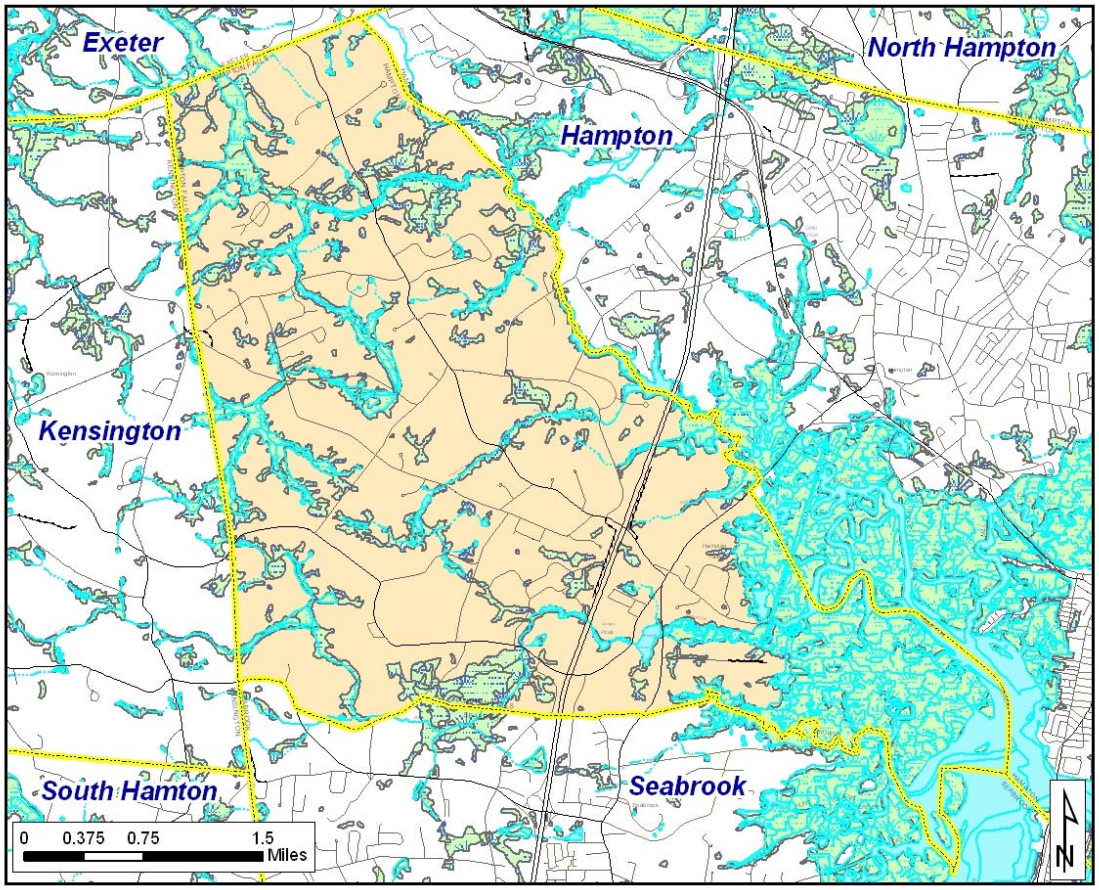

Figure 1: Location Map of Hampton Falls, New Hampshire

LAND USE AND DEVELOPMENT

A land use map was prepared for this *Plan* using data from GRANIT (The New Hampshire Geographically Referenced Analysis and Information Transfer System). The land use data was created for Rockingham County in 1998. The data was developed through interpretation of 1:12,000 scale black and white digital orthophoto quadangles from the United States Geologic Survey. For more information on this data layer please visit http://granit.sr.unh.edu. This data is presented in Map 1: Hampton Falls Land Use.

Future land use in Hampton Falls will be, in part, governed by the goals laid out in the Hampton Falls Master Plan. These goals include Maintaining the rural character of the Town, managing growth, promoting agricultural and forestry uses and preserving open space. A build-out analysis completed by the Rockingham Planning Commission in 1998 concluded that there were approximately 1,500 acres that were undeveloped in Town, and only 16 of these undeveloped acres were commercially zoned.

CHAPTER III – NATURAL HAZARDS IN THE TOWN OF HAMPTON FALLS

WHAT ARE THE HAZARDS?

The first step in planning for natural hazard mitigation is to identify hazards that may affect the Town. Some communities are more susceptible to certain hazards (i.e., flooding near rivers, hurricanes on the seacoast, etc.). The Town of Hampton Falls is prone to several types of natural hazards. These hazards include: flooding, hurricanes or other extreme weather events, severe winter weather, wildfires and earthquakes. Although the Town does not directly abut the Atlantic Ocean, Hampton Falls could still be affected by coastal storms and storm surge due to its relative proximity. Other natural hazards can and do affect the Town of Hampton Falls, but these were the hazards prioritized by the Committee for mitigation planning. These were the hazards that were considered to occur with regularity and/or were considered to have high damage potential, and are discussed below.

Natural hazards that are included in the State's 2000 Hazard Mitigation Plan that are not included in the *Plan* include: drought, extreme heat, landslide, subsidence, radon and avalanche. Subsidence and avalanche are rated by the State as having Low and No risk in Rockingham County, respectively; due to this they were left out of the *Plan*. Hampton Falls has no record of landslides and little chance of one occurring that could possibly damage property of cause injury; so landslides were not included in this *Plan*. The State's Plan indicates that Rockingham County is at Moderate risk to drought, extreme heat, and radon; these hazards were not included in the *Plan*. When compared to natural hazards that could be potentially devastating to the Town (earthquakes or hurricanes) or natural hazards that occur with regularity (flooding or severe winter weather) it was not considered an effective use of the Committee's time to include drought, extreme heat, and radon in the *Plan* at this time. When the *Plan* is revised and updated in the future, possible inclusion of these hazards will be reevaluated.

HAZARD DEFINITIONS

Flooding

Floods are defined as a temporary overflow of water onto lands that are not normally covered by water. Flooding results from the overflow of major rivers and tributaries, storm surges, and/ or inadequate local drainage. Floods can cause loss of life, property damage, crop/livestock damage, and water supply contamination. Floods can also disrupt travel routes on roads and bridges.

Inland floods are most likely to occur in the spring due to the increase in rainfall and melting of snow; however, floods can occur at any time of the year. A sudden thaw in the winter or a major downpour in the summer can cause flooding because there is suddenly a lot of water in one place with nowhere to go. Coastal flooding can be caused by storm surge associated with high wind events hurricanes or from tsunami.

100-year Floodplain Events

Floodplains are usually located in lowlands near rivers, and flood on a regular basis. The term 100 year flood does not mean that flood will occur once every 100 years. It is a statement of probability that scientists and engineers use to describe how one flood compares to others that are likely to occur. It is more accurate to use the phrase "1%

annual chance flood". What this means is that there is a 1% chance of a flood of that size happening in any year.

Rapid Snow Pack Melt
Warm temperatures and heavy rains cause rapid snowmelt. Quickly melting snow coupled with moderate to heavy rains are prime conditions for flooding.

River Ice Jams
Rising waters in early spring often breaks ice into chunks, which float downstream and often pile up, causing flooding. Small rivers and streams pose special flooding risks because they are easily blocked by jams. Ice collecting in river bends and against structures presents significant flooding threats to bridges, roads, and the surrounding lands.

Coastal Storm Surge
Storm Surge is most often associated with the landfall of a hurricane. Strong winds and low pressure combine to cause waves that can be 1 to 10 meters above normal[2]. Strong winds blowing toward shore cause the water to pile up at the shore, causing the storm surge. These affects are most intense on the right side of the hurricane eye where the winds are blowing on shore.

Tsunami
The National Tsunami Hazard mitigation Program (http://www.pmel.noaa.gov/tsunami-hazard/terms.html) defines a Tsunami as Japanese term derived from the characters "tsu" meaning harbor and "nami" meaning wave. It is generally accepted by the international scientific community to describe a series of traveling waves in water produced by the displacement of the sea floor associated with submarine earthquakes, volcanic eruptions, or landslides.

Hurricane – Extreme Weather Event
Significantly high winds occur especially during hurricanes, tornadoes, winter storms and thunderstorms. Falling objects and downed power lines are dangerous risks associated with high winds. In addition, property damage and downed trees are common during high wind occurrences.

Hurricanes
A hurricane is a tropical cyclone in which winds reach speeds of 74 miles per hour or more and blow in a large spiral around a relatively calm center (see Appendix C). The eye of the storm is usually 20-30 miles wide and may extend over 400 miles. High winds are a primary cause of hurricane-inflicted loss of life and property damage.

Tornadoes
A tornado is a violent windstorm characterized by a twisting, funnel shaped cloud. They develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. The atmospheric conditions required for the formation of a tornado include great thermal instability, high humidity and the convergence of warm, moist air at low levels with

[2] University of Illinois, World Weather 2010 Project http://ww2010.atmos.uiuc.edu/

cooler, drier air aloft. Most tornadoes remain suspended in the atmosphere, but if they touch down they become a force of destruction.

Tornadoes produce the most violent winds on earth, at speeds of 280 mph or more. In addition, tornadoes can travel at a forward speed of up to 70 mph. Damage paths can be in excess of one mile wide and 50 miles long. Violent winds and debris slamming into buildings cause the most structural damage.

The Fujita Scale is the standard scale for rating the severity of a tornado as measured by the damage it causes (see Appendix D). A tornado is usually accompanied by thunder, lightning, heavy rain, and a loud "freight train" noise. In comparison with a hurricane, a tornado covers a much smaller area but can be more violent and destructive.

Severe Thunderstorms
All thunderstorms contain lightning. During a lightning discharge, the sudden heating of the air causes it to expand rapidly. After the discharge, the air contracts quickly as it cools back to ambient temperatures. This rapid expansion and contraction of the air causes a shock wave that we hear as thunder, which can damage building walls and break glass.

Bow Echo
A Bow Echo is named for the bow-shaped radar echo that is associated with these multi-cell storms, also referred to as a squall line of thunder storms. Powerful mid-level winds are drawn downward by rain and or hail from a bow echo These strong storms can produce winds of up to 150 mph while the storms themselves travel at up too 80 mph[3].

Lightning
Lightning is a giant spark of electricity that occurs within the atmosphere or between the atmosphere and the ground. As lightning passes through air, it heats the air to a temperature of about 50,000 degrees Fahrenheit, considerably hotter than the surface of the sun. Lightning strikes can cause death, injury and property damage.

Hail
Hailstones are balls of ice that grow as they're held up by winds, known as updrafts, which blow upwards in thunderstorms. The updrafts carry droplets of supercooled water – water at a below freezing temperature – but not yet ice. The supercooled water droplets hit the balls of ice and freeze instantly, making the hailstones grow. The faster the updraft, the bigger the stones can grow. Most hailstones are smaller in diameter than a dime, but stones weighing more than a pound have been recorded. Details of how hailstones grow are complicated, but the results are irregular balls of ice that can be as large as baseballs, sometimes even bigger. While crops are the major victims, hail is also a hazard to vehicles and windows.

Severe Winter Weather
Ice and snow events typically occur during the winter months and can cause loss of life, property damage and tree damage.

[3] www.skywarn.ampr.org/radar2.htm

Heavy Snow Storms

A winter storm can range from moderate snow to blizzard conditions. Blizzard conditions are considered blinding, wind-driven snow over 35 mph that lasts several days. A severe winter storm deposits four or more inches of snow during a 12-hour period or six inches of snow during a 24-hour period.

Ice Storms

An ice storm involves rain, which freezes upon impact. Ice coating at least one-fourth inch in thickness is heavy enough to damage trees, overhead wires and similar objects. Ice storms often produce widespread power outages.

Nor'easter

A Nor'easter is large weather system traveling from South to North passing along or near the seacoast. As the storm approaches New England and its intensity becomes increasingly apparent, the resulting counterclockwise cyclonic winds impact the coast and inland areas form a Northeasterly direction. The sustained winds may meet or exceed hurricane force, with larger bursts, and may exceed hurricane events by many hours (or days) in terms of duration[4].

Wildfire

Wildfire is defined as an uncontrolled and rapidly spreading fire.

Forest Fires and Grass Fires

A forest fire is an uncontrolled fire in a woody area. They often occur during drought and when woody debris on the forest floor is readily available to fuel the fire. Grass fires are uncontrolled fires in grassy areas.

Earthquakes

Geologic events are often associated with California, but New England is considered a moderate risk earthquake zone. An earthquake is a rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines, and often cause landslides, flash floods, fires, and avalanches. Larger earthquakes usually begin with slight tremors but rapidly take the form of one or more violent shocks, and end in vibrations of gradually diminishing force called aftershocks. The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. The magnitude and intensity of an earthquake is determined by the use of scales such as the Richter scale[5] and Mercalli scale.

PROFILE OF PAST AND POTENTIAL HAZARDS

As discussed above the natural hazards that were identified for mitigation in this *Plan* include: flooding, hurricanes-extreme weather events, severe winter weather, wildfire and earthquakes. Some of the natural hazards could be included under more than one type of hazard. For example

[4] Definition of Nor'easter taken from NH State Natural Hazards Mitigation Plan October 2000 Edition.
[5] A copy of the Richter scale is displayed in Appendix E.

a hurricane could be considered a high wind event or a flooding event depending on the storm's consequences.

The hazard profiles below include: a description of the events included as part of the natural hazard, the geographic location of each natural hazard (if applicable), the extent of the natural hazard (e.g. magnitude or severity), probability, past occurrences, and community vulnerability. Past occurrences of natural hazards were mapped if possible (Map 2: Past and Future Hazards). Some of the natural hazards have not occurred within the Town of Hampton Falls (within written memory), for these hazards the plan refers to a table of hazards that have occurred regionally and statewide (Table 3). Community vulnerability identifies the specific areas, general type of structures, specific structures, or general vulnerability of the Town of Hampton Falls to each natural hazard.

Flooding

Description: Flooding events can include hurricanes, 100-year floods, 500-year floods, debris-impacted infrastructure, erosion, mudslides, rapid snow pack melt, river ice jams, dam breach and/or failure, coastal storm surge, and tsunami.

Location: Hampton Falls is vulnerable to flooding in several locations. Generally, the Town is at risk within the Flood Zones identified by FEMA on the Digital Flood Insurance Rate Maps (DFIRM). Hampton Falls has three major flood zones: AE, A and X. The AE flood zones are areas that have a 1% annual chance of flooding and have a base flood height determined. A zones also have a 1% annual chance of flooding but have no base flood height determined. X zones have an 0.2% annual chance of flooding. In Hampton Falls the AE zones are located on the ocean side of Town where the land is tidally influenced. The base flood height in these areas is 9 feet. As you move inland flood zones transition from AE zones to A zones and then to X zones. The flood zones are depicted on the DFIRM's numbering 0408, 0410, 0420, 0436-0439, all from Rockingham County.

There are also several locally-identified areas susceptible to flooding that may or may not lie within these flood zones, these areas are described below and displayed on Map 2: Past and Future Hazards.

Extent: The extent of the Special Flood Hazard Zone can be seen in Map 2: Past and Future Hazards. This map also includes areas of locally chronic flood problems.

Probability: **HIGH**

Table 1: Probability of Flooding based on return interval

Flood Return Interval	Chance of Occurrence in Any Given Year
10-year	10%
50-year	2%
100-year	1%
500-year	0.2%

Past Occurrence: Flooding is a common hazard for the Town of Hampton Falls. Several locations were identified as areas of chronic reoccurring flooding or high potential for future flooding. These areas are listed below. Larger flood events are listed in Table3.

Community Vulnerability:

- Structures located in the flood zone
- Culverts
- Basements
- Erodable soils
- Locally-identified flood areas (Map 2: Past and Future Hazards)

Hurricane – Extreme Weather Event

Description: High wind events can include hurricanes, tornadoes, "Nor'-Easters," downbursts or bow echoes, and lightning/thunderstorm events.

Location: Hurricane events are more potentially damaging with increasing proximity to the coast. For this *Plan*, high-wind events were considered to have an equal chance of affecting any part of the Town of Hampton Falls.

Extent: Hampton Falls is located within a Zone II hurricane-susceptible region (indicating a design wind speed of 160 mph)[6]. Between 1900 and 1996 2 hurricanes have made landfall in New Hampshire, a category 1 and a category 2. In Maine, 5 hurricanes have made landfall (all category 1). In Massachusetts, 6 hurricanes have made landfall (2 category 1, 2 category 2 and 2 category 3). From this information it can be extrapolated that Hampton Falls is a high risk to a hurricane event, with variable wind speeds between 74 – 130 mph (category 1-3).

From 1950 to 1995 Rockingham County was subject to 9 recorded tornado events, these included 2 type F0 (Gale Tornado, 40-72 mph), 2 type F1 (Moderate Tornado, 73-112 mph), 4 type F2 (Significant Tornado, 113-157 mph) and 1 type F3 (Severe Tornado, 158-206 mph)[7]. Type 3 tornados can cause severe damage including tearing the roofs and walls from well-constructed homes, trees can be uprooted, trains over-turned, and cars lifted off the ground and thrown[8].

On August 20th, 2004, a Bow Echo traveled across Hampton Falls from west to east, causing damage to the Wakeda Camp Ground and several houses. One death resulted from this event. There is also evidence of damage in small areas of Town from microbursts.

Probability: **HIGH**. The State of New Hampshire's Natural Hazards Mitigation Plan rates Rockingham County with high likelihood of hurricane, tornado and "Nor'-Easters" events. Also, it rates the risk of downbursts, lightning and hail events as moderate.

Past Occurrence: Between 1635 and 1991, 10 hurricanes have impacted the State of New Hampshire. The worst of these occurred on September 21, 1938, with wind speeds of up to 186 mph in MA and 138mph elsewhere. Thirteen of 494 people killed by this storm

[6] "Understanding Your Risks, Identifying Hazards and Estimating Losses", FEMA, page
[7] The tornado project .com
[8] "Understanding Your Risks, Identifying Hazards and Estimating Losses", FEMA, page

were residents of New Hampshire. The Storm caused $12,337,643 in damages (1938 dollars), timber not included.

Rockingham County tornado history is as follows: Category F0 tornados occurred on Oct. 03, 1970 and June 09, 1978. Category F1 tornados occurred on July 31, 1954 and July 26, 1966. Category F2 tornados occurred on Aug. 21, 1951, June 19, 1957, July 02, 1961 and June 09, 1963. The category F3 tornado occurred on June 09, 1953.

In august of 2004 Hampton Falls was struck by a Bow Echo. This severe wind event damaged the Wakeda campground, toppling or breaking many trees and injuring 10 people; one of whom later died.

Community Vulnerability:

- Power lines,
- Shingled roofs,
- Chimneys, and
- Trees

Severe Winter Weather

Description: There are three types of winter events**:** blizzards, ice storms and extreme cold. All of these events are a threat to the community with subzero temperatures from extreme wind chill and storms causing low visibility for commuters. Snow storms have been known to collapse buildings. Ice storms disrupt power and communication services. Extreme cold affects the elderly.

Location: Severe winter weather events have and equal chance of affecting any part of the Town of Hampton Falls.

Extent: Large snow events in Southeastern New Hampshire can produce 30 inches of snow, or more. Portions of central New Hampshire recorded snowfalls of 98" during one slow moving storm in February of 1969. Ice storms occur with regularity in New England. Seven severe ice storms have been recorded that affected New Hampshire since 1929. These events caused disruption of transportation, loss of power and millions of dollars in damage.

Probability: **HIGH**. The State of New Hampshire's Natural Hazards Mitigation Plan rates Rockingham County with high likelihood of heavy snows and ice storms.

Past Occurrence: A list of past winter storm events is displayed below, in Table 3.

Community Vulnerability:

- Power lines
- Trees
- Elderly Populations

Wildfire

Description: Wildfires include grass fires and forest fires.

Location: The Committee identified wooded areas of Town as at-risk to wildfires (see Map 2: Past and Future Hazards).

Extent: A wildfire in the Town of Hampton Falls is unlikely, but if a crown fire were to occur it could be very damaging to structures abutting large wooded areas of Town.

Probability: **MODERATE**. The State of New Hampshire's Natural Hazards Mitigation Plan rates Rockingham County with moderate risk to wildfires.

Past Occurrence: No large fires have affected Hampton Falls within recent memory.

Community Vulnerability:

- Structures located near large open vegetated areas prone to lightning strike
- Vulnerability increases during drought events

Earthquake

Description: Seismic activity including landslides and other geologic hazards.

Location: An earthquake has an equal chance of affecting all areas in the Town of Hampton Falls.

Extent: New England is particularly vulnerable to the injury of its inhabitants and structural damage because of our built environment. Few New England States currently include seismic design in their building codes. Massachusetts introduced earthquake design requirements into their building code in 1975 and Connecticut very recently did so. However, these specifications are for new buildings, or very significantly modified existing buildings only. Existing buildings, bridges, water supply lines, electrical power lines and facilities, etc. have rarely been designed for earthquake forces (New Hampshire has no such code specifications).

Probability: **MODERATE**. The State of New Hampshire's Natural Hazard Mitigation Plan ranks all of the Counties in the State with at moderate risk to earthquakes. The Town of Hampton Falls's Peak Ground Acceleration (PGA) values range between 6.1 and 21.0[9]. These numbers are associated with how much an earthquake is felt and how much damage it may cause (Table 2).

Table 2: Peak Ground acceleration (PGA) values for Hampton Falls (information from State and Local Mitigation Planning, FEMA).

PGA	Chance of being exceeded in the next 50 years	Perceived Shaking	Potential Damage
6.1	10%	Moderate	Very Light
10.6	5%	Strong	Light
21.0	2%	Very Strong	Moderate

[9] http://geohazards.cr.usgs.gov/eq/pubmaps/us.pga.050.map.gif

Past Occurrence: Large earthquakes have not affected the Town of Hampton Falls within recent memory. A list of earthquakes that have affected the region is displayed in Table 3.

Community Vulnerability:

- Dams,
- Bridges,
- Brick Structures,
- Infrastructure,
- Water and Gas lines, and
- Secondary hazards such as fire, power outages, or hazardous material leak or spill.

Coastal Storm

Description: The State's Atlantic seacoast and estuaries are vulnerable to extremes of storm water runoff and storm surge from coastal storms and hurricanes. A storm surge, especially when coupled with astronomical high tides, presents a threat to all land areas adjacent to the marine environment.

Location: The potential size of a storm surge is variable and sources also differ on the potential maximum size of a storm surge in the area of Hampton Falls, NH. NOAA's website states a Storm Surge could affect an area up to 15 feet above the normal tide level[10]. A University of Illinois website states that a storm surge could be as high as 25 feet[11]. These events are extreme, and very unlikely. The data that was used in this *Plan* to identify the location and extent of possible storm surge comes from a study by the Army Corps of Engineers in conjunction with the National Hurricane Center. This study mapped the maximum storm surge inundation associated with category 1 through 4 hurricanes. More extensive Storm surge could occur if associated with a Tsunami, but this event is unlikely and difficult to determine the possible level of inundation.

Extent: Coastal storms could affect much of Hampton Falls, due to the Town's low elevation. Assuming that the Town is vulnerable to category 4 hurricanes, the potential storm surge related to such a wind event could reach several feet above normal sea level[12]. The Inundations zones for the 4 categories of hurricane are shown on Map 2: Past and Future Hazards.

Probability: **HIGH**. The State of New Hampshire's Natural Hazards Mitigation Plan rates Rockingham County with high likelihood of storm surge and hurricane events. The probability of this maximum storm surge event is **Very Low**. Figure 2 below show the chance of a "named storm" affecting the areas as a percentage per year. From this map it can be interpolated that New Hampshire has between 18% and 24% of being affected by a named storm each year.

[10] http://hurricanes.noaa.gov/prepare/surge.htm
[11] http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/hurr/damg/surg.rxml
[12] "Understanding Your Risks, Identifying Hazards and Estimating Losses", FEMA, page

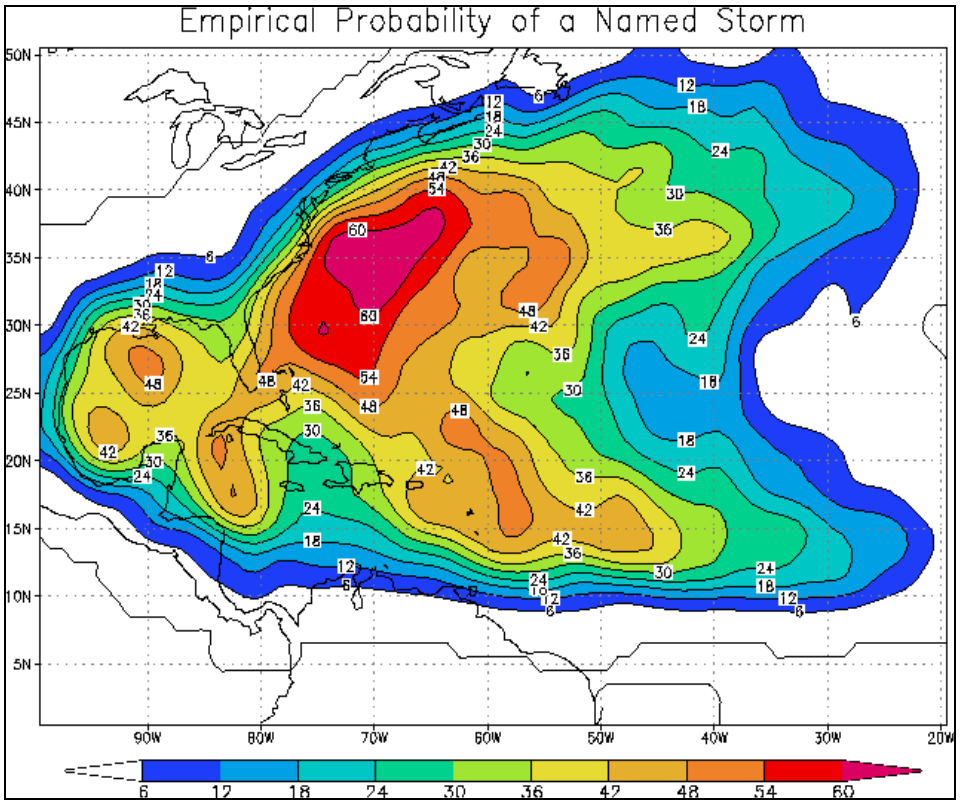

Figure 2: Coastal Storm Probability, per year. Source NOAA www.aoml.noaa.gov/hrd/tcfaq/tcfaqG.htm1#G12

Past Occurrence: A list of hurricanes and Nor'easters that have affected the region are displayed below in Table 3.

Community Vulnerability: The Inundation zones shown on Map 2: Past and Future Hazards, indicate that most of the flooding damage would occur in the parcels and roadways nearest the salt marsh. This area is generally uninhabited, but a few home, businesses, and roads could be affected. The roads include: Route 1 (in two sections), Depot Road, Brimmer Lane and Marsh Lane. Other areas that could be affected are listed below:

- Shoreline or salt marsh erosion
- Utilities near the shoreline
- Other flooding damage inland, associated with the hurricanes rainfall

Table 3: Past Hazard Events in Hampton Falls and Rockingham County

Hazard	Date	Location	Critical Facility or Area Impacted	Remarks/Description
Flood	March 11-21, 1936	Statewide	$133,000,000 in damage throughout New England, 77,000 homeless.	Double Flood; snowmelt/heavy rain.
Flood	September 21, 1938	Statewide	Unknown	Hurricane; stream stage similar to March 1936
Flood	July 1986 – August 10, 1986	Statewide	Unknown	**FEMA DR-771-NH**: Severe storms; heavy rain, tornadoes , flash flood, severe wind
Flood	August 7-11 1990	Statewide	Road Network	**FEMA DR-876-NH**: A series of storms with moderate to heavy rains; widespread flooding.
Flood	August 19, 1991	Statewide, Primarily Rockingham and Strafford Counties	Road Network	**FEMA DR-917-NH:** Hurricane Bob; effects felt statewide; counties to east hardest hit.
Flood	October 28, 1996	Rockingham County	Unknown - Typically structures and infrastructure in the floodplain	North and west regions; severe storms.
Flood	June – July 1998	Rockingham County	Heavy damage to secondary roads occurred	**FEMA DR-1231-NH:** A series of rainfall events
Hurricane	October 18,19 1778	Portions of State	Unknown	40-75 mph winds
Hurricane	1804	Portions of State	Unknown	
Hurricane	September 8, 1869	Portions of State	Unknown	> 50 mph winds
Great Hurricane Of 1938	September 21, 1938	All of Southern New England	2 billion board feet of timber destroyed; electric and telephone disrupted, structures damaged, flooding; statewide 1,363 families received assistance.	Max. wind speed of 186 mph in MA and 138mph max. elsewhere 13 of 494 dead in NH; $12,337,643 total storm losses (1938 dollars), timber not included.
Hurricane Carol	August 31, 1954	Southern New England	Extensive tree and crop damage in state.	SAFFIR/SIMPSON HURRICANE SCALE[13] - Category 3, winds 111-130 mph
Hurricane Donna	September 12, 1960	Southern and Central NH	Unknown	Category 3 Heavy Flooding
Hurricane Belle	August 10, 1976	Southern New England	Unknown	Category 1, winds 74-95 mph Rain and flooding in NH

[13] For a complete description of the Saffir/Simpson Hurricane Scale see Appendix C.

Hazard	Date	Location	Critical Facility or Area Impacted	Remarks/Description
Hurricane Gloria	September 27, 1985	Southern New England	Unknown	Category 2, winds 96-110 mph >70 mph winds; minor wind damage and
Tropical Storm Floyd	September 16-18 1999	Statewide	Unknown	
Ice Jam	Feb 29, 2000	Brentwood, NH Exeter River	Unknown	Discharge 570 cfs
Ice Jam	Mar 29, 1993	Epping, NH Lamprey River	Road flooding	
Tornado	May 21, 1814	Rockingham County	Unknown	F2[14]
Tornado	May 16, 1890	Rockingham County	Unknown	F2
Tornado	August 21, 1951	Rockingham County	Unknown	F2
Tornado	June 9, 1953	Rockingham County	Unknown	F3
Tornado	June 19, 1957	Rockingham County	Unknown	F2
Tornado	July 2, 1961	Rockingham County	Unknown	F2
Tornado	June 9, 1963	Rockingham County	Unknown	F2
Downburst	July 6, 1999	Stratham, NH	Five fatalities and eleven injuries. Major tree damage, power outages	Microburst $2,498,974 in damages
Bow Echo	August 20, 2004	Hampton Falls, NH	Town Campground, several houses	10 people injured, 1 death; several mature trees were toppled or sheared off.
Ice Storm	December 17-20 1929	NH	Telephone, telegraph and power disrupted.	
Ice Storm	December 29-30 1942	NH	Unknown- Typically damage to overhead wires and trees.	Glaze storm; severe intensity
Ice Storm	December 22 1969	Parts of NH	Power disruption	Many communities affected
Ice Storm	January 17, 1970	Parts of NH	Power disruption	Many communities affected

[14] For a complete description of the Fujita Tornado Damage Scale see Appendix D

Hazard	Date	Location	Critical Facility or Area Impacted	Remarks/Description
Ice Storm	January 8-25 1979	NH	Major disruption of Power and transportation	
Ice Storm	March 3-6 1991	Southern NH	Numerous power outages in southern NH	Numerous in Southern NH
Ice Storm	January 7, 1998	Rockingham County	Power and phone disrupted, communication tower collapsed.	$17,000,000 in damages to PSNH equipment.
Snowstorm	February 4-7 1920	New England	Disrupt transportation for weeks	Boston 37-50cm of sleet , ice and snow
Snowstorm	February 15, 1940	New England	Paralyzed New England	30cm of snow with high wind.
Snowstorm	February 14-17 1958	Southern NH	Unknown	20-33" of snow
Snowstorm	March 18-21 1958	South central NH	Unknown	22-24"of snow
Snowstorm	March 2-5 1950	Southern NH	Unknown	25"of snow
Snowstorm	January 18-20 1961	Southern NH	Unknown	Blizzard Conditions; 50cm of snow
Snowstorm	February 8-10 1969	Southeastern NH	Paralyzing snow	27"of snow and high winds
Snowstorm	February 22-28 1969	Central NH	Unknown	34-98"of snow; very slow moving
Snowstorm "Blizzard of'78"	February 5-7 1978	Statewide	Trapped commuters on highways, businesses closed	Hurricane force winds; 25-33"of snow. People disregard warnings due to a series of missed forecasts
Snowstorm	April 5-7 1982	Southern NH	Unknown	Late season with thunderstorms and 18-22" of snow
Earthquake	November 18, 1929	Grand Banks Newfoundland	No damage	Richter Magnitude Scale: 7.2[15]
Earthquake	December 20, 1940	Ossipee	Ground Cracks and damage over a broad area	Richter Magnitude Scale: 5.5; Felt over 341 miles away.
Earthquake	December 24, 1940	Ossipee	Ground Cracks and damage over a broad area	Richter Magnitude Scale: 5.5; Felt over 550 KM away.
Earthquake	June 15, 1973	Quebec/NH border	Minor damage	Richter Magnitude Scale: 4.8
Earthquake	June 19, 1982	West of Laconia	Little damage	Richter Magnitude Scale: 4.5
Drought	1929-36	Statewide	Unknown	Regional
Drought	1939-44	Statewide	Unknown	Severe in southeast NH
Drought	1947-50	Statewide	Unknown	Moderate

[15] For a complete description of the Richter Magnitude Scale see Appendix E.

Hazard	Date	Location	Critical Facility or Area Impacted	Remarks/Description
Drought	1960-69	Statewide	Unknown	Longest recorded continuous period of below normal precipitation
Drought Warning	June 6, 1999	Most of State	Unknown	Governors office declaration; Palmer Drought Survey Index indicate "moderate drought" for most of state.

CHAPTER IV – CRITICAL FACILITIES

The Critical Facilities List for the Town has been identified by Hampton Falls' Hazard Mitigation Committee. The Critical Facilities List has been broken up into four categories. The *first category* contains facilities needed for Emergency Response in the event of a disaster. The *second category* contains Non-Emergency Response Facilities that have been identified by the committee as non-essential. These are not required in an emergency response event, but are considered essential for the everyday operation of Hampton Falls. The *third category* contains Facilities/Populations that the committee wishes to protect in the event of a disaster. The *fourth category* contains Potential Resources, which can provide services or supplies in the event of a disaster. Map 3: Critical Facilities at the end of this Chapter identifies the location of the facilities and the evacuation routes. A detailed description of critical facilities can be found in Table 4.

Table 4: Category 1 - Emergency Response Services and Facilities:

Critical Facility	Facility Type	Comments
Police/Fire Safety Complex		Fire and Police Station, EOC, has back-up power
Town Hall	Municipal	
Road Agent Equipment Storage		
"Brush Dump"		Materials Storage
I-95 over Taylor River	Bridge	Evacuation Route
NH 88 over I-95	Bridge	Evacuation Route
NH 84 over Hampton Falls River	Bridge	Evacuation Route
NH 84 over I-95	Bridge	Evacuation Route
Northbound access to I-95	Road	Emergency Access to Evacuation Route (needs to be mapped)
3 Emergency Speakers (Seabrook Station) Town can access if needed		Connected to Seabrook Nuclear Power Station. (Not Mapped)

Table 4: Category 2 - Non Emergency Response Facilities:

The Town has identified these facilities as non-emergency facilities; however, they are considered essential for the everyday operation of Hampton Falls.

Critical Facility	Facility Type	Comments
Library	Municipal	
Lincoln Akerman School	School	
Post Office	Municipal	
Cell Tower		
Historical Society		
Unitarian Church	Religious Facility	
Baptist Church	Religious Facility	
Power Sub-Station (Unitel)		
Gas Station (Citgo)		
Applecrest Farm	Commercial Farm	

Critical Facility	Facility Type	Comments
Towle Farm Rd, over Taylor River	Bridge	
Old Stage Rd. over Taylor River	Bridge	Currently blocked by barriers
Dam; Route 1, Hampton Falls River	Dam	Could use gates to stop Flooding; Could Affect Evacuation Route
Dam; I-95 at Hampton Falls River	Dam	Could Affect Evacuation Route
Dam; Kensington Road #1, Hampton Falls River	Dam	Could Affect Evacuation Route
Dam; Kensington Road #2, Hampton Falls River	Dam	Could Affect Evacuation Route
Dam; Old Stage Road, Taylor River	Dam	

Table 4: Category 3 - Facilities/Populations to Protect:
The third category contains people and facilities that need to be protected in event of a disaster.

Critical Facility	Facility Type	Comments
Lincoln Akerman School	School/Kindergarten/Daycare	
Robins Child's Place	Daycare	
Hampton Falls Child Care	Daycare	
Wakeda Campground	Outdoor Recreation	
Proposed Elderly Housing	Elderly Housing	Plan is approved by the Planning Board,12-unit project will likely be completed.
Hampton Falls Motor Inn	Motel	

Table 4: Category 4 - Potential Resources:
This category contains facilities that provide potential resources for services or supplies in the event of a natural disaster.

Critical Facility	Facility Type	Comments
Lincoln Akerman School	School/ Shelter	Approved Shelter, no back-up power
Hampton Falls Motor Inn	Motel	Potential Shelter and source of bedding
Function Hall		Potential Shelter, no back-up power
Town Hall	Municipal	

CHAPTER V – POTENTIAL HAZARD DAMAGE

IDENTIFYING VULNERABLE FACILITIES

It is important to determine what the most vulnerable areas of the Town of Hampton Falls are and to estimate their potential loss. The first step is to identify the areas most likely to be damaged in a hazard event. To do this, the locations of buildings and other structures were compared to the location of potential hazard areas identified by the Hazard Mitigation Committee using GIS (Geographic Information Systems). Vulnerable buildings were identified by comparing their location to possible hazard events. For example, all of the structures within the 100-year floodplain were identified and used in conducting the potential loss analysis for flooding.

CALCULATING THE POTENTIAL LOSS

The next step in completing the loss estimation involved assessing the level of damage from a hazard event as a percentage of the buildings' assessed value. The assessed value for every parcel in Hampton Falls was provided for the purpose of calculating damage estimates. The damage estimates are divided into two categories based on hazard types: hazards that are location specific (e.g. flooding), and hazards that could affect all areas of Hampton Falls equally. Damage estimates from hazards that could affect all of Hampton Falls equally are much rougher estimates, based on percentages of the total assessed value of structures and utilities in Hampton Falls. Damage estimates from hazard with a specific location are derived from the assessed values of each parcel that had its center in the hazard area in question. Hampton Falls's Parcel database (with assessor's data) was queried using the GIS to determine the assessed value of all of the parcels within a hazard area.

After identifying the parcels and buildings that are at risk, the next step was to calculate a damage estimate for each potential hazard area. FEMA provides a model for estimating damage for various flooding events, so the flood damage estimates provide information including: damage estimates for structures, contents of buildings, functional downtime and replacement time. For wildfire and urban conflagration, damage estimates were determined for the buildings in the potential hazard areas as well as estimates of the building content value, based on the same estimates from the flood model. The following discussion summarizes the potential loss estimates due to natural hazard events.

Flooding

Flooding is often associated with hurricanes, rapid snow melt in the spring and heavy rains.

The average replacement value was calculated by adding up the assessed values of all structures in the 100 year floodplains. These structures were identified by overlaying digital versions of FEMA's FIRM maps on digital aerial photography of the town of Hampton Falls. Because of the scale and resolution of the FIRM maps and imagery this is only an approximation of the total structures located within the 100-year floodplain (A-zone and AE-zone). The Federal Emergency Management Agency (FEMA) has developed a process to calculate potential loss for structures during flood. The potential loss for residential and non-residential structures was calculated separately. The value of residential structures was determined by dividing the number of

residential unit in the Town by the total assessed value of the residences (2004 Hampton Falls Town Report). Structures identified in the Residential/ Agricultural Zone was assumed to be residencies. The value of structures in the Business District was determined by dividing the total assessed value of commercial and industrial structures in Hampton Falls by the number of parcels in that District that had structures. The average assed value of a residential structure was $ 227,611, the average value for a commercial/ industrial structure was $215,169.

The costs for repairing or replacing bridges, railroads, power lines, telephone lines, and contents of structures are not included in this estimate. In addition, the figures used were based on buildings which are one or two stories high with basements. The percentage of structural damage and contents damage that could be expected for each flood depth is shown in Table 5, along with estimates of functional downtime (how long a business/residence would be down before relocating) and displacement time (how long a business/residence would be displaced from its flooded location).

The following calculation is based on **eight-foot flooding** and assumes that, on average, one or two story buildings with basements receive 49% damage (Understanding Your Risks, Identifying Hazards and Estimating Losses, FEMA page 4-13):

Potential Structure Damage: 49%
Approximately 2 structures in the AE Zone assessed at $455,222 = $223,058 potential damage
Approximately 9 structures in the A Zone assessed at $2,048,499 = $1,003,765 potential damage

The following calculation is based on **four-foot flooding** and assumes that, on average, one or two story buildings with basements receive 28% damage:

Potential Structure Damage: 28%
Approximately 2 structures in the AE Zone assessed at $455,222 = $127,462 potential damage
Approximately 9 structures in the A Zone assessed at $2,048,499 = $573,579 potential damage

The following calculation is based on **two-foot flooding** and assumes that, on average, one or two story buildings with basements receive 20% damage (Understanding Your Risks, Identifying Hazards and Estimating Losses, FEMA page 4-13):

Potential Structure Damage: 20%
Approximately 2 structures in the AE Zone assessed at $455,222 = $91,044 potential damage
Approximately 9 structures in the A Zone assessed at $2,048,499 = $409,700 potential damage

Table 5: Percentages of structural and content damage, based on the assessed value of a flooded parcel. Also shows the functional downtime and displacement time for each flood event.

Flood Depth	One-foot	Two-foot	Four-foot
% Structural Damage: Buildings	15%	20%	28%
% Structural Damage: Mobile Homes	44%	63%	78%
% Contents Damage: Buildings	22.5%	30%	42%
% Contents Damage: Mobile Homes	30%	90%	90%
Flood Functional Downtime: Buildings	15 days	20 days	28 days
Flood Functional Downtime: Mobile Homes	30 days	30 days	30 days
Flood Displacement Time: Buildings	70 days	110 days	174 days
Flood Displacement Time: Mobile Homes	302 days	365 days	365 days

~Dam Breach and Failure

Dam breach and failure could impact Hampton Falls through flooding. Potential losses will depend on the extent of the breach and would mostly affect Roadway infrastructure.

~Storm Surge

Storm Surge could affect approximately31 structures, 16 commercial/industrial (Assessed value $ 3,442,704) and 15 residential (assessed Value $3,414,165). Using the same flood damage assumptions as above in the ***Flooding*** section for this type of the flooding, the damage estimates would be as follows:

Residential Zone
8-foot flood (49% damage to structures) = $1,672,941 potential damage
4-foot flood (28% damage to structures) = $955,966 potential damage
2-foot flood (20% damage to structures) = $682,833 potential damage

Business Zone
8-foot flood (49% damage to structures) = $1,686,925 potential damage
4-foot flood (28% damage to structures) = $963,957 potential damage
2-foot flood (20% damage to structures) = $688,541 potential damage

Hurricane/ High Wind Events

~Hurricane

Hurricanes do affect the Northeast coast periodically. Since 1900, 2 hurricanes have made landfall in the State of New Hampshire. Due to the coastal location of the Town of Hampton Falls, hurricanes and storm surges present a real hazard to the community. Even degraded hurricanes or tropical storms could still cause significant damage to the structures and infrastructure of the Town of Hampton Falls. The assessed value of all residential and commercial structures in the Town of Hampton Falls, including exempt structures such as schools and churches, and utilities is $189,198,700 (Assuming 1% to 5% damage, a hurricane could result in $1,891,987 to $9,459,935 of structure damage.

~Tornado

Tornadoes are relatively uncommon natural hazards in New Hampshire. On average, about six touch down each year. Damage largely depends on where the tornado strikes. If is strikes an inhabited area, the impact could be severe. The assessed value of all residential and commercial structures in the Town of Hampton Falls including exempt structures such as schools and churches, and utilities is $189,198,700 (Assuming 1% to 5% damage, a Tornado could result in $1,891,987 to $9,459,935 of structure damage.

~Severe Lightning

The amount of damage caused by lightning will vary according to the type of structure hit and the type of contents inside. There is no record of monetary damages inflicted in the Town of Hampton Falls from lightning strikes.

Severe Winter Weather

~Heavy Snowstorms

Heavy snowstorms typically occur during January and February. New England usually experiences at least one or two heavy snow storms with varying degrees of severity each year. Power outages, extreme cold and impacts to infrastructure are all effects of winter storms that have been felt in Hampton Falls in the past. All of these impacts are a risk to the community, including isolation, especially of the elderly, and increased traffic accidents. Damage caused as a result of this type of hazard varies according to wind velocity, snow accumulation and duration. Heavy Snowstorms in Hampton Falls could be expected to cause damage ranging from a few thousand dollars to several million, depending on the severity of the storm.

~Ice Storms

Ice storms often cause widespread power outages by downing power lines, making power lines at risk in Hampton Falls. They can also cause severe damage to trees. In 1998, an ice storm inflicted $12,466,202 worth of damage to New Hampshire as a whole. Ice storms in Hampton Falls could be expected to cause damage ranging from a few thousand dollars to several million, depending on the severity of the storm.

Wildfire

Wildfires have not damaged homes in Hampton Falls in recent memory. Due to the ability and coordination of the emergency response services in Hampton Falls and the surrounding Towns, a catastrophic wildfire is highly unlikely. In an extreme drought year the potential would increase

for a severe fire that could damage homes. If a fire were to occur in a drought year it would still be rapidly contained but still has the potential to destroy a number of homes. Single family homes of wood-frame construction would be at the highest risk. Damage estimates would be the number of homes destroyed multiplied by the average assessed value, of the residential structures which is $227,611.

Earthquakes

Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines and are often associated with landslides and flash floods. Four earthquakes in New Hampshire between 1924-1989 had a magnitude of 4.2 or more. Two of these occurred in Ossipee, one west of Laconia, and one near the Quebec border. If an earthquake were to impact the Town of Hampton Falls, underground lines would be susceptible. In addition, buildings that are not built to a high seismic design level would be susceptible to structural damage. The assessed value of all residential and commercial structures in Hampton Falls, including exempt structures such as schools and churches, and utilities is $189,198,700 Based on Table 9 below, an earthquake could cause a range of damage depending on the construction and materials used to build the structures. Making the assumption that all of the structures in Hampton Falls are single family homes built Pre-code, and wood frame construction, an earthquake could result in $756,795 of damage for a 0.07 PGA earthquake to $6,243,557 of damage for a 0.20 PGA earthquake.

Table 6: Earthquake Damage and Loss of Function Table. Building Damage and Functional Loss are based on the type of Structure and the PGA (g). Two PGA (Peak Ground Acceleration) were chosen for this Table, 0.07 and 0.20 which represent a low and high example of potential earthquake in Hampton Falls, NH.

		Wood Frame Construction				**Reinforced Masonry**				**Unreinforced Masonry**	
PGA (g)		High	Mod.	Low	Precode	High	Mod.	Low	Precode	Low	Precode
0.07	**Single Family**	**0.1**	**0.2**	**0.3**	**0.4**	**0.1**	**0.2**	**0.4**	**0.5**	**0.6**	**1.0**
0.20		**1.3**	**1.7**	**2.8**	**3.3**	**1.3**	**2.5**	**6.1**	**9.0**	**6.5**	**9.4**
0.07		0	0	1	1	0	1	2	7	6	12
0.20		2	3	9	15	4	16	58	106	64	114
0.07	**Apartment**	**0.1**	**0.2**	**0.3**	**0.3**	**0.1**	**0.2**	**0.4**	**0.5**	**0.6**	**0.8**
0.20		**1.5**	**1.9**	**3.0**	**3.2**	**1.5**	**2.6**	**5.4**	**6.9**	**5.5**	**7.5**
0.07		0	0	1	1	0	1	2	8	7	13
0.20		2	3	10	16	4	19	72	129	76	147
		Steel Frame (Braced)				**Reinforced Masonry**				**Unreinforced Masonry**	
		High	Mod.	Low	Precode	High	Mod.	Low	Precode	Low	Precode
0.7	**Retail Trade**	**0.2**	**0.3**	**0.4**	**0.5**	**0.1**	**0.2**	**0.4**	**0.6**	**0.7**	**1.0**
0.20		**2.4**	**2.8**	**3.8**	**5.6**	**1.5**	**2.7**	**5.9**	**8.3**	**6.1**	**8.7**
0.07		0	0	0	0	0	0	0	1	1	2
0.20		2	3	6	12	1	3	12	22	14	24
		Pre-Cast Concrete Tilt-up				**Light Metal Building**					
		High	Mod.	Low	Precode	High	Mod.	Low	Precode		
0.07	**Wholesale Trade**	**0.2**	**0.4**	**0.5**	**0.6**	**0.4**	**0.7**	**1.0**	**1.6**		
0.20		**2.6**	**4.1**	**8.3**	**10.8**	**3.8**	**5.4**	**10.3**	**14.8**		
0.07		0	1	1	2	1	2	3	6		
0.20		4	8	22	36	6	13	28	43		
0.07	**Office Building**	**0.2**	**0.3**	**0.4**	**0.6**	**0.2**	**0.3**	**0.4**	**0.5**		
0.20		**2.0**	**2.9**	**5.6**	**8.1**	**2.5**	**2.9**	**3.7**	**5.2**		
0.07		0	0	0	1	0	0	0	1		
0.20		1	3	11	21	2	3	5	11		
		Pre-cast Concrete Tilt-up									
		High	Mod.	Low	Precode						
0.07	**Light Industrial**	**0.1**	**0.4**	**0.4**	**0.5**						
0.20		**2.6**	**3.9**	**6.0**	**7.4**						
0.07		0	1	1	2						
0.20		4	7	21	34						

2.0	Building Damage = % of damage based on value
2	Loss of Function (# of Days)
	No Information

High, Moderate, Low and Precode refer to general seismic design level

CHAPTER VI – EXISTING HAZARD MITIGATION ACTIONS

This section identifies those programs that are currently in place as hazard mitigation actions or strategies for the Town of Hampton Falls, NH. The table below (Table 7), displays existing ordinance, regulations, plans and Town departments that plan for, or react to, natural hazards to mitigate possible damage.

Table 7: Existing Mitigation Actions

Existing Protection	Protections Provided and Additional Comments
Seabrook Emergency Preparedness Plan	Plan is coordinated by NH Emergency Management and Nuclear Regulatory Committee; 22 communities with the 10-mile zone around Seabrook Station participate; 2 drills and 1 graded exercise are preformed by Police, Fire and Town Employees every other year.
Fire Department	Full time chief and approximately 40 volunteer firefighters, 15 of which are EMTs; mutual aid agreements with approximately 40 communities in NH, Maine and Massachusetts; answered over 500 fire/rescue and service calls in 2003. Participate in Seacoast Technical Assistance Response Team to deal with Hazardous materials issues
Police Department	Police chief, lieutenant, and two full-time officers are assisted by 5 part-time officers; mutual aid agreements with several communities but relies on aid from Hampton, Kensington, Seabrook and Exeter. Answered approximately 10,850 calls in 2003.
Highway Department / Road Agent	Town Road Agent is responsible for maintenance on the 26.3 miles of Town roads; maintaining and replacing culverts, removing snow; and maintaining tree safety along Town roads
Floodplain Ordinance/ NFIP	Floodplain ordinance is in place for compliance with the NFIP program; Hampton Falls has been a member of the NFIP program since 1982. Adopted new DFIRM's in 2005. Currently 5 polices for flood insurance are active for Hampton Falls totaling $1,242,800.
Building Codes	Town has adopted the IBC (International Building Codes)
Storm Drain Maintenance	See Highway Department / Road Agent above
Evacuation and Notification	Evacuation route and notification associated with Seabrook Station. There are 3 speakers in Town that are linked to this system but can also be used independently by the Town officials.
Hazardous Material Response Team	Members of the "START" Team for response to emergencies involving hazardous materials, see Fire Department above.
Best Management Practices	Best Management Practices are required for Subdivision and Site Plan Review.
Wellhead Protection Program	Municipal wells for the Town of Seabrook are located in Hampton Falls and are protected at a distance of 1,000-foot. Signs are posted to notify the public of this protective zone.
Fire Prevention Week	One week a year fire education and outreach projects are conducted by the Town
State Dam Program	State inspects the dams on a yearly basis
Wetland Protections	Zoning Ordinance provides for a 100' buffer around wetland in Town

CHAPTER VII – POTENTIAL MITIGATION ACTIONS

POTENTIAL MITIGATION STRATEGIES

The Action Plan was developed by analyzing the existing Town programs, the proposed improvements and changes to these programs. Additional programs were also identified as potential mitigation strategies. These potential mitigation strategies were ranked in five categories according to how they accomplished each item:

- Prevention
- Property Protection
- Structural Protection
- Emergency Services
- Public Information and Involvement

The Committee brainstormed a list of strategies and actions that could be taken to mitigation future hazards are compiled in Table 8. Following the table is a summary of each proposed strategy or action.

Table 8: Potential Mitigation Actions

Mitigation Strategies or Action	Hazard(s) Mitigated	Mitigation Category
Flood control gates on the dams near Route 1 (State Road)	Frequent Local Flooding	Structural, property protection, prevention
Assess buildings in town for potential Snow Loading problems	Severe Winter Storms	property protection, prevention
Maintain Elevation Certificates	Flooding/NFIP	property protection
Investigate officially turning the Function Hall into a Shelter	All Hazards Requiring Emergency Shelter	Emergency Services
Complete an Emergency Operation Plan (EOP)	All Hazards	Emergency Services, public education
Investigate changes to current vegetation setbacks and fire prevention regulations	Wildfire	property protection, prevention, public education
Purchase Back-up generators for Shelters	All Hazards Requiring Emergency Shelter	Emergency Services

Flood control gates on the dams near Route 1: Route 1 is a State Road and therefore maintenance issues are not the responsibility of the Town. That being said, a project to reduce flooding issues on Route 1 (a major State road and potential evacuation route) would be to install flood gates on the dams on Dodge pond near Route 1, which could be opened in the event of a major rain event. The dams are owned by the Town of Hampton Falls

Assess Town buildings for potential snow loading problems: Several of the commercial and municipal buildings in Hampton Falls have flat roofs. This project would involve inventorying these buildings and ensuring that they are aware of the potential damage from snow loading and have a plan in place to remove heavy snow before it becomes dangerous.

Maintain Elevation Certificates: The Floodplain Manager in Hampton Falls is required to maintain elevation certificates to be involved in the NFIP (National Flood Insurance Program). This project will be

for the selectmen to designate a Floodplain Manager for Hampton Falls. The Floodplain Manager will then be responsible for maintaining elevation certificates.

Investigate officially turning the Function Hall into shelter: The Function Hall in Hampton Falls could easily serve as an emergency shelter. The Board of Selectmen and the Emergency Management Director will investigate establishing a signed agreement to use this building in this capacity. After this the Red Cross could become involved to begin the process of designating this building as an official "red-cross certified" shelter. An emergency generator for this shelter would be required. Funding for this may come from the Pre-Disaster Mitigation Grant Fund.

Complete Emergency Operations Plan: A completed EOP would lay out in detail how the Town functions and reacts to hazards and disasters. This document is a response or reactionary plan and would dovetail with this *Plan* which takes a proactive approach to hazard planning.

Investigate changes to current vegetation setbacks: Due to the juxtaposition of the forest and Town's residences it is pertinent to investigate if the current Zoning and other Town regulations are adequate to protect residential and commercial structures from potential wildfire.

Purchase Back-up Power Generators for Shelter(s): Back-up Power should be available for all emergency shelters in Town. Currently the Lincoln Akerman School does not have back-up power. Also if the Hampton Falls Function Hall becomes a shelter then it too should have back-up power.

CHAPTER VIII – PRIORITIZATION OF MITIGATION ACTIONS

The goal of each strategy or action is reduction or prevention of damage from a hazard event. In order to determine their effectiveness in accomplishing this goal, a set of criteria was applied to each proposed strategy. A set of questions developed by the Committee that included the STAPLEE method was developed to rank the proposed mitigation actions. The STAPLEE method analyzes the Social, Technical, Administrative, Political, Legal, Economic and Environmental aspects of a project and is commonly used by public administration officials and planners for making planning decisions. The following questions were asked about the proposed mitigation strategies identified in Table 8:

- Does it reduce disaster damage?
- Does it contribute to other goals?
- Does it benefit the environment?
- Does it meet regulations?
- Will historic structures be saved or protected?
- Does it help achieve other community goals?
- Could it be implemented quickly?

STAPLEE criteria:

- **Social**: Is the proposed strategy socially acceptable to the community? Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- **Technical**: Will the proposed strategy work? Will it create more problems than it solves?
- **Administrative**: Can the community implement the strategy? Is there someone to coordinate and lead the effort?
- **Political**: Is the strategy politically acceptable? Is there public support both to implement and to maintain the project?
- **Legal**: Is the community authorized to implement the proposed strategy? Is there a clear legal basis or precedent for this activity?
- **Economic**: What are the costs and benefits of this strategy? Does the cost seem reasonable for the size of the problem and the likely benefits?
- **Environmental**: How will the strategy impact the environment? Will the strategy need environmental regulatory approvals?

Each proposed mitigation strategy was evaluated using the above criteria and assigned a score (Good = 3, Average = 2, Poor = 1) based on the above criteria. An evaluation chart with total scores for each strategy can be found in the collection of individual tables under Table9.

Table 9.1: Flood control gates on the dams on Rt. 1

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	2.75
Does it contribute to other goals?	2.75
Does it benefit the environment?	2.75
Does it meet regulations?	2.5
Will historic structures be saved or protected?	1
Does it help achieve other community goals?	2.5
Could it be implemented quickly?	2
S: Is it Socially acceptable?	2.75
T: Is it Technically feasible and potentially successful?	2.75
A: Is it Administratively workable?	2.25
P: Is it Politically acceptable?	2.75
L: Is there Legal authority to implement?	2.25
E: Is it Economically beneficial?	2.25
E: Are other Environmental approvals required?	2.25
Score	**33.5**

Table 9.2: Assess Town buildings for potential snow loading problems

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	2.5
Does it benefit the environment?	1.75
Does it meet regulations?	2.5
Will historic structures be saved or protected?	3
Does it help achieve other community goals?	2.25
Could it be implemented quickly?	1.5
S: Is it Socially acceptable?	2.75
T: Is it Technically feasible and potentially successful?	2.75
A: Is it Administratively workable?	2
P: Is it Politically acceptable?	1.75
L: Is there Legal authority to implement?	2
E: Is it Economically beneficial?	1.75
E: Are other Environmental approvals required?	1.25
Score	**30.75**

Table 9.3: Maintain Elevation Certificates

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	2.75
Does it benefit the environment?	2.5
Does it meet regulations?	2.75
Will historic structures be saved or protected?	2.25
Does it help achieve other community goals?	2.5
Could it be implemented quickly?	2.5
S: Is it Socially acceptable?	2.75
T: Is it Technically feasible and potentially successful?	2.75
A: Is it Administratively workable?	2.75
P: Is it Politically acceptable?	2.75
L: Is there Legal authority to implement?	2.75
E: Is it Economically beneficial?	2.25
E: Are other Environmental approvals required?	2.25
Score	**36.5**

Table 9.4: Investigate officially turning the Function Hall/ School into shelter

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	2.75
Does it contribute to other goals?	2.75
Does it benefit the environment?	2
Does it meet regulations?	2.5
Will historic structures be saved or protected?	2.25
Does it help achieve other community goals?	3
Could it be implemented quickly?	2.5
S: Is it Socially acceptable?	2.5
T: Is it Technically feasible and potentially successful?	2.75
A: Is it Administratively workable?	2.5
P: Is it Politically acceptable?	2.5
L: Is there Legal authority to implement?	2
E: Is it Economically beneficial?	2.5
E: Are other Environmental approvals required?	1.5
Score	**34**

Table 9.5: Complete Emergency Operations Plan

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	3
Does it contribute to other goals?	3
Does it benefit the environment?	2.5
Does it meet regulations?	3
Will historic structures be saved or protected?	2.5
Does it help achieve other community goals?	3
Could it be implemented quickly?	2
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	2.75
P: Is it Politically acceptable?	2.75
L: Is there Legal authority to implement?	2.75
E: Is it Economically beneficial?	2.5
E: Are other Environmental approvals required?	2
Score	**37.75**

Table9.6: Investigate changes to current vegetation setbacks

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	2.75
Does it contribute to other goals?	2.5
Does it benefit the environment?	3
Does it meet regulations?	2.25
Will historic structures be saved or protected?	3
Does it help achieve other community goals?	2.5
Could it be implemented quickly?	2
S: Is it Socially acceptable?	2.5
T: Is it Technically feasible and potentially successful?	2.25
A: Is it Administratively workable?	2.25
P: Is it Politically acceptable?	1.75
L: Is there Legal authority to implement?	2.5
E: Is it Economically beneficial?	2.25
E: Are other Environmental approvals required?	2.5
Score	**34**

Table 9.8: Purchase Back-up Power Generators for Shelter(s)

Criteria	Evaluation Rating (1-3)
Does it reduce disaster damage?	2.75
Does it contribute to other goals?	3
Does it benefit the environment?	1.5
Does it meet regulations?	2.75
Will historic structures be saved or protected?	2
Does it help achieve other community goals?	3
Could it be implemented quickly?	2.5
S: Is it Socially acceptable?	2.75
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	2.5
P: Is it Politically acceptable?	2.25
L: Is there Legal authority to implement?	2
E: Is it Economically beneficial?	2.75
E: Are other Environmental approvals required?	1.5
Score	**34.25**

CHAPTER IX – ACTION PLAN

This step involves developing an action plan that outlines who is responsible for implementing each of the prioritized strategies determined in the previous step, as well as when and how the actions will be implemented. The following questions were asked to develop an implementation schedule for the identified priority mitigation strategies:

WHO? Who will lead the implementation efforts? Who will put together funding requests and applications?

HOW? How will the community fund these projects? How will the community implement these projects? What resources will be needed to implement these projects?

WHEN? When will these actions be implemented, and in what order?

Table 10 is the Action Plan. In addition to the prioritized mitigation projects, Table 10 includes the responsible party (WHO), how the project will be supported (HOW), and what the timeframe is for implementation of the project (WHEN).

Table 10: Action Plan for proposed mitigation actions

Score	Project	Responsibility/ Oversight	Funding/ Support	Estimated Cost	Timeframe
37.75	Complete Emergency Operations Plan	Emergency Management Director	NHBEM	$15,000	2007
36.5	Maintain Elevation Certificates	Building Inspector	Local	-	ongoing
34.25	Purchase Back-up Power Generators for Shelter(s)	Emergency Management Director	PMD/ grants	$130,000	2006
34	Investigate changes to current vegetation setbacks	Emergency Management Director	Local	-	2006
34	Investigate officially turning the Function Hall/ School into shelter	Emergency Management Director, Police Chief	Local	-	2006
33.5	Flood control gates on the dams on Route 1	Board of Selectmen, Road Agent, NHDOT	PMD/DOT	$1,000,000+	2007
30.75	Assess Town buildings for potential snow loading problems	Building Inspector, Emergency Management Director	Local	-	2006

CHAPTER X – INCORPORATING, MONITORING, EVALUATING AND UPDATING THE PLAN

Incorporating the Plan into Existing Planning Mechanisms

Upon completion and approval by FEMA and the State of New Hampshire, the *Plan* will be adopted as a stand alone document of the Town and as an appendix of the Town's Emergency Operations Plan (EOP). Future updates the EOP will incorporate the *Plan* as a referenced appendix, but the two plans will always be printed as separated documents. The EOP is subject to annual review.

The *Plan* will also be consulted when the Town updates its Capital Improvement Program (CIP). The Planning Board is responsible for updating the CIP annually, and will review the Action Plan during each update. The Planning Board in conjunction with Hampton Falls Emergency Management will determine what items can and should be added to the CIP based on the Town's annual budget and possible sources of other funding.

The *Plan* will also be referenced in any future update of the Hampton Falls Master Plan. Portions of the *Plan* could be incorporated into a Natural Hazards Chapter of the Master Plan. It will also be the responsibility of the Planning Board to incorporate current and future strategies identified in the *Plan* into proposed zoning ordinances and updates to Town Subdivision and Site Plan Review Regulations.

Monitoring, Evaluating and Updating the Plan

Recognizing that many mitigation projects are ongoing, and that while in the implementation stage communities may suffer budget cuts, experience staff turnover, or projects may fail altogether, a good plan needs to provide for periodic monitoring and evaluation of its successes and failures and allow for updates of the *Plan* where necessary.

In order to track progress and update the Mitigation Strategies identified in the Action Plan (Table 10), it is recommended that the Town revisit the *Plan* annually, or after a hazard event. If it is not realistic or appropriate to revise the *Plan* every year, then the *Plan* will be revisited no less then every five years. The Emergency Management Director is responsible for initiating this review with members of the Town that are appropriate including members of the public. In keeping with the process of adopting the 2006 *Plan,* a public hearing to receive public comment on *Plan* maintenance and updating will be held during to finalize any revision of the *Plan*. This publicly noticed meeting will allow for members of the community not involved in developing the *Plan* to provide input and comments each time the *Plan* is revised. The final revised *Plan* will be adopted by the Board of Selectmen appropriately, at a second publicly noticed meeting.

Changes should be made to the *Plan* to accommodate for projects that have failed or are not considered feasible after a review for their consistency with STAPLEE, the timeframe, the community's priorities, and funding resources. Priorities that were not ranked high, but identified as potential mitigation strategies, should be reviewed as well during the monitoring and update of this *Plan* to determine feasibility of future implementation.