Town of Exeter, NH

Natural Hazard Mitigation Plan 2006

Exeter Board of Selectmen

November 13th, 2006

Prepared with the Assistance of the

Rockingham Planning Commission

This project was partially funded by

NH Bureau of Emergency Management

Town of Exeter, New Hampshire
A Resolution Adopting the Exeter Hazard Mitigation Plan

Date: November 13, 2006

WHEREAS, the Town of Exeter received funding from the NH Homeland Security and Emergency Management to assist in the preparation of the Exeter Hazard Mitigation Plan; and

WHEREAS, several public meetings and committee meetings were held between November 2004 and March 2005 regarding the development and review of the Exeter Hazard Mitigation Plan; and

WHEREAS, the Exeter Hazard Mitigation Plan contains several potential future projects to mitigate hazard damage in the Town of Exeter; and

WHEREAS, a public meeting was held by the Board of Selectmen on November 13, 2006 to formally adopt the Exeter Hazard Mitigation Plan.

NOW, THEREFORE BE IT RESOLVED that the Exeter Board of Selectmen Adopts the Exeter Hazard Mitigation Plan.

APPROVED and SIGNED this 13th day of November, 2006.

Signature:

Paul Binette, Chairman

Robert Eastman, Vice-Chairman

Joseph Pace, Clerk of the Board

Lionel Ingram

William Campbell

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EXECUTIVE SUMMARY

The *Exeter Hazard Mitigation Plan* (herein also referred to as the *Plan*) was compiled to assist the Town of Exeter 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 Exeter *Natural Hazard Mitigation Committee* and contains the tools necessary to identify specific hazards, and aspects of existing and future mitigation efforts.

The following *natural* hazards are addressed:

- Flooding
- Hurricane-High Wind Event
- Severe Winter Weather
- Wildfire
- Earthquake

The list of *critical facilities* includes:

- Municpal facilities;
- Communication facilities;
- Fire stations and law enforcement facilities;
- Schools;
- Shelters;
- Evacuation routes; and
- Vulnerable Populations

The *Exeter Hazard Mitigation 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 Hall and the Emergency Operations Center. A copy of the *Plan* is also on file at The Rockingham Planning Commission, the New Hampshire Bureau of Emergency Management (NHBEM) and the Federal Emergency Management Agency (FEMA). This Document was approved by both agencies prior its adoption at the local level.

CHAPTER I. INTRODUCTION

Background

The New Hampshire Bureau of Emergency Management (NH BEM) has a goal for all communities within the State of New Hampshire 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 *Exeter Hazard Mitigation Plan* was prepared by participants from the Town of Exeter Hazard Mitigation Team with the assistance and professional services of the Rockingham Planning Commission (RPC) 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 *Exeter Hazard Mitigation Plan* serves as a strategic planning tool for use by the Town of Exeter in its efforts to identify and mitigate the future impacts of natural and/or man-made hazard events.

Methodology

The Rockingham Planning Commission (RPC) organized the first meeting with emergency management officials from the Town of Exeter to begin the initial planning stages of the *Exeter Hazard Mitigation Plan* This meeting precipitated the development of the *Natural Hazards Mitigation Committee* (herein after, the *Committee*). RPC and participants from the Town developed the content of the *Plan* using the ten-step process set forth in the *Hazard Mitigation Planning for New Hampshire Communities*. The following is a summary of the ten-step process conducted to compile the *Plan.*

Step 1 – Map the Hazards

Participants in the *Committee* identified areas where damage from historic natural disasters have 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 Critical Facilities and Areas of Concern

Participants in the Committee then identified facilities and areas that were considered to be important to the Town for emergency management purposes, 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. Digital images were collected for each Critical Facility using Pictometry™ software and images of the Town of Exeter.

Step 3 – Identify Existing Mitigation Strategies

After collecting detailed information on each critical facility in Exeter, the Committee and RPC staff identified existing Town mitigation strategies relative to flooding, wind, fire, ice and snow events and earthquakes.

Step 4 – Identify the Gaps in Existing Mitigation Strategies

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

Step 5 – Identify Potential Mitigation Strategies

A list was developed of additional hazard mitigation actions and strategies for the Town of Exeter.

Step 6 – Prioritize and Develop the 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

Using the chart provided under Step 9 in the handbook, an implementation strategy was created 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 and the Town of Exeter's 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 abutting communities, to insure their opportunity to review the *Plan* prior to finalization. A duly noticed public meeting was held by the Exeter Board of Selectmen in 2003. This meeting allowed the community to provide comments and suggestions for the *Plan* in person, prior to the document being finalized. The initial draft was sent to FEMA Region 1 in July of 2003. The draft was revised to incorporate comment from the Selectmen, Planning Board and general public; then submitted to the NHBEM and FEMA Region I for their second review and comments. When the draft was approved by the NHBEM and FEMA Region I the Board of Selectman held a public hearing on November 13th, 2006. At this public hearing the *Plan* was approved by the Board of Selectman.

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 Exeter concurs and adopts these goals and objectives.

Acknowledgements

The Exeter Board of Selectmen extends special thanks to those that assisted in the development of this *Plan* by serving as member of Natural Hazards Mitigation Committee:

Russell Dean, Town Manager
Keith Noyes, Public Works Director
Jennifer Perry, Town Engineer
Rich Kane, Police Chief
Brian Comeau, Fire Chief
Eric Wilking, Assistant Fire Chief
Sylvia Von Aulock, Town Planner
Doug Eastman, Building Inspector
Brian Comeau, Emergency Management Director

The Exeter Board of Selectmen offers thanks to the **New Hampshire Bureau of Emergency Management** (www.nhBEM.state.nh.us), which provided the model and funding for this *Plan*.

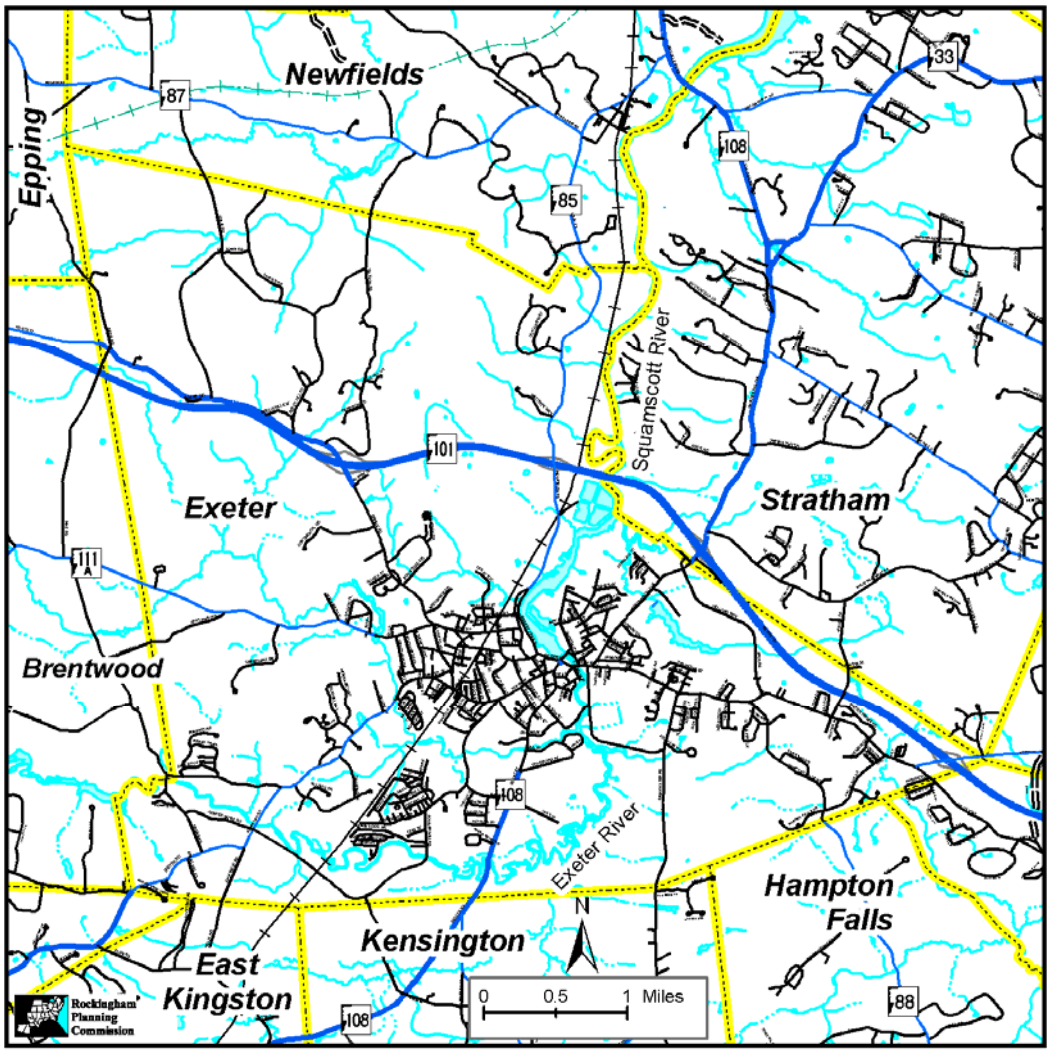
In addition, thanks are extended to the staff of the **Rockingham Planning Commission** for professional services, process facilitation and preparation of this document.

CHAPTER II. COMMUNITY PROFILE

Natural Features

The Town of Exeter is located in New Hampshire in Rockingham County. Exeter is bordered by Kingston, East Kingston, Hampton Falls, Hampton, and Kensington to the south, Stratham to the east, Newfields to the north, and Brentwood and Epping to the west, as seen below in Figure 1. The town was founded in 1638 and the NH Office of Energy and Planning estimated in 2005 the population to be 14,563. From 1990 to 2000, Exeter's population grew by 12.6 percent. The median age is 40 years, with 25 percent of the population under the age of 18 and 17 percent age 65 and older. As of April 1, 2000, there were 6,107 housing units.

Figure 1: Location Map of Exeter, New Hampshire



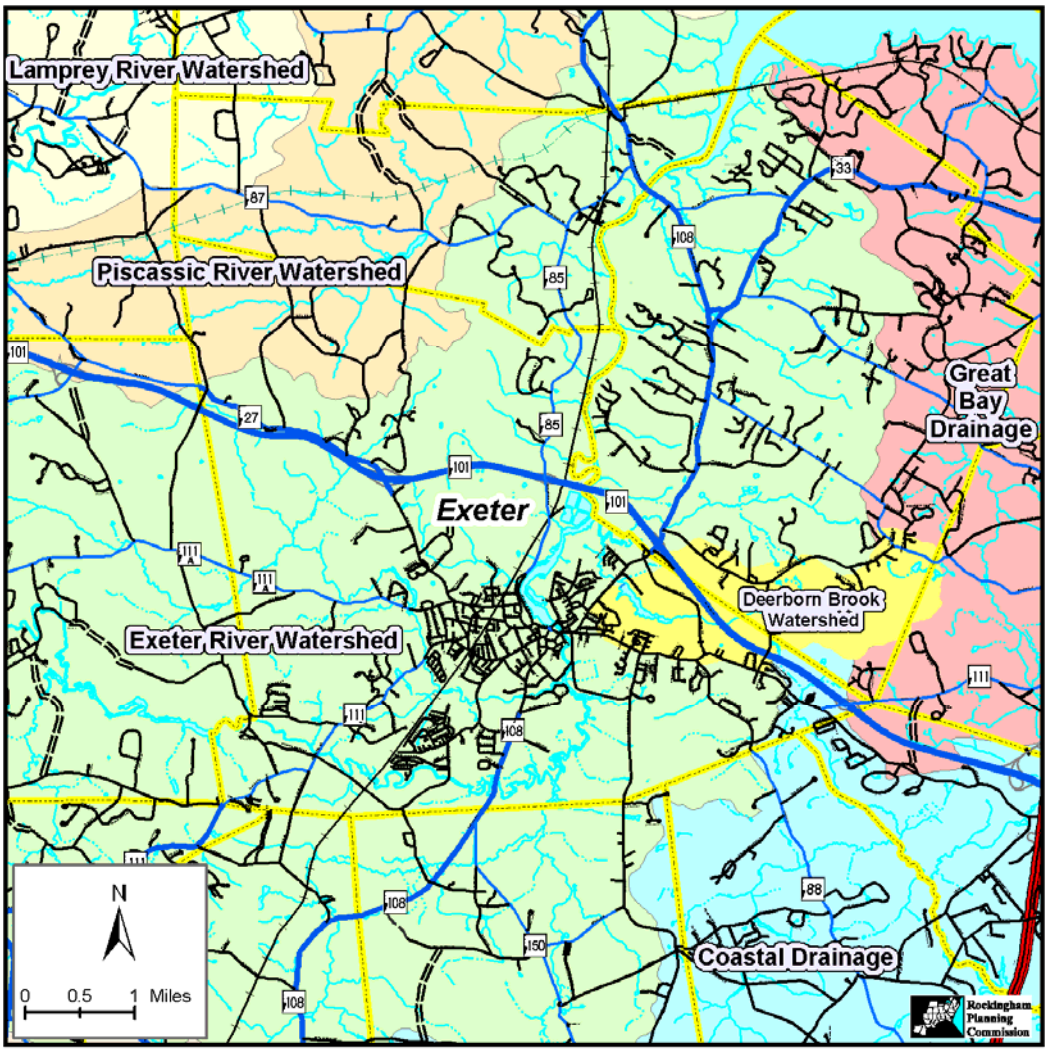
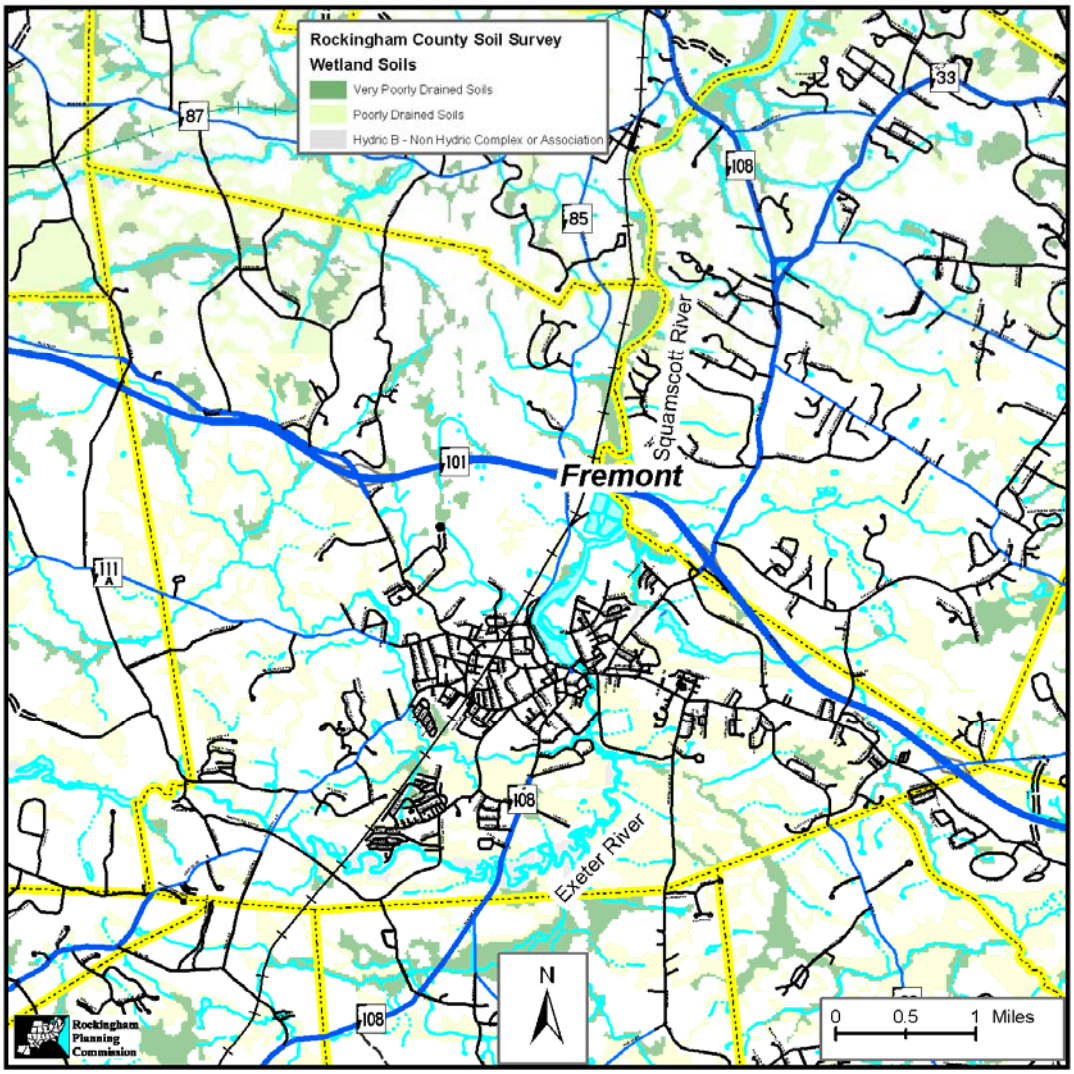


Figure 2: Watershed map of Exeter, New Hampshire.

Exeter has portions of four regional watersheds: the Piscassic River, Exeter River, the tidal Squamscott River, and the Coastal Watershed. The first three watersheds are part of the larger Piscataqua River Basin, while the Coastal Watershed is part of the larger Coastal River Basin. In an effort to delineate meaningful drainage patterns, two sub-watersheds were identified in the 1994 Exeter Master Plan. The first is the Dearborn Brook Sub-Watershed which forms a portion of the Squamscott River Watershed, and the second is the Little River Sub-Watershed which forms a portion of the Exeter River Watershed. **Figure 2** shows the Watershed Boundaries in the Town of Exeter.

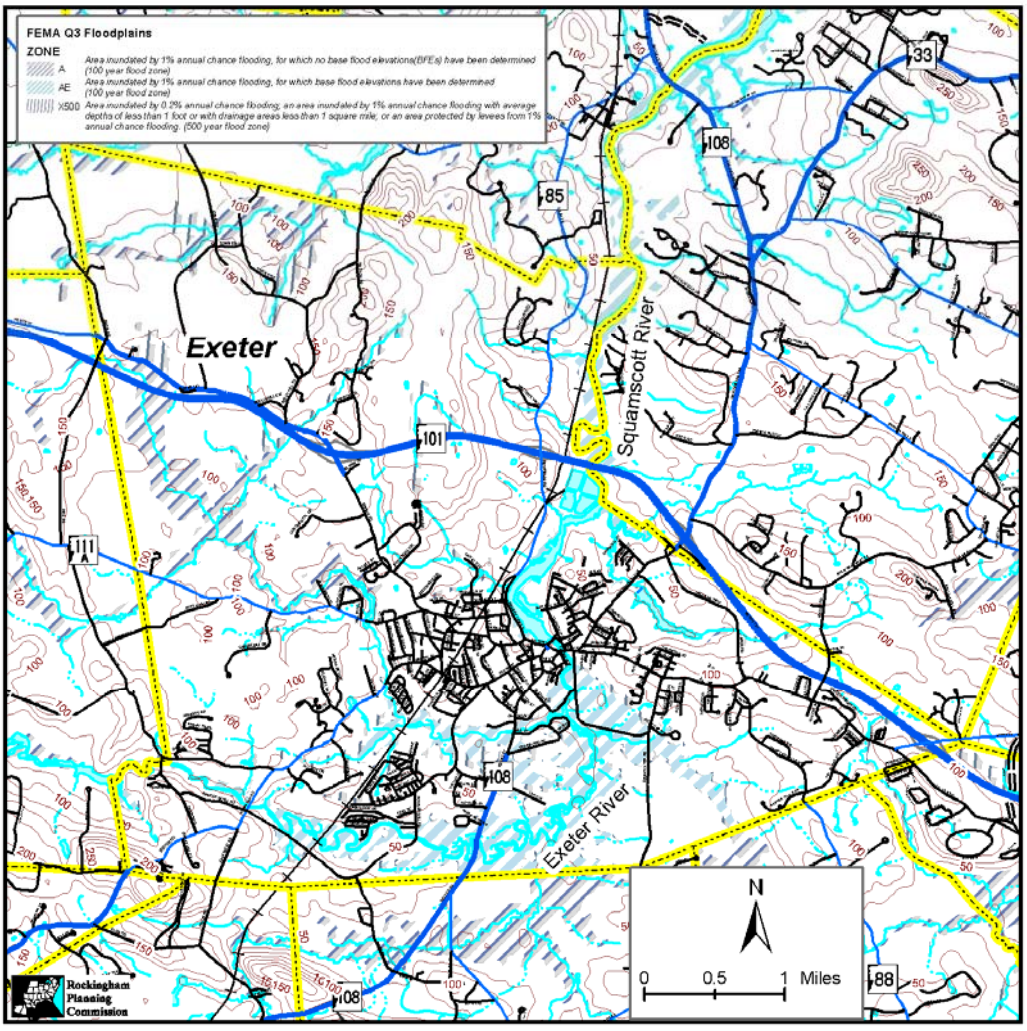
Wetlands are an important part of the Town of Exeter's surface water. Wetland, or hydric, soils include poorly and very poorly drained soils. These soil types are often associated with marine silts and clays where the water table is at or near the surface for five to nine months of the year. Exeter has mapped and identified Prime Wetlands in the community and has adopted stricter land use regulations for work adjacent to prime wetlands.

Figure 3: Wetlands Map of Exeter, New Hampshire. Wetland delineated as poorly and very poorly drained soils, and Wetlands from the National Wetland Inventory.



Floodplains for this *Plan* are defined as the 100-year and 500-year flood hazard zones, as depicted on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM). Floodplains in the Town of Exeter are shown below in Figure 4. Exeter maintains participation in the National Flood Insurance Program administered by FEMA. Development should be located away from wetlands and floodplains whenever possible. The filling of wetlands for building construction not only destroys wetlands and their numerous benefits, but may also lead to groundwater contamination. Building within a flood zone may also reduce the floodplain's capacity to absorb and retain water during periods of excessive precipitation and runoff. Moreover, in regard to building within floodplains, contamination may result from flood damage to septic systems.

Figure 4: Floodplains of Exeter, New Hampshire



Current and Future Development Trends

Current Development is predicated on the Town of Exeter's Zoning Ordinance. The Town is divided into thirteen zones, as seen on Map 1 – Existing Land Use. For more information on these specific zones see the Exeter Zoning Ordinance.

The Town of Exeter recently completed a build-out analysis to assist with planning effort.. The general parameters of expected growth are outlined in the Master Plan. The expected population for the year 2020 is estimated to be 16,776 by the New Hampshire Office of Energy and State Planning. The commercial growth is expected to be concentrated along Routes 27 and 108, and to include the renovation and replacement of some of the businesses by others that involve more intense utilization of the real estate.

INSERT MAP 1 – EXISTING LAND-USE

CHAPTER III. NATURAL HAZARDS IN THE TOWN OF EXETER

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 Exeter is prone to several types of natural hazards. These hazards include: flooding, hurricanes or other high-wind events, severe winter weather, wildfires and earthquakes. Other natural hazards can and do affect the Town of Exeter, 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 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*. Exeter 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 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 us of the Committee 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.

Definitions of Natural Hazards

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.

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.

Erosion and Mudslides
Erosion is the process of wind and water wearing away soil. Typically in New Hampshire, the land along rivers is relatively heavily developed. Mudslides may be formed when a layer of soil atop a slope becomes saturated by significant precipitation and slides along a more cohesive layer of soil or rock. Erosion and mudslides become significant threats to development during floods. Floods speed up the process of erosion and increase the risk of mudslides.

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 in riverbeds and against structures present significant flooding threats to bridges, roads, and the surrounding lands.

Dam Breach and Failure
Dam failure results in rapid loss of water that is normally held by the dam. These kinds of floods are extremely dangerous and pose a significant threat to both life and property.

Severe Storms
Flooding associated with severe storms can inflict heavy damage to property. Heavy rains during severe storms are a common cause of inland flooding.

Hurricane-High Wind Events

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[1] 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. 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

[1] The Saffir/Simpson Hurricane Scale can be viewed in Appendix C

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[2] is the standard scale for rating the severity of a tornado as measured by the damage it causes. 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.

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.

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

[2] The Fujita Tornado Scale can be viewed in Appendix D.

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 also often produce widespread power outages.

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[3] and Mercalli scale.

Profile of Past and Potential Natural Hazards

As discussed above the natural hazards that affect, or potentially could affect Exeter, New Hampshire, that were identified for designation in this *Plan* include: flooding, hurricanes-high wind events, severe winter weather, wildfire and earthquakes. 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 Exeter (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 Exeter to each natural hazard.

[3] A copy of the Richter scale is displayed in Appendix E.

Flooding

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

Location: Exeter is vulnerable to flooding in several locations. Generally, the Town is at risk within the Flood Zones identified by FEMA on Flood Insurance Rate Maps (FIRM). As can be seen in Figure 4 in Chapter 2, Exeter has two major flood zones: A and X. These flood zones correspond to the Special Flood Hazard Area (100-year flood zone) and the 500-year flood zone respectively. There are also several areas susceptible to flooding that are not within these flood zones, these areas are listed below and displayed on Map 2: Past and Future Hazards.

- Franklin and River Street neighborhoods
- Court Street (NH Route 108) at the intersection of Bell Avenue and at the Exeter/Kensington town line
- Kingston Road (NH Route 111) at the intersection of Juniper Ridge Road, between Ernest Avenue and Westside Drive.
- Portsmouth Avenue (NH Route 108) abutting the Town of Exeter's Water Treatment Plant, which lies in the 100 year floodplain
- Swasey Parkway is vulnerable to tidal storm surges
- Sewage Treatment Lagoons vulnerable to tidal storm surges
- Powder Mill Road at the bridge crossing the Exeter River
- Lary Lane neighborhood
- Brentwood Road (NH Route 111A) at the intersection of Crestview Drive, east of the intersection of Greenleaf Drive, and west of the intersection with Dogtown Road.

Extent: The extent of the flood zones can be seen in Map 2: Past and Future Hazards. This area includes FIRM Zones A and X, as well as, 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 Exeter. Several locations were identified by the Committee as areas of chronic reoccurring flooding or high potential for future flooding, as listed above. Larger flood events are listed in Table 3.

Community Vulnerability: Flooding is most likely to occur in the 100-year flood zones. Especially in low lying areas adjacent to the Exeter River, Little River, Dudley Brook and tidal Squamscott River..

There are six dams within or immediately adjacent to Exeter's boundaries, these are:

- Class AA dam at Colcord Pond (Little RiverO off of Brenwtood Road (NH Route 111A)
- Class A dam at Pickpocket Road (Exeter River)
- Class A dam at Great Bridge in downtown Exeter (Exeter River)
- Class B dam at the Town of Exeter Sewage Lagoons (Squamscott River) at the Wastewater Treatment Plant off Newfields Road
- Class B Stormwater Holding Pond Lagoons off Jady Hill Avenue (Squamscott River)
- Class C dam at the Water Treatment Plant/Dearborn Brook Reservoir off Portsmouth Avenue

Hurricanes-High Wind Events

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

Location: Hurricane events are more potentially damaging with increasing proximity to the coast. Exeter's immediate proximity to the Atlantic Coast make hurricanes and high wind events severe threats. For this *Plan*, high-wind events were considered to have an equal chance of affecting any part of the Town of Exeter.

Extent: Exeter is located within Zone II hurricane-susceptible region (indicating a design wind speed of 160 mph)[4]. From 1950 to 1995 Rockingham County was subject to 9 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)[5]. 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[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 Exeter is a high risk to a hurricane event, with wind speeds variable between 74 – 130 mph (category 1-3).

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

[4] "Understanding Your Risks, Identifying Hazards and Estimating Losses", FEMA
[5] The tornado project .com
[6] "Understanding Your Risks, Identifying Hazards and Estimating Losses", FEMA

Rockingham 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.

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 are known to collapse buildings. Ice storms disrupt power and communication services. Extreme cold affects the elderly. None of these storms affect one area of town more than another.

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

Extent: Large snow events in Southeastern New Hampshire can produce 30 inches of snow. Portions of central New Hampshire recorded snowfalls of 98" during one slow moving storm 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, and
- Elderly Populations

Wildfires

Description: Wildfires include grass fires, forest fires and issues with isolated homes and residential areas.

Location: The Committee identified one large wooded area of Town as at-risk to wildfires, see Map 2: Past and Future Hazards.

Extent: A wildfire in the Town of Exeter is unlikely, but if a crown fire were to occur it could be very damaging to several small sections of Town, such as the Town Forest.

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

Past Occurrence: The majority of wildfires in Exeter are minor brush fires. No Large fires have occurred within recent memory.

Community Vulnerability:

- Structures located near large open vegetated areas prone to lightning strike

Earthquakes

Description: including landslides and other geologic hazards related to seismic activity.

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

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 Exeter's Peak Ground Acceleration (PGA) values range between 6.1 and 21.0[7]. 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 Exeter (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

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

Community Vulnerability:

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

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

Table 3: Past Hazard Events in Exeter 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
Flood	May 13-15, 2006	Statewide	Heavy damage to secondary roads and homes	**FEMA DR-?**
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[8] - Category 3, winds 111-130 mph

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

Hazard	Date	Location	Critical Facility or Area Impacted	Remarks/Description
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
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[9]
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
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

[9] 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 17, 1970	Parts of NH	Power disruption	Many communities affected
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[10]
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

[10] 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.

Sources: New Hampshire Bureau of Emergency Management, 2000; Town of Exeter;

Northeast States Emergency Consortium (NESEC) Website: http://www.nesec.org;

US Army Corp of Engineers Ice Jam Database, http://www.crrel.usace.army.mil/cgi-bin/ice/ijdb;
Tornado Project, http://www.tornadoproject.com

Map 2: Past and Future Hazards

CHAPTER IV. CRITICAL FACILITIES

The Critical Facilities List for the Town of Exeter has been identified by Exeter's 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 Exeter. 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 through Table 7.

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

Critical Facility Name	Address	Comments	Hazard Vulnerability
Exeter Safety Complex	20 Court Street	Primary EOC, back-up power, fuel	All
Police Station	20 Court Street		All
Fire Station	20 Court Street		All
Town Offices	10 Front Street	Back-up power	All
Department of Public Works	13 Newfields Road	fuel	All
Exeter Hospital	10 Buzzell Avenue	Back-up power, helipad	All
Wastewater Treatment Plant	13 Newfields Road	Back-up power	All
Water Treatment Plant	Portsmouth Avenue	Back-up power; Within 100-year floodplain	All
Water Supply Reservoir	Portsmouth Avenue	Within 100-year floodplain	All
Water Tank	Cross Road		All
Water Tank	Fuller Lane		All
Water Tank	89 Epping Road		All
Water Supply Well	Lary Lane	Back-up power	All
Water Supply Intake	Access off Gilman Ln		All
Electric Substation	River Street		All
Electric Substation	Franklin Street		All
Electric Substation	Portsmouth Avenue		All
Cell Tower	Guinea Road	Back-up power	All
Cell Tower	Watson Road	Back-up power	All
Cell Tower	Commerce Way	Back-up power	All
Cell Tower	115 Epping Road	Back-up power	All
Telephone Building	Center Street	Back-up power	All

Table 5: 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 Exeter.

Critical Facility Name	Address	Comments	Hazard Vulnerability
Exeter Town Hall	Front Street	Emergency Shelter	All
Water Pumping Station	Kingston Road		All
Water Pumping Station	Epping Road	Back-up power	All
Sewer Pumping Station	Court Street	Back-up power	All
Sewer Pumping Station	Main Street	Back-up power	All
Sewer Pumping Station	Webster Avenue	Back-up power	All
Sewer Pumping Station	Riverwoods Drive	Back-up power	All
Sewer Pumping Station	Front Street	Back-up power	All
Sewer Pumping Station	Colcord Pond Drive		All
Sewer Pumping Station	Folsom Way		All
Sewer Pumping Station	Riverbend Circle		All
Sewer Pumping Station	Langdon Avenue		All

Table 6: 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 Name	Address	Comments	Hazard Vulnerability
A.B. Hearty and Friends	35 Hampton Road	Daycare	All
Appleseeds Day School	15 Hampton Road	Daycare	All
Building Blocks School	125 Kingston Road	Daycare	All
Decolores Children's Center	87 Epping Road	Daycare	All
Great Bay Kids Company	13 School Street	Daycare	All
Great Bay Kids Company	25 Lincoln Street	Daycare	All
Great Bay Kids Company	40 Main Street	Daycare	All
Great Hill Childcare	14 South Road	Daycare	All
Kim's Corner Care	50 Epping Road	Daycare	All
Phillips Exeter Academy Daycare	Water Street	Daycare	All
Riverwoods	7 Riverwoods Drive	Elderly	All
The Ridge at Riverwoods	White Oak Drive	Elderly	All
Langdon Place	17 Hampton Road	Elderly	All
Sunbridge	8 Hampton Road	Elderly	All
Eventide Home	81 High Street	Elderly	All
Squamscott View	277 Water Street	Elderly	All
Exeter Healthcare	4 Alumni Driver	Elderly & Disabled	All
Exeter Elms	188 Court Street	Campground	All
Green Gate	185 Court Street	Campground	All
Exeter Day School	11 Marlboro Street	School	All
Exeter High School	315 Epping Road	School	All
Former Exeter High School/Annex	30 Linden Street	School	All
Former Exeter High School Fields	30 Linden Street	Staging Area	All
Lincoln Street School	25 Lincoln Street	School	All

Main Street School	40 Main Street	School	All
Montessori School of Exeter	2 Newfields Road	School	All
Phillips Exeter Academy	Front Street	School	All
PEA Powerstation	Marston Street	Back-up power	All
PEA Love Gym	Gilman Street	Emergency Shelter	All
PEA Athletic Fields	Gilman Street	Staging Area	Within 100& 500 yr flood zones
Rinks at Exeter	40 Industrial Drive	Emergency Shelter	All
Gilman Garrison House	Water Street	Historic building	All
Exeter Historical Society	47 Front Street	Historic building	All
American Independence Museum	1 Governor's Lane	Historic building	All
Town Bandstand	Water and Front Street	Historic structure	All
Calvary Baptist Church	12 Little River Road	Religious facility	All
Calvary Chapel Seacoast	104 Epping Road	Religious facility	All
Christ's Church Episcopal	43 Pine Street	Religious facility	All
Church of Jesus Christ of the Latter Day Saints	55 Hampton Falls Road	Religious facility	All
Community Church of Exeter	134 Front Street	Religious facility	All
Congregational Church	21 Front Street	Religious facility	All
Exeter Assembly of God	47A Hampton Falls Road	Religious facility	All
Exeter Christian Fellowship	50 Newfields Road	Religious facility	All
Exeter Presbyterian Church	29 Front Street	Religious facility	All
Faith Lutheran Church	4 Elm Street	Religious facility	All
First Baptist Church of Exeter	2 Spring Street	Religious facility	All
First Unitarian Society of Exeter	12 Elm Street	Religious facility	All
Phillips Church	Tan Lane	Religious facility	All
Saint Michaels Catholic Church	9 Lincoln Street	Religious facility	All
United Methodist Church	307 Epping Road	Religious facility	All
OSRAM Sylvania	131 Portsmouth Avenue	Manufacturing facility /Hazardous Waste	All
Hartman Oil Company	122R Epping Road	Hazardous Waste	All

Table 7: 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 Name	Address	Comments	Hazard Vulnerability
Stop and Show Supermarket	Portsmouth Avenue	Food and water	All
Shaw's Supermarket	Portsmouth Avenue, Stratham, NH	Food and water	All
Market Basket Supermarket	Portsmouth Avenue, Stratham, NH	Food and water	All
Wentworth Lumber	Portsmouth Avenue	Building supplies	All
Arjays Hardware	Lincoln Street	Building supplies	All
Simpson Gravel Pit	Kingston Road	Sand and gravel	All
SAU 16 Transporation	Epping Road	Transportation	All
AMTRAK Rail Station	Lincoln Street	Transportation	All

Map 3: Critical Facilities

CHAPTER V. DETERMINING HOW MUCH WILL BE AFFECTED

Identifying Vulnerable Facilities

It is important to determine which critical facilities are the most vulnerable and to estimate their potential loss. The first step is to identify the facilities most likely to be damaged in a hazard event. To do this, the location of critical facilities illustrated on Map 3 was compared to the location of various topographical elements, floodplains, roads, and water bodies using GIS (Geographic Information Systems). Vulnerable facilities were identified by comparing their location to possible hazard events. For example, all of the structures within the 100-year and 500-year floodplains 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 facility's structural value. The Federal Emergency Management Agency (FEMA) has developed a process in which replacement values for structures located in the 100 and 500-year floodplains can be calculated according to the amount of damage suffered[11]. In Exeter, the assessed values were determined for every structure identified in the floodplain. The potential loss was then calculated by multiplying the assessed value of the structure by the percent of damage expected from a hazard event (i.e., 100-year, 4-foot flood, etc.). The following discussion summarizes the potential loss estimates to structures (residential and non-residential) due to natural hazard events.

Flooding

Flooding is often associated with hurricanes, ice jams, rapid snow melt in the spring and heavy rains. Founded along the banks of the Squamscott and Exeter Rivers in 1638, it is not surprising that the natural hazard that poses the greatest threat to Exeter is riverine flooding.

The average replacement value was calculated by adding up the assessed values of all structures in the 100 and 500 year floodplains. These structures were identified by overlaying digital versions of FEMA's FIRM maps on digital aerial photography of the town of Exeter. 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 and 500 year floodplains. The Federal Emergency Management Agency (FEMA) has developed a process to calculate potential loss for structures during flood. The potential loss was calculated by multiplying the replacement value by the percent of damage expected from the hazard event. Residential and non-residential structures were combined. 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 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 443 structures assessed at $600,000 = $130,242,000 potential damage

[11] "Understanding Your Risks, Identifying Hazards and Estimating Losses", FEMA, page 4-13.

The following calculation is based on four-foot flooding and assumes that, on average, one or two story buildings with basements receive 28% damage (Understanding Your Risks, Identifying Hazards and Estimating Losses, FEMA page 4-13):

Potential Structure Damage: 28%
Approximately 443 structures assessed at $600,000 = $74,424,000 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 443 structures assessed at $600,000 = $53,160,000 potential damage

Several areas of Exeter were identified as having high risk of flooding. These areas are identified in Chapter III and Map 2: Past and Future Hazards. Potential losses were also calculated for these at-risk areas in the same manner as those structures in the 100 and 500 year floodplains. Again these assessments are only based on the potential damages to building within the identified at-risk areas.

~Dam Breach and Failure

Dam breach and failure could impact Exeter through flooding. Potential losses will depend on the extent of the breach and could include both residential and non-residential damage, including town owned facilities. Areas identified by the Hazard Mitigation Planning Committee as at risk to flooding from dam breech were the neighborhoods below Pickpocket Dam and Colcord Pond Dam, and the Water Treatment Plant and Portsmouth Avenue box culverts below the Reservoir Dam.

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 Exeter, 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 Exeter. The assessed value of all residential and commercial structures in the Town of Exeter, including exempt structures such as schools and churches, is $1,586,473,374 (Assuming 1% to 5% damage, a hurricane could result in $15,864,734 to $79,323,689 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. In the State of New Hampshire, the total cost of tornadoes between 1950 and 1995 was $9,071,389 (The Disaster Center). The assessed value of all residential and commercial structures in the Town of Exeter, including exempt structures such as schools and churches, is $1,586,473,374. Assuming 1% to 5% damage, an earthquake could result in $15,864,734 to $79,323,689 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 now record of monetary damages inflicted in the Town of Exeter 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 Exeter 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. The assessed value of all residential and commercial structures in the Town of Exeter, including exempt structures such as schools and churches, is $1,586,473,374. Assuming 1% to 5% damage, an earthquake could result in $15,864,734 to $79,323,689 of structure damage.

~Ice Storms
Ice storms often cause widespread power outages by downing power lines, making power lines at risk in Exeter. 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 Exeter could be expected to cause damage ranging from a few thousand dollars to several million, depending on the severity of the storm.

Wildfire
The risk of fire is difficult to predict based on location. Forest fires are more likely to occur during years of drought. The area identified as at risk to wildfire (Map 2: Past and Future Hazards) by the Hazard Mitigation Committee is in the northern section of Town and includes the Town Forest. The total value of all residential and commercial structures in this section of Exeter, including exempt structures such as schools and churches, is $1,586,473,374. Assuming 1% to 5% damage, a wildfire could result in $15,864,734 to $79,323,689 of structure damage.

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 Exeter, 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 Exeter, including exempt structures such as schools and churches, is $1,586,473,374. Assuming 1% to 5% damage, an earthquake could result in $15,864,734 to $79,323,689 of structure damage.

CHAPTER VI. EXISTING HAZARD MITIGATION PROGRAMS

The next step involves identifying existing mitigation strategies for the hazards likely to affect the town and evaluate their effectiveness. This section outlines those programs and recommends improvements and changes to these programs to ensure the highest quality emergency service possible.

Table 8: Existing Hazard Mitigation Programs for the Town of Exeter.

Existing Protection	Description-Area Covered	Responsible Local Agent	Effectiveness (Poor, Avg., Good)	Recommended Changes-Actions-Comments
Town of Exeter Local Emergency Management Plan	Town-wide	EMD, Police and Fire Departments, DPW	Good	Plan is updated every 3 years
Zoning Regulations	Town-wide	Code Enforcement Office	Good	Updated in 2006
Town Building Code	Town-wide	Building Inspector	Good	Adopt Seismic Design Code
NFIP Floodplain Ordinance	Development restriction in Special Flood Hazard Areas	Building Inspector and Planning Board	Good	None
Town Master Plan	Town-wide	Town Planner, Planning Board	Good	Updates ongoing
Town Capital Improvements Plan	Town-wide	Town Administrator/Department Heads	Good	Reviewed annually
Elevation Certificates	Component of building permit	Building Inspector	Good	None
Flood Warning System	Town-wide	Emergency Management Director	Average	Increase public education on cable access channel, town report, water and sewer bills
Emergency Services	Town-wide	EMD, Police Chief, Fire Chief	Good	None
CEMPS (Comprehensive Emergency Management Planning for Schools)	Schools	SAU 16 Superintendent, EMD	Good	None
FEMA Community Rating System	Town-wide	Building Inspector	Average	Consider applying for CRS
Emergency Water Plan	Town Water System	Water and Sewer Department	Good	None
Wellhead Protection	Specific areas of town	Code Enforcement Officer	Good	None
Wetlands Protection	Specific areas of town	Code Enforcement Officer	Good	Town has designated Prime Wetlands
Shoreland Protection	Specific areas of town	Code Enforcement Officer and Building Inspector	Good	None
Aquifer Protection	Specific areas of town	Code Enforcement Officer	Good	None
Hazardous Materials Plan	Town-side	Emergency Management Director	Good	On-going training for terrorist response

Existing Protection	Description-Area Covered	Responsible Local Agent	Effectiveness (Poor, Avg., Good)	Recommended Changes-Actions-Comments
Exeter River Corridor and Watershed Management Plan	Exeter River watershed	Exeter River Local Advisory Committee and Exeter Conservation Commission	Good	None
Exeter River Study	Exeter River watershed in Exeter	Exeter River Study Committee	Good	Conducting studies on use and management of the Exeter River and its tributaries
Tree Maintenance/Hazardous Tree Program	Town-wide	Department of Public Works	Needs additional resources	Forest management plan needed
Local Road Design Standards	Town-wide	Planning Board, Code Enforcement Officer, DPW	Good	None
Bridge Design and Inspection	Town-wide	State DOT and Town DPW	Good	Implement engineering review proposed by DPW
Storm Drain/Culvert Maintenance Program	Town-wide	Department of Public Works	Good	Implement engineering review proposed by DPW
State and Local Dam Program	NHDES/Town/ Private Owners	Department of Public Works	Average	Establish a dam warning system
Emergency Backup Power	Exeter Safety Complex, Exeter Town Office, portable generators	Emergency Management Director	Average	DPW and Elementary Schools and High School need back-up power
Mitigation Grants	Town-wide	EMD, DPW	Good	None
Geographic Information Systems (GIS)	Town-wide	Planning and Building Department, Assessor's Office, DPW	Good	None

CHAPTER VII. NEWLY IDENTIFIED MITIGATION STRATEGIES/ 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 10.

Table 9: List of hazard mitigation strategies or actions developed by the Natural Hazard Mitigation Committee

Mitigation Strategies or Action	Hazard(s) Mitigated
Radio Upgrade/Repeater/Interoperability	All Hazards
Emergency Operations Center/Second Fire Station	All Hazards
Sand Bag Filling Station	All Hazards
Public Outreach Program for Hazard Mitigation	All Hazards
Portable Lights (2)	All Hazards
16′ Shallow Draft Boat and Motor	All Hazards
Modifications to Great Dam	All Hazards
Modifications to Pickpocket Dam	All Hazards
Modifications to Colcord Pond Dam	All Hazards
Exeter River Level Monitoring	All Hazards
Upgrade Exeter Reservoir Dam Spillway	All Hazards
Move and Upgrade Exeter Water Treatment Plant	All Hazards
Culvert Inventory	All Hazards
Study Use and Management of Exeter River	All Hazards

CHAPTER VIII. FEASIBILITY AND PRIORITIZATION OF PROPOSED MITIGATION STRATEGIES

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 10:

- 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 Table 11a – 11 p.

Table 10a: Mitigation Action: Radio Upgrade/Repeater/Interoperability

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Average	2
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Average	2
Does it meet regulations?	Good	3
Will historic structures be saved or protected?	Good	3
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Average	2
S: Is it Socially acceptable?	Good	3
T: Is it Technically feasible and potentially successful?	Good	3
A: Is it Administratively workable?	Good	3
P: Is it Politically acceptable?	Average	2
L: Is there Legal authority to implement?	Good	3
E: Is it Economically beneficial?	Average	2
E: Are other Environmental approvals required?	Good	2
	Score	**40**

Table 10b: Mitigation Action: Emergency Operations Center/Second Fire Station

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Good	3
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Average	2
Does it meet regulations?	Average	2
Will historic structures be saved or protected?	Average	2
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Average	2
S: Is it Socially acceptable?	Average	2
T: Is it Technically feasible and potentially successful?	Good	3
A: Is it Administratively workable?	Average	2
P: Is it Politically acceptable?	Average	2
L: Is there Legal authority to implement?	Average	2
E: Is it Economically beneficial?	Good	3
E: Are other Environmental approvals required?	Average	2
	Score	**33**

Table 10c: Mitigation Action: Sand Bag Filling Station

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Good	3
Does it contribute to other goals?	Average	2
Does it benefit the environment?	Average	2
Does it meet regulations?	Average	2
Will historic structures be saved or protected?	Good	3
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Good	3
S: Is it Socially acceptable?	Good	3
T: Is it Technically feasible and potentially successful?	Good	3
A: Is it Administratively workable?	Average	2
P: Is it Politically acceptable?	Good	3
L: Is there Legal authority to implement?	Good	3
E: Is it Economically beneficial?	Good	3
E: Are other Environmental approvals required?	Good	3
	Score	**36**

Table 10d: Mitigation Action: Public Outreach Program for Hazard Mitigation

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Good	3
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Good	3
Does it meet regulations?	Good	3
Will historic structures be saved or protected?	Good	3
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Good	3
S: Is it Socially acceptable?	Good	3
T: Is it Technically feasible and potentially successful?	Good	3
A: Is it Administratively workable?	Good	3
P: Is it Politically acceptable?	Good	3
L: Is there Legal authority to implement?	Good	3
E: Is it Economically beneficial?	Good	3
E: Are other Environmental approvals required?	Good	3
	Score	**43**

Table 10e: Mitigation Action: Portable Light Units (2)

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Average	2
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Poor	1
Does it meet regulations?	Poor	1
Will historic structures be saved or protected?	Poor	1
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Good	3
S: Is it Socially acceptable?	Good	3
T: Is it Technically feasible and potentially successful?	Good	3
A: Is it Administratively workable?	Good	3
P: Is it Politically acceptable?	Average	2
L: Is there Legal authority to implement?	Poor	1
E: Is it Economically beneficial?	Poor	1
E: Are other Environmental approvals required?	Good	3
	Score	**30**

Table 10f: Mitigation Action: 16′ Shallow Draft Boat and Motor

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Average	2
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Good	3
Does it meet regulations?	Average	2
Will historic structures be saved or protected?	Average	2
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Good	3
S: Is it Socially acceptable?	Good	3
T: Is it Technically feasible and potentially successful?	Good	3
A: Is it Administratively workable?	Average	2
P: Is it Politically acceptable?	Average	2
L: Is there Legal authority to implement?	Average	2
E: Is it Economically beneficial?	Average	2
E: Are other Environmental approvals required?	Good	3
	Score	**35**

Table 10g: Mitigation Action: Modifications to Great Dam

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Good	3
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Average	2
Does it meet regulations?	Good	3
Will historic structures be saved or protected?	Average	2
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Poor	1
S: Is it Socially acceptable?	Average	2
T: Is it Technically feasible and potentially successful?	Average	2
A: Is it Administratively workable?	Average	2
P: Is it Politically acceptable?	Good	3
L: Is there Legal authority to implement?	Poor	1
E: Is it Economically beneficial?	Average	2
E: Are other Environmental approvals required?	Poor	1
	Score	**30**

Table 10h: Mitigation Action: Modifications to Pickpocket Dam

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Good	3
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Average	2
Does it meet regulations?	Good	3
Will historic structures be saved or protected?	Average	2
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Poor	1
S: Is it Socially acceptable?	Average	2
T: Is it Technically feasible and potentially successful?	Average	2
A: Is it Administratively workable?	Average	2
P: Is it Politically acceptable?	Good	3
L: Is there Legal authority to implement?	Poor	1
E: Is it Economically beneficial?	Average	2
E: Are other Environmental approvals required?	Poor	1
	Score	**30**

Table 10i: Mitigation Action: Modifications to Colcord Pond Dam

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Good	3
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Average	2
Does it meet regulations?	Good	3
Will historic structures be saved or protected?	Average	2
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Poor	1
S: Is it Socially acceptable?	Average	2
T: Is it Technically feasible and potentially successful?	Average	2
A: Is it Administratively workable?	Average	2
P: Is it Politically acceptable?	Good	3
L: Is there Legal authority to implement?	Poor	1
E: Is it Economically beneficial?	Average	2
E: Are other Environmental approvals required?	Poor	1
	Score	**30**

Table 10j: Mitigation Action: Exeter River Level Monitoring

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Good	3
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Good	3
Does it meet regulations?	Good	3
Will historic structures be saved or protected?	Average	2
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Good	3
S: Is it Socially acceptable?	Good	3
T: Is it Technically feasible and potentially successful?	Good	3
A: Is it Administratively workable?	Good	3
P: Is it Politically acceptable?	Good	3
L: Is there Legal authority to implement?	Good	3
E: Is it Economically beneficial?	Good	3
E: Are other Environmental approvals required?	Good	3
	Score	**41**

Table 10k: Mitigation Action: Upgrade Exeter Reservoir Dam Spillway

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Good	3
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Average	2
Does it meet regulations?	Good	3
Will historic structures be saved or protected?	Good	3
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Average	2
S: Is it Socially acceptable?	Good	3
T: Is it Technically feasible and potentially successful?	Good	3
A: Is it Administratively workable?	Good	3
P: Is it Politically acceptable?	Good	3
L: Is there Legal authority to implement?	Good	3
E: Is it Economically beneficial?	Good	3
E: Are other Environmental approvals required?	Good	3
	Score	**40**

Table 10l: Mitigation Action: Move and Upgrade Exeter Water Treatment Plant

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Good	3
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Good	3
Does it meet regulations?	Good	3
Will historic structures be saved or protected?	Good	3
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Poor	1
S: Is it Socially acceptable?	Average	2
T: Is it Technically feasible and potentially successful?	Good	3
A: Is it Administratively workable?	Good	3
P: Is it Politically acceptable?	Average	2
L: Is there Legal authority to implement?	Good	3
E: Is it Economically beneficial?	Average	2
E: Are other Environmental approvals required?	Average	2
	Score	**36**

Table 10m: Mitigation Action: Culvert Inventory

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Good	3
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Good	3
Does it meet regulations?	Good	3
Will historic structures be saved or protected?	Average	2
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Good	3
S: Is it Socially acceptable?	Good	3
T: Is it Technically feasible and potentially successful?	Good	3
A: Is it Administratively workable?	Good	3
P: Is it Politically acceptable?	Good	3
L: Is there Legal authority to implement?	Good	3
E: Is it Economically beneficial?	Good	3
E: Are other Environmental approvals required?	Good	3
	Score	**41**

Table 10n: Mitigation Action: Study Management and Use of Exeter River

Criteria	Evaluation Rating	Score
Does it reduce disaster damage?	Good	3
Does it contribute to other goals?	Good	3
Does it benefit the environment?	Good	3
Does it meet regulations?	Good	3
Will historic structures be saved or protected?	Good	3
Does it help achieve other community goals?	Good	3
Could it be implemented quickly?	Good	3
S: Is it Socially acceptable?	Good	3
T: Is it Technically feasible and potentially successful?	Good	3
A: Is it Administratively workable?	Good	3
P: Is it Politically acceptable?	Good	3
L: Is there Legal authority to implement?	Good	3
E: Is it Economically beneficial?	Good	3
E: Are other Environmental approvals required?	Good	3
	Score	**42**

After each strategy was evaluated and prioritized according to the final score. The highest scoring strategies were determined to be of more importance, economically, socially, environmentally, and politically feasible and, hence, prioritized over those that were lower scoring.

CHAPTER IX. IMPLEMENTATION SCHEDULE FOR PRIORITY MITIGATION STRATEGIES

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 12 is the Action Plan. In addition to the prioritized mitigation projects, Table 12 includes the responsible party (WHO), how the project will be supported (HOW), and what the timeframe is for implementation of the project (WHEN). Also included is a cost estimate for each project if available.

Table 11: Action Plan for proposed mitigation actions

STAPLEE Rank (Priority)	Project	Responsibility/ Oversight	Funding/ Support	Estimated Cost	Time frame
1	Study Use and Management of Exeter River	Town Administrator/ DPW/Board of Selectmen	Local/Grants	$150,000	2006
2	Public Outreach Program for Hazard Mitigation	Town Administrator/EMD/ DPW	Local/Grants	$7,500	2007
3	Exeter River Level Monitoring	DPW	Local/State/Grants	$50,000	2006
4	Culvert Inventory	DPW	Local	$10,000	2007
5	Radio Upgrade/Repeater/Interoperability	Fire/Police/EMD	Local/Grants	$35,000	2008
6	Upgrade Exeter Reservoir Dam Spillway	DPW	Local/Federal	$35,000	2007
7	Sand Bag Filling Station	Fire	Local	$4,500	2007
8	Move and Upgrade Exeter Water Treatment Plant	DPW	Local/State/Federal	$18 million	2007
9	16' Shallow Draft Boat and Motor	Fire	Local/Grants	$18,500	2008
10	Emergency Operations Center/Second Fire Station	Fire/Police/EMD	Local/Grants	$4.5 million	2010
11	Portable Lights (2)	Fire	Local/Grants	$22,000	2007
12	Modifications to Great Dam	DPW	Local/State/Federal	$1 million	2012
13	Modifications to Pickpocket Dam	DPW	Local/State/Federal	$1 million	2012
14	Modifications to Colcord Pond Dam	DPW	Local/State/Federal	$500,000	2012

CHAPTER X. 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 8), it is recommended that the Town revisit the *Exeter Hazard Mitigation 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. At each review of the *Plan* the need for new mitigation actions should be reviewed. A list of general mitigation strategies has been included in the *Plan* as a starting point by which to establish new additions to the Action Plan (Appendix A).

The Emergency Management Director is responsible for initiating the review of the *Plan* with members of the Town that are appropriate including members of the public. In keeping with the process of adopting the 2006 *Exeter Hazard Mitigation Plan*, a public hearing to receive public comment on *Plan* maintenance and updating will be held during the any review 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 the *Plan* to determine feasibility of future implementation.