CHAPTER III

NATURAL HAZARDS IN THE TOWN OF SALEM
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 Salem is prone to several types of natural hazards. These hazards include: drought, flooding, hurricanes or other high-wind events, severe winter weather, wildfires and earthquakes. Other natural hazards can and do affect the Town of Salem, 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: 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*. Salem has no record of landslides and little chance of one occurring that could possibly damage property or cause injury; so landslides were not included in this *Plan*. The State's Plan indicates that Rockingham County is at Moderate risk to 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 (drought, flooding or severe winter weather) it was not considered an effective use of the Committee time to include 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

Drought
A drought is defined as "a period of abnormally dry weather sufficiently prolonged for the lack of water to cause serious hydrologic imbalance in the affected area." -Glossary of Meteorology (1959).

In easier to understand terms, a drought is a period of unusually persistent dry weather that persists long enough to cause serious problems such as crop damage and/or water supply shortages. The severity of the drought depends upon the degree of moisture deficiency, the duration, and the size of the affected area.

There are actually four different ways that drought can be defined.

> Meteorological-a measure of departure of precipitation from normal. Due to climatic differences, what might be considered a drought in one location of the country may not be a drought in another location.
>
> Agricultural-refers to a situation where the amount of moisture in the soil no longer meets the needs of a particular crop.
>
> Hydrological-occurs when surface and subsurface water supplies are below normal.
>
> Socioeconomic-refers to the situation that occurs when physical water shortages begin to affect people.

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

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[3] 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 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[4] 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 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.

3 The Saffir/Simpson Hurricane Scale can be viewed in Appendix C
4 The Fujita Tornado Scale can be viewed in Appendix D

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[5] and Mercalli scale.

Profile of Past and Potential Natural Hazards

As discussed above the natural hazards that affect, or potentially could affect Salem, 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. Some of the natural hazards have not occurred within the Town of Salem (within written memory), for these hazards the *Plan* refers to a table of hazards that have occurred regionally and statewide (Table 4). Community vulnerability identifies the specific areas, general type of structures, specific structures, or general vulnerability of the Town of Salem to each natural hazard.

Drought

Description: Droughts can be one or a combination of the following four types: meteorological, agricultural, hydrological, or socioeconomic.

Location: Salem is vulnerable to hydrological drought which can quickly become socioeconomic. The municipal water system draws its water from two reservoirs: Canobie Lake a naturally occurring 373 acre lake and Arlington Pond a 320 acre lake created by the damning of the Spicket River. Both reservoirs are susceptible to prolonged periods of limited rain fall and low groundwater tables.

5 A copy of the Richter scale is displayed in Appendix E

Extent: Approximately, 60% of the Town's residents and several major commercial/industrial parks are serviced by the municipal water system. Also at risk are approximately 500 acres of land which are farmed for small fruits and vegetables and 4 ponds and lakes used for summer recreation purposes. Based upon the Town's average daily water consumption (2 million gallons in 2003) replacement water would cost the community over $6,000 per day.

Probability: Moderate.

Table 1: Probability of Drought based on return interval

Drought Return Interval	Degree of Severity
10-year	Moderate
10-25-year	Sever
>25-year	Extreme

Past Occurrence: Between 1929 and 2003, 12 droughts have impacted the State of New Hampshire. The worst of these occurred from 1960-69, with rainfall 25% of normal. The most resent drought with the greatest economic impact to the Town of Salem occurred from the summer of 1994 to the summer of 1995. During a 14 month period rainfall was at 70% of normal. The Town had to purchase 1 million gallons of water a day from a neighboring community and had less than a month's supply of water in its reservoir before the drought ended.

Community Vulnerability: Moderate droughts requiring water rationing is likely to reoccur in 10 year intervals.

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: Salem 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). These flood zones correspond to the Special Flood Hazard Area (100-year flood zone) and the 500-year flood zone. There are also several areas susceptible to flooding that are not within these flood zones, these areas are described below.
Extent: The extent of the flood zones can be seen on Map 4: Town Flood Zone. This area includes FIRM Zones A and X, as well as, areas of locally chronic flood problems highlighted on Map 5: Potential Flood Hazard Areas.

Probability: **High**.

Table 2: 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 Salem. Several locations were identified by the Committee as areas of chronic reoccurring flooding or high potential for future flooding. These areas are listed below. Larger flood events are listed in Table 2.

- Bluff Street Extension
- Cluff Crossing Road
- Emerson Way
- Fairmont Road
- Haigh Avenue
- Hampshire Road
- Lawrence Road
- Lou Avenue
- Main Street in the area of the Central Fire Station
- Millville Street and Millville Circle intersection
- North Main Street
- Pleasant Street and Cornwell Court
- Route 111 at Shadow Lake (Shadow Lake Road)
- South Broadway, Route 28 commercial area (south of state line)
- Goodluck Trailer Park
- Larry's Country Square at the southern end of Route 28
- Town Farm Road

Community Vulnerability: Flooding is most likely to occur in the 100-year flood zones. These zones are located along the banks of the Little River and its tributaries, and also in proximity to wetlands.

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. For the Town of Salem, any hurricane event is likely to have downgraded significantly after making landfall, prior to reaching the town boundary. For this *Plan*, high-wind events were considered to have an equal chance of affecting any part of the Town of Salem.

Extent: Salem is located within Zone II hurricane-susceptible region (indicating a design wind speed of 160 mph)[6]. 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)[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]. 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, hurricanes have made landfall (2 category 1, 2 category 2 and 2 category 3). From this information it can be extrapolated that Salem 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 138 mph elsewhere. Thirteen of the 494 people killed by this storm were residents of New Hampshire. The Storm caused $12,337,643 in damages (1938 dollars), timber not included.

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

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

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 an equal chance of affecting any part of the Town of Salem.

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 in Table 4.

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 large wooded areas of Town as at-risk to wildfires, see Map 9: Structures in Wooded Areas. These areas are 10+ acres of continuous woodlands and include the Salem Town Forest.

Extent: A wildfire in the Town of Salem is unlikely, but if a crown fire were to occur it could be very damaging to a small section of Town. The housing in this North-end section of town is relatively low-density when compared to other areas of Town, but a crown fire could affect as many as 122 structures, mostly residential.

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 Salem 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 Salem.

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 Salem'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 3).

Table 3: Peak Ground acceleration (PGA) values for Salem (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 Salem within recent memory. A list of earthquakes that have affected the region is displayed in Table 4.

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.

9 http://eqhazmaps.usgs.gov/

Table 4: Past Hazard Events in Salem and Rockingham County

Hazard	Date	Location	Critical Facility or Area Impacted	Remarks
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	March 22-23, 2001	South Central Rockingham County	Typically structures and infrastructure in the floodplain	Localized prolonged moderate rain event coupled with snow melt

Flood	April 1-4, 2004	South Central Rockingham County	Typically structures and infrastructure in the floodplain	Localized prolonged moderate rain event
Hurricane	October 18-19, 1778	Portions of State	Unknown	40-75 mph winds
Hurricane	1804	Portions of State	Unknown	
Hazard	**Date**	**Location**	**Critical Facility or Area Impacted**	**Remarks**
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[9] - 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
Hurricane Gloria	September 27, 1985	Southern New England	Unknown	Category 2, winds 96-110 mph >70 mph winds; minor wind damage
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[10]
Tornado	May 16, 1890	Rockingham County	Unknown	F2
Hazard	**Date**	**Location**	**Critical Facility or Area Impacted**	**Remarks**
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	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
Ice Storm	January 8-25, 1979	NH	Major disruption of power and transportation	Many communities affected
Ice Storm	March 3-6, 1991	Southern NH	Numerous power outages in southern NH	Many communities affected
Hazard	**Date**	**Location**	**Critical Facility or Area Impacted**	**Remarks**
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 37-50” of sleet, ice and snow
Snowstorm	February 15, 1940	New England	Paralyzed New England	30” 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; 50” 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[11]
Hazard	**Date**	**Location**	**Critical Facility or Area Impacted**	**Remarks**
Earthquake	December 20, 1940	Ossipee, NH	Ground Cracks and damage over a broad area	Richter Magnitude Scale: 5.5; Felt over 341 miles away
Earthquake	December 24, 1940	Ossipee, NH	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, NH	Little damage	Richter Magnitude Scale: 4.5
Earthquake	Aug. 19, 2005	North of Concord, NH	No reports of damage	Richter Magnitude Scale: 1.7
Drought	1929-36	Statewide	Unknown	Regional
Drought	1939-44	Statewide	Unknown	Severe in southeast NH
Drought	1947-50	Statewide	Unknown	Moderate
Drought	1960-69	Statewide	Unknown	-6 on the Palmer Drought Index[12]

Drought	1979-81	Maine to Carolinas	Local wells and reservoirs	-4.5 on the Palmer Drought Index
Drought	1984-85	Maine to Florida	Local wells and reservoirs	-5 on the Palmer Drought Index
Drought	1988-89	Maine to Pennsylvania	Local wells and reservoirs	-2.5 on the Palmer Drought Index
Hazard	**Date**	**Location**	**Critical Facility or Area Impacted**	**Remarks**
Drought	1991-92	Northeast	Local wells and reservoirs	-4.1 on the Palmer Drought Index
Drought	1993	Maine to Florida	Local wells and reservoirs	-4.0 on the Palmer Drought Index
Drought	1994-95	Maine to Virginia	Local wells and reservoirs	-4.6 on the Palmer Drought Index
Drought Warning	1998-99	New England to North Carolina	Local wells and reservoirs	-5.7 on the Palmer Drought Index

9 For a complete description of the Saffir/Simpson Hurricane Scale see Appendix C
10 For a complete description of the Fujita Tornado Damage Scale see Appendix D
11 For a complete description of the Richter Magnitude Scale see Appendix E
12 For a complete description of the Palmer Drought Index see Appendix F

Sources: New Hampshire Bureau of Emergency Management, 2000; Town of Salem;
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
National Oceanic & Atmosphere Administration,
http://www.erh.noaa.gov/er/okx/HydroPage/comparison.html