City of Lebanon
New Hampshire

HAZARD MITIGATION PLAN

Update 2016

Dulac Street and Slayton Hill Road, July 2013

Prepared by the
City of Lebanon Hazard Mitigation Committee and
Upper Valley Lake Sunapee Regional Planning Commission

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I. INTRODUCTION

A. BACKGROUND

The New Hampshire Department of Homeland Security and Emergency Management (NH HSEM) has a goal for all communities within the State of New Hampshire to establish local hazard mitigation plans as a means to reduce future losses from natural or man-made hazard events before they occur. The NH HSEM has provided funding to the City of Lebanon, to update their local Hazard Mitigation Plan. UVLSRPC wrote the first Lebanon Hazard Mitigation Plan that was approved in 2011. The *Lebanon Hazard Mitigation Plan Update 2016* serves as a strategic planning tool for use by the City of Lebanon in its efforts to reduce future losses from natural and/or man-made hazard events before they occur.

The Lebanon Hazard Mitigation Committee updated the *Lebanon Hazard Mitigation Plan* with the assistance and professional services of the Upper Valley Lake Sunapee Regional Planning Commission (UVLSRPC). After a public meeting held in the Lebanon City Offices, the Lebanon City Council adopted the updated plan on November 2, 2016 as shown in Appendix E.

B. PURPOSE

The Lebanon Hazard Mitigation Plan Update 2016 is a planning tool for use by the City of Lebanon in its efforts to reduce future losses from natural and/or human-made hazards. This plan does not constitute a section of the City Master Plan, nor is it adopted as part of the Zoning Ordinance.

C. HISTORY

On October 30, 2000, President Clinton signed into law the Disaster Mitigation Act of 2000 (DMA 2000). The ultimate purpose of DMA 2000 is to:

- Establish a national disaster mitigation program that will reduce loss of life and property, human suffering, economic disruption, and disaster assistance costs resulting from disasters, and
- Provide a source of pre-disaster mitigation funding that will assist States and local governments in accomplishing that purpose.

DMA 2000 amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act by, among other things, adding a new section: 322 – Mitigation Planning. This places new emphasis on local mitigation planning. It requires local governments to prepare and adopt jurisdiction-wide hazard mitigation plans as a condition to receiving any hazard mitigation grants. Local governments must review and if necessary, update the mitigation plan annually to continue program eligibility.

Why develop a Mitigation Plan?
Planning ahead to lessen or prevent a disaster will reduce the human, economic, and environmental costs. The State of NH is vulnerable to many types of hazards, including, but not limited to, floods, hurricanes, winter storms, wildfires, wind events, and earthquakes. All of these types of events can have significant economic, environmental, and social impacts. The full cost of the damage resulting from the impact of natural hazards – personal suffering, loss of lives, disruption of the economy, and loss of tax base – is difficult to quantify and measure.

D. SCOPE OF THE PLAN

The scope of the *Lebanon Hazard Mitigation Plan Update 2016* includes the identification of natural hazards affecting the City, as identified by the Lebanon Hazard Mitigation Committee. The hazards were reviewed under the following categories as outlined in the State of New Hampshire Hazard Mitigation Plan.

- Dam Failure
- Flooding
- Hurricane
- Tornado & Downburst
- Thunderstorm/Lightning/Hail
- Severe Winter Weather
- Earthquake
- Drought
- Extreme Heat
- Erosion
- Landslide
- Wildfire
- Natural Contaminants
- Hazardous Materials Spill
- Terrorism

E. METHODOLOGY

Using the *Local Mitigation Planning Handbook by FEMA (2013)*, the Lebanon Hazard Mitigation Committee, in conjunction with the UVLSRPC, developed the content of the *Lebanon Hazard Mitigation Plan* by tailoring the nine-task process set forth in the guidebook appropriate for the City of Lebanon. Many FEMA resources and multiple State and Federal websites were also used as well.

The Committee held a total of two posted meetings in 2016. The first meeting was posted in on the City's website, at City Hall, and at the two City libraries website inviting the general public. Though notices invited the general public to participate, no public

attended the meetings. Invitations to attend the public meetings were sent to all abutting municipalities. Major employers Dartmouth Hitchcock Medical Center, Hypertherm, Dartmouth College, and Timken were also invited to attend. Although no abutting towns attended, several City industries attended the first meeting and Dartmouth-Hitchcock Hospital also had a representative at the second posted meeting. Meeting documentation is provided in Appendix C.

The following hazard mitigation meetings were vital to the development of this Plan:

April 5, 2016
May 24, 2016

The Lebanon City Council also held a public meeting to gain additional input from the citizens of Lebanon and to raise awareness of the ongoing hazard mitigation planning process prior to adopting the Plan which had been conditionally approved by FEMA. The plan was formally adopted by the city on November 2, 2016 which is shown in Appendix E.

To complete this updated Plan, the Hazard Mitigation Committee followed the following planning steps to re-evaluate the plan sections of the existing 2010 plan and to update it to reflect current information and issues:

Task 1: Determine the Planning Area and Resource (March - April 2016)
Lebanon is a small city and chose to continue their planning as process as a single municipality. The City chose to work with the Upper Valley Lake Sunapee Regional Planning Commission to provide technical support.

Task 2: Build the Planning Team (March – April 2016)
Members of the Committee included all relevant personnel as well as any interested citizens. This included a department heads and the City Manager to represent municipal organizations with general and land use planning authority.

Task 3: Create an Outreach Strategy (March – April 2016)
The Committee chose to provide public notices to the public to encourage participation at the public meetings. They also put a notice on the city website. Notices were also sent to each of the neighboring towns to invite them to participate in the meetings, send comments, or request a final plan. The final plan will also be available for public review prior to adoption. Meeting documentation is provided in Appendix C.

Task 4: Review Community Capabilities (April - May 2016)

Committee members identified facilities that were considered to be of value to the City for emergency management purposes, for provision of utilities and services, and for historic, cultural and social value. A GIS-generated map was prepared to show critical facilities identified by the Lebanon Hazard Mitigation Committee. A summary listing of "Critical Facilities" is presented in Chapter IV. Costs were determined for losses for each type of hazard. Using information and activities in the handbook, the Committee and UVLSRPC staff identified existing mitigation strategies which are already implemented in the City related to relevant hazards. A summary chart and the results of this activity are presented in Chapter VI.

Task 5: Conduct a Risk Assessment (April - May -2016):

The Committee determined natural and human-made hazards affecting the City and updated a description, location, and extent of those previous and potential hazards. Existing and future assets were updated to determine vulnerability to potential hazard events. Critical facilities needed during an emergency were identified and given values based on tax data. It was also determined if these facilities are in a hazard zone or not. Other facilities identified are those needed to continue the daily operation of the municipality and those that have dense populations or valued historical structures and vulnerable natural areas.

Task 6: Develop a Mitigation Strategy (April – May 2016):

The Committee evaluated the goals in the previous plan and determined they were still appropriate, although minor revisions were made to make the goals easier to read. They then determined actions that they could take to meet those goals to reduce their risk to hazard events. They discussed existing regulations, ordinances, and the Master Plan and how they could continue to incorporate hazard mitigation strategies into these documents to include hazard mitigation in land use planning. Committee members agreed to pursue this integration with appropriate municipal boards.

Task 7: Keep the Plan Current: (annually):

The plan will be reviewed after every major event to evaluate the effectiveness of the plan. It will also be updated at least every five years as required.

Task 8: Review and Adopt the Plan:

The Committee will incorporate any feedback from Committee members, municipal officials, residents, businesses and institutions, and neighboring communities. The plan will be assessed by using FEMA's Local Mitigation Plan Review Tool prior to sending to NH Homeland Security and Emergency Management for preliminary review. If HSEM considers the plan to meet the requirements, they will forward the draft plan to FEMA for their review. Once FEMA determines the plan meets requirements, the municipality will hold a public meeting to obtain further comments and review the final draft. If there are no major suggested changes, the municipal government will adopt the plan and the adoption form will be sent to HSEM and then to FEMA to receive a final approval of the plan.

Task 9: Create a Safe and Resilient Community:
The municipality will implement the plan by committing to task accomplishment as indicated in the plan. The municipality will take advantage of available funding opportunities such as FEMA's mitigation grant programs. The process for monitoring and updating the Plan can be found in Chapter IX.

UVLSRPC staff compiled the results of tasks one through nine in a draft document, as well as helpful and informative materials from the *State of New Hampshire Multi-Hazard Mitigation Plan* (2013), which served as a resource for the *Lebanon Hazard Mitigation Plan Update 2016*. The process for monitoring and updating the Plan can be found in Chapter IX.

F. HAZARD MITIGATION GOALS

The Lebanon Hazard Mitigation Committee reviewed the hazard mitigation goals set forth in the previous Hazard Mitigation Plan and revised them as follows:

1. To identify, introduce and implement cost effective Hazard Mitigation measures so as to accomplish the City's goals and to raise awareness and acceptance of hazard mitigation opportunities generally.

2. To improve upon the protection of the general population, the citizens, and visitors of the City of Lebanon from natural and human-made hazards.

3. To reduce the potential impact of natural and human-made disasters to:
   - the City of Lebanon's Critical Support Services,
   - Critical Facilities in the City of Lebanon,
   - the City of Lebanon's infrastructure,
   - Lebanon School Properties,
   - private property,
   - the City's economy,
   - the City's natural environment, and
   - the City's specific historic treasures and interests.

4. To improve the City's Disaster Response and Recovery capability as a hazard mitigation strategy to be prepared for emergencies and reduce their impact.

G. ACKNOWLEDGEMENTS

The following people participated in the meetings to develop the update of this plan as the Hazard Mitigation Committee. Thank you to the other City staff providing information outside the meetings.

- Paula Maville, City of Lebanon Interim City Manager
- David Brooks, City of Lebanon Planning & Zoning Director
- Chris Christopoulos, City of Lebanon EMD and Fire Chief
- Richard Mello, City of Lebanon Police Chief
- Mike Lavalla, City of Lebanon Director Public Works Director

- Paul Hatch, Field Representative, NH Homeland Security and Emergency Management
- Victoria Davis, Planner, Upper Valley Lake Sunapee Regional Planning Commission

The Hazard Mitigation Committee was composed of local officials, local business representatives, and a staff representative of the UVLSPRC for meeting facilitation and plan development. Neighboring communities were invited by e-mail to participate. The general public was invited to attend meetings by public postings on, the bulletin board at the City Clerk's office. These were posted 10 days prior to the first posted meeting date and posted on the City web site. No citizens inquired about the update process or attended any of the meetings. No comments were made by neighboring towns. Meeting documentation is provided in Appendix C.

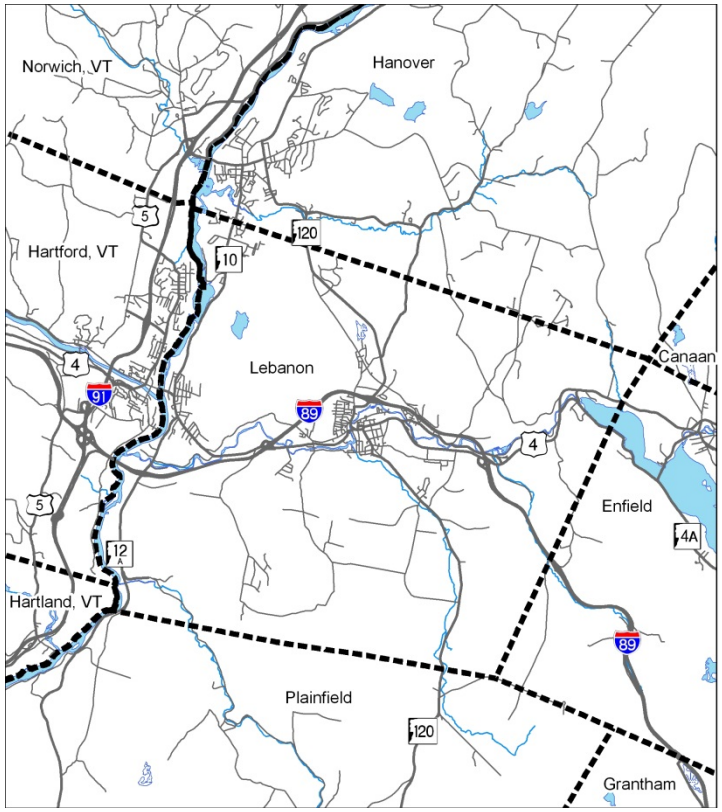
Historical information, relevant data and potential future mitigation strategies were contributed by all parties involved in the planning process. For a record of all meeting topics see Appendix C: Meeting Documentation. The staff representative of the UVLSRPC gathered all information from local officials and agency representatives and compiled the information to develop the Plan.

II. COMMUNITY PROFILE

A. INTRODUCTION[1]

Geographical Location and Information

The City of Lebanon, New Hampshire - together with our neighboring communities of Hanover, New Hampshire (to the north) and Hartford, Vermont (to the west) - is the regional center of the Upper Connecticut River Valley. Lebanon is a thriving small City that offers our 13,151 residents (2010 Census) the best of rural and urban living. Approximately 19,000 people work in our City, including at the Dartmouth-Hitchcock Medical Center (DHMC) campus, in one of the many high-tech companies located in our business parks, at one of the national or local retail stores or restaurants in our commercial areas, or at a small business in one of our historic central business districts. Lebanon's infrastructure — state-of-the art telecommunications, direct interstate highway access, public water and sewer systems with available capacity, and recently resumed freight rail service — supports a dynamic and diverse business community.



Lebanon developed along the Connecticut and Mascoma Rivers and the natural landscape is characterized by the ridgeline and undulating hills that define the river valleys. The Mascoma River serves a dual role of linking historically the eastern and the western ends of the City and of partitioning the north from the south. The Connecticut River serves as a landmark that defines our City limits on the west and ties the northwest section of Lebanon with the southwest corner.

Today, our built landscape is a composite of traditional and modern land use patterns. Lebanon's early use of land replicated traditional European development patterns - a dense urban center surrounded by farm and forest land. That land use pattern remains

[1] City of Lebanon Master Plan (2012) and discussions with Committee

within our two urban centers, located in the river valleys, one in the central (Lebanon village) and the other in the western (West Lebanon village) part of the City. Spurred by the construction of Interstate 89, a new pattern began to emerge 50 years ago. The modern land use pattern included the large-lot residential development in rural areas and retail strip development along the main highways now described as suburban sprawl. While much development has occurred outside the traditional urban centers in recent decades, we are fortunate to have retained a substantial amount of rural land. The value of these open, rural spaces to the City's quality of life is now widely recognized. Lebanon's land use patterns are again shifting - from auto-dependent, low-

density suburban sprawl that would consume our remaining rural lands to pedestrian-friendly, higher-density, mixed-use smart growth that will focus growth in our core developed areas and conserve open space.

During the 2000s, more than 75,000 square feet of public institution use was added to the City, including the Mose E. Sanville DPW facility, Grafton County Senior Center, Veterans Memorial Pool, Airport Hangars, and both new and expanded religious buildings. Medical use in the 1980s was estimated to account for less than 100,000 square feet, consisting of the Alice Peck Day Memorial Hospital. During the 2000s, approximately 700,000 additional square feet were added to the approximately 1.0 million square feet built in the 1990s. Dartmouth Hitchcock Medical Center, including the main building and additional campus structures, accounted for the vast majority of this development. In 1959, there was approximately 850,000 square feet of general commercial and industrial space in the City. The average amount added per decade since has been just shy of 1 million square feet, with a high of 1.35 million square feet in the 1980s and a low of 626,000 square feet in the 1960s. The 2000s brought an additional 1.07 million square feet. Several large projects, recently approved by the Planning Board, will ensure that the decade average is met or exceeded out to 2030 if they come to fruition.

As documented in Lebanon's Landscape Report (2008), the City is approximately 25% developed and 75% undeveloped land. The vast majority of the undeveloped land is forested with a small percentage of open field, active farm, or shrubby woodland. There are approximately 2,100 acres of permanently protected land, representing 11% of the undeveloped land.

City Government Structure

The City of Lebanon operates under a City Council/City Manager form of government. A nine-member City Council is elected for two-year terms. The City Council is responsible for establishing City policies.

The City Manager is the Chief Executive Officer, appointed by the City Council. The City Manager is responsible for supervising and conducting the day-to-day operations and affairs of the City, and to carry out the policies established by the City Council.

B. DEVELOPMENT TRENDS

Development in Lebanon is greatly dependent on the economic growth of the Lebanon and Hanover area. Significant increases could occur in the future if housing shortages develop in the region and job growth continues in the Lebanon-Hanover areas where new housing opportunities may be limited. Although the City would like to focus on redevelopment of existing developed areas, the Committee identified tracts of land where new development may occur.

Table II-1: AREA POPULATION TRENDS

Area	1980	1990	2000	2010
Lebanon	**11,134**	**12,191**	**12,571**	**13,151**
Enfield	3,175	3,979	4,618	4,582
Canaan	2,456	3,045	3,319	3,909
Plainfield	1749	2,059	2,254	2,364
Hanover	9,119	9,212	10,850	11,260
Grafton County	*65,806*	*74,929*	*81,743*	*89,101*
New Hampshire	*920,610*	*1,109,252*	*1,235,786*	*1,316,470*

Source: US Census

Table II-2: POPULATION GROWTH IN LEBANON

	1980	1990	2000	2010
Population	**11,134**	**12,191**	**12,571**	**13,151**
Decade Change in Population		9.5%	3.1%	4.6%

Source: 1980 – 2010 US Censuses

Table II-3: POPULATION PROJECTIONS FOR LEBANON

Area	2015	2020	2025	2030	2035	2040
Lebanon	12,954	12,952	13,180	13,341	13,434	13,470
Change in Population 5 yrs	*-1.5%*	*0.0%*	*1.8%*	*1.2%*	*1.5%*	*0.3%*

Source: State of New Hampshire, Regional Planning Commissions, Office of Energy and Planning - County Population Projections, 2013

Building permits and subdivisions in recent years are as shown below. Permits for minor renovation or additions are not included.

Table II-4: BUILDING PERMITS & SUBDIVISIONS 2009 - 2014

Year	Building Permits		Subdivisions	
	Residential	Commercial	Number of Subdivisions	Number of Lots
2011	15	9	6	54
2012	32	4	3	21
2013	3	7	2	12
2014	65	2	4	4
2015	16	3	4	31

Source: Lebanon Planning Office, January 2016

The vulnerability of parts of the City has decreased since the previous plan was done. The Rivermere project on Slayton Hill Road was greatly affected by the runoff and erosion from the microburst storm in 2013. This was an exceptional event, and tremendous renovations to the area have since occurred to ensure the area will be safe in future major rain events.

The River Park project is located along the Connecticut River, just below the Wilder Dam. The project layout did not include any structures or improvements within the floodplain areas. However, much of the project (and most of West Lebanon itself) would fall within the PMF (probable maximum flood) area of the Wilder and Moore Dams in the event of a failure based on the inundation map data provided by TransCanada in 2011.

Much of the rest of the development approved over the last several years has been in the Route 120 corridor, which isn't identified as a significant hazard areas.

III. HAZARD IDENTIFICATION

The Lebanon Hazard Mitigation Committee reviewed the list of hazards provided in the *State of New Hampshire Multi-Hazard Mitigation Plan*, and some hazard history for the State of New Hampshire and Grafton County in particular. A list of past hazard events in Lebanon, Grafton County, and the State of New Hampshire can be found in the following discussion and tables. After reviewing this information and the Emergency Operations Plan, the Committee conducted a Risk Assessment. The resulting risk designations are provided in the heading of each hazard table below as well as a more detailed discussion further into this chapter.

A. WHAT ARE THE HAZARDS IN LEBANON?

Lebanon is prone to a variety of natural and human-made hazards. The hazards that Lebanon is most vulnerable to were determined through gathering historical knowledge of long-time residents and city officials; research into the CRREL Ice Jam Database, FEMA and NOAA documented disasters, and local land use restrictions; and from the input of representatives from state agencies (NH HSEM). The hazards potentially affecting the City of Lebanon are dam failure, flooding, hurricane, tornado & downburst, thunderstorm (including lightning and hail), severe winter weather, earthquake, drought, extreme heat, erosion, landslide, wildfire, natural contaminants, hazardous materials spills, and terrorism. Each of these hazards and the past occurrences of these hazards are described in the following sections. Hazards that were eliminated from assessment are those that have not had a direct impact on the City of Lebanon and are not anticipated to have an impact as determined by the Hazard Mitigation Planning Committee, representatives from state agencies and citizens of the City of Lebanon. Eliminated hazards include Land Subsidence, Expansive Soils, and Snow Avalanches.

B. DESCRIPTIONS OF HAZARDS

An assessment of each hazard relevant to Lebanon is provided below. An inventory of previous and potential hazards is provided. Past events are shown in the following tables and the potential for future events is then discussed. The "risk" designation for each hazard was determined after evaluations discussed later in this chapter.

- Dam Failure
- Flooding
- Hurricane
- Tornado & Downburst
- Thunderstorm/Lightning/Hail
- Severe Winter Weather
- Earthquake
- Drought
- Extreme Heat
- Erosion
- Landslide
- Wildfire
- Natural Contaminants
- Hazardous Materials Spill
- Terrorism

Dam Failure

Dam failure results in rapid loss of water that is normally held by the dam. These kinds of floods pose a significant threat to both life and property. Appendix D shows the location of active dams in Lebanon.

NH DES assigns a hazard designation to each dam in the state depending upon the potential damage it would cause if the dam failed:

- A "high hazard potential" is indicated if the dam is in a location and of a size that failure or mis-operation of the dam would result in the following: major economic loss to structures or property; structural damage to roads; major environmental; or public health losses; and probable loss of human life.

- A "significant hazard potential" would mean the dam is in a location and of a size that failure or mis-operation of the dam would result in any of the following: major economic loss to structures or property; structural damage to roads; major environmental or public health losses.

- A "low" hazard dam failure could cause some structural damage to buildings and roads.

- A "non-menace" dam failure would not cause any significant damage.

"High" and Significant" hazard potential dam owners must provide NH DES with maps of the potential inundation area if the dam were to fail. It should be noted that there are some exemptions from this requirement such as lagoons.

Past Dam Failure Events

There have been no dam failures within the City of Lebanon or outside the city that would have affected the city.

Table III-1 – DAMS

DAMS: POTENTIAL FAILURE- Low-Medium Risk									
Dam #	**Class**	**Dam Name**	**Water Body**	**Owner (now or formerly)**	**Status**	**Type**	**Impoundment Area in Acres**	**Height of Dam (Ft)**	**Drainage Area in Acres**
134.17	S	Boston Lot Lake Dam	T/R Connecticut River	City of Lebanon	Active	Earth	44.000	25.00	0.81
134.27	NM	Car Store Pond	Mink Brook Extension	Charles F. Folliott	Active	Concrete	0.500	5.00	2.00
134.28	L	Dartmouth Hitchcock Pond	Unnamed Stream	DHMC	Active	Earth	2.000	15.50	0.60
134.30	NM	Densmore Det Pond	Runoff	C. R. Wilson Properties NH Inc.	Active	Earth	0.530	6.00	0.01
134.33	-	Detention Pond	Runoff	CDA Development LLS	Exempt	Earth	0.180	8.00	0.00
134.20	NM	Farm Pond	Natural Swale	Karen Moulton	Active	Earth	1.500	11.00	0.04
134.22	NM	Farm Pond Dam	Natural Swale	Grand Ayr Farm	Active	Earth	0.360	6.00	0.01
134.11	-	Glen Hydro Dam	Mascoma River	City of Lebanon	Breached	Timber/Stone	30.000	23.00	194.00
134.12	L	Glen Road Dam	Mascoma River	Enel North America Inc.	Active	Concrete	7.000	21.00	193.00
134.29	NM	Hazlett Beaver Pond Dam	T/R Martin Brook	Robert Hazlett	Active	Earth	4.000	6.00	0.86
134.31	NM	Keane Recreation Pond Dam	Unnamed Stream	Chris Keane	Active	Earth	0.150	14.00	0.30
134.36	L	LCS Settling Pond	N/A	Pike Industries	Active	Earth	6.600	15.00	0.00
134.18	-	Lebanon Reservoir Dam	Unnamed Stream	City of Lebanon	Breached	Concrete	0.410	22.00	0.00
134.04	S	Lebanon Water Treatment Intake	Mascoma River	City of Lebanon	Active	Concrete	0.400	16.00	169.00
134.01	S	Mascoma Lake	Mascoma River	NH Water Resources Council	Active	Concrete	1155.000	18.00	153.00
134.14	NM	Mascoma River	Mascoma River	City of Lebanon	Active	Concrete	2.000	8.00	194.00
134.10	NM	Plant No. 1 Dam	Mascoma River	City of Lebanon	Active	Concrete	3.000	12.00	188.00

DAMS: POTENTIAL FAILURE- Low-Medium Risk									
Dam #	**Class**	**Dam Name**	**Water Body**	**Owner (now or formerly)**	**Status**	**Type**	**Impoundment Area in Acres**	**Height of Dam (Ft)**	**Drainage Area in Acres**
134.21	-	Poverty Lanes Orchard Dam	T/R Connecticut River	Poverty Lane Orchards	Exempt	Earth	0.100	3.80	0.01
134.09	H	Rivermill Hydro Dam	Mascoma River	Rivermill Hydroelectric Inc.	Active	Concrete	20.000	21.70	188.00
134.24	NM	Sanborn Dam	Unnamed Stream	Joel Sanborn	Active	Earth	0.250	4.00	0.01
134.35	-	Shop'n Save Detention Pond Dam	Runoff	Hannaford Brothers Company	Exempt	Earth	0.090	4.60	0.00
134.37	-	Sleeper village Detention Pond 4	Runoff	Nyala Farms Corporate Center	Exempt	Earth	0.200	6.50	0.00
134.38	-	Sleeper Village Detention Pond 7	Runoff	Nyala Farms Corporate Center	Exempt	Earth	0.100	8.00	0.00
134.34	NM	Stillwater Drive Detention Basin	Runoff	Simpson Development Corp.	Active	Earth	0.350	15.00	0.08
134.23	NM	Stone Pond	Blodgett Brook	Hardy Hill Associates	Active	Earth	3.000	16.70	1.94
134.25	-	Wheelock Detention Pond Dam	Runoff	ITD Group Inc.	Exempt	Earth	0.030	3.00	0.00
134.15	H	Wilder Dam	Connecticut River	TransCanada Hydro Northeast	Active	Concrete	3100.000	39.00	9975.00

Source: Dam information provided by the NH Dam Bureau in 2007; Contact in 2016 indicated no updated list. Significant & High Hazard dams must have an emergency action plan. The State of New Hampshire classifies dams into the following four categories: Blank- Non-Active; NM – Non-menace; L – Low hazard; S – Significant hazard; H – High Hazard Material: T-timber; S-stone; E-earth; C-concrete
Note: The 2016 Committee eliminated dams from the State list that have not been built and are not anticipated to be built. They also eliminated dams deemed to be "ruins."

Potential Future Dam Failure Damage

There have been no dam failures in Lebanon or any surrounding towns which impacted Lebanon. Several dams are rated by the State as "non menace" or "low" hazard structures. This means there is no possibility for loss of life if any of these dams fail. A "low"

hazard dam failure could cause some structural damage to buildings and roads though a "non menace" dam failure would not. There are 11 non-menace dams and three low hazard dams. There are three dams rated as "significant" hazard. This means there is a significant hazard potential because the dam is in a location and of a size that failure or mis-operation of the dam would result in any of the following: Major economic loss to structures or property; structural damage roads; major environmental or public health losses.

The Rivermill Hydro Dam on the Mascoma River and the Wilder Dam on the Connecticut River are considered to be a "high" hazard risk. This means the dams have high hazard potential because they are in locations and of a size that failure or mis-operation of the dams would result in probable loss of human life. In addition, two dams farther north on the Connecticut River could impact the City of Lebanon if there were a dam failure: the Union Village Dam and the Moore Dam. Although the Comerford Dam is located on the Connecticut River north of the Wilder Dam and south of the Moore Dam, it is not calculated to have an impact on the City of Lebanon.

According to the NH Department of Environmental Services Dam Bureau, the Lebanon Water Treatment Intake Dam would not cause flooding of residences downstream in the event of a failure so no dam inundation area is needed to be designated. This dam is classified as a significant hazard as it provides the raw water supply for the City of Lebanon, and the loss of the dam would result in damage to a water supply that would take greater than 48 hours to repair. (May 11, 2016)

The inundation areas for all of the above-mentioned dams are shown on a map in Appendix D. The inundation mapping information for the Connecticut River dams including the Moore, Wilder, and Union Village Dams is from TransCanada. The government facilities within the inundation areas include the West Lebanon Fire Station #2, the US Post Office in West Lebanon, the Lebanon Wastewater Treatment Facility, and the Department of Public Works facility.

Table III-2: STRUCTURE ASSESSED VALUES IN DAM INUNDATION AREAS BY PROPERTY TYPE - 2016

Dam	Residential				Commercial		Industrial		Government		Total Value
	House	Mobile Homes	Multi-Unit Building	Value	Units	Value	Units	Value	Units	Value	
CT River Dams	101	0	22	$18,796,130	84	$107,001,800	4	$4,957,900	3	$4,863,600	$135,619,430
Boston Lot Dam	0	0	0	0	0	0	0	0	0	0	$0
Rivermill Dam	14	0	0	$2,117,600	0	0	0	0	0	0	$2,117,600
Mascoma Lake Dam	132	0	7	$30,975,498	56	$53,878,500	8	$7,051,500	1 DPW/pool	$2,754,300	$94,659,798
TOTALS	247	0	29	$51,889,228	140	$160,880,300	12	$12,009,400	4	$7,617,900	$232,396,828

Potential Future Dam Failure Events

According to the State's Multi-Hazard Mitigation Plan (2013), Grafton County has a low risk of dam failure. The Committee determined dam failure is a *Low-Medium* risk in Lebanon.

Flooding

Flooding is the 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 inadequate local drainage. Floods can cause loss of life, property damage, crop/livestock damage, and water supply contamination, and can disrupt travel routes on roads and bridges.

Floods in the Lebanon area are most likely to occur in the spring due to the increase in rainfall, snowmelt and ice flow; however, floods can occur at any time of the year. A sudden winter thaw or a major summer downpour can cause flooding. Floodplains indicate areas potentially affected by flooding. FEMA has determined most flood areas in Lebanon although the Lebanon Hazard Mitigation Committee has delineated additional flood areas in the City as noted in Table III-5. There are several types of flooding.

Base Flood Elevation Means the water surface elevation having a one percent possibility of being equaled or exceeded in any given year. Formerly the term "100-year flood" was used which does not mean that flooding will occur once every 100 years, but is a statement of probability to describe how one flood compares to others that are likely to occur. The name was changed to make the

meaning more clear. These areas were mapped for all towns in New Hampshire by FEMA. Appendix D displays the "Special Flood Hazards Areas" which include the base flood elevations.

River Ice Jams Ice forming in riverbeds and against structures presents significant hazardous conditions storm waters encounter these ice formations which may create temporary dams. These dams may create flooding conditions where none previously existed (i.e., as a consequence of elevation in relation to normal floodplains). Additionally, there is the impact of the ice itself on structures such as highway and railroad bridges. Large masses of ice may push on structures laterally and/or may lift structures not designed for such impacts. A search on the Cold Regions Research and Environmental Laboratory (CRREL) did not reveal any historical ice jams.

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.

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.

Beaver Dams and Lodging Flooding associated with beaver dams and lodging can cause road flooding or damage to property.

Bank Erosion and Failure As development increases, changes occur that increase the rate and volume of runoff, and accelerate the natural geologic erosion process. Erosion typically occurs at the outside of river bends and sediment deposits in low velocity areas at the insides of bends. Resistance to erosion is dependent on the riverbank's protective cover, such as vegetation or rock riprap, or its soils and stability. Roads and bridges are also susceptible to erosion.

Past Flooding Events

Appendix D is a map that shows the locally identified flood area and the Flood Insurance Rate Map of Special Flood Hazard Areas. The following tables provide a list of floods in the State, County, and Lebanon.

A flood occurred in the Hardy Hill area in 2008 and resulted in a $25,000 flood claim to FEMA. In August 2011, flooding from Tropical Storm Irene caused the Connecticut River to rise above its banks and flood the Upper Valley and Kmart Plazas in West Lebanon. Many stores in the plazas were closed for recovery and repairs for several weeks. A more recent flood occurred due to microbursts in early July of 2013 when over four inches of rain fell in a 24-hour period, and a state of emergency was declared by Governor Hassan. Flash flooding forced Lebanon firefighters to evacuate 24 people from the newly opened Rivermere housing complex when a brook overflowed and destroyed a nearby portion of Slayton Hill Road. Culverts on Slayton Hill Road jammed up

with storm debris, and water rushed off the road pushing silt and dirt up against the edge of the building. Residents lost personal belongings as the mud entered homes. Other areas of the City were damaged including Bank Street, Forest Street, and Kimball Streets near downtown Lebanon. Maple and Tracy Streets in West Lebanon were closed by flooding, and much of the Staples shopping plaza along Route 12A was briefly covered by water.

The Committee rated flooding events as "Highly Likely" events, as the Mahan Flats area floods annually, and there is a good likelihood of several other areas flooding in any given year. These flood-prone areas are listed on the following page and are identified on the GIS map at the end of this chapter.

Riverine flooding is the most common disaster event in the State of New Hampshire, according to the State of New Hampshire Multi-Hazard Mitigation Plan. According to the Plan: "Localized street flooding occasionally results from severe thundershowers, or over larger areas, from more general rain such as tropical cyclones and coastal "nor'easters." More general and disastrous floods are rare but some occur in the spring from large rainfall quantities combined with warm, humid winds that rapidly release water from the snowpack."

FEMA's 1980 Flood Insurance Study details much of Lebanon's flood history. Similar to many New Hampshire communities, the City of Lebanon developed along the waterways. According to this document, "Large magnitude floods, caused by heavy rainfall alone or by a combination of heavy rain and melting snow, have occurred on both the Mascoma and Connecticut Rivers in Lebanon. Repeated damage has occurred to structures in the floodplains of the streams during such floods as those that occurred in 1913, 1922, 1927, 1933, 1936, 1938, 1953, and 1973."

According to *History in a Nutshell: A Brief History of Lebanon, NH, 1761-1961* (1972, Bernard Chapman), the flood of November 1927 was the most devastating tributary flood in Connecticut River history and left extensive damage. FEMA also calls this flood the "maximum flood of record" with a discharge of 136,000 cubic feet per second (cfs) and a recurrence interval of well in excess of 100 years [1% flood possibility each year] under present conditions.

The flood of March 1936 was the highest ever in Lebanon Village (on the Mascoma River) and caused nearly $50,000 damage in five days. This flood had a discharge of 5,800 cfs and a recurrence interval of approximately 45 years. The 1953 flood had a discharge of 73,300 cfs on the Connecticut River and 4,900 cfs on the Mascoma River, with a recurrence interval of approximately 15 years on the Connecticut and 30 years on the Mascoma, according to FEMA.

The USGS gage on the Mascoma River is located just downstream of Mascoma Lake and measures runoff from 153 of the total 194-square mile Mascoma River watershed. According to FEMA's 1980 Flood Insurance Study: "The lake has a desynchronizing effect

on flood flows; consequently, peak discharges in Lebanon are principally a function of runoff from the 153-square mile watershed above the gage, with some contribution to peak runoff from the steep and mountainous local area below the gage."

Table III-3: FLOODING – FEMA DISASTER DECLARATIONS, LOCAL RECOLLECTIONS & CRREL ICE JAM INFORMATION

FLOODING – Medium-High Risk				
Hazard	**Date**	**Location**	**Description of Areas Impacted**	**Damages**
Flood	March 11-21, 1936	NH State; around Lebanon	Flooding caused by simultaneous heavy snowfall totals, heavy rains and warm weather. Run-off from melting snow with rain overflowed the rivers.	Damage to road network.
Flood/ Hurricane	September 21, 1938	Statewide; around Lebanon	Flooding in several locations	Damage to buildings and bridges
Flooding	June 15-16, 1943	Upper CT River	Intense rain exceeding four inches	No damage recorded
Flooding	March 1953	Lebanon	Rain and snowmelt	Damage to buildings and bridges
Flooding	August 1955	CT River Basin	Heavy rains caused extensive damage throughout basin	Specific damage in Lebanon not recorded
Flood	June 1973	Localized flooding in Lebanon	Flooding in several locations	Damage to buildings and bridges
Ice Jam	February 2, 1976	Connecticut River, Lebanon (just downstream of I-89 bridge and can cause water backup in Mascoma River)	Sewer pipe damaged	Raw sewage discharge into river
Flooding	April 1976	Connecticut River	Rain and snowmelt	No damage recorded
Ice Jam	March 7, 1979	Connecticut River, West Lebanon	Unknown	No damage recorded
Ice Jam	February 12,1981	Connecticut River, West Lebanon	Unknown	No damage recorded
Flooding	July - August 1986	Statewide	Severe summer storms: heavy rains, tornados flash flood, and severe winds (FEMA DR-771-NH)	No damage recorded in Lebanon
Flood / Severe Storm	April 16, 1987	Cheshire, Carroll, Grafton, Hillsborough, Merrimack, Rockingham, & Sullivan Counties, NH	FEMA Disaster Declaration # 789-DR (Presidentially Declared Disaster). Flooding of low-lying areas along river caused by snowmelt and intense rain.	$4,888,889 in damage.
Ice Jam	January 27, 1990	Connecticut River, West Lebanon	Unknown	No damage recorded
Flood	August 7-11, 1990	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack & Sullivan Counties, NH	FEMA Disaster Declaration #876-DR. Flooding caused by a series of storm events with moderate to heavy	No damage recorded

FLOODING – Medium-High Risk				
Hazard	**Date**	**Location**	**Description of Areas Impacted**	**Damages**
			rains. $2.3 million damage in NH.	
Flooding	August 19, 1991	Statewide	Hurricane Bob - effects felt statewide; FEMA DR-917-NH	No damage recorded in Lebanon
Ice Jam	March 18, 1995	Connecticut River, West Lebanon	Unknown	No damage recorded
Flooding	October - Nov. 1995	North/West NH	Grafton County Declared: FEMA DR-1144-NH	No damage recorded in Lebanon
Ice Jam	January 19, 1996	Great Brook, Lebanon	Flooding in Logan Ballfield	Damage to ballfield
Flood	October 29, 1996	Grafton, Hillsborough, Merrimack, Rockingham, Strafford & Sullivan Counties, NH	FEMA Disaster Declaration # 1144-DR. Flooding caused by heavy rains. $2.3 million damage in NH	No damage recorded
Ice Jam	January 8, 1998	Connecticut River, West Lebanon (due to ice jam letting go on White River)	Unknown	No damage recorded
Flood	June-July 1998	Series of rainfall events	Unknown	Minor Road Damage
Flood/ Hurricane	September 18-19, 1999	Central and Southwest regions of NH	Heavy rains associated with Hurricane Floyd	No damage recorded.
Ice Jam	February 28, 2000	Connecticut River, West Lebanon	Unknown	No damage recorded.
Ice Jam	March 28, 2005	Stoney Brook, Lebanon	Unknown	Severely damaged house
Flood	October 26th 2005	Cheshire, Grafton, Merrimack, Sullivan, and Hillsborough Counties	FEMA Disaster Declaration #1610-DR. Severe storms and flooding; $30 million in damages in NH	No damage recorded.
Ice Jam	January 16, 2006	Connecticut River, West Lebanon (upstream from Wilder Dam)	Unknown	No damage recorded.
Flood	May 13 -17, 2006 "Mother's Day Flood"	Belknap, Carroll, Grafton, Hillsborough, Rockingham, Strafford Counties	FEMA Disaster Declaration #1643-DR	Minor debris cleanup
Flood	April 16, 2007	All counties, NH	FEMA Disaster Declaration #1695. Severe storms and flooding; $27,000,000 in damages; 2,005 home owners and renters applied for assistance in NH.	No damage recorded.

FLOODING – Medium-High Risk				
Hazard	**Date**	**Location**	**Description of Areas Impacted**	**Damages**
Flood	2008 and another time in late 1990s; see also 2011	Great Brook/Mascoma confluence with Connecticut River and Stoney Brook in the Upper Valley Plaza and K-Mart Plaza	FEMA designated flood area; FEMA 1787-DR	Washed riverbank behind TJ Maxx store and threatened water lines to commercial complex; water in parking lot in late 1990s.
Flood	2008	Hardy Hill	FEMA floodplain; FEMA 1787-DR July 24, 2008	$25,000 claim to FEMA
Flood	May 26-30, 2011	Northern and Western NH	FEMA-4006-DR; severe storms and flooding	No damage recorded.
Flood/ Tropical Storm Irene	August – September 2011	Upper Valley and Kmart plazas	Connecticut River flooded its banks due to heavy rains ; FEMA DR-4026-NH	Major damage to retail area in West Lebanon. City FEMA Claim $10,000
Flood	July 2013	Several areas of Lebanon	Slayton Hill Road and Rivermere housing complex as well as other areas	Damage to Rivermere housing; Slayton Hill Road, Bank Street, and several other streets; See Table III-8 for more information.
Flood	Every couple years	Spencer, Mayhan, and Thompson Streets including Emerson Gardens and other residences	FEMA designated flood area	Evacuated 4-5 times 2000-2010
Flood	Seasonal most years with heavy rains and snow melt	Pumping Station Road	Not in FEMA determined flood area; Water Treatment Plant and Pumping Station Road (every 4 years or so, an additional 3 feet higher than past flooding events would threaten water supply)	No recent damage. Minor damage to several homes in 2005.

The following table shows the number and value of buildings within the FEMA designated floodplain.

Table III-4: STRUCTURES IN FEMA FLOOD INSURANCE RATE MAP 1% SPECIAL FLOOD HAZARD AREAS

Flood Area	Residential				Commercial		Industrial		Government		Total Value
	Single-Unit	Mobile Homes	Multi-Unit Bldgs	Value	Units	Value	Units	Value	Units	Value	
Mascoma R	124	0	5	$28,395,798	36	$28,441,800	6	$17,675,800	1 - DPW	$2,754,300	$77,267,698
CT River	3	0	3	$2,642,330	26	$62,947,900	2	$3,075,200	1 - WW	$2,831,300	$71,496,730
TOTALS	127	0	8	$31,038,128	62	$91,389,700	8	$$20,751,000	2	$5,585,600	$148,764,428

Potential Future Flooding Events

According to the State's Mitigation Plan, flooding is a high hazard risk in the county. The Committee determined flooding is a *Medium-High* risk in Lebanon.

The City of Lebanon has been a participant in the National Flood Insurance Program since June 4, 1980. The current effective NFIP map is dated February 20, 2008. There are approximately 121 structures located in the FEMA designated Special Flood Hazard Areas as noted in the above table. There are currently 126 NFIP flood insurance policy holders in the City of Lebanon including 42 non-residential units. The total insurance coverage is $37.9 million. Since 1980, 20 NFIP claims have been made. There is one repetitive loss property in Lebanon and loss payments have totaled $4,026. This property is a single-family residence. *(Source: NH OEP January 2016)*

Hurricane

A hurricane is an intense tropical weather system with a well-defined circulation and maximum sustained winds of 74 mph (64 knots) or higher. Hurricane winds blow in a large spiral around a relative calm center known as the "eye." The "eye" is generally 20 to 30 miles wide, and the storm may extend outward 400 miles. As a hurricane nears land, it can bring torrential rains, high winds, and storm surges. The torrential rains that the hurricanes can bring can cause significant flooding as a result of the hurricane. A single hurricane can last for more than 2 weeks over open waters and can run a path across the entire length of the eastern seaboard. August and September are peak months during the hurricane season that lasts from June 1 through November 30. Damage resulting from winds of this force can be substantial, especially considering the duration of the event, which may last for many hours (*NH Multi-Hazard Mitigation Plan Update 2013*; FEMA website).

The Saffir-Simpson Hurricane Wind Scale provides categories of sustained winds by miles per hour: 1 – 74-95 mph; 2 – 96-110 mph;

3 – 111-129 mph; 4 – 130 – 156 mph; and 5 – 157 mph or higher. Categories 3 -5 are considered to be major wind events that can cause devastating to catastrophic damage.

Past Hurricane Events

There have been several hurricanes over the years which have impacted New England and New Hampshire. These are listed below. The Hurricane of 1938 caused estimated $150,000 damage in Lebanon, and possibly $300,000 more in timber loss. Buildings were unroofed or flattened, streets and cars were ruined, and 300-400 trees were downed in the villages (*History in a Nutshell*).

Table III-5: HURRICANES & TROPICAL STORMS

HURRICANES AND TROPICAL STORMS – Low-Medium Risk				
Hazard	**Date**	**Location**	**Description of Areas Impacted**	**Damages**
Hurricane	August, 1635	n/a	Unknown	No recorded damages
Hurricane	October 18-19, 1778	n/a	Winds 40-75 mph	No recorded damages
Hurricane	October 9, 1804	n/a	Unknown	No recorded damages
Gale	September 23, 1815	n/a	Winds > 50mph	No recorded damages
Hurricane	September 8, 1869	n/a	Unknown	No recorded damages
Hurricane	September 21, 1938	New England; substantial damage in Lebanon	Unknown	Flooding caused damage to road network and structures. 13 deaths, 494 injured throughout NH. Disruption of electric and telephone services for weeks. 2 Billion feet of marketable lumber blown down. Total storm losses of $12,337,643 (1938 dollars). 186 mph maximum winds.
Hurricane (Carol)	August 31, 1954	Southern New England	Category 3, winds 111-130 mph.	Extensive tree and crop damage in NH, localized flooding
Hurricane (Edna)	September 11, 1954	Southern New England	Category 3 in Massachusetts. Heavy rain in NH	This Hurricane moved off shore but still cost 21 lives and $40.5 million in damages throughout New England. Following so close to Carol it made recovery difficult.
Hurricane (Donna)	September 12, 1960	Southern and Central NH	Category 3 (Category 1 in NH). Heavy flooding in some parts of the State.	No recorded damage.

HURRICANES AND TROPICAL STORMS – Low-Medium Risk				
Hazard	**Date**	**Location**	**Description of Areas Impacted**	**Damages**
Tropical Storm (Daisy)	October 7, 1962	Coastal NH	Heavy swell and flooding along the coast	No recorded damage.
Tropical Storm (Doria)	August 28, 1971	New Hampshire	Center passed over NH resulting in heavy rain and damaging winds	No recorded damage.
Hurricane (Belle)	August 10, 1976	Southern New England	Primarily rain with resulting flooding in New Hampshire. Category 1	No recorded damage.
Hurricane (Gloria)	September, 1985	Southern New England	Category 2, winds 96-110 mph.	Electric structures damaged; tree damages. This Hurricane fell apart upon striking Long Island with heavy rains, localized flooding, and minor wind damage in NH
Hurricane (Bob)	August 19, 1991	Southern New England	Federal Disaster FEMA-917-DR	Structural and electrical damage in region from fallen trees. 3 persons were killed and $2.5 million in damages were suffered along coastal New Hampshire.
Hurricane (Edouard)	September 1, 1996	Southern New England	Winds in NH up to 38 mph and 1 inch of rain along the coast.	Roads and electrical lines damaged
Tropical Storm (Floyd)	September 16-18, 1999	Southern New England	FEMA DR1305NH. Heavy rain	Lebanon received damage; extent unrecorded
Hurricane (Katrina)	August 29, 2005	East Coast of US and more	FEMA-3258-EM. Heavy rains and flooding devastating SE US	No damage in Lebanon
Tropical Storm (Tammy)	October 5-13, 2005	East Coast of US	Remnants of Tammy contributed to the October 2005 floods, which dropped 20 inches of rain	No damage in Lebanon
Tropical Storm (Irene)	August 26 – September 6, 2011	East Coast of US	FEMA-4026-DR for Coos, Carroll, Grafton, Strafford, Belknap, Merrimack and Sullivan Counties; EM-3333 Hillsboro, Rockingham, and Cheshire Counties	City-wide damage with multiple roads and the majority of repairs done by using force labor and equipment. Total damage cost was $373,837 of which FEMA reimbursed 75%.

HURRICANES AND TROPICAL STORMS – Low-Medium Risk				
Hazard	**Date**	**Location**	**Description of Areas Impacted**	**Damages**
Hurricane (Sandy)	October 26 – November 8, 2012	East Coast of US	FEMA-4095-DR-NH for Belknap, Carroll, Coos, Grafton and Sullivan Counties; strong storm surge and heavy rains	No damage in Lebanon

Potential Future Hurricane Events

Hurricane events will affect the entire City. It is impossible to predict into the future what damage will occur in the City. According to the State's mitigation plan, Grafton County has a low risk for hurricanes. The Committee determined the hurricane risk to be *Low-Medium* in Lebanon.

Tornado & Downburst

"A tornado is a violent windstorm characterized by a twisting, funnel shaped cloud. These events are spawned by thunderstorms and, occasionally by hurricanes, and may occur singularly or in multiples. They develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. Most vortices remain suspended in the atmosphere. Should they touch down, they become a force of destruction." (*NH Multi-Hazard Mitigation Plan*). The Enhanced Fujita Scale is the standard scale for rating the severity of a tornado as measured by the damage it causes. Most tornadoes are in the F0 to F2 Class. Building to modern wind standards provides significant property protection from these hazard events. New Hampshire is located within Zone 2 for Design Wind Speed for Community Shelters, which suggests that buildings should be built to withstand 160 mph winds.

Significantly high winds occur especially during tornadoes, hurricanes, 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 severe wind occurrences. A downburst is a severe, localized wind blasting down from a thunderstorm. These "straight line" winds are distinguishable from tornadic activity by the pattern of destruction and debris. Downbursts fall into two categories: 1. Microburst, which covers an area less than 2.5 miles in diameter, and 2. Macroburst, which covers an area at least 2.5 miles in diameter. Most downbursts occur with thunderstorms, but they can be associated with showers too weak to produce thunder.

Table III-6 FUJITA SCALE

Enhanced Fujita Scale		
Scale	**Wind Strength (MPH)**	**Typical Damage**
EF0	**65-85**	**Gale:** Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
EF1	**86-109**	**Weak:** Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
EF2	**110-137**	**Strong:** Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	**138-165**	**Severe damage:** Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown
EF4	**166-200**	**Devastating damage:** Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated
EF5	**Over 200**	**Incredible damage:** Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yds.); trees debarked; incredible phenomena will occur.

Source: Enhanced Fujita Scale, October 10, 2006, Revision 2, Wind and Science Engineering Center, Texas Tech University

Past Tornado & Downburst Events

The following table displays tornadoes occurring in Grafton County between 1950 and 1995 as provided by the "Tornado Project" (www.tornadoproject.com) and the *NH Multi-Hazard Mitigation Plan*. The committee did not recall any tornadoes or downbursts in which the city was impacted other than the 2013 microbursts. The tornado on April 15, 2007 in neighboring Enfield, did not cause damage in Lebanon. Similarly, the damage from the 2008 tornado in Concord did not impact the City of Lebanon. A microburst in 2013, devastated the City with major damage.

The 2013 microburst disaster (4139-DR) included multiple funding sources and efforts: the City of Lebanon, FEMA, and NRCS as well as insurance claims. Please note that we are currently closing out a number of these projects especially Slayton Hill Road and the Airport and undergoing FEMA and City audits. These numbers, while close, should not be offered as exact expenditures. All current projects, except for Airport Swale 2A (as of spring 2016), are now completed.

The disaster included 68 city streets and resulted in damage ranging from just a few potholes to full reconstruction. Slayton Hill Road required total reconstruction and is responsible for the greater portion of expenditures. Immediate response and temporary reconstruction to get through the winter and maintain safety for the residents accounted for almost $700,000 of which 75% was

eligible for FEMA reimbursement. The cost for full reconstruction of Slayton Hill, including mitigation and betterments, is currently at an additional $5,509,008. Of this amount $1,749,422 is the cost of betterments that the City determined were necessary but were not eligible costs under FEMA. The remaining costs are 75% FEMA eligible.

Repairs to the Storrs Hill Ski Area came in at $247,112 (75% FEMA reimbursed). This was primarily due to erosion resulting in huge sinks holes and wash outs. Repair included filling and stabilizing the slopes and replacing culverts.

The Lebanon Airport suffered significant damage to the Emergency Access Road, the large swale which diverts water under I-89 and multiple areas of slope erosion. To date, Lebanon has expended approximately $545,000 and anticipates they will have approximately $85,000 of additional work to do to stabilize Slope 2A which is migrating to the taxiway. It should be noted that the largest area of slope erosion (areas 2C, 2D and 2E) adjacent I-89 has not been addressed. While the slope collapse was a result of the 2013 Disaster, FEMA determined that the slope was far enough away from the airport taxiway that it was not deemed a threat to the airport infrastructure at that time. As the erosion progresses, it will threaten both I-89 and the airport taxiway. The cost to stabilize this section was estimated at approximately $700,000. This number is not included in the $8.45 million estimated to date.

The last major project was the collapse of the City's sewer interceptor in West Lebanon which sits directly adjacent to the Connecticut River. The problem with the interceptor was not discovered until after the FEMA walk through and, because it could not be proved that it resulted from the weekend micro bursts, it was deemed not eligible. However, the Natural Resource Conservation Service (NRCS) found the project eligible under the Emergency Watershed Program (EWP) due to its immediate threat to the Connecticut River. The total construction costs associated with the project were $981,704; however, NRCS provided all design, engineering and construction management and oversight at no cost. This is a significant cost which must be included in the total estimate. Based on other projects we estimate this cost to be approximately $247,112 (25% of construction).

Table III-7: TORNADOES IN OR NEAR GRAFTON COUNTY

TORNADOES & DOWNBURSTS – Medium-High Risk			
	Date	**Enhanced Fujita Scale**	**Damages**
Tornado	July 14, 1963	F1	No deaths or injuries; no recorded costs
Tornado	June 27, 1964	F0	No deaths or injuries; no recorded costs
Tornado	August 11, 1966	F2	No deaths or injuries; no recorded costs
Tornado	August 25, 1969	F1	No deaths or injuries; no recorded costs
Tornado	July 21, 1972	F1	No deaths or injuries; no recorded costs
Tornado	May 11, 1973	F2	No deaths or injuries; no recorded costs
Tornado	June 11, 1973	F0	No deaths or injuries; no recorded costs
Wind Event	1991	NA	Damage in area along Route 4A at Lebanon city line
Downburst	July 6, 1999	NA	Damage along Route 4A (Goodhue Road) and Boys Camp Road
Tornado	August 13, 1999	F1	No deaths or injuries; costs unknown
Downburst	August 2001	NA	Falling trees
Downburst	April 15, 2007	NA	Many swaths or trees were knocked down in Lebanon and neighboring towns; Debris removal-Federal Disaster Declaration FEMA-1695-DR-NH $20,700
Tornado	July 24, 2008	(EF 2)	DR 1799: Numerous trees and utility poles down and tearing down houses near Concord with one fatality and two injuries. No recorded damages in Lebanon.
Microburst	July 3, 2013	NA	DR 4139: the disaster included 68 city streets and resulted in damage ranging from a few potholes to full reconstruction; primary damage sites included Slayton Hill Road, the Airport emergency access road; and Storrs Hill Skiway. Total cost so far is about $8.5 million: $1.75 million of the total cost were not eligible for FEMA funding and were paid by the City; $29K paid by City insurance; almost $4 million paid by FEMA (as 75% match), over a million dollars provided by the Natural Resources Conservation Service (NRCS) for a sewer interceptor replacement; and an additional $1.8 million paid by the City for betterments and mitigation not eligible for FEMA funding. These costs do not include private projects such as Rivermere housing which had significant damage due to inundation of a mud by a slide behind the buildings off Slayton Hill Road.

Source: City of Lebanon Committee; www.tornadoproject.com

Potential Future Tornado and Downburst Damage

It is impossible to predict where a tornado or downburst will occur or what damage it will inflict, therefore, the entire city is at an equal risk for such an event. The Lebanon Committee does not recall tornadoes or downbursts in Lebanon other than the significant microbursts in July 2013.

The FEMA website places the State of NH in the Zone II Wind Zone which provides that a community shelter should be built to a 160 mph "design wind speed." According to the State's mitigation plan, Grafton County has a *Medium-High* risk for tornadoes. The Committee determined there is a *Medium-High* risk for tornadoes and downbursts in Lebanon.

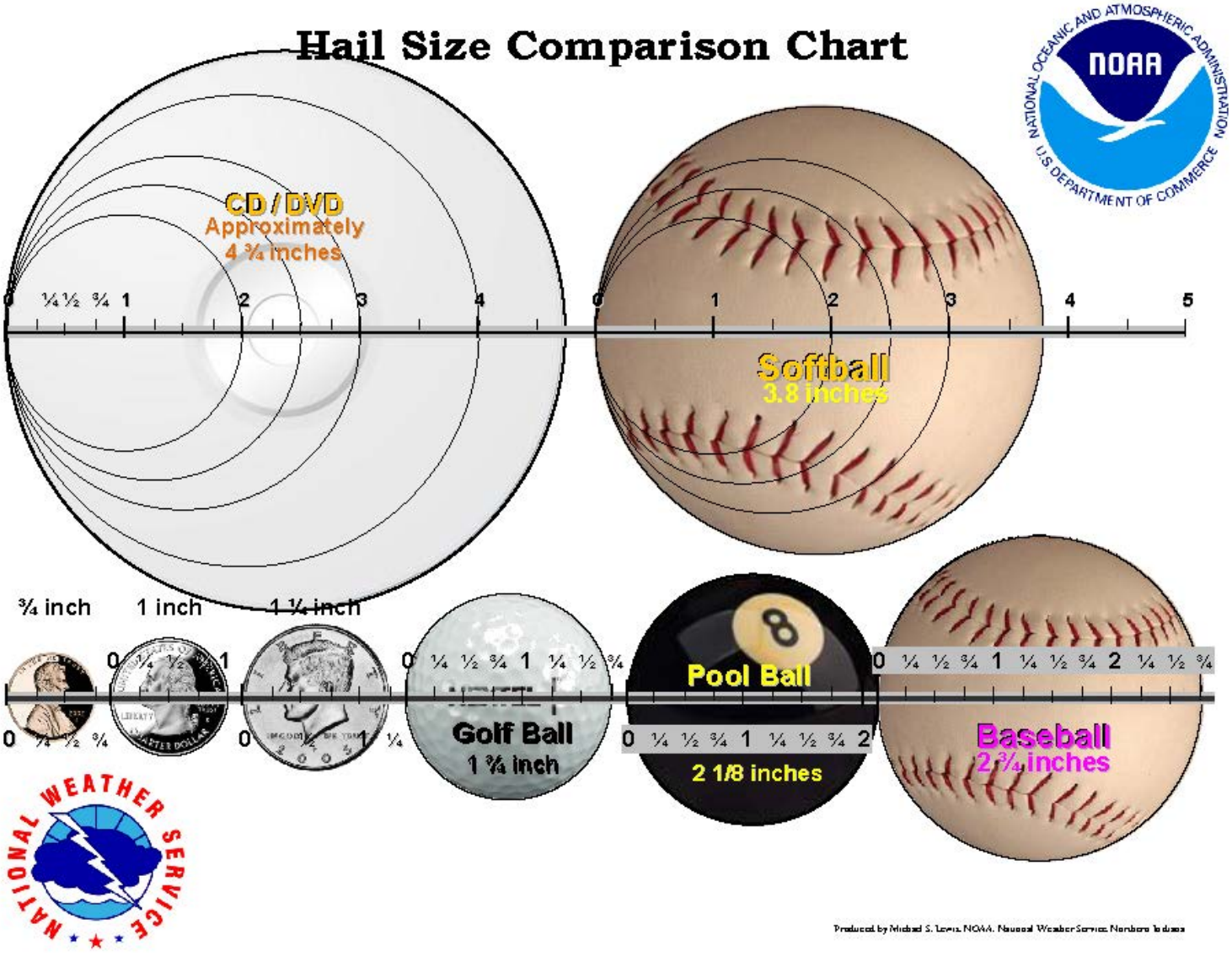
Thunderstorms/Lightning/Hail

A thunderstorm is a rain shower during which you hear thunder. Since thunder comes from lightning, all thunderstorms have lightning. A thunderstorm is classified as "severe" when it contains one or more of the following: hail three-quarter inch or greater, winds gusting in excess of 50 knots (57.5 mph), tornado. Hail is a form of precipitation that occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. When the hail particle becomes heavy enough to resist the updraft, it falls to the ground. The resulting wind and hail can cause death, injury, and property damage.

An average thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. Winter thunderstorms are rare because the air is more stable, strong updrafts cannot form because the surface temperatures during the winter are colder.

Lightning is a giant spark of electricity that occurs within the atmosphere or between the atmosphere and the ground. As lightning passes through the air, it heats the air to a temperature of about 50,000 degrees Fahrenheit, considerably hotter than the surface of the sun. Fires are a likely result of lightning strikes, and lightning strikes can cause death, injury, and property damage. It is impossible to predict where lightning will strike. There have probably been lightning strikes throughout Lebanon, but there is no record of damage.

Figure III-1: HAIL SIZE COMPARISON CHART



A lightning activity level has been developed by the National Weather Service and is shown below:

Table III-8: LIGHTNING ACTIVITY LEVEL

Lightning Activity Level	Description
1	No thunderstorms
2	Isolated thunderstorms: Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a five minute period.
3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a 5 minute period.
4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud to ground strikes in a 5 minute period.
5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a 5 minute period.
6	Dry lightning (same as LAL3, but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.

Source: http://graphical.weather.gov/definitions/defineLAL.html

Past Thunderstorm Events

There have been lightening strikes in Lebanon, but the Committee has recollection of minor damage. Some buildings have been hit and the Whipple Building was recently hit in 2009. A 2015 lightning strike hit a duplex in Rock Ridge on Old Pine Tree Cemetery Road causing a minor fire.

Table III-9: THUNDERSTORM/LIGHTNING/HAIL

Thunderstorms/Lightning/Hail – Low/Medium Risk				
Hazard	**Date**	**Location**	**Description of Areas Impacted**	**Damages**
Hail	June 16, 2007	SW NH	A severe thunderstorm produced large hail (.75 in) in southwestern New Hampshire.	No damage in Lebanon
Hail	August 3, 2007	Sullivan County	An isolated thunderstorm produced large hail in Sullivan County.	No damage in Lebanon
Lightning	2009	Lebanon	A thunderstorm produced lightning strikes in Lebanon	Whipple Building struck – no significant damage
Lightning	2015	Rock Ridge	Lightning hit a duplex in Rock Ridge off Old Pine Tree Cemetery Road	Minor fire

Potential Future Thunderstorm Damage

It is inevitable that thunderstorms will occur in Lebanon's future. Lightning, hail, or wind from a thunderstorm could impact anywhere in the city. It is not possible to estimate potential damage. According to the State's mitigation plan, Grafton County has a medium risk of a lightning hazard. The risk for future thunderstorm damage was determined by the Committee to be *Low-Medium Risk* in Lebanon.

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 heavy snowstorm is generally considered to be one which deposits four or more inches of snow in a twelve-hour period. A blizzard is a sustained wind or frequent gusts greater than or equal to 35 miles per hour accompanied by falling and/or blowing snow, frequently reducing visibility to less than ¼ mile for three hours or more (NOAA National Weather Service). A blizzard includes the conditions under which dry snow, which has previously fallen, is whipped into the air and diminishes visual range. Such conditions, when extreme enough, are called "white outs."

Ice Storms Freezing rain occurs when snowflakes descend into a warmer layer of air and melt completely. When these liquid water drops fall through another thin layer of freezing air just above the surface, they don't have enough time to refreeze before reaching the

ground. Because they are "supercooled," they instantly refreeze upon contact with anything that is at or below O degrees C, creating a glaze of ice on the ground, trees, power lines, or other objects. A significant accumulation of freezing rain lasting several hours or more is called an ice storm. This condition may strain branches of trees, power lines and even transmission towers to the breaking point and often creates treacherous conditions for highway travel and aviation. Debris impacted roads make emergency access, repair and cleanup extremely difficult.

The National Weather Service has developed a Scaled Predictive Ice Storm Aftermath (SPIA) Index. The potential impacts are scaled from 0 to 5 and suggest potential electrical outage coverage and duration. Current ice storm warnings are based on forecast of ice accumulation only. SPIA reports on the combined effects of the predicted ice and wind. Below is a chart of the SPIA index levels.

Figure III-2: SCALED PREDICTIVE ICE STORM AFTERMATH INDEX

Ice & Wind: Average Ice in Inches and Wind in Miles per hour	**<15 mph**	**15-25 mph**	**25-35 mph**	**≥35 mph**
0.10 – 0.25 inches	0	1	2	3
0.25 – 0.50 inches	1	2	3	4
0.50 – 0.75 inches	2	3	4	5
0.75 – 1.00 inches	3	4	5	5
1.00 – 1.50 inches	4	5	5	5
>1.50 inches	5	5	5	5

"Nor'easters" Nor'easters can occur in the eastern United States at any time during the year, when moisture and cold air are plentiful. They are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surfs that cause severe beach erosion and coastal flooding. A Nor'easter is named for the winds that blow in from the northeast and drive the storm up the east coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast.

There are two main components to a Nor'easter: Gulf Stream low-pressure system (counter-clockwise winds) generate off the coast of Florida. The air above the Gulf Stream warms and spawns a low-pressure system. This low circulates off the southeastern U.S. coast, gathering warm air and moisture from the Atlantic. Strong northeasterly winds at the leading edge of the storm pull it up the east coast. As the strong northeasterly winds pull the storm up the east coast, it meets with cold Arctic high-pressure system (clockwise winds) blowing down from Canada. When the two systems collide, the moisture and cold air produce a mix of precipitation.

Winter conditions make Nor'easters a normal occurrence, but only a handful actually gather the force and power to cause problems inland. The resulting precipitation depends on how close you are to the converging point of the two storms. Nor'easter events which occur toward the end of a winter season may exacerbate the spring flooding conditions by depositing significant snow pack at a time of the season when spring rains are poised to initiate rapid snow pack melting.

Past Extreme Winter Weather Events

Extreme winter weather events occur annually in Lebanon but usually have minimal impacts on infrastructure and property. The following table provides a list of past extreme winter weather events in New Hampshire and Lebanon.

Table III-10: SEVERE WINTER WEATHER

SEVERE WINTER WEATHER – Medium Risk				
Hazard	**Date**	**Location**	**Description of Areas Impacted**	**Damages**
Ice Storm	December 17-20, 1929	New Hampshire	Unprecedented disruption and damage to telephone, telegraph and power system. Comparable to 1998 Ice Storm (see below)	No damages recorded in Lebanon
Ice Storm	Dec. 29-30, 1942	New Hampshire	Glaze storm; severe intensity	No damages recorded in Lebanon
Blizzard	February 14-17, 1958	New Hampshire	20-30 inches of snow in parts of New Hampshire	No damages recorded in Lebanon
Snow Storm	March 18-21, 1958	New Hampshire	Up to 22 inches of snow in south central NH	No damages recorded in Lebanon
Snow Storm	December 10-13, 1960	New Hampshire	Up to 17 inches of snow in southern NH	No damages recorded in Lebanon
Snow Storm	January 18-20, 1961	New Hampshire	Up to 25 inches of snow in southern NH	Unknown
Snow Storm	February 2-5, 1961	New Hampshire	Up to 18 inches of snow in southern NH	Unknown
Snow Storm	January 11-16, 1964	New Hampshire	Up to 12 inches of snow in southern NH	Unknown
Blizzard	January 29-31, 1966	New Hampshire	Third and most severe storm of 3 that occurred over a 10-day period. Up to 10 inches of snow across central NH	Unknown
Snow Storm	December 26-28, 1969	New Hampshire	Up to 41 inches of snow in west central NH; ice storm took out power around Goose Pond Road for a week.	Unknown

SEVERE WINTER WEATHER – Medium Risk				
Hazard	**Date**	**Location**	**Description of Areas Impacted**	**Damages**
Snow Storm	February 18-20, 1972	New Hampshire	Up to 19 inches of snow in southern NH	Unknown
Snow Storm	January 19-21, 1978	New Hampshire	Up to 16 inches of snow in southern NH; Rip Road in Lebanon particularly hard hit.	Unknown
Blizzard	February 5-7, 1978	New Hampshire	New England-wide. Up to 25 inches of snow in central NH	Unknown
Ice Storm	January 8-25, 1979	New Hampshire	Major disruptions to power and transportation	Unknown
Snow Storm	February, 1979	New Hampshire	President's Day storm	Unknown
Snow Storm	April 5-7, 1982	New Hampshire	Up to 18 inches of snow in southern NH	Unknown
Ice Storm	February 14, 1986	New Hampshire	Fiercest ice storm in 30 yrs in the higher elevations in the Monadnock region. It covered a swath about 10 miles wide from the MA border to New London NH	Unknown
Extreme Cold	November-December, 1988	New Hampshire	Temperature was below 0 degrees F for a month	Unknown
Ice Storm	March 3-6, 1991	New Hampshire	Numerous outages from ice-laden power lines in southern NH	Unknown
Snow Storm	March 16, 1993	New Hampshire	$832,400 damages in NH; numerous power outages; DR 3101	Unknown
Snow Storm	1997	New Hampshire	Power outages throughout Lebanon due to heavy snowfall	Unknown
Ice Storm	January 15, 1998	New Hampshire; I-89 Exits 14-15 areas heavily impacted in Lebanon	Federal disaster declaration DR-1199-NH, 20 major road closures, 67,586 without electricity, 2,310 without phone service, $17+ million in damages to Public Service of NH alone	Unknown
Snow Storm	2000	Regional	Heavy snow	Unknown
Snow Storm	March 5-7, 2001	Lebanon	Heavy snow.	$22,500
Snow Storm	December 6-7, 2003	Lebanon	Heavy snow. Federal Disaster Declaration FEMA-3193-NH	$29,200
Snow Storm	January 15, 2004	Most of State	Snow emergency; EM-3193; $3.2 million in damages statewide; numerous power outages	Unknown

SEVERE WINTER WEATHER – Medium Risk				
Hazard	**Date**	**Location**	**Description of Areas Impacted**	**Damages**
Ice Storm	2004	Regional	Ice storm resulted in many trees down and loss of power.	Unknown
Snow Storm	February 10-12, 2005	Lebanon	Heavy snow. Federal Disaster Declaration FEMA-3208-NH	$32,700
Snow Storm	March 30, 2005	New Hampshire	$4.6 million in damages statewide; EM 3207; numerous power outages	Unknown
Rain Event	July 24 – August 14, 2008	Region	FEMA 1787-DR-NH Heavy rains impacted several local streets by flooding and/or washouts.	$22,000
Ice Storm	December 12, 2008	Regional	Ice storm resulted in many trees down and loss of power; $17+ million in damages to Public Service of NH	$135,000
Wind Storm	February 23 – March 3, 2010	New Hampshire	FEMA DR-1812; Federal funding to Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan Counties; power loss; $20 million in damages statewide	$29,000
Snow Storm	October 29-30, 2011	Statewide	EM-3344; FEMA-4049 Hillsborough & Rockingham Counties	No damage in Lebanon
Ice Storm	January 27, 2012	Region	Isolated power outages in region; several limbs down	$30,000
Snow Storms	First two weeks in January, 2013	Region	Continuous snow causing slippery roads	No damage in Lebanon
Snow Storm (Nemo)	February 8-10, 2013	New Hampshire	Heavy Snow. FEMA DR-4105	No damage in Lebanon

Potential Future Severe Winter Damage:

All areas of Lebanon are at risk from severe winter weather and ice storms. There is the potential for severe winter damage every year. The event would affect the entire City. According to the State's mitigation plan, Grafton County has a high risk for severe winter weather. The Committee determined severe winter weather to be a *Medium* risk in Lebanon.

Earthquake

Earthquakes are characterized by a sudden and rapid shaking of the ground caused by the shifting of rock beneath the ground. The damage caused by an earthquake can be severe, causing the collapse and destruction of buildings, bridges, roads and other critical infrastructure. As a result, there can be many other hazards that occur, such has gas leaks, fires, electrical outages, landslides, etc. The magnitude and intensity of an earthquake can be rated on a scale such as the Richter or Mercalli, which are both illustrated below.

Past Earthquake Events

The following is a list of earthquakes which have impacted New England, New Hampshire, and potentially Lebanon.

Table III-11: EARTHQUAKES

EARTHQUAKES – Low-Medium Risk			
Date	**Location**	**Magnitude**	**Damage**
1638	Central NH	6.5-7	
October 29, 1727	Off NH/MA coast	NA	Widespread damage Massachusetts to Maine: cost unknown
December 29, 1727	Newburyport, MA	NA	Widespread damage Massachusetts to Maine: cost unknown
November 18, 1755	Cape Ann, MA	6.0	Tremendous damage in New England around Boston where at least 1,500 houses were destroyed in whole or in part; it was felt from South Carolina to Nova Scotia; mostly felt along the coast. No one was killed.
1800s	Statewide	83 felt earthquake in NH	No damage recorded in Lebanon
1900s	Statewide	200 felt earthquake in NH	No damage recorded in Lebanon
March 18, 1926	Manchester, NH	Felt in Hillsborough Co	No damage recorded in Lebanon
December 20, 1940	Ossipee, NH	5.5	No damage recorded in Lebanon
December 24, 1940	Ossipee, NH	5.5	No damage recorded in Lebanon
December 28, 1947	Dover-Foxcroft, ME	4.5	No damage recorded in Lebanon
June 10, 1951	Kingston, RI	4.6	No damage in Lebanon
April 26, 1957	Portland, ME	4.7	No damage in Lebanon
April 10, 1962	Middlebury, VT	4.2	No damage in Lebanon
June 15, 1973	Near Quebec Border	4.8	No damage in Lebanon
Summer 1977-1978*	Centered in Franklin	NA	No damage in Lebanon
January 19, 1982	West of Laconia	4.5	Structure in Concord; no damage in Lebanon

EARTHQUAKES – Low-Medium Risk			
Date	**Location**	**Magnitude**	**Damage**
October 20, 1988	Near Berlin, NH	4	No damage in Lebanon
June 23, 2010	Ontario-Quebec border	5.0	No damage in Lebanon
September 26, 2010	New Hampshire	3.4	Centered in Boscawen, NH; no damage in Lebanon
August 23, 2011	Central Virginia, East Coast	5.8	Felt in region; No damage in Lebanon
September 18, 2012	Concord, NH	1.2	Epicenter was Concord, NH and the quake was felt in the capital region of NH; No damage in Lebanon
October 16, 2012	Southern Maine	4.0	The earthquake was located in southern Maine and felt throughout the area and into southern NH; No damage in Lebanon

Source: earthquake.usgs.gov/earthquakes/states/new_hampshire/history.php for earthquakes through 1964. NH Multi-Hazard Mitigation Plan, 2013 1638; earthquake.usgs.gov/earthquakes (12/13/11)
**Committee recollection*

Table III-12: RICHTER SCALE AND MERCALLI INTENSITY

Richter Scale and Mercalli Intensity		
Richter Scale	**Modified Mercalli Intensity**	**Average Earthquake Effects**
1.0-3.0	I	**I** – Not felt except by a very few under especially favorable conditions.
3.0-3.9	II-III	**II** – Felt only by a few persons at rest, especially on upper floors of buildings. **III** – Felt quite noticeably by persons indoors. Standing motor cars may rock slightly.
4.0-4.9	IV-V	**IV** – Felt indoors by many, outdoors by few during the day. Dishes, windows, doors disturbed; walls make cracking sound. V – Felt by nearly everyone; many awakened. Some dishes, windows broken.
5.0-5.9	VI-VII	**VI** – Felt by all. Some heavy furniture moved; a few instances of fallen plaster. **VII** – Damage negligible in buildings of good design and construction, considerable damage in poorly built or badly designed structures; some chimneys broken.
6.0-6.9	VII-IX	**IX** – Damage considerable in specially designed structures; damage great is substantial buildings, with partial collapse.
7.0 and higher	VIII or higher	**VIII** and higher: damage slight in specially designed structures. Fall of chimneys, factory stacks, columns, monuments, walls. **X** – Some well-built wooden structures destroyed, most masonry and frame structures destroyed with foundations. **XI** – Few if any masonry structures remain standing. Bridges destroyed. **XII** – Total damage. Lines of sight and level are distorted. Objects thrown in air.

Past Earthquake Events:

The committee determined there has not been any earthquakes that have caused damage to the city in the memorable past. Though some very small earthquakes have been felt in the region, like in August of 2011, they have not caused any damage to the city. The quake in 2011 could feel mild shaking of homes, but was not strong enough to produce damage.

Potential Future Earthquake Damage:

A United States Geographic Survey mapping tool on the web (geohazards.cr.usgs.gov/ projects) projects a 5 – 6 peak ground acceleration (pga) with 10% probability of exceedance in 50 years for the City of Lebanon. This pga rating is equivalent to a Modified Mercalli Intensity of "V" with moderate perceived shaking and very light potential damage. Due to the nature of earthquakes impacting large areas, all parts of the city are determined to be at the same risk. An earthquake event would impact the entire city. According to the State's mitigation plan, Grafton County has a medium risk for earthquakes. The Committee determined the risk to be *Low-Medium* in Lebanon.

Drought

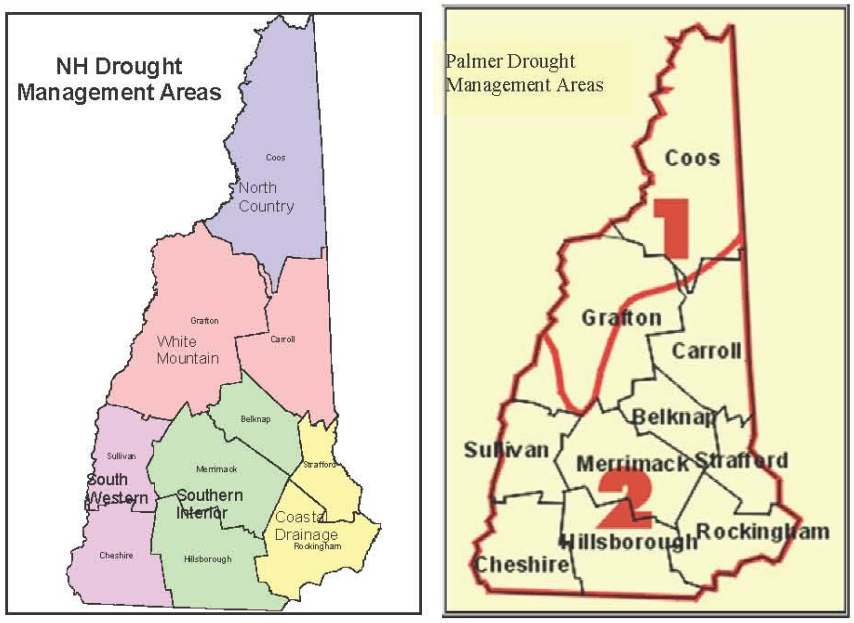
Droughts or abnormally low precipitation are generally not as damaging or disruptive as floods, but are more difficult to define. A drought is a natural hazard that evolves over months or even years and can last as long as several years or only a few months. Fortunately, droughts are rare in New Hampshire. The severity of the water deficit if gauged by the degree of moisture deficiency, its duration, and the size of the area affected. The effects of drought are indicated through measurements of soil moisture, groundwater levels and stream flow; however, not all of these indicators will be low during a drought. Not all of these indicators will be minimal during a particular drought. For example, frequent minor rainstorms can replenish the soil moisture without raising ground water levels or increasing stream flow.

Low stream flow correlates with low ground water level because it is ground water discharge to streams and rivers that maintain stream flow during extended dry periods. Low stream flow and low ground water levels commonly cause diminished water supply. This could affect the municipal water supply.

New Hampshire breaks the State into five Drought Management Areas, with one in the north, one across the central region, and three along the southern portion of the State. The National Oceanic and Atmospheric Administration (NOAA) and the US government use the Palmer Drought Survey Index for conditions of the nation. The Palmer Drought Management areas divide the State into two areas and use the Palmer Drought Severity Index which is based on rainfall, temperature, and historic data. The City of Lebanon is in Area

2. The NH Drought Management Team, coordinated by the NH Department of Environmental Services Dam Bureau, use these maps to help determine which areas are hardest hit.

Figure III-3: DROUGHT MAPS



Past Drought Events

Around 2001-2002, Lebanon and other nearby towns had drought issues. This occurred again in 2010, however, the damage and impacts were not significant. Residents were advised to reduce water consumption, but the impacts of the drought were not significant. The committee noted that though some agricultural operations may have been impacted, the city does not have any large scale commercial farms to note significant damage to crops.

Table III-13: DROUGHT

DROUGHT – Low-Medium Risk			
Date	**Location**	**Description**	**Damages**
1929-1936	Statewide	Regional. Recurrence Interval 10 to > 25 years	Unknown
1939-1944	Statewide	Severe in southeast and moderate elsewhere. Recurrence Interval 10 to > 25 years	Unknown
1947-1950	Statewide	Moderate. Recurrence Interval 10 to > 25 years	Unknown
1960-1969	Statewide	Regional longest recorded continuous spell of less than normal precipitation. Encompassed most of the Northeastern US. Recurrence Interval > 25 years	No impact on Lebanon
2001-2002	Statewide	Affected residential wells and agricultural water sources; third worst drought on record, exceeded only by the drought of 1956-1966 and 1941-1942; recurrence level not determined yet	Minor impact on Lebanon
2010	Mostly southern counties	Affected dug wells and those in hillsides.	Minor impact on Lebanon

Source: NH DES through 2002; Concord Monitor August 22, 2010

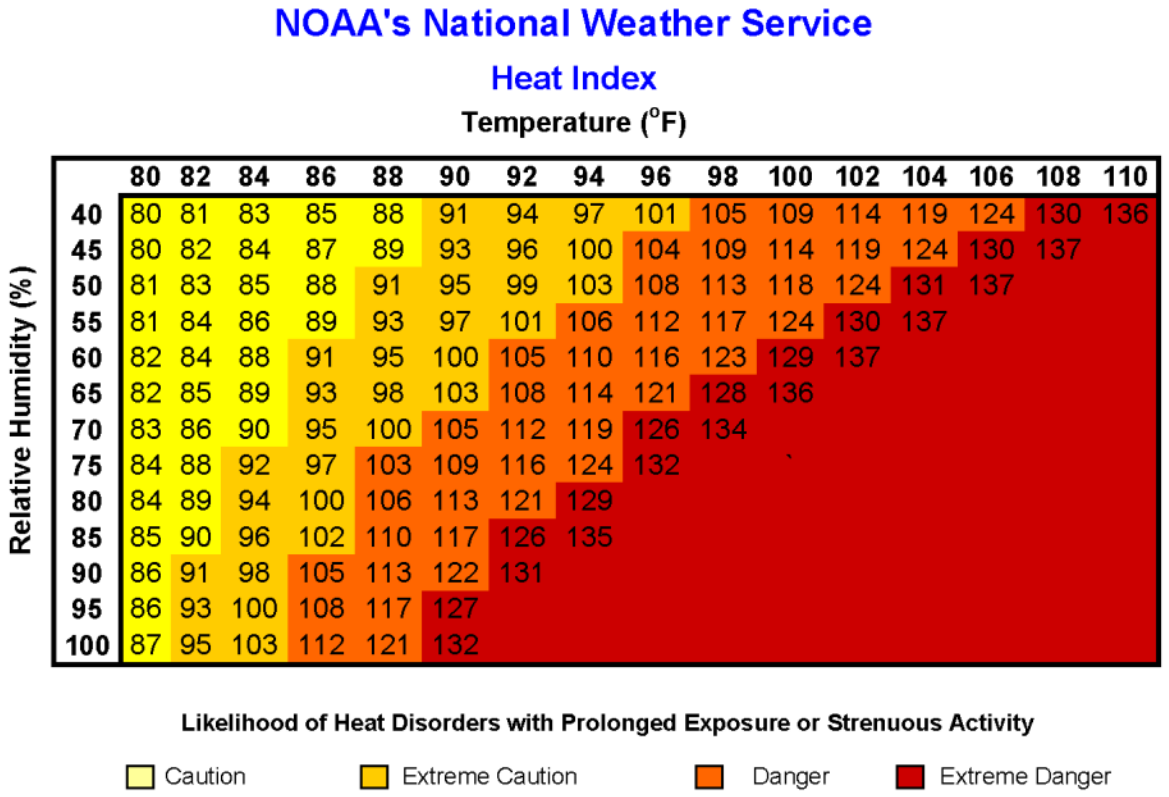
Potential Future Drought Damage

Drought will affect the entire city equally with no particular area at a greater risk. The damage will depend upon the crops being grown at the time of the drought. No cost has been assigned to residential wells going dry though new wells may have to be dug or drilled. According to the State's mitigation plan, Grafton County has a medium risk for drought. The Committee determined that drought is a *Low-Medium* risk in Lebanon.

Extreme Heat

Extreme heat is characterized by abnormally high temperatures and/or longer than average time periods of high temperatures. These event conditions may impact the health of both humans and livestock. The National Weather Service developed a heat index based upon temperature and relative humidity. This is shown below.

Figure III-4: HEAT INDEX



Past Extreme Heat Events

The following table lists the extreme heat events in the past which included the Northeast and New Hampshire. The extreme heat events that have occurred, such as July 2010, have not had a significant impact on the city.

Table III-14: EXTREME HEAT

EXTREME HEAT – Low-Medium Risk			
Date	**Location**	**Description**	**Damage**
July, 1911	New England	11-day heat wave in New Hampshire	No recorded impact in Lebanon.
Late June to September, 1936	North America	Temps to mid 90s in the northeast	No recorded impact in Lebanon
June - August, 1999	Northeast	Mean temperatures well above long-term average	No significant impact in Lebanon
Early August, 2001	New Hampshire	Mid 90s and high humidity	No significant impact in Lebanon
August 2-4, 2006	New Hampshire	Regional heat wave and severe storms	No significant impact in Lebanon
July 2010	Northeast	Regional heat wave	No significant impact in Lebanon

Potential Future Extreme Heat Events

Extreme heat would impact the entire city equally; though those with air conditioning in their homes would have less impact. The costs of extreme heat are most likely to be in human life. The elderly are especially susceptible to extreme heat. The State did not develop a county risk factor for extreme heat in its *NH Multi-Hazard Mitigation Plan*. The Committee determined extreme heat to be a *Low-Medium* risk in Lebanon.

Erosion

Soil erosion, although a natural process, can be greatly accelerated by improper construction practices. Because of the climate in New Hampshire and the general nature of our topography, eroded soils can be quickly transported to a wetland, stream, or lake. The New Hampshire Department of Environmental Services (DES) regulates major construction activities to minimize impacts upon these resources. A properly conducted construction project should not cause significant soil erosion.

Soil becomes vulnerable to erosion when construction activity removes or disturbs the vegetative cover. Vegetative cover and its root system play an extremely important role in preventing erosion by: (1) Shielding the soil surface from the impact of falling rain drops; (2) Reducing the velocity of runoff; (3) Maintaining the soil's capacity to absorb water, and (4) Holding soil particles in place. Because of the vegetation's ability to minimize erosion, limiting its removal can significantly reduce soil erosion. In addition, decreasing the area and duration of exposure of disturbed soils is also effective in limiting soil erosion. The designer must give special consideration to the phasing of a project so that only those areas actively under construction have exposed soils. Other factors influencing soil erosion are: (1) Soil types, (2) Land slope, (3) Amount of water flowing onto the site from up-slope, and (4) Time of year of disturbance.

Past Erosion Events

There have been several erosion events in Lebanon. Many were primarily road washes associated with flooding and are addressed in that section. There are also several road washes associated with major storms, most recently in July/August 2013, September 2011, August 2008, April 2007, and October 2005

Table III-15: EROSION EVENTS

EROSION – Medium Risk			
Date	**Area**	**Description**	**Damages**
Seasonal with heavy rains and snow melt	Slayton Hill	Wash-outs due to gouging of drainage systems from heavy water flows on steep sloped roads	Road wash-out
Seasonal with heavy rains and snow melt	Kinne Street	Wash-outs due to gouging of drainage systems from heavy water flows on steep sloped roads	Road wash-out
Seasonal with heavy rains and snow melt	Eagle Ridge and Stevens Road	Wash-outs due to gouging of drainage systems from heavy water flows on steep sloped roads	Road wash-out
Seasonal with heavy rains and snow melt	Brook Road & Hardy Hill Road	Wash-outs due to gouging of drainage systems from heavy water flows	Took out edge of road near culvert mouths; $8-10,000 in 2008
Seasonal with heavy rains and snow melt	Sunset Hill Road	Wash-outs due to gouging of drainage systems from heavy water flows	Road wash-out
Heavy rains	Interchange Drive	Run-off from airport	Road wash-out
Seasonal with heavy rains and snow melt	Manchester Drive and Monica Street	Erosion over steep slopes	Road wash-out

Potential Erosion Events

Due to the topography and types of soils of the city, there is always potential for erosion. As properties are developed there will be less vegetative buffer to protect the city from erosion during rainstorms. The Committee determined that erosion is a *Medium* risk in Lebanon.

Landslide

A landslide is the downward or outward movement of sloped materials reacting under the force of gravity, including mudslides, debris flows, and rockslides. The type of material and moisture content determine the susceptibility to a landslide. Formations of sedimentary deposits along the Connecticut River also create potential landslide conditions. Landslides can damage or destroy roads, homes, railroads, electrical and phone lines, and other structures.

Past Landslide Events

There have been several erosion and landslide events in Lebanon Bank Street Extension near Winona Circle and Dorothy Perley Road during 1999 Hurricane Floyd. There was substantial rain and the travel lane of the river side of the road collapsed leaving a hanging sewer line and unsupported guardrails. Around 2002 on Jenkins Road, a private leach field (Thayer) washed across the road with three feet of materials. The bank behind Rivermere housing slid into the housing development in 2013. Most heavy rains cause riverbank slides along Mill Road Trail.

Table III-16: LANDSLIDE EVENTS

LANDSLIDE – Low-Medium Risk			
Date	**Area**	**Description**	**Damages**
1999	Bank Street Extension, Winona Circle & Perley Road	Substantial rain during Hurricane Floyd	Travel lane on river side of road collapsed leaving a hanging sewer line and unsupported guardrails.
2002	Jenkins Road	Substantial rain	Private leach field washed across road with three feet of materials
2013	Rivermere, Slayton Hill Road	Microburst caused tremendous stormwater runoff down Slayton Hill Road and over bank behind Rivermere housing development	Mud poured into Rivermere housing development residential units; residents evacuated; see Table III-8 for more information
Most heavy rains	Mill Road Trail	Riverbank erosion of glacial till; affects Route 4 and force main; just above water plant and Mascoma River	Bank slides annually

Potential Future Landslide Events

There is always the potential for a landslide in an extreme weather event. It is possible that the above areas could be impacted again, but only during an extreme event. The Committee considers landslide events to have a Low-Medium risk.

Wildfire

Wildfire is defined as any unwanted and unplanned fire burning in the forest, shrub or grass. Wildfires are frequently referred to as forest fires, shrub fires or grass fires, depending on their location. They often occur during drought and when woody debris on the forest floor is readily available to fuel the fire. The threat of wildfires is greatest where vegetation patterns have been altered by past unsafe land-use practices, fire suppression and fire exclusion. Vegetation buildup can lead to more severe wildfires.

Increased severity over recent years has decreased capability to extinguish wildfires. Wildfires are unpredictable and usually destructive, causing both personal property damage and damage to community infrastructure, cultural and economic resources.

Negative short term effects of wildfires include destruction of timber, forage, wildlife habitats, scenic vistas and watersheds. Some long term effects include erosion and lowered water quality.

There are many types and causes of fires. Wildfires, arson, accidental fires and others all pose a unique danger to communities and individuals. Since 1985, approximately 9,000 homes have been lost to urban/wild land interface fires across the United States (Northeast States Emergency Consortium: www.nesec.org). The majority of wildfires usually occur in April and May, when home owners are cleaning up from the winter months, and when the majority of vegetation is void of any appreciable moisture making them highly flammable.

The threat of wildfires for people living near wildland areas or using recreational facilities in wilderness areas is real. Dry conditions at various times of the year and in various parts of the United States greatly increase the potential for wildfires. Advance planning and knowing how to protect buildings in these areas can lessen the devastation of a wildfire. To reduce the risk to wildfire, it is necessary to consider the fire resistance of structures, the topography of property and the nature of the vegetation in the area.

According to the National Wildfire Coordination Group, there are categories of wildfire based upon size: Class A - one-fourth acre or less; Class B - more than one-fourth acre, but less than 10 acres; Class C - 10 acres or more, but less than 100 acres; Class D - 100 acres or more, but less than 300 acres; Class E - 300 acres or more, but less than 1,000 acres; Class F - 1,000 acres or more, but less than 5,000 acres; Class G - 5,000 acres or more.

Past Wildfire Events

There have been very few wildfires in the City of Lebanon. There is strict enforcement of outside burning and fire permits. The greatest danger is weather driven during periods of drought especially in spring before the grass has greened up.

Potential Future Wildfire Events

There are many large, contiguous forest tracts in Lebanon. Just over half the land in Lebanon is in the "current use" taxation program, and over 80% of that land is considered "forest land." Where development interfaces with the forested areas is called the "urban interface." These are the areas where structures could be impacted by a wildfire. The Committee considers all structures within Lebanon to be in an urban interface, and wildfire could affect the entire City in structural and timber loss. According to the State's mitigation plan, the county has a high probability of wildfire. However, the Committee determined that the risk of wildfire in Lebanon is *Medium*.

Natural Water & Air Contaminants

Radium, radon and uranium are grouped together because they are radionuclides, unstable elements that emit ionizing radiation. These three particular substances are a health risk only if taken into the body by ingestion or inhalation. They occur naturally in the environment, uranium and radium as solids in rock while radon exists as a gas. Radionuclides are undetectable by taste, odor, or color, so only analytical testing can determine if they are present in water. Because they are associated with rock, wells drilled into bedrock are more likely to contain elevated levels of radionuclides than shallow or dug wells.

Radon gas can also be found in the soil. Openings between the soil and buildings, such as foundation cracks and where pipes enter, provide conduits for radon to move into structures. The difference in air pressure, caused by heated indoor air moving up and out of buildings, results in a flow of soil gas toward the indoors, allowing radon to potentially accumulate in structures. Air quality in a home can also be tested for radon. . Following is a map of New Hampshire by the U.S. EPA to show radon zones

There are many other natural contaminants which can render drinking water unsafe such as arsenic. The Drinking Water and Groundwater Bureau of the NH Department of Environmental Services has several fact sheets available to address these natural materials and suggests which materials to be included in testing. See their list of fact sheets at http://www.des.state.nh.us/dwg.htm.

Past Natural Water & Air Contaminant Events

There have been no known events related to natural water and air contamination in Lebanon. However, although the Hazard Mitigation Committee is not aware of radon contamination incidents in Lebanon, it is likely that some homes are affected by radon given that we are in the "Granite State." Also, uranium was found when constructing I-89 which runs through Lebanon.

Table III-17: RADON

RADON – Low-Medium Risk					
Summary Table of Short-term Indoor Radon Test Results in NH's Radon Database 11/04/2003)					
County	**# Tests**	**G. Mean**	**Maximum**	**% > 4.0 pCi/l**	**% > 12.0 pCi/l**
Belknap	744	1.3	22.3	14.4	1.3
Carroll	1042	3.5	478.9	45.4	18
Cheshire	964	1.3	131.2	15.6	2.3
Coos	1072	3.2	261.5	41	17
Grafton	**1286**	**2.0**	**174.3**	**23.2**	**5.2**
Hillsborough	2741	2.1	202.3	29.6	6.8
Merrimack	1961	2.0	152.8	25.2	6
Rockingham	3909	3.0	155.3	40	9.5
Strafford	1645	3.4	122.8	44	13
Sullivan	466	1.4	29.4	15.7	2.1
STATEWIDE	**15860**	**2.4 pCi/L**	**478.9 pCi/L**	**32.4**	**8.6**

Potential Future Natural Air & Water Contaminant Damage:

Although there are no known records of illness that can be attributed to radium, radon, or uranium or other contaminants in Lebanon, residents should be aware that they are present. Houses with granite and dirt cellars are at increased risk to radon gas infiltration. According to the table above, Grafton County radon levels are lower than for Statewide. According to the State's mitigation plan, Grafton County has a medium probability of a radon related hazard. No single area of the city is known to be a higher risk for these natural contaminants.

In addition radium, radon, and uranium as well as other natural materials can be present in drinking water. Residents, especially with bedrock wells, should be aware of the possibility of water contamination and the availability of testing and remediation. The Committee determined that the risk of natural contaminants is *Low-Medium*.

Figure III-5: MAP OF RADON ZONES

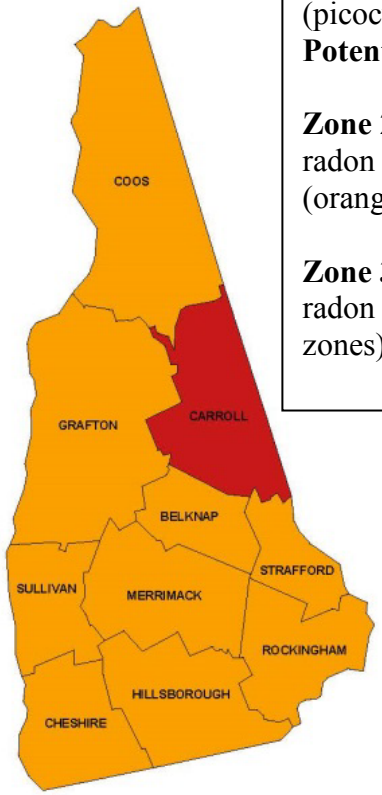
NEW HAMPSHIRE - EPA Map of Radon Zones

The purpose of this map is to assist National, State and local organizations to target their resources and to implement radon-resistant building codes.

This map is not intended to determine if a home in a given zone should be tested for radon. Homes with elevated levels of radon have been found in all three zones.

All homes should be tested, regardless of zone designation.

http://www.epa.gov/radon/zonemap.html



Zone 1 counties have a predicted average indoor radon screening level greater than 4 pCI/L (picocuries per liter) (red zones) **Highest Potential**

Zone 2 counties have a predicted average indoor radon screening level between 2 and 4 pCi/L (orange zones) **Moderate Potential**

Zone 3 counties have a predicted average indoor radon screening level less than 2 pCi/L (yellow zones) **Low Potential**

IMPORTANT: Consult the publication entitled "Preliminary Geologic Radon Potential Assessment of New Hampshire" (USGS Open-file Report 93-292-A) before using this map. http://energy.cr.usgs.gov/radon/grpinfo.html This document contains information on radon potential variations within counties. EPA also recommends that this map be supplemented with any available local data in order to further understand and predict the radon potential of a specific area.

Hazardous Materials Spills

Hazardous materials spills or releases can cause loss of life and damage to property. Short or long-term evacuation of local residents and businesses may be required, depending on the nature and extent of the incident. The spills may occur on-site at hazardous waste generators or in transport through city.

In Lebanon, there are 380 potential hazardous waste generators listed on the NH Department of Environmental Services (DES) "one-stop" list. These are not all active producers at the moment, but they are potential generators at some point in time and have obtained a hazardous waster generator identification number in the past to transport hazardous waste. Many of these generators are small businesses probably generating little waste; however, there are several larger manufacturers generating waste as well. Other hazardous materials could be transported to or through Lebanon such as materials for production or fuel.

Past Hazardous Waste Spill Events

No known significant spills have occurred in Lebanon.

Potential Future Hazardous Waste Spill Damage

There conceivably could be other spills near any home in Lebanon due to home heating fuel delivery. The property owner is responsible for clean-up. The State oversees these reported spills.

The Lebanon Hanover Emergency Planning Committee (LEPC) developed a hazardous materials response plan, to develop policies and procedures for responding to hazardous materials incidents.

The highest potential for incidents is fuels being used by the public for transportation or heating. The Hazardous Materials Response Plan also lists fixed facilities of concern: Water Treatment Plant, Irving Oil, Suburban Propane, Rymes Propane, Kleen Laundry, DHMC, Pike Industries, and the Campion Ice Rink. There are a number of facilities with small quantities of Extremely Hazardous Substances as identified during annual Tier II reporting..

The Police, Fire and Emergency Medical Services are all charged with responding to incidents involving hazardous materials. Public Works is used as a support organization to supply such needs as sand, heavy equipment, and manpower. The Lebanon Police Department, trained to hazardous materials "awareness" levels is the initial responder on the scene. The hazardous materials response plan lays out notification and response protocol.

The local emergency Local Emergency Planning Committee (LEPC) established that one of the potential problems with hazardous materials is transportation of these materials. I-89 is a major thoroughfare for truck traffic going from New England to Canada. The Port of Highgate in Vermont has some of the highest trafficking of hazardous materials of any Canadian border site in the country, and many of the vehicles traveling through that Port pass through Lebanon. Two intersections are considered to have an especially high potential for an accidental release: NH 120 and I-89 and NH 12A and I-89. The State did not determine county risk for hazardous waste spills in the *NH Multi-Hazard Mitigation Plan*. The Committee determined that a hazardous waste spill is a *Medium* risk.

Terrorism

Terrorism has been defined in many ways. The word terrorism is derived from the Latin term "terrere" which means to frighten. Section 802 of the USA Patriot Act expanded the definition of terrorism to cover "domestic," as opposed to international terrorism. A person engages in domestic terrorism if they do an act "dangerous to human life" that is a violation of the criminal laws of a state or the United States, if the act appears to be intended to: (i) to intimidate or coerce a civilian population; (ii) to influence the policy of a government by intimidation or coercion; or (iii) to affect the conduct of a government by mass destruction, assassination, or kidnapping; and (C) occur primarily within the territorial jurisdiction of the United States."

Past Terrorism Events

There have been no terrorism events within Lebanon in the past.

Future Terrorism Events

Due to the proximity of Dartmouth College, as well as Dartmouth Hitchcock Medical Center and the Lebanon Airport, there is potential for both terrorism and civil unrest incidents; however, the Hazard Mitigation Committee determined the risk of Terrorism in Lebanon as *Low-Medium*.

C. HAZARD RISK RATINGS

The City of Lebanon Hazard Mitigation Committee reviewed each potential hazard and rated the probability of occurrence and vulnerability (cost if the hazard actually occurs) to come up with an overall risk rating. These ratings were reevaluated and changed in 2013. The ratings were based on past occurrences of hazards affecting the State of New Hampshire, Grafton County, and the City of Lebanon. The two highest risks in Lebanon were determined to be flooding and tornado/downburst.

Assessing Probability

The process involved assigning a number to each hazard type based on its potential of occurring determined using the committee's knowledge of past events:

1 – Low: 0-33% chance of occurrence during a 10-year period
2 – Medium: 33-66% chance of occurrence during a 10 year-period
3 – High: 66-100% chance of occurrence during a 10-year period

An n/a score was given if there was insufficient evidence to make a decision. For comparative purposes the Low rating was given a designation of "1," the Medium rating a designation of "2," and the High rating a designation of "3." These figures are shown in Table III-16 and III-17.

Assessing Vulnerability

A relative scale of 1 to 3 was used to determine the impact and cost for human death and injury, property losses and damages, and business/agricultural impact: 1 – limited damage and cost; 2 - moderate amount of damage and cost, and 3 – high damage and cost.

Table III-18: VULNERABILITY OF EXISTING DEVELOPED AREAS

Committee Assessment of Vulnerability	Human Impact	Property Impact	Economic Impact	Vulnerability
	Probability of death or injury	Physical losses and damages	Cottage businesses & agriculture	Avg. of human/ property/ business impact
Dam Failure	2	2	1	1.67
Flooding	2	2	2	2.00
Hurricane	3	3	3	3.00
Tornado & Downburst	3	3	3	3.00
Thunderstorm/Lightning/Hail	1	1	1	1.00
Severe Winter/Ice Storms	2	2	2	2.00
Earthquake	1	2	2	1.67
Drought	1	1	1	1.00
Extreme Heat	2	1	1	1.33
Erosion	1	2	2	1.67
Landslide	1	1	1	1.00
Wildfire	1	3	1	1.67
Natural Contaminants	1	1	1	1.00
HazMat Spills	2	2	2	2.00
Terrorism	3	3	3	3.00

Assessing Risk

The averages of each vulnerability and probability were multiplied to arrive at the overall risk the hazard has on the community. The overall risk or threat posed by a hazard over the next 25 years was determined on a scale outlined below:

HIGH**:** There is very strong potential for a disaster of major proportions during the next 25 years; or (2) history suggests the occurrence of multiple disasters of moderate proportions during the next 25 years. The threat is significant enough to warrant major program effort to prepare for, respond to, recover from, and mitigate against this hazard. This hazard should be a major focus of the city's emergency management training and exercise program.

MEDIUM/HIGH: There is strong potential for a disaster of significant proportions during the next 25 years. The threat is significant enough to warrant major program effort to prepare for, respond to, recover from, and mitigate against this hazard. This hazard should be a major focus of the city's emergency management training and exercise program.

MEDIUM: There is moderate potential for a disaster of less than major proportions during the next 25 years. The threat is great enough to warrant modest effort to prepare for, respond to, recover from, and mitigate this hazard. This hazard should be included in the city's emergency management training and exercise program.

LOW/MEDIUM: There is slight potential for disaster in the in the next 25 years. The modest threat warrants modest effort to prepare for, respond to, recover from, and mitigate this hazard. This hazard should be included in the city's emergency management training and exercise program.

LOW**:** There is little potential for a disaster during the next 25 years. The threat is such as to warrant no special effort to prepare for, respond to, recover from, or mitigate this hazard. This hazard need not be specifically addressed in the city's emergency management training and exercise program except as generally dealt with during hazard awareness training.

Table III-19: RISK ASSESSMENT

Risk Assessment 0-1.9 Low 2-3.9 Low/Med 4-5.9 Med 6-7.9 Med-High 8-9 High					
Hazards	**State Determined Hazard Risk for Grafton County * (for comparison only)**	**Probability based on Committee Review**	**Vulnerability based on Committee Review**	**Risk Rating (Probability x Vulnerability)**	**Risk**
Dam Failure	Medium	1	3.00	3.00	Low/Medium
Flooding	NA	3	2.33	6.99	**Medium/High**
Hurricane	Medium	2	1.67	3.34	Low/Medium
Tornado & Downburst	Medium	3	2.00	6.00	**Medium/High**
Thunderstorm/Lightning/Hail	Medium	3	1.33	3.99	Low/Medium
Severe Winter	Medium	3	1.67	5.01	Medium
Earthquake	Medium	2	1.67	3.34	Low/Medium
Drought	Medium	2	1.67	3.34	Low/Medium
Extreme Heat	NA	2	1.33	2.66	Low/Medium
Erosion	NA	3	1.67	5.01	Medium
Landslide	Medium	3	1.00	3.00	Low/Medium
Wildfire	Medium	2	2.00	4.00	Medium
Natural Contaminants	Low for radon	3	1.00	3.00	Low/Medium
HazMat	Low	3	1.67	5.01	Medium
Terrorism	Low	1	3.00	3.00	Low/Medium

**Table 4.14 State of New Hampshire Multi-Hazard Mitigation Plan, 2013*

IV. CRITICAL FACILITIES/LOCATIONS

The Critical Facilities list, identified by the Lebanon Hazard Mitigation Committee, is divided into three 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 are not required in an event, but that are considered essential for the everyday operation of the City of Lebanon. The third category contains facilities/populations that the Committee wishes to protect in the event of a disaster. Values for all buildings in this document were obtained from city tax records for main structures plus accessory structures for late 2015 and early 2016. These assessments are constantly being updated in the City. The values below do not include land.

Table IV-1: EMERGENCY RESPONSE FACILITIES, SERVICES & STRUCTURES

Map #	Critical Facility	Tax Map #	Hazard Vulnerability	Value
1	Police Station (back-up Emergency Operations Center)	117/1	None	$1,699,900
2	Central Fire Station #1 (Emergency Operations Center)	91/253	HazMat	$1,009,800
3	West Lebanon Fire Station #2	72/15	CT River Dam Failure	$398,200
4	Mascoma Fire Station #3	84/11	None	$171,200
--	Evacuation Routes – Interstates 89 & 91; Routes 4, 10, 120, 12A	--	HazMat	Unknown
5	City Public Works Facility	108/23	Flood, Mascoma Dam Failure	$2,754,300
6	Senior High School/Hanover Street School (primary shelter)	64/33	HazMat	$11,018,500
7	Lebanon Middle School (secondary shelter)	109/30	HazMat	$27,501,000

Table IV-2: NON-EMERGENCY RESPONSE FACILITIES & STRUCTURES

Map #	Critical Facility	Tax Map #	Hazard Vulnerability	Value
8	Carter Witherall Complex, Taylor St (other shelter)	92/25	HazMat, Flood, Mascoma Dam Failure	$3,922,200
9	Old Carter Witherall Building, Campbell St (other shelter)	92/64	Haz Mat	640,200
10	Lebanon Airport	131/1	HazMat	1,104,500
11	City Hall	91/246	HazMat	2,214,400
12	Water Treatment Plant (includes tank and pumping station) Wastewater Treatment Facility	101/2	Mascoma Dam Failure, Flood (administrative buildings and Prospect Street tank out of dam failure and flood areas)	2,381,300
13	Crafts Hill Water Tank	73/90	None	Unknown
14	DHMC Water Tank	5/1	None	Unknown
15	Farnum Hill Water Tank	132/10	None	Unknown
16	Prospect Hill Water Tank	108-22	None	19,000

Table IV-3: FACILITIES & POPULATIONS TO PROTECT

Critical Facility or Population	Tax Map #	Hazard Vulnerability	Value
COMMUNITY FACILITIES			
Grafton County Senior Center, Campbell St	92/23	HazMat, Flood, Mascoma Dam Failure	1,205,300
Lebanon Landfill & Recycling Center	157/3	None, HazMat	552,800
Alice Peck Day Hospital	90/59	None	10,844,300
Dartmouth Hitchcock Medical Center	10/8-200	None	549,041,300
West Central Behavioral Health	91/243	HazMat	482,500
Lebanon Library (historic)	92/126	None	877,300
Kilton Library	72/71	None	2,131,700
River Valley Community College	91/242	HazMat	Unknown
Franklin Pierce College	130/10	HazMat	1,568,800
Campion Rink	5/2	None	Unknown
Municipal Pool	108/23	Flood, Mascoma Dam Failure	2,754,300
Courthouse	10/11-400	None	1,644,300
Lebanon Post Office	92/127	None	575,500
West Lebanon Post Office	10/11-400	Flood, CT River Dam Failure	1,634,100
Mount Lebanon School	73-93	None	2,142,900
LARGE EMPLOYERS/COMMERCIAL AREAS:			
Timken	104/2	HazMat	$4,649,400
Victor Technology	115/3	HazMat, Flood, Dam Failure	2,522,400
Hypertherm	26/24	HazMat	298,400
Hypertherrm	145/8	HazMat	1,059,500
Hypertherm	130/3	HazMat	710,300
Route 12A commercial		Flood, HazMat	Unknown
Airpark Industrial/Commercial		HazMat	Unknown
Centerra Park area / Altaria		None	Unknown
Etna Road industrial area		None	Unknown
West Lebanon Village Central Business District		Erosion, Haz Mat, Flood, CT River Dam Failure	Unknown
Lebanon Central Business District		Erosion, HazMat, Flood, Dam Fail	Unknown
RETIREMENT/SENIOR HOUSING:			
Harvest Hill Retirement Community / Woodlands	76/4	None	18,721,300
Quail Hollow Elderly Housing / Quail Ridge	8/2-200	None	3,641,000
Quail Hollow Elderly Housing	8/2-100	None	3,464,200
Genesis Health Care	50/32	HazMat	6,149,300

Critical Facility or Population	Tax Map #	Hazard Vulnerability	Value
Rogers House Elderly Housing	92/12	HazMat	1,840,800
Lebanon Towers Elderly Housing	77/129	HazMat, Flood, Dam Failure	2,188,500
Maple Street Manor	87/35	None	1,452,300
DAYCARE FACILITIES:			
Children's Center of the Upper Valley	105/12	None	408,000
DHMC Child Care Center	10/8-701	None	1,381,900
Kids Club at River Valley Club – Fit Kids Daycare	10/11-700	None	2,533,200
Lebanon Area Headstart at Hanover St School/Leb. HS	64/33	HazMat	11,018,500
White Mountain Children's Center	64/12	HazMat	289,800
Montessori Discovery School of the Twin States, 22 School Street	92/2	None	159,100
Romano After School Program at Romano Circle	101/20	HazMat, Flood	1,804,000
Twin River Children's Center	102/13	None	172,500
RESIDENTIAL AREAS:			
Olympic Trailer Park, Route 4A	98/22	None	816,600
Jensen's Mobile Home Park (Hannah Village)	90/42	None	2,513,800
Mascoma Meadows Cooperative / Currier's	56/15	Flood	1,108,900
Sachem Village	5/1	None	20,298,300
R1 Zoning Districts		Flood, HazMat	
R2 Zoning Districts		Erosion, Flood, Ice Jam	
R3 Zoning Districts		Erosion, Flood, HazMat	
DAMS:			
Wilder Dam	n/a	Dam Failure, Flood	
Boston Lot Dam	22/1	None	
Glen Road Dam	n/a	Dam Failure, Flood	
Rivermill Dam	n/a	Dam Failure, Flood	
Mascoma Lake Dam	n/a	Dam Failure, Flood	

V. DETERMINING HOW MUCH WILL BE AFFECTED

A. IDENTIFYING VULNERABLE FACILITIES

It is important to determine which critical facilities and other structures are the most vulnerable and to estimate potential losses. The first step is to identify the facilities most likely to be damaged in a hazard event. To do this, the locations of critical facilities were compared to the location of past and potential hazard events. Facilities and structures located in federally and locally determined flood areas, dam inundation areas, etc. were identified and included in the analysis. There is neither large land areas slated for potential development nor large development projects in the works, so vulnerability of undeveloped land was not analyzed except to note logical future development areas.

Table V-1: VULNERABILITY OF EXISTING DEVELOPED AREAS

Area	Hazard	Critical Facilities	Buildings		Total Known Building Value	Infrastructure
			Residential - Number	Non-Residential – Number		
Connecticut River Floodplain	Flooding	Wastewater	3	29	$71,496,730	Roads & one bridge
Mascoma River Floodplain	Flooding	DPW	129	45	77,267,698	Roads & 13 bridges
Locally Determined Floodplain	Flooding	Mascoma Fire Station #3	77	0	7,864,400	Roads & bridges
Mascoma Lake Dam Inundation Area	Dam Failure	Senior Center; DPW	139	65	94,659,798	Roads & 13 bridges
Rivermill Hydro Dam Inundation Area	Dam Failure	None	14	0	2,117,600	Roads & two bridges
Boston Lot Dam Inundation Area	Dam Failure	None	0	0	Not Available	Dam and natural resources
CT River Dams Inundation Areas	Dam Failure	W Leb Fire Station #2, W Leb PO, Wastewater	123	91	135,619,430	Roads & one bridge
Erosion Areas (throughout city)	Erosion	None	0	Unknown	Unknown	Roads & bridges

Table V-2: VULNERABILITY OF POTENTIAL DEVELOPMENT

Area	Hazard	Critical Facilities	Projected Buildings	Projected Infrastructure	Projected Value
Lebanon Village and Heater Road	Flooding; HazMat	Central Fire Station #1	Potential in-fill	none	unknown
West Lebanon Village	Flooding; HazMat	West Lebanon Village Fire Station #2	Potential in-fill	none	unknown
Airport Business Park	HazMat	Airport	Potential in-fill of commercial	none	unknown

B. IDENTIFYING VULNERABLE SPECIAL POPULATIONS

There are several centers of special populations in Lebanon such as elderly housing or schools as identified in Table IV-3. The elderly and physically or mentally impaired residents are also located within the community, but scattered throughout the City in their homes. City-wide programs will have to take this into account. City officials having knowledge of its residents will assist in protection of those with special needs.

C. POTENTIAL LOSS ESTIMATES

This section identifies areas in the City that are most vulnerable to hazard events and estimates potential losses from these events. It is difficult to ascertain the amount of damage caused by a natural hazard because the damage will depend on the hazard's extent and severity, making each hazard event quite unique. In addition, human loss of life was not included in the potential loss estimates, but could be expected to occur. FEMA's *Understanding Your Risks: Identifying Hazards and Estimating Losses* (August 2001) was used in estimating loss evaluations. The value of structures was determined by using City records. The City's tax maps were used to determine number of units within each hazard area. The land damage cost, structure content loss costs, and function loss cost were not determined.

Dam Failure – Low-Medium Risk - $65 Million Estimated Cost

There are 247 houses, 29 multi-family buildings, 140 commercial buildings, and 12 industrial buildings within the dam inundation areas in the City. Also within the dam inundation areas are the West Lebanon Fire Station #2, the US Post Office in West Lebanon, the Lebanon Wastewater Treatment Facility, and the Department of Public Works facility including the City's public swimming pool complex. Assuming a 28% structural damage to the buildings valued at over $232 million, the damage could total an estimated $38.5

million. In addition the Boston Lot Dam owned by the City is valued at a few million dollars including associated structures. Since two of the dams are classified as "high hazard," there is also the probability that people could be killed if these dams failed.

Flooding – Medium-High Risk - $42 Million Estimated Cost
There are approximately 127 single-unit houses and eight multi-family houses located within the FEMA designated Special Flood Hazard 1% Floodplains. The total value of the houses is about $31 million. There are no mobile homes located in these areas. There are also about 62 commercial and eight industrial buildings within these floodplains at a total value of $112 million. The critical facilities within the floodplain include the Lebanon Department of Public Works and the City's wastewater treatment facility with about a $6 million value. Assuming a 28% structural damage to the houses and non-residential structures, the damage could total close to $42 Million.

Hurricane – Low-Medium Risk – No Estimated Cost
It is random which structures would be impacted and how much the damage would cost. Hurricane Floyd in 1999 produced severe damage on Bank Street Extension at a cost of approximately $451,000. The total assessed value of all buildings within the City is over $2 billion ($2,045,081,250). A hurricane could damage or demolish buildings; knock down utility lines causing breaks in water, sewer, and electricity; cause heavy rain and flooding; and kill livestock and people.

Tornado & Downburst – Medium-High Risk – No Recorded or Estimated Cost
Tornadoes, downbursts, and microbursts are relatively uncommon natural hazards in New Hampshire. On average, about two tornado events strike each year in New Hampshire. In the State, the average annual cost of tornadoes between 1950 and 1994 was $9 million (NOAA's Storm Prediction Center) in adjusted US dollars. These wind events occur in specific areas, so calculating potential city-wide losses is difficult. There is no standard loss estimation model available for tornadoes due to their random nature although it is likely that there could be severe damage to buildings, utilities, crops, livestock, and trees as well as potential for human fatalities.

Although more recent information was not found for New Hampshire, a July 2008 tornado which touched down in Deerfield, NH where it resulted in one fatality and damaged nearly 100 homes and completely destroyed two homes. The 52 mile long damage path was the longest damage path for any tornado in NH and extended from several other NH counties before crossing into Maine. Twisted trees still remained in some towns five years later, as property owners could not afford to clear them. No cost estimate for this disaster was found, but FEMA provided about $2.5 million in assistance to affected NH communities.

The 2013 microburst that caused havoc in Lebanon, resulted in around $9 million damage.

Thunderstorm/Lightning/Hail – Low-Medium Risk – No Recorded or Estimated Cost
According to the Federal Alliance for Safe Homes, in an average year, hail causes more than $1.6 billion worth of damage to residential roofs in the United States, making it, year in and year out, one of the most costly natural disasters. Lightning is one of the most underrated severe weather hazards, yet it ranks as the second-leading weather killer in the United States. More deadly than hurricanes or tornadoes, lightning strikes in America each year killing an average of 73 people and injuring 300 others, according to the National Weather Service. There is no cost estimation model for thunderstorms due to their random nature. Lightning strikes can start fires in buildings and forests causing great loss of property and natural resources. Lightning can also cause power outages costing significantly in repairs to utilities, not to mention great inconvenience to homeowners and businesses.

Erosion – Medium Risk – $127,000 Estimated Annual Cost
Development on steep slopes can cause substantial erosion in the adjacent area. This can impact the adjacent roads in the area by making them more susceptible to erosion and washout. Construction itself can cause erosion if best management practices are not used to control run-off from disturbed soils, and the rooftops of buildings displace water which would have gone into the ground. This is then exacerbated by the steep slopes where the run-off moves more quickly and can cause more damage**.**

Over the years, the City of Lebanon has spent a substantial amount of money on road improvement and repair due to erosion. The Department of Public Works estimates that the City spends about $127,000 per year on erosion damage to their roads.

Landslide – Low/Medium Risk – No Estimated Annual Cost
There was a landslide event during the 1999 Hurricane Floyd and another in 2002. A landslide behind the Rivermere housing development occurred in 2013 costing $5.5 million including betterments to prevent future landslides. The Mill Road Trail has a slide whenever there is a heavy rain. It is not possible to estimate an annual cost mostly since improvements have been made to prevent future landslides in the case of Rivermere. Although no one was killed in the 2013 landslide, it was evident that it could have happened due to the mud entering homes and the need for evacuation.

Severe Winter Weather – Medium Risk – Unknown
Ice storms often cause widespread power outages by downing power lines, and these storms can also cause severe damage to trees. New England usually experiences at least one or two severe snowstorms, with varying degrees of severity, each year. All of these impacts are a risk to the community and put all residents, especially the elderly, at risk.

According to a study done for the Institute for Catastrophic Loss Reduction (Canada) and the Institute for Business and Home Safety (U.S.), the 1998 Ice Storm inflicted $1.2 billion (U.S.) worth of damage in the U.S. and Canada. In New Hampshire alone, over

67,000 people were without power (http://www.meteo.mcgill.ca/extreme/Research_Paper_No_1.pdf site last visited 10/19/09). The U.S. average insurance claim was $1,325 for personal property, $1,980 for commercial property, and $1,371 for automobiles. In a 2014 study by the Insurance Information Institute, winter-related disasters totaled $3.7 billion nationwide. The organization further reported that severe winter weather caused 15% of all insured auto, home, and business catastrophe losses in the US in 2014.

In 1998, an ice storm in Lebanon cost the City an estimated $40,000.

Earthquake – Low-Medium Risk – $204.5 Million Estimated Cost
Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines, and precipitate landslide and flash flood events. Four earthquakes in NH between 1924 and 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. Buildings in Lebanon have not been subject to any seismic design level requirement for construction and would be susceptible to structural damage. The dams, bridges, and roads would be vulnerable to a sizable earthquake event. Building practices can make a difference in the deaths during an earthquake. Even a moderate rupture beneath a city with structure unprepared for shaking can produce many casualties.

FEMA's *Understanding Your Risks: Identifying Hazards and Estimating Costs*, August 2001 provides that an earthquake with a 5% peak ground acceleration (as determined by the US Geologic Survey for the area) could cause damage to single-family residences by around 10% of the structural value. If all buildings in Lebanon (total value $2 billion) were impacted by an earthquake, the estimated damage could be around $204.5 million.

Drought – Low-Medium Risk – No Recorded or Estimated Cost
A long drought would cause damage to crops and dry up wells. There is no cost estimate for this hazard in Lebanon as no drought has significantly affected Lebanon in the past. If any farms are impacted, the crop loss could be devastating, but it depends upon the length of the drought. Drought can also require the development of new and deeper wells for residential use. Fires can occur during a drought especially if combined with a lightning strike and dry tinder.

Wildfire – Medium Risk – No Recorded or Estimated Cost
The risk of fire is difficult to predict based on location. Forest fires are more likely to occur during drought years. In addition, areas and structures that are surrounded by dry vegetation that has not been suitably cleared are at high risk. Fire danger is generally universal, however, and can occur practically at any time. Dollar damage would depend on the extent of the fire and the number and type of buildings burned. Some of the developed area of Lebanon interfaces with forest, where structures are potentially vulnerable to wildfire. The estimated value of all structures in the city is over $2 billion. If 1% of the structures (by value) received 50% damage, the total estimated cost would be about $10 million.

According to the Grafton County Forester, there are no reliable figures for the value of timber in New Hampshire; and excluding the last big fires of the early 1940s, the acres and timber values affected by fires would not be supportive of major investment in fire prevention in this region (v. fire-prone western regions).

Extreme Heat – Low-Medium Risk – No Recorded or Estimated Cost
Excessive heat kills more people in the U.S. than tornadoes, hurricanes, floods, and lightning combined. The elderly, very young, obese and those who work outdoors or have substance abuse problems are most at risk from succumbing to heat. Additionally, people in urban areas are more susceptible as asphalt and cement tend to hold in heat throughout the night (Federal Alliance of Safe Homes website). The costs for this hazard are in terms of human suffering. It is not anticipated that there would be any structural or infrastructure costs.

Natural Contaminants – Low-Medium Risk – No Recorded or Estimated Cost
The cost of a radon hazard would be the health of individuals exposed to radon. No cost estimate is provided for this hazard as often people do not even know they have radon in their home interior air or water. The impact to their health may never be known as they may not realize the source of their illness if it is related to radon which can cause cancer. The Centers for Disease Control and Prevention, the American Lung Association and the American Medical Association agree with estimates that radon causes thousands of preventable lung cancer deaths every year. (US EPA)

Hazardous Material Spills – Medium Risk – No Recorded or Estimated Cost
The cost of a hazardous material spill would depend upon the extent of the spill, the location of the spill in relation to population, structures, infrastructure, and natural resources, as well as the type of hazardous material. The cost of any clean-up would be imposed upon the owner of the material. However, other less tangible costs such as loss of water, soil, and air quality might be borne by the community. No cost estimate has been provided for this possible hazard. There are several hazardous waste generators in Lebanon due to the many industries and hospitals and accompanying laboratories. Other potential spills could be from heating fuel delivery or transport of materials through the City on Routes 4, 4A, 10, 12A and 120 and I-89. These are major transportation routes in the area.

Critical facilities in areas especially susceptible to hazardous waste spills include the Lebanon High School, West Lebanon Fire Station, Lebanon Fire Station, and DHMC

Terrorism Risk – Low-Medium Risk - No Recorded or Estimated Cost
The cost of any terrorism event is unpredictable and not estimated in this document. The intent of terrorism is typically to cause deaths and destroy infrastructure. The Committee does not feel that terrorism is a substantial threat in Lebanon.

VI. EXISTING MITIGATION ACTIONS

A. EXISTING HAZARD MITIGATION PROGRAMS

The following table provides the existing mitigation actions in Lebanon. The fourth or "Effectiveness" column ranks each program as one of the following: "high" – the existing program works as intended and meets its goals; "average" – the existing program works though there is room for improvement; and "low" – the existing program does not work as intended or falls short of its goals. The fifth column lists if there were recommendations for improvement in the previous hazard mitigation plan and if those recommendations were put into action or not and if not, why. The final column provides either an update of the mitigation action or proposed improvements that are currently being recommended for the future. Any proposed actions or actions to be continued and will be shown again in future tables for evaluation, prioritization, and scheduling for implementation.

Table VI-1: EXISTING MITIGATION ACTIONS

Existing Mitigation Action & Description	Hazard Type/Service Area	Responsible Local Agent	Effectiveness (Low, Average, High)	Recommendations in Previous Plan/ *Actions Taken to Meet Recommendations or Why Not*	Update/ Future Proposed Improvements
Emergency Power – Provide power during outages to emergency response facilities	Multi-Hazard/ Entire City	EMD	Average	No recommendation in previous plan	The City will continue to maintain its emergency power units.
Building Code and Permit - The International Building Code requires new construction and major renovations to meet national standards for flood, wind, earthquake, fire & snow. City always adopts most current code.	Multi-Hazard/ Entire City	Zoning Administrator	High	No recommendations in previous plan.	The City will continue to enforce to amended building code and permit system.

Existing Mitigation Action & Description	Hazard Type/Service Area	Responsible Local Agent	Effectiveness (Low, Average, High)	Recommendations in Previous Plan/ *Actions Taken to Meet Recommendations or Why Not*	Update/ Future Proposed Improvements
Manufactured Housing Tie-downs Requirement in Building Code - Attach manufactured housing to the ground to prevent destruction during hazard event; concrete pad	Multi-Hazard/ Entire City	Zoning Administrator /Entire City	High	No recommendations in the previous plan	The City will continue to enforce the requirement.
Tree Inventory/ Maintenance - Trim trees as needed to prevent or restore electric or telephone service after hazard event.	Multi-Hazard/ Entire City	Liberty Utility	Low	No recommendations in previous plan	The Public Works Department will continue to work with Liberty Utility to provide necessary tree trimming
Zoning Ordinance - Cluster Design and Planned Unit Development Subdivisions - Current ordinance allows these forms of subdivision to provide greater open space.	Multi-Hazard/ Entire City	Planning Board	High	Amend ordinance update to require conservation design subdivisions in rural lands zoning districts with no development in hazard areas/ INCOMPLETE as working on it now..	Complete the zoning amendment and present to the City Council for consideration.
Natural Resources Inventory – Inventory and assessment of all natural resources such as wetlands and floodplains.	Multi-Hazard/ Entire City	Conservation Commission & Planning Department	High	Complete the inventory; floodplain and other hazard areas will be included as a component of this plan (e.g. identifying undeveloped floodplain lands for protection or passive recreational usage)/ COMPLETED in 2012; use FEMA maps for floodplain inventory.	The City will continue to use the NRI and FEMA flood maps as a guide for future protection and development.

Existing Mitigation Action & Description	Hazard Type/Service Area	Responsible Local Agent	Effectiveness (Low, Average, High)	Recommendations in Previous Plan/ *Actions Taken to Meet Recommendations or Why Not*	Update/ Future Proposed Improvements
Dam Maintenance/ Enforcement - All dams designated as significant or high hazard dams must have Emergency Action Plans.	Dam Failure/ Entire City	State and Public Works Department	High	No recommendations in previous plan.	The City will continue to inspect its own dams to prevent failure.
Floodplain Management Ordinance - Requires elevation of new or improved structures above the 1% flood line	Flooding/ Entire City	Zoning Administrator & City Engineer	Average	Review need for required compensatory flood storage areas./ NOT COMPLETED due to lack of resources	The City will continue to enforce the ordinance. Pursue protection proposals such as compensatory flood storage areas to replace floodplain development. It is anticipated that the City will develop a better mapping system once NH DES provides LIDAR mapping data. The City will combine this with a culvert inventory to analyze the need to replace undersized culverts.
National Flood Insurance Program - The City participates in this program to provide affordable insurance options to its residents	Flooding/ Entire City	FEMA & Planning Board to meet criteria	High	No recommendations in previous plan.	The City will continue to participate in the NFIP and comply with NFIP requirements as well as inform its residents about the program. The City provides digital mapping of the FEMA floodplain and floodway on the City website.
Zoning Ordinance - Wetlands Regulations - The Conservation Commission has a "no net loss" policy if wetlands are impacted.	Flooding/ Entire City	Zoning Administrator	Average	Complete the inventory which will be the basis for wetland re-designation; designate appropriate wetlands as prime for greater protection/ COMPLETED NRI in 2012 which delineated high and very high value wetlands; these now have buffers in the zoning ordinance.	The City will continue to enforce the zoning ordinance to protect wetlands and buffer areas around the very high and high valued wetlands.

Existing Mitigation Action & Description	Hazard Type/Service Area	Responsible Local Agent	Effectiveness (Low, Average, High)	Recommendations in Previous Plan/ *Actions Taken to Meet Recommendations or Why Not*	Update/ Future Proposed Improvements
Public Education – Program to teach hazard mitigation awareness to City residents	Flooding/ Entire City	Department Heads; Zoning Administrator and City Engineer; EMD	Average	Add information to web page to let residents know that the insurance is available outside the flood zones/INCOMPLETE as will do this now. Previous plan mentioned FEMA's CRS program which the City will not pursue.	The City will add a link to their web page to provide Citizen's with information about all hazards.
NH Shoreland Protection Act - This act establishes minimum standards for the future subdivision, use, and development of the shoreland within 250 feet of the state's public waters classified as "Fourth Order" or higher. Repairs, improvements, or expansions to existing development must conform.	Flooding & Erosion/ Entire City	State	Average	No recommendations in previous plan.	Amended Zoning Ordinance in 2013 to create "Riverbank Protection District" to apply to more streams than the NH Shoreland Protection Act. The City will continue to enforce the NH Shoreland Protection Act as well as their zoning ordinance protecting more than 4th order streams.
Zoning Ordinance - Steep slopes restrictions - Restricts development including on slopes greater than 25% in certain zones.	Erosion/ RL3 Zoning District	Zoning Administrator	Low	Expand requirement to entire city/NOT COMPLETED due to lack of time resources	Pursue expansion of zoning ordinance steep slopes requirements to entire City.

Existing Mitigation Action & Description	Hazard Type/Service Area	Responsible Local Agent	Effectiveness (Low, Average, High)	Recommendations in Previous Plan/ *Actions Taken to Meet Recommendations or Why Not*	Update/ Future Proposed Improvements
Fire Protection – Review development in area with risk of wildfire	Wildfire/City wide	Fire Chief	Average	No recommendations in previous plan	The city requires permits for fires to reduce unsafe conditions. Further, the State Fire Code has adopted NFPA 1141**,** STANDARD FOR FIRE PROTECTION INFRASTRUCTURE FOR LAND DEVELOPMENT IN WILDLAND, RURAL, AND SUBURBAN AREAS. This standard will be applied to all new development in areas where there is a risk of wild land fire.
Subdivision and Site Plan Review Regulations - Storm Water Management - Require storm water management. The federal storm water regulations will also cover the City	Erosion/ Entire City	Planning Board & Zoning Administrator	Average/	No recommendations in previous plan.	Currently working on revisions to stormwater regulations to require 50 year storm with 100 year detention capability.
Subdivision and Site Plan Review Regulations - Erosion and Sedimentation Control Requirements - Construction provision to reduce erosion and sedimentation.	Erosion/ Entire City	Planning Board & Zoning Administrator	Average	Amend regulations for more stringent requirements; in the process of updating regulations/ INCOMPLETE as currently working on revisions to require more comprehensive erosion control planning and monitoring..	The City will continue to enforce its regulations and complete amendments for erosion control in Subdivision and Site Plan Review Regulations..

*On-going projects will continue throughout the life of the plan.

The City of Lebanon will provide a public education and outreach program by using brochures and the city website to reach their citizens. There will also be one-on-one outreach as appropriate. Below is a table showing the potential topics and outreach methods. Dam failure is not included as this is performed by the State Dam bureau in their assessment of all dams in the State. Landslide is also not included as there is not anything private citizens can do about the sites in Lebanon.

Table VI-2: PUBLIC EDUCATION AND OUTREACH TOPICS

Natural Hazard	Educational Topics	Outreach Methods
Multi-Hazard	Shelters; evacuation routes; proper evacuation procedures; emergency kits and family plans	City web site City meeting display LebAlert system for all
Flooding	National Flood Insurance Program participation; building in a floodplain; stormwater runoff; driving on flooded roads; protecting natural systems which provide flood mitigation; securing property items such as propane tanks prior to a flood	City web site Brochures
Wind Events (Hurricane, Tornado, Downburst	Wind retrofits such as shutters, hurricane clips; school and city official sheltering basics; resident and business sheltering basics; window coverings	City web site
Severe Winter Weather	Installation of carbon monoxide monitor and alarms; ventilation of fuel-burning equipment; protecting water pipes	City web site
Thunderstorms/Lightning/Hail	Taking cover; staying inside when it thunders	City web site
Earthquake	Structural and non-structural home retrofitting; securing furnishings	City web site
Drought	Water-saving measures; crop insurance; soil and water conservation practices by farmers	City web site
Extreme Heat	Preparing for extreme heat; air conditioning; cooling shelters	City web site
Erosion	High risk areas; stormwater management; bank stabilization; water body buffers	City web site
Wildfire	Most vulnerable areas; reducing fuel for fires such as dry brush	City web site; Fire Department and Fire Warden interactions
Natural Contaminants	Testing for contaminants in air and water	City web site
Hazardous Materials Spills	What to do if there's a fuel delivery spill	City web site

B. NEW MITIGATION PROGRAMS

The Committee evaluated the existing programs and proposed improvements to determine if they were addressing all the hazards they felt could impact the city. Table VII-3 summarizes this evaluation and notes where new programs could be implemented to address all hazards.

Table VI-3: COMMITTEE ASSESSMENT FOR NEW HAZARD MITIGATION ACTIONS

Hazard	Committee Ideas and Assessment
Dam Failure	The committee felt that overall they did not have the ability to mitigate dam failures. They noted that NH DES keeps record of dam inspections and that the dams keep updated inundation plans. The committee felt that any actions that could be taken regarding dam failure were beyond what the city has for resources
Drought	Upon discussion of drought the city did not feel they needed to pursue any mitigation strategies. Possible stormwater requirements for greater infiltration to address drought conditions. If a water emergency is declared, the City can make requests to its residents to conserve water if an emergency through City list serve e-mails, the City web site, radio public service announcements, and LebAlert.
Earthquake & Severe Wind (Hurricane, Tornado, Downburst)	For earthquake and major wind events, the City already has the State International Building Code and International Residential Code which take these events into account. The Committee did not feel they could adopt more stringent requirements since these events are so rare and that the available actions to take were outside of the capacity and resources of the city at this time. The city does plan to continue its tree trimming by the highway department, which will reduce the damage of severe wind by eliminating the vulnerable trees and limbs.
Erosion	Road maintenance and upgrades; Subdivision and Site Plan Review regulations address stormwater; Driveway Regulations assure proper culvert size; culvert inventory to assure proper culvert size throughout city.
Landslide	Road maintenance and upgrades can be used to address landslide problems such as on Slayton Hill Road.
Extreme Temperatures	The city offers cooling stations and water to the public at the following locations: Lebanon Library, Kilton Library and Lebanon City Hall. The Committee did not feel that further mitigation was required.
Flooding (Hurricane, Thunderstorm, etc.)	NFIP member; adopted Flood Plain Ordinance; will participate in NFIP trainings to maintain compliance. Will evaluate various bridge and culvert upgrades to reduce the impacts and flooding of high water flows due to inadequately sized structures to allow large volumes of water to pass through.
Thunderstorms, Lightning and Hail	The Committee discussed the hazards but did not feel a particular area of city is more prone to these events (i.e. lightning strikes) than any other and that there were not any feasible mitigation strategies at this point. The tree trimming program will reduce the impacts of the high winds that are often associated with a thunderstorm.

Severe Winter Weather	The City does its best to maintain the roads in winter to keep them clear of snow and debris. The City already has adopted the State's International Building Code and International Residential Code which are enforced by the Building Inspector. The City provides shelters during major storms and power outages. The cooling stations for extreme heat are also used in the event of a power outage and during the winter has a warming station.
Earthquake	The Committee felt that the risk of a destructive earthquake was not sufficient enough to warrant the expensive undertaking of enacting strategies to mitigate the hazard. The City adopted the State's International Building Code and International Residential Code several years ago and feel that the codes provide enough building standard to meet the risk of earthquakes in Lebanon.
Wildfire	The Committee felt that the threat of wildfire was significant enough to warrant further mitigation strategies. The city requires permits for fires to reduce unsafe conditions. Further, the State Fire Code has adopted NFPA 1141**,** STANDARD FOR FIRE PROTECTION INFRASTRUCTURE FOR LAND DEVELOPMENT IN WILDLAND, RURAL, AND SUBURBAN AREAS. This standard will be applied to all new development in areas where there is a risk of wild land fire.
Natural Contaminants	The Committee discussed what the different natural contaminants and noted that radon is always a risk living in a region on granite bedrock, but they did not feel that the risk was significant to warrant any action from the city other than educating the public to be aware of the potential problem. The committee felt similarly with other natural contaminants, that there is not a prevalence of any contaminations that warrants further action.
Hazardous Materials	The Committee felt that the most suitable strategies for Hazardous Materials are to continue their mutual aid agreements regarding HazMat spills. They recognize this is considered a preparedness item, but the committee feels it is the best action for the City to take and did not feel they could take on any other measures at this time.
Terrorism	The Committee felt that because terrorism is very rare and difficult to plan for a specific event due to the unknown nature of such occurrences that they could not take further actions. The Committee noted that the school has protocols in place and that the police participate in trainings on how to deal with such an event. Though they realize these are preparedness actions, they feel this is the best way for the city to continue to prepare for terrorism.

Table VI-4 provides a list of proposed new mitigation actions including ones that had been proposed in the previous plan. If these actions had not been accomplished since the last plan, then there is an explanation, however, all mitigation actions are new.

Table VI-4: PROPOSED NEW MITIGATION ACTIONS

Proposed New Mitigation Action Description	Problem Statement	Hazard Addressed	Responsible Party	If Recommended in Previous Plan, why was it not put into place?
Connecticut River - Stream Bank Stabilization projects-Stream bank stabilization work is needed in an area on the Connecticut River to decrease siltation and flooding impacts on commercial properties.	The stream Bank along the Connecticut river has stabilization issues and causes siltation and flooding issues to commercial Properties. (in the City's Capital Improvement Plan)	Erosion, Flooding	NH DOT	Not completed due to lack of resources.
Mill Road Trail - Correct Drainage and slope stabilization	Mill Road Trail has drainage and slope stabilization issues and is up stream from the Water Treatment Plant Intake area	Erosion, Landslide	DPW Engineer	Not completed due to lack of resources.
Mascoma River - City will work with USGS and FEMA to update the NFIP study for the Mascoma River.	Detailed Engineering flood study of Mascoma-The FEMA study is outdated and flood maps need updating	Flooding	DPW Engineer	Not completed due to lack of resources.
Ruddsboro Road - Study and correct drainage	Ruddsboro Road has yard drainage, street and bank washouts	Erosion, Flooding	DPW Engineer	Not completed due to lack of resources.
Pumping Station Road - Study and correct the cross drains drainage and river bank stabilization issues	Pumping Station Road has cross drainage and bank stabilization issues along the Mascoma, River – sink hole around culvert pipe between Route 4 and Pumping Station Road	Erosion, Flooding	DPW Engineer	Not completed due to lack of resources.
Pasture Lane - Study and correct, New drainage system and change inflow	Pasture Lane has drainage problems	Erosion, Flooding	DPW Engineer	Not completed due to lack of resources.
Kinne Street Neighborhood - Study and introduce a Closed Drainage System	Kinne Street neighborhood has drainage problems due to an open drainage system and steep slopes	Erosion, Flooding	DPW Engineer	Not completed due to lack of resources.
Early Ridge and Stevens Road - Study and Change drainage characteristics	Eagle Ridge and Stevens Road has drainage problems	Erosion, Flooding	DPW Engineer	Not completed due to lack of resources.
Brook Road & Hardy Hill - Study and improve drainage; concrete headers on culverts	Brook Road & Hardy Hill has drainage problems	Erosion, Flooding	DPW Engineer	Not completed due to lack of resources.

Proposed New Mitigation Action Description	Problem Statement	Hazard Addressed	Responsible Party	If Recommended in Previous Plan, why was it not put into place?
Eastman Hill Road - Study and improve drainage, culverts and ditching	Eastman Hill Road has drainage problems	Erosion, Flooding	DPW Engineer	Not completed due to lack of resources.
Interchange Drive - Study and correct drainage	Interchange Drive has drainage problems.	Erosion, Flooding	DPW Engineer	Not completed due to lack of resources.
Westview Lane and Hardy Hill Road - Study and correct Drainage	Westview Lane Area; Hardy Hill Road has drainage problems	Erosion, Flooding	DPW Engineer	Not completed due to lack of resources.
Manchester Drive & Monica Street - Study and improve drainage with dykes	Manchester Drive & Monica Street has drainage problems	Erosion, Flooding	DPW Engineer	Not completed due to lack of resources.
Riverside Drive - Study and correct drainage	Riverside Drive drainage issues	Erosion, Flooding	DPW Engineer	Not in previous plan
Blueberry Hill - Study and correct drainage	Blueberry Hill Deteriorated storm drainage pipes and drainage issues	Erosion, Flooding	DPW Engineer	Not in previous plan
Pleasant/Mack/Maple - Study and correct drainage from cemetery road to new drainage infrastructure on Main Street	Pleasant/ Mack/Maple very poor storm water drainage	Erosion, Flooding	DPW Engineer	Not in previous plan
Buckingham Place/King's Grant area - Study and Correct drainage	Buckingham Place drainage issues	Erosion, Flooding	DPW Engineer	Not in previous plan

C. CRITICAL EVALUATION FOR IMPROVEMENTS TO EXISTING PROGRAMS AND NEW PROGRAMS

The Lebanon Hazard Mitigation Committee reviewed each of the proposed improvements to existing programs and proposed new programs identified for existing mitigation programs using the following factors:

- Does it reduce disaster damage?
- Does it contribute to community objectives?
- Does it meet existing regulations?
- Can it be quickly implemented?
- Is it socially acceptable?
- Is it technically feasible?
- Is it administratively possible?
- Does the action offer reasonable benefits compared to cost of implementation?

Each mitigation strategy was evaluated and assigned a score (High – 3; Average – 2; and Low – 1) based on the criteria.

The Lebanon Hazard Mitigation Committee assigned the following scores to each strategy for its effectiveness related to the critical evaluation factors listed above, and actions had the following scores, with the highest scores suggesting the highest priority. These scores are re-evaluated during each update process for new and existing strategies.

Table VI-5 examines the proposed improvements and evaluates them as 1: Low; 2: Average; and 3: High for effectiveness looking at several criteria as shown in the table. The totals are then ranked to prioritize the improvements to help the Committee focus on the most effective strategy improvements.

Old or deferred actions have been reprioritized with new actions.

Table VI-5: PRIORITIZING EXISTING AND PROPOSED MITIGATION STRATEGY IMPROVEMENTS

Rank	Strategy Improvement	Reduce Damage	Community Objectives	Existing Regulations	Quickly Implemented	Socially Acceptable	Technically Feasible	Administratively Possible	Benefit to Cost	TOTAL SCORE	Mitigate Existing, or New Development
7	Connecticut River - Stream Bank Stabilization projects-Stream bank stabilization work is needed in an area on the Connecticut River to decrease siltation on commercial properties.	2	2	1	1	2	3	2	1	14	Both
6	Mill Road Trail - Correct Drainage and slope stabilization	2	2	1	1	2	3	2	2	15	Existing
8	Mascoma River - City will work with USGS and FEMA to update the NFIP study for the Mascoma River.	1	1	1	2	2	2	2	1	12	Both
8	Ruddsboro Road - Study and correct drainage	1	1	1	2	2	2	2	1	12	Both
8	Pumping Station Road - Study and correct the cross drains drainage and river bank stabilization issues	1	1	1	2	2	2	2	1	12	Both
8	Pasture Lane - Study and correct, New drainage system and change inflow	1	1	1	2	2	2	2	1	12	Both
9	Kinne Street Neighborhood - Study and introduce a Closed Drainage System	1	1	1	1	2	2	2	1	11	Both
8	Eagle Ridge and Stevens Road - Study and Change drainage characteristics	1	1	1	2	2	2	2	1	12	Both
8	Eastman Hill Road - Study and improve drainage, culverts and ditching	1	1	1	2	2	2	2	1	12	Both
8	Manchester Drive & Monica Street - Study and improve drainage with dikes	1	1	1	2	2	2	2	1	12	Both
5	Pleasant/Mack/Maple - Study and correct drainage from cemetery road to new drainage infrastructure on Main Street	2	3	3	1	2	2	2	1	16	Both
5	Buckingham Place - Study and Correct drainage	2	3	3	1	2	2	2	1	16	Both
2	Subdivision and Site Plan Review Regulations – Complete amendments for erosion control	1	3	3	3	3	3	3	3	22	Both
2	Public Education – Add information to the City website	3	2	3	2	3	3	3	3	22	Both
4	Zoning Ordinance – Expand steep slopes requirements to entire City	2	2	3	1	2	3	2	3	18	New
1	Site Plan & Subdivision Regulations – More stringent erosion and sedimentation control requirements including 50-year storm with 100 year detention capability	3	3	3	3	2	3	3	3	23	New
3	Zoning Ordinance - Amend ordinance to require conservation design subdivisions with no development in hazard areas.	2	3	3	2	2	3	3	3	21	New
3	Floodplain Management Ordinance - Review need for required compensatory flood storage areas.	3	3	3	2	2	3	2	3	21	Both

D. EMERGENCY PREPAREDNESS ACTIONS

Although this is a hazard mitigation plan, the Committee felt it was important to address new and proposed emergency preparedness actions. It is sometimes difficult to distinguish between hazard mitigation and emergency preparedness. Essentially, emergency preparedness is the preparation to act once a hazard has occurred. And as has been discussed previously, hazard mitigation includes actions to eliminate or reduce hazards before they happen. Table VI-6 below is a list of the emergency preparedness actions that the Committee felt should be addressed and included in this plan.

Table VI-6: EMERGENCY PREPAREDNESS ACTIONS

Existing Emergency Preparedness Action & Description	Hazard Type/ Service Area	Responsible Local Agent	Effectiveness (Low, Average, High)	Recommendations in Previous Hazard Mitigation Plan/*Actions Taken to Meet Recommendations or Not Met*	Update/Future Proposed Improvements
911 Number System – Numbering system for emergency response location	Multi-Hazard/ Entire City	City Engineer	High	Replace illegible numbers for emergency notification and location; GIS system/ON-GOING	On-going updating and training
Emergency Notification System – Door-to-door notification if anticipated hazard event	Multi-Hazard/ Entire City	EMD & Fire Chief	Low	Explore use of Code Red reverse notification system with Grafton County and implement statewide reverse 911 system/COMPLETED	City has trained key emergency staff on the use of the Statewide emergency notification system.
ICS (Incident Command System) & NIMS (National Incident Management System) – Provides training for City personnel	Multi-Hazard/ Entire City	EMD	Average	Provide additional training to City and school personnel/COMPLETED	All key Emergency Management Leadership has completed ICS 300 & ICS 400 Advanced Incident Command Training.
Comprehensive Emergency Management Program for Schools (CEMPS) - Lebanon schools have been involved in this NH Office of Emergency Management program.	Multi-Hazard/ Entire City	SAU, State, EMD	Low	Update plan per State requirement; provide more training for key SAU personnel/ON-GOING	City EM Staff continues to work with the Lebanon SAU on implementing the School EM Plan.

Existing Emergency Preparedness Action & Description	Hazard Type/ Service Area	Responsible Local Agent	Effectiveness (Low, Average, High)	Recommendations in Previous Hazard Mitigation Plan/*Actions Taken to Meet Recommendations or Not Met*	Update/Future Proposed Improvements
City Emergency Management Plan - Describes the preparation and response necessary for the city to address emergency situations	Multi-Hazard/ Entire City	EMD	Average	Provide training and exercises for key city personnel/ON-GOING	On-going training
Mutual Aid Compact - Lebanon has an informal compact with all communities in the Upper Valley, to maximize use of resources to address and respond to hazard events for fire, police and EMS.	Multi-Hazard/ Entire City	Fire Chief	High	Formalize mutual aid agreements among municipalities/ INCOMPLETE; Not done due to lack of resources	Formalize mutual aid agreements among municipalities
Hazardous Materials Plan – Provides emergency response to hazardous materials spills	HazMat/ Entire City & the Town of Hanover	Local Emergency Planning Committee	Average/ Currently updating plan	Provide more training and exercises/ON-GOING	LEPC Plan will be updated in 2017.

*On-going projects will continue throughout the life of the plan.

VII. PRIORITIZED IMPLEMENTATION SCHEDULE

The Lebanon Hazard Mitigation Committee created the following action plan for implementation of priority mitigation strategies. Actions ranked in Table VI:5 are provided here in the order they were ranked in priority.

Table VII-1: PRIORITIZED IMPLEMENTATION SCHEDULE FOR EXISTING AND NEW PROGRAM IMPROVEMENTS

Rank	Evaluation Score	Problem Statement	Mitigation Action	Hazard Addressed	Responsible Party	Anticipated Cost	Potential Funding Source	Timeframe
1	23	**Site Plan & Subdivision Regulation**s –	More stringent erosion and sedimentation control requirements including 50-year storm with 100 year detention capability	Erosion	Planning Department and Planning Board	$0	Staff Time	1-2 years
2	22	**Subdivision and Site Plan Review Regulations** –	Complete amendments for erosion control	Erosion	Planning Department and Planning Board	$0	Staff Time	1-2 years
2	22	**Public Education** -	Provide hazard mitigation information to residents on City web page		EMD	$0	Staff Time	1-2 years
3	21	**Zoning Ordinance** -	Amend ordinance to allow conservation design subdivisions with no development in hazard areas.	All Hazards	Planning Department and Planning Board	$0	Staff Time	1-2 years
3	21	**Floodplain Management Ordinance** -	Review need for required compensatory flood storage areas.	Flooding	Planning Department and Planning Board	$0	Staff Time	1-5 years
4	18	**Zoning Ordinance** –	Expand steep slopes requirements to entire City	Erosion	Planning Department and Planning Board	$0	Staff Time	4-5 years
5	16	**Pleasant/ Mack/Maple** - very poor storm water drainage	Study and correct drainage from cemetery road to new drainage infrastructure on Main Street	Erosion, Flooding	DPW Engineer	$314,600	Taxes & Grants	4-5 years

Rank	Evaluation Score	Problem Statement	Mitigation Action	Hazard Addressed	Responsible Party	Anticipated Cost	Potential Funding Source	Timeframe
5	16	**Buckingham Place & King's Grant** - drainage issues	Study and Correct drainage	Erosion, Flooding	DPW Engineer	$1,279,000	Taxes & Grants	4-5 years
6	15	**Mill Road Trail** - Correct drainage and slope stabilization issues and is up stream from the Water Treatment Plant Intake area	Correct Drainage and slope stabilization	Erosion, Landslide	DPW Engineer	$3,258,000	Taxes & Grants	4-5 years
7	14	**Connecticut River** - The stream bank along the river has stabilization issues for commercial properties.	Stream Bank Stabilization projects-Stream bank stabilization work is needed in an area on the Connecticut River to decrease siltation and flooding impacts on commercial properties.	Erosion, Flooding	FERC	None to the City	Grants	Unknown as this is NH DOT
8	12	**Mascoma River** - Detailed Engineering flood study of Mascoma	City will work with USGS and FEMA to update the NFIP study for the Mascoma River.	Flooding	DPW Engineer	None to the City	Federal	4-5 years
8	12	**Ruddsboro Road** - yard drainage, street and bank washouts	Study and correct drainage	Erosion, Flooding	DPW Engineer	$1,045,000	Taxes & Grants	4-5 years
8	12	**Pumping Station Road** - has cross drainage and bank stabilization issues along the Mascoma, River; sink hole around culvert pipe between Route 4 and Pumping Station Rd	Study and correct the cross drains drainage and river bank stabilization issues	Erosion, Flooding	DPW Engineer	$382,000	Taxes & Grants	4-5 years

Rank	Evaluation Score	Problem Statement	Mitigation Action	Hazard Addressed	Responsible Party	Anticipated Cost	Potential Funding Source	Timeframe
8	12	**Pasture Lane** - has drainage problems	Study and correct, New drainage system and change inflow	Erosion, Flooding	DPW Engineer	$492,600	Taxes & Grants	4-5 years
8	12	**Eagle Ridge and Stevens Road** - has drainage problems	Study and Change drainage characteristics	Erosion, Flooding	DPW Engineer	$786,000	Taxes & Grants	4-5 years
8	12	**Eastman Hill Road** - has drainage problems	Study and improve drainage, culverts and ditching	Erosion, Flooding	DPW Engineer	$140,000	Taxes & Grants	4-5 years
8	12	**Manchester Drive & Monica Street** - has drainage problems	Study and improve drainage with dykes	Erosion, Flooding	DPW Engineer	$60,000	Taxes & Grants	4-5 years
9	11	**Kinne Street** - neighborhood has drainage problems due to an open drainage system and steep slopes	Study and introduce a Closed Drainage System	Erosion, Flooding	DPW Engineer	$1,160,000	Taxes & Grants	4-5 years

*This action will be completed on an ongoing basis throughout the life of the plan.

VIII. ADOPTION & IMPLEMENTATION OF THE PLAN

A good plan needs to provide for periodic monitoring and evaluation of its successes and challenges, and to allow for updates of the Plan where necessary. In order to track progress and update the Mitigation Strategies identified in the Plan, the City of Lebanon will revisit the Hazard Mitigation Plan *annually, or after a hazard event*. The Lebanon Emergency Management Director will initiate this review and should consult with the Hazard Mitigation Committee. Changes will be made to the plan to accommodate for projects that have failed, or that are not considered feasible after a review for their consistency with the evaluation criteria, the timeframe, the community's priorities, and funding resources. Priorities that were not ranked highest, but that were identified as potential mitigation strategies, will be reviewed as well during the monitoring and update of this plan, to determine feasibility for future implementation. The plan will be updated and submitted for FEMA approval at a minimum every five years as required by the Disaster Mitigation Act 2000.

A. IMPLEMENTATION THROUGH EXISTING PROGRAMS

The Hazard Mitigation Committee will meet annually to reassess the plan and to assure that they are accomplishing their goals. Additionally, the Hazard Mitigation Committee will revisit the plan within 90 days of a declared disaster to review and revise the goals and actions of the plan. The City had not incorporated the Hazard Mitigation Plan into City documents in the past but in 2015 Lebanon has incorporated the document into a draft of the Emergency Operations Plan and will include the plan in the upcoming Master Plan revisions. The City Council, during the Capital Improvement Process, will review and include any proposed structural projects outlined in this plan. In the past, the city has not formally reviewed the plan each year, but has used it informally has a planning tool. Going forward, the plan will be addressed annually at a City Council meeting to review the progress of any mitigation activities that have been undertaken and to review the goals and strategies. At this time, the public will have the opportunity to participate in the meeting regarding the city's plan and fulfillment of the projects outlined in the plan. Notably to plan for infrastructure repairs and equipment purchases. The city will also add hazard mitigation information to city web site.

Many municipalities have web sites where they can share information about hazard mitigation and emergency management. The use of the web site by its citizens is often dictated by the availability of broadband service to easily access the web. The City of Lebanon has provided a link to the Regional Planning Commission's web page, "A Citizen's Guide to Hazard Mitigation and Emergency Management."

Municipalities have documents to convey town goals and objectives that are used to guide future programs. They can be used to promote and implement hazard mitigation. A Municipal Master Plan outlines how the community wants to grow and develop. It

includes overall goals and objectives of the community and recommendations for ordinances and regulations to accomplish those goals. A zoning ordinance is a common vehicle to implement goals of the master plan and regulates land use. It can be used to restrict development in flood zones, steep sloped areas, buffer zones around wetlands and water bodies, drinking water recharge areas, hillsides, and ridgelines. These areas may be "overlay districts" mapped out for protection. A zoning ordinance can also require best management practices in forestry and timber harvesting and stormwater management to prevent erosion. A floodplain management plan is part of the zoning ordinance and has typically followed a format recommended by the NH Flood Management Program.

Other municipal documents include regulations such as Curb Cut Regulations, Excavation Regulations, Subdivision Regulations and Site Plan Review Regulations. Curb Cut Regulations are used to make sure the culverts at the intersection of driveways and roads are adequate to handle runoff water or stream flow. Excavation Regulations are used to restrict the removal of earth including distance to seasonal high water table and the requirements to restore the site once the excavation is completed. This is essential to make sure the area is graded and re-vegetated to reduce the chances of erosion. Subdivision Regulations determine how lots are to be laid out in a subdivision. This might include requirements for fire protection, stormwater runoff management, vegetated buffers, and reference back to the zoning ordinance. Site Plan Review Regulations are for multi-family housing and commercial development. Again, these regulations refer back to the zoning ordinance. The regulations can determine site specific development requirements such as parking, open space, vegetated buffers, and traffic flow.

Subdivision Regulations and Site Plan Review Regulations typically refer back to the Zoning Ordinance, so it may be more effective to amend the zoning ordinance to address hazard mitigation through specific restrictions though this can vary by municipality.

Another important municipal document is the Capital Improvements Program which is a "budget of the future" to consider potential capital expenditures such as new roads, equipment, schools, parks. This allows a systematic evaluation of potential projects. Any capital expenditures related to hazard mitigation will be incorporated into this document.

There are other regulations and ordinances that municipalities may adopt such as to regulate water use during a drought or restrict development in areas around drinking water sources. This all varies by municipality.

It should also be noted that many municipalities do not update these documents very often, and some towns do not have them at all. However, where they exist, they offer the potential to include hazard mitigation and emergency management topics.

In Lebanon, the most recent version of the Master Plan is 2012, the latest version of Subdivision Regulations is October 2, 1997, the most recent Site Plan Review Regulations is October 2, 1997, and the Zoning Ordinance is March 12, 2013. The most critical documents to reference hazard mitigation are primarily the master plan and the zoning ordinance. The Zoning Ordinance was

amended in 2013 to include lot size averaging to provide more open space during a subdivision. The city will continue to evaluate its documents to include hazard mitigation.

B. CONTINUED PUBLIC INVOLVEMENT

The public will continue to be invited to participate in the hazard mitigation planning process. In future years, a public meeting will be held (separate from the adoption hearing) to inform and educate members of the public. . It is hoped that a separate meeting discussing hazard mitigation and emergency management will create more interest in the process Additionally, a press release to local newspapers and information will be posted on the City website.

Copies of the Hazard Mitigation Plan will be shared with to the following parties for review for reference:

- Select Board Offices in neighboring towns
- NH Homeland Security & Emergency Management
- Lebanon City Council, Conservation Commission, and Planning Board
- Upper Valley Lake Sunapee Regional Planning Commission

RESOURCES USED IN THE PREPARATION OF THIS PLAN

Guide to Hazard Mitigation Planning for New Hampshire Communities, prepared for NH HSEM by the Southwest Regional Planning Commission, October 2002

FEMA *Multi-Hazard Mitigation Planning Guidance Under the Disaster Mitigation Act of 2000*, March 2004, Last Revised June 2007

FEMA 386-1 *Getting Started: Building Support for Mitigation Planning*, September 2002

FEMA 386-2 *Understanding Your Risks: Identifying Hazards and Estimating Costs,* August 2001

FEMA 386-3 *Developing the Mitigation Plan: Identifying Mitigation Actions and Implementation Strategies*, April 2003

Ice Storm '98 by Eugene L. Lecomte et al for the Institute for Catastrophic Loss Reduction (Canada) and the Institute for Business & Home Safety (U.S.), December 1998

City of Lebanon Emergency Operations Plan, 2012

City of Lebanon Master Plan, 2012

NH HSEM's *State of New Hampshire Multi-Hazard Mitigation Plan*, Update 2013

www.fema.gov/news/disasters.fema: Website for FEMA's Disaster List
www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms: Website for National Oceanic & Atmospheric Administration Disaster List

www.tornadoproject.com: Website for The Tornado Project

www.crrel.usace.army.mil/: Website for Cold Regions Research and Engineering Laboratory Website (CRREL)

www.nesec.org: Website for Northeast States Emergency Consortium

http://earthquake.usgs.gov/research/hazmaps/products_data/2002/ceus2002.php: Website for area earthquake information

APPENDICES

APPENDIX A:

Technical Resources

APPENDIX A: TECHNICAL RESOURCES

1) Agencies

New Hampshire Homeland Security and Emergency Management
Hazard Mitigation Section 271-2231
Federal Emergency Management Agency ..... (617) 223-4175
NH Regional Planning Commissions:
Upper Valley Lake Sunapee Regional Planning Commission 448-1680
NH Executive Department:
Governor's Office of Energy and Community Services 271-2611
New Hampshire Office of State Planning 271-2155
NH Department of Cultural Affairs: 271-2540
Division of Historical Resources 271-3483
NH Department of Environmental Services: 271-3503
Air Resources 271-1370
Waste Management 271-2900
Water Resources 271-3406
Water Supply and Pollution Control 271-3504
Rivers Management and Protection Program 271-1152
NH Office of Energy and Planning 271-2155
NH Municipal Association 224-7447
NH Fish and Game Department 271-3421
NH Department of Resources and Economic Development: 271-2411
Natural Heritage Inventory 271-3623
Division of Forests and Lands 271-2214
Division of Parks and Recreation 271-3255
NH Department of Transportation 271-3734
Northeast States Emergency Consortium, Inc. (NESEC) ..... (781) 224-9876
US Department of Commerce:
National Oceanic and Atmospheric Administration:
National Weather Service; Gray, Maine 207-688-3216

US Department of the Interior:
- US Fish and Wildlife Service 225-1411
- US Geological Survey 225-4681
- US Army Corps of Engineers ..... (978) 318-8087

US Department of Agriculture:
- Natural Resource Conservation Service 868-7581

2) Mitigation Funding Resources

404 Hazard Mitigation Grant Program (HMGP)	NH Homeland Security and Emergency Management
406 Public Assistance and Hazard Mitigation	NH Homeland Security and Emergency Management
Community Development Block Grant (CDBG)	NH HSEM, NH OEP, also refer to RPC
Dam Safety Program	NH Department of Environmental Services
Disaster Preparedness Improvement Grant (DPIG)	NH Homeland Security and Emergency Management
Emergency Generators Program by NESEC‡	NH Homeland Security and Emergency Management
Emergency Watershed Protection (EWP) Program	USDA, Natural Resources Conservation Service
Flood Mitigation Assistance Program (FMAP)	NH Homeland Security and Emergency Management
Flood Plain Management Services (FPMS)	US Army Corps of Engineers
Mitigation Assistance Planning (MAP)	NH Homeland Security and Emergency Management
Mutual Aid for Public Works	NH Municipal Association
National Flood Insurance Program (NFIP) †	NH Office of Energy and Planning
Power of Prevention Grant by NESEC‡	NH Homeland Security and Emergency Management
Project Impact	NH Homeland Security and Emergency Management
Roadway Repair & Maintenance Program(s)	NH Department of Transportation
Section 14 Emergency Stream Bank Erosion & Shoreline Protection	US Army Corps of Engineers
Section 103 Beach Erosion	US Army Corps of Engineers
Section 205 Flood Damage Reduction	US Army Corps of Engineers
Section 208 Snagging and Clearing	US Army Corps of Engineers
Shoreland Protection Program	NH Department of Environmental Services
Various Forest and Lands Program(s)	NH Department of Resources and Economic Development
Wetlands Programs	NH Department of Environmental Services

‡NESEC – Northeast States Emergency Consortium, Inc. is a 501(c)(3), not-for-profit natural disaster, multi-hazard mitigation and emergency management organization located in Wakefield, Massachusetts. Please, contact NH HSEM for more information.

† Note regarding National Flood Insurance Program (NFIP) and Community Rating System (CRS):
The National Flood Insurance Program has developed suggested floodplain management activities for those communities who wish to more thoroughly manage or reduce the impact of flooding in their jurisdiction. Through use of a rating system (CRS rating), a community's floodplain management efforts can be evaluated for effectiveness. The rating, which indicates an above average floodplain management effort, is then factored into the premium cost for flood insurance policies sold in the community. The higher the rating achieved in that community, the greater the reduction in flood insurance premium costs for local property owners. The NH Office of State Planning can provide additional information regarding participation in the NFIP-CRS Program.

3) Websites

Sponsor	Internet Address	Summary of Contents
Natural Hazards Research Center, U. of Colorado	http://www.colorado.edu/litbase/hazards/	Searchable database of references and links to many disaster-related websites.
Atlantic Hurricane Tracking Data by Year	http://wxp.eas.purdue.edu/hurricane	Hurricane track maps for each year, 1886 – 1996
National Emergency Management Association	http://nemaweb.org	Association of state emergency management directors; list of mitigation projects.
NASA – Goddard Space Flight Center "Disaster Finder:	http://www.gsfc.nasa.gov/ndrd/disaster/	Searchable database of sites that encompass a wide range of natural disasters.
NASA Natural Disaster Reference Database	http://ltpwww.gsfc.nasa.gov/ndrd/main/html	Searchable database of worldwide natural disasters.
U.S. State & Local Gateway	http://www.statelocal.gov/	General information through the federal-state partnership.
National Weather Service	http://nws.noaa.gov/	Central page for National Weather Warnings, updated every 60 seconds.
USGS Real Time Hydrologic Data	http://h20.usgs.gov/public/realtime.html	Provisional hydrological data
Dartmouth Flood Observatory	http://www.dartmouth.edu/artsci/geog/floods/	Observations of flooding situations.
FEMA, National Flood Insurance Program, Community Status Book	http://www.fema.gov/fema/csb.htm	Searchable site for access of Community Status Books
Florida State University Atlantic Hurricane Site	http://www.met.fsu.edu/explores/tropical.html	Tracking and NWS warnings for Atlantic Hurricanes and other links

Sponsor	Internet Address	Summary of Contents
National Lightning Safety Institute	http://lightningsafety.com/	Information and listing of appropriate publications regarding lightning safety.
NASA Optical Transient Detector	http://www.ghcc.msfc.nasa.gov/otd.html	Space-based sensor of lightning strikes
LLNL Geologic & Atmospheric Hazards	http://wwwep.es.llnl.gov/wwwep/ghp.html	General hazard information developed for the Dept. of Energy.
The Tornado Project Online	http://www.tornadoroject.com/	Information on tornadoes, including details of recent impacts.
National Severe Storms Laboratory	http://www.nssl.uoknor.edu/	Information about and tracking of severe storms.
Independent Insurance Agents of America IIAA Natural Disaster Risk Map	http://www.iiaa.iix.com/ndcmap.htm	A multi-disaster risk map.
Earth Satellite Corporation	http://www.earthsat.com/	Flood risk maps searchable by state.
USDA Forest Service Web	http://www.fs.fed.us/land	Information on forest fires and land management.

APPENDIX B:

Hazard Mitigation Assistance Grants

APPENDIX B:
HAZARD MITIGATION ASSISTANCE GRANTS

Hazard Mitigation Assistance (HMA) grant programs of the Department of Homeland Security (DHS) Federal Emergency Management Agency (FEMA), presents a critical opportunity to protect individuals and property from natural hazards while simultaneously reducing reliance on Federal disaster funds. The HMA programs provide pre-disaster mitigation grants annually to local communities. The statutory origins of the programs differ, but all share the common goal of reducing the loss of life and property due to natural hazards. Eligible applicants include State-level agencies including State institutions; Federally recognized Indian Tribal governments; Public or Tribal colleges or universities (PDM only); and Local jurisdictions that are participating in the National Flood Insurance Program (NFIP).

All sub-applicants for Flood Mitigation Assistance Program (FMA) must currently be participating in the National Flood Insurance Program (NFIP) to be eligible to apply for this grant. Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) mitigation project sub-applications for projects sited within a special flood hazard area are eligible only if the jurisdiction in which the project is located is participating in the NFIP. There is no NFIP participation requirement for HMGP and PDM project sub-applications located outside the special flood hazard area. Properties included in a project sub-application for FMA funding must be NFIP-insured at the time of the application submittal. Flood insurance must be maintained at least through completion of the mitigation activity.

The HMA grant assistance includes three programs:

1. *Hazard Mitigation Grant Program (HMGP*): This program assists in the implementation of long-term hazard mitigation measures following a major disaster.

2. *The Pre-Disaster Mitigation (PDM) program*: This provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are awarded on a competitive basis.

3. *The Flood Mitigation Assistance (FMA) program*: This provides funds so that cost-effective measures can be taken to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities.

HMGP - http://www.fema.gov/hazard-mitigation-grant-program

PDM – www.fema.gov/government/grant/pdm/

FMA – www.fema.gov/government/grant/fma

Mitigation Project:	HMPG	PDM	FMA
1. Mitigation Projects	**X**	**X**	**X**
Property Acquisition and Structure Demolition	**X**	**X**	**X**
Property Acquisition and Structure Relocation	**X**	**X**	**X**
Structure Elevation	**X**	**X**	**X**
Mitigation Reconstruction	**X**	**X**	**X**
Dry Floodproofing of Historic Residential Structures	**X**	**X**	**X**
Dry Floodproofing of Non-residential Structures	**X**	**X**	**X**
Generators	**X**	**X**	
Localized Flood Reduction Projects	**X**	**X**	**X**
Non-Localized Flood Reduction Projects	**X**	**X**	
Structural Retrofitting of Existing Buildings	**X**	**X**	**X**
Non-structural Retrofitting of Existing Buildings and Facilities	**X**	**X**	**X**
Safe Room Construction	**X**	**X**	
Wind Retrofit for One- and Two-Family Residences	**X**	**X**	
Infrastructure Retrofit	**X**	**X**	**X**
Soil Stabilization	**X**	**X**	**X**
Wildfire Mitigation	**X**	**X**	
Post-Disaster Code Enforcement	**X**		
Advance Assistance	**X**		
5% Initiative Projects	**X**		
Misc. Other	**X**	**X**	**X**
2. Hazard Mitigation Planning	**X**	**X**	**X**
Planning Related Activities	**X**		
3. Technical Assistance			**X**
4. Management Costs	**X**	**X**	**X**

OTHER HAZARD MITIGATION ASSISTANCE FUNDING

Environmental Protection Agency

The EPA makes available funds for water management and wetlands protection programs that help mitigate against future costs associated with hazard damage.

Mitigation Funding Sources Program	Details	Notes
Clean Water Act Section 319 Grants	Grants for water source management programs including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and regulation. http://www.epa.gov/OWOW/NPS/cwact.html	Funds are provided only to designated state and tribal agencies
Clean Water State Revolving Funds	State grants to capitalize loan funds. States make loans to communities, individuals, and others for high-priority water-quality activities. http://www.epa.gov/owow/wetlands/initiative/srf.html	States and Puerto Rico
Wetland Program Development Grants	Funds for projects that promote research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution. http://www.epa.gov/owow/wetlands/initiative/#financial	See website

National Oceanic and Atmosphere Administration (NOAA)

NOAA is the major source for mitigation funding related to coastal zone management and other coastal protection projects.

Mitigation Funding Sources Program	Details	Notes
Coastal Services Center Cooperative Agreements	Funds for coastal wetlands management and protection, natural hazards management, public access improvement, reduction of marine debris, special area management planning, and ocean resource planning. http://www.csc.noaa.gov/funding/	May only be used to implement and enhance the states' approved Coastal Zone Management programs
Coastal Services Center Grant Opportunities	Formula and program enhancement grants for implementing and enhancing Coastal Zone Management programs that have been approved by the Secretary of Commerce. http://www.csc.noaa.gov/funding/	Formula grants require non-federal match
Coastal Zone Management Program	The Office of Ocean and Coastal Resource Management (OCRM) provides federal funding and technical assistance to better manage our coastal resources. http://coastalmanagement.noaa.gov/funding/welcome.html	Funding is reserved for the nation's 34 state and territory Coastal Zone Management Programs
Marine and Coastal Habitat Restoration	Funding for habitat restoration, including wetland restoration and dam removal. http://www.nmfs.noaa.gov/habitat/recovery/	Funding available for state, local and tribal governments and for- and non-profit organizations.

Floodplain, Wetland and Watershed Protection Programs

USACE and the U.S. Fish and Wildlife Service offer funding and technical support for programs designed to protect floodplains, wetlands, and watersheds.

Funding and Technical Assistance for Wetlands and Floodplains Program	Details	Notes
USACE Planning Assistance to States (PAS)	Fund plans for the development and conservation of water resources, dam safety, flood damage reduction and floodplain management. http://www.lre.usace.army.mil/planning/assist.html	50 percent non-federal match
USACE Flood Plain Management Services (FPMS)	Technical support for effective floodplain management. http://www.lrl.usace.army.mil/p3md-o/article.asp?id=9&MyCategory=126	See website
USACE Environmental Laboratory	Guidance for implementing environmental programs such as ecosystem restoration and reuse of dredged materials. http://el.erdc.usace.army.mil/index.cfm	See website
U.S. Fish & Wildlife Service Coastal Wetlands Conservation Grant Program	Matching grants to states for acquisition, restoration, management or enhancement of coastal wetlands. http://ecos.fws.gov/coastal_grants/viewContent.do?viewPage=home	States only. 50 percent federal share
U.S. Fish & Wildlife Service Partners for Fish and Wildlife Program	Program that provides financial and technical assistance to private landowners interested in restoring degraded wildlife habitat. http://ecos.fws.gov/partners/viewContent.do?viewPage=home	Funding for volunteer-based programs

Housing and Urban Development

The Community Development Block Grants (CDBG) administered by HUD can be used to fund hazard mitigation projects.

Mitigation Funding Sources Program	Details	Notes
Community Development Block Grants (CDBG)	Grants to develop viable communities, principally for low and moderate income persons. CDBG funds available through Disaster Recovery Initiative. http://www.hud.gov/offices/cpd/communitydevelopment/programs/	Disaster funds contingent upon Presidential disaster declaration
Disaster Recovery Assistance	Disaster relief and recovery assistance in the form of special mortgage financing for rehabilitation of impacted homes. http://www.hud.gov/offices/cpd/communitydevelopment/programs/dri/assistance.cfm	Individuals
Neighborhood Stabilization Program	Funding for the purchase and rehabilitation of foreclosed and vacant property in order to renew neighborhoods devastated by the economic crisis. http://www.hud.gov/offices/cpd/communitydevelopment/programs/neighborhoodspg/	State and local governments and non-profits

Bureau of Land Management

The Bureau of Land Management (BLM) has two technical assistance programs focused on fire mitigation strategies at the community level.

Mitigation Funding Sources Program	Details	Notes
Community Assistance and Protection Program	Focuses on mitigation/prevention, education, and outreach. National Fire Prevention and Education teams are sent to areas across the country at-risk for wildland fire to work with local residents. http://www.blm.gov/nifc/st/en/prog/fire/community_assistance.html	See website
Firewise Communities Program	Effort to involve homeowners, community leaders, planners, developers, and others in the effort to protect people, property, and natural resources from the risk of wildland fire before a fire starts. http://www.firewise.org/	See website

U.S. Department of Agriculture

There are multiple mitigation funding and technical assistance opportunities available from the USDA and its various sub-agencies: the Farm Service Agency, Forest Service, and Natural Resources Conservation Service.

Mitigation Funding Sources Agency Program	Details	Notes
USDA Smith-Lever Special Needs Funding	Grants to State Extension Services at 1862 Land-Grant Institutions to support education-based approaches to addressing emergency preparedness and disasters. http://www.csrees.usda.gov/funding/rfas/smith_lever.html	Population under 20,000
USDA Community Facilities Guaranteed Loan Program	This program provides an incentive for commercial lending that will develop essential community facilities, such as fire stations, police stations, and other public buildings. http://www.rurdev.usda.gov/rhs/cf/cp.htm	Population under 20,000
USDA Community Facilities Direct Loans	Loans for essential community facilities. http://www.rurdev.usda.gov/rhs/cf/cp.htm	Population of less than 20,000
USDA Community Facilities Direct Grants	Grants to develop essential community facilities. http://www.rurdev.usda.gov/rhs/cf/cp.htm	Population of less than 20,000
USDA Farm Service Agency Disaster Assistance Programs	Emergency funding and technical assistance for farmers and ranchers to rehabilitate farmland and livestock damaged by natural disasters. http://www.fsa.usda.gov/	Farmers and ranchers
USDA Forest Service National Fire Plan	Funding for organizing, training, and equipping fire districts through Volunteer, State and Rural Fire Assistance programs. Technical assistance for fire related mitigation. http://www.forestsandrangelands.gov/	See website
USDA Forest Service Economic Action Program	Funds for preparation of Fire Safe plans to reduce fire hazards and utilize byproducts of fuels management activities in a value-added fashion. http://www.fs.fed.us/spf/coop/programs/eap/	80% of total cost of project may be covered
USDA Natural Resources Conservation Service Emergency Watershed Protection Support	Funds for implementing emergency measures in watersheds in order to relieve imminent hazards to life and property created by a natural disaster. http://www.nrcs.usda.gov/programs/ewp/	See website

Mitigation Funding Sources Agency Program	Details	Notes
Services		
USDA Natural Resources Conservation Service Watershed Protection and Flood Prevention	Funds for soil conservation; flood prevention; conservation, development, utilization and disposal of water; and conservation and proper utilization of land. http://www.nrcs.usda.gov/programs/watershed/index.html	See website

Health and Economic Agencies

Alternative mitigation programs can be found through health and economic agencies that provide loans and grants aimed primarily at disaster relief.

Federal Loans and Grants for Disaster Relief Agency Program	Details	Notes
Department of Health & Human Services Disaster Assistance for State Units on Aging (SUAs)	Provide disaster relief funds to those SUAs and tribal organizations who are currently receiving a grant under Title VI of the Older Americans Act. http://www.aoa.gov/doingbus/fundopp/fundopp.asp	Areas designated in a Disaster Declaration issued by the President
Economic Development Administration (EDA) Economic Development Administration Investment Programs	Grants that support public works, economic adjustment assistance, and planning. Certain funds allocated for locations recently hit by major disasters. http://www.eda.gov/AboutEDA/Programs.xml	The maximum investment rate shall not exceed 50 percent of the project cost
U.S. Small Business Administration Small Business Administration Loan Program	Low-interest, fixed rate loans to small businesses for the purpose of implementing mitigation measures. Also available for disaster damaged property. http://www.sba.gov/services/financialassistance/index.html	Must meet SBA approved credit rating

Research Agencies

The United States Geological Survey (USGS) and the National Science Foundation (NSF) provide grant money for hazard mitigation-related research efforts.

Hazard Mitigation Research Grants Agency Program	Details	Notes
National Science Foundation (NSF) Decision, Risk, and Management Sciences Program (DRMS)	Grants for small-scale, exploratory, high-risk research having a severe urgency with regard to natural or anthropogenic disasters and similar unanticipated events. http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5423&org=SES	See website
U.S. Geological Survey (USGS) National Earthquake Hazards Reduction Program	The purpose of NEHRP is to provide products for earthquake loss reduction to the public and private sectors by carrying out research on earthquake occurrence and effects. http://www.usgs.gov/contracts/nehrp/	Community with a population under 20,000

Appendix C: Meeting Documentation of Posted Meetings

Meeting #1: Tuesday, April 5, 2016 10:00 – 11:30 AM (1.5 hours)

- General discussion of requirements and in-kind match process
- Review goals of hazard mitigation plan and revise
- Review hazards
- Identify and map past/potential hazards (update map & lists in Chapter 2)
- Flooding – Are there any non-FEMA flood areas?
- Specific past and potential events of hazards not in 2010 plan (recent events)
- Potential development areas in city (compare with list in 2010 plan)
- Identify critical facilities (update map and list)

Meeting #2 Tuesday, May 24, 2016 9:00 – 10:30 AM (1.5 hours)

- Determine Vulnerability to Hazards for City
- Determine Probability of Hazards for City
- Review Critical Facilities & hazard vulnerability
- Discuss future meetings, public notice, stakeholders to be notified, notices to abutting towns
- Review previously determined potential mitigation efforts (were they implemented? If not, why not and are they still on the table to be implemented?)
- Brainstorm improvements to existing mitigation efforts
- Brainstorm potential new mitigation efforts
- Evaluate the past and potential mitigation efforts
- Develop a prioritized implementation schedule and discuss the adoption and monitoring of the plan

PUBLIC MEETING

HAZARD MITIGATION PLAN UPDATE

TUESDAY, APRIL 5, 2016

10:00AM – NOON

COUNCIL CHAMBERS

CITY HALL, LEBANON

The City is beginning the process of updating the Hazard Mitigation Plan, last adopted by the City Council on August 18, 2010. The public is invited and encouraged to attend and provide feedback regarding potential updates.

The plan is available on the City's website at http://planning.lebnh.net/a/lebnh.net/planning/home/documents/planning-news-and-studies/hazard-mitigation-plan-updated-2010

Any person with a disability who wishes to attend this public meeting and needs additional accommodations, please contact the ADA coordinator at City Hall by calling 448-4220 at least 72 hours in advance so that the City can make any necessary arrangements.

Vickie Davis

From: Vickie Davis
Sent: Tuesday, March 15, 2016 5:05 PM
To: Julia N. Griffin (julia.griffin@hanovernh.org); Peter Kulbacki (peter.kulbacki@hanovernh.org); Steven P. Schneider; Jim Taylor; Mike Samson; Stephen Halleran
Subject: Lebanon Hazard Mitigation Plan Meeting

Greetings,

You are invited to attend the meetings for the City of Lebanon's hazard mitigation plan update. Abutting municipalities are invited as natural hazards cross political boundaries, and you may be able to better address a hazard together.

The first meeting will be Tuesday, April 5 at the Lebanon City Hall in the Council Chambers (2nd floor) from 10:00 AM to Noon.

If you are not able to make the meeting, feel free to submit written comments. You would also be welcome to obtain a copy of the draft and/or final plan, by request.

Please let me know if you have any questions.

Vickie

Victoria Davis
Upper Valley Lake Sunapee Regional Planning Commission
10 Water Street, Suite 225
Lebanon, NH 03766
603-448-1680
603-448-0170 fax

Visit our Household Hazardous Waste web site at http://hhw.uvlsrpc.org
Visit our Waste web site at http://waste.uvlsrpc.org
Visit the Healthy Home Facebook Page at www.Facebook.com/HealthyHomeProgram

Join our Mailing List

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Lebanon Fire Department > LFD News >

Hazard Mitigation Plan Update Meeting

posted Mar 11, 2016, 8:50 AM by Lebanon NH **[updated Mar 11, 2016, 8:50 AM]**

The City is beginning the process of updating the Hazard Mitigation Plan, last adopted by the City Council on August 18, 2010. The public is invited and encouraged to attend and provide feedback regarding potential updates.

Date: Tuesday, April 5, 2016
Time: 10:00am - Noon
Location: Council Chambers, City Hall, Lebanon, NH

The plan is available on the City's website at: http://goo.gl/DF2Y1s.

Any person with a disability who wishes to attend this public meeting and needs additional accommodations, please contact the ADA coordinator at City Hall by calling 603-448-4220 at least 72 hours in advance so that the City can make any necessary arrangements.

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Contact Information▼

For Immediate Emergency Help Call 911

Chris Christopoulos
Fire Chief

Jeffrey Libbey
Assistant Fire Chief

EMAIL: fire@lebcity.com

PHONE:
603-448-8810
603-448-8811 fax

HOURS:
Monday - Friday
8:00am - 5:00pm

ADDRESS:
12 South Park Street
Lebanon, NH 03766

Lebanon Hazard Mitigation Plan Meeting - April 5, 2016

Name	Title & Municipality
Victoria Davis	Planner, UVLSRPC
Chris Christopher	Lebanon FD
BRYAN ANDERSON	HYPERTHERM INC
~~LEAF DEGEORGE~~	~~CRREL DPW~~
~~Larry Dearfield~~	~~CRREL SEMO~~
Laura Shea	DHMC - EH+S
MIKE CAVALLA	CITY OF LEBANON
MICHAEL COMIS	DARTMOUTH COLLEGE
MARTY MCMILLAN	HANOVER FIRE CHIEF
Paula Maville	Acting CM, City of Lebanon
Richard Mello	Police Chief
Dave Brooks	Lebanon Planning
Jim Lamarro	Valley News

May 24, 2014
Hazard Mitigation Plan Meeting
Lebanon

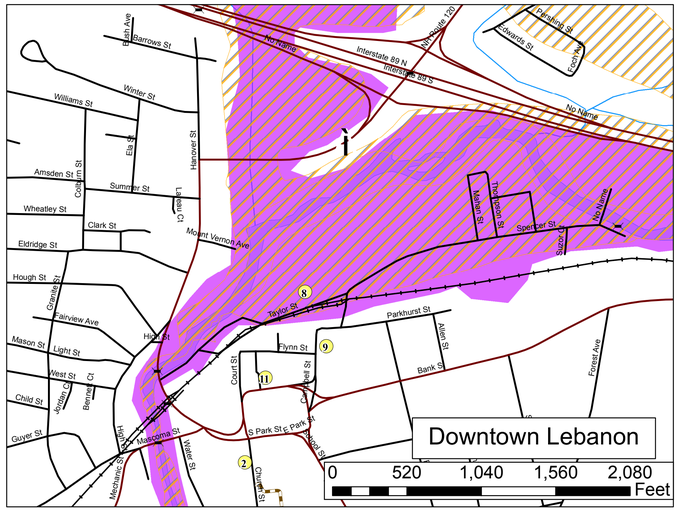
PAUL HATCH	NHHS EM
MIKE LAVALLEE	CITY OF LEBANON
Rich Mello	Police Chief
Chris Christopoulos	Fire Dept.
Jim Alexander	D-H
Victoria Davis	UVLSRPC

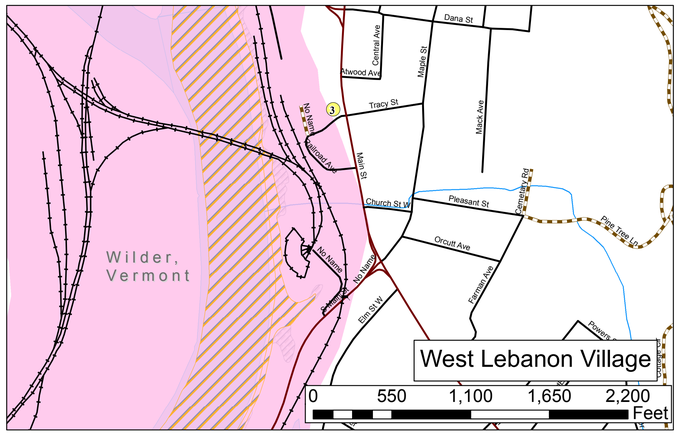
APPENDIX D:

Map of Hazard Areas and Critical Facilities

Hazard Areas & Critical Facilities Map
Lebanon, NH

ID #	Name of Critical Facility
1	Police Station
2	Fire Station #1
3	West Lebanon Fire Station #2
4	Mascoma Fire Station #3
5	Public Works Facility
6	LHS/Hanover St School
7	Lebanon Middle School
8	Carter Witherall Complex
9	Old Carter Witherall Building
10	Lebanon Airport
11	City Hall
12	Water/Wastewater Treatment Plants
13	Crafts Hill Water Tank
14	DHMC Water Tank
15	Farnum Water Tank
16	Prospect Hill Tank





Legend

- Critical Facilities
- High hazard potential
- Significant hazard potential
- BostonInudation
- Rivermill Hydro Dam
- Mascoma Lake Dam
- Connecticut River Dams

Floodplains, FEMA

- 100-Yr Floodplain, Zone A
- 100-Yr Floodplain, Zone AE

Roads

- State
- Local
- Not Maintained
- Private
- Railroad
- Bridges
- City Boundary
- Lake, Pond, Reservoir
- Streams

N W E S

0 0.25 0.5 1 1.5 2 Miles

MAP PREPARED BY UVLSRPC FOR LEBANON
HAZARD MITIGATION PLAN FEBRUARY 2016.

UPPER VALLEY LAKE SUNAPEE
REGIONAL PLANNING COMMISSION

Note: Dams rated at Low Hazard Potential or No Menace are not shown on the map. This includes the Glen Rd Dam which is marked as Low Hazard Potential.

NH DES does not require an Emergency Action Plan or inundation area for the Lebanon Water Treatment Intake Dam as it would not cause flooding of residences downstream in the event of a failure. This dam is classified as a significant hazard as it provides the raw water supply for the City of Lebanon and the loss of the dam would result in damage to a water supply that would take greater than 48 hours to repair.

Data Source: Dam hazard class and inundation data from NH DES Dam Bureau. FEMA floodplain data. Critical Facilities and Flood Prone Areas data developed by UVLSRPC with the Lebanon Hazard Mitigation Committee. Roads and Bridges data NH DOT 2016.

Map created May 2016 by UVLSRPC. THIS MAP IS INTENDED FOR PLANNING PURPOSES ONLY.

APPENDIX E:

FEMA Approvals and City Adoption of Hazard Mitigation Plan

City of Lebanon, New Hampshire
City Council
A Resolution Adopting the Lebanon Hazard Mitigation Plan Update 2016

WHEREAS, the City of Lebanon received assistance from the Upper Valley Lake Sunapee Regional Planning Commission through funding from the NH Homeland Security and Emergency Management to prepare a hazard mitigation updated plan; and WHEREAS, several planning meetings to develop the hazard mitigation plan update were held in April and May 2016; and WHEREAS, the Lebanon Hazard Mitigation Plan Update 2016 contains several potential future projects to mitigate the hazard damage in the City of Lebanon and WHEREAS, the City Council held a public meeting on November 2, 2016 to formally approve and adopt the Lebanon Hazard Mitigation Plan Update 2016.

RESOLVED by the Lebanon City Council:

1. The Plan is hereby adopted as an official plan of the City of Lebanon;
2. The respective officials identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them;
3. Future revisions and Plan maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as a part of this resolution for a period of five (5) years from the date of this resolution.
4. An annual report on the progress of the implementation elements of the Plan shall be presented to the City Council by the Emergency Management Director.

IN WITNESS WHEREOF, the undersigned has affixed his/her signature this 2nd day of November, 2016:

Lebanon City Council.

Georgia A. Tuttle, MD, Mayor, Ward 1

Bill Finn, Councilor Ward 2

Karen Liot Hill, Councilor At Large

Suzanne Prentiss, Asst Mayor, Ward 1

Sarah L. Welsch, Councilor Ward 3

Erling Heistad, Councilor At Large

Bruce Bonner, Councilor Ward 2

Clifton Below, Councilor Ward 3

Timothy McNamara, Councilor At Large

Attest to Signatures:

Sandra Allard, City Clerk

Corporate Seal

LOCAL MITIGATION PLAN REVIEW TOOL

City of Lebanon, NH

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: City of Lebanon, NH	**Title of Plan:** City of Lebanon New Hampshire Hazard Mitigation Plan Update 2016	**Date of Plan:** 2016
Single or Multi-jurisdiction plan? Single	**New Plan or Plan Update?** Update	
Regional Point of Contact: Victoria Davis Planner, Upper Valley Lake Sunapee Regional Planning Commission 10 Water Street Lebanon, NH 03766 ; vdavis@uvlsrpc.org; 603-448-1680	**Local Point of Contact:** Paula Maville Interim City Manager City of Lebanon, NH 51 North Park Street Lebanon, NH 03766 Paula.Maville@LebCity.com; 603-448-4220	

State Reviewer:	**Title:**	**Date:**
Whitney Welch	State Hazard Mitigation Planner Whitney.welch@dos.nh.gov	7/22/2016
D. Parker Moore	EM Planning Specialist Parker.moore@dos.nh.gov	7/22/2016

FEMA Reviewer:	**Title:**	**Date:**
Emma Reed Jay Neiderbach	CERC Community Planner	8/15/2016 8/19/2016; 12/1/2016
Date Received in FEMA Region I	7/22/2016	
Plan Not Approved		
Plan Approvable Pending Adoption	8/23/2016	
Plan Approved	12/1/2016	

SECTION 1:
REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Section I, pp. 2-6, Appendix C	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Section I, pp. 2-3, Appendix C	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section I, pp. 2-3	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section VIII, p. 85	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Section VIII, p. 84	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Section VIII, p. 82	X	
ELEMENT A: REQUIRED REVISIONS			

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Section III, pp. 11-51	X	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Section III, pp. 11-51	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Section III, pp. 11-55	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Section III, p. 22	X	
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section VI, pp. 65-70; Section VIII, pp. 82-84	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Section III, p. 22; Section VI, p. 67	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Section I, p. 5	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Section VI, pp. 65-74	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Section VI, p. 75; Section VII, pp. 79-81	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Section VIII, pp. 82-84	X	
ELEMENT C: REQUIRED REVISIONS			

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section II, pp. 9-10	X	
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Section VI, pp. 65-74	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Section VI, p. 76	X	
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Appendix E	X	
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))			
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 2:
PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Recommended Corrections:

- On page 3, the plan states that no representatives from abutting towns attended the planning meetings. Similarly, page 6 indicates that "no comments were made by neighboring towns." The meeting sign-in sheets indicate that the Hanover Fire Chief attended the April 2016 meeting. Revise pages 3 and 6 to reflect this.

Element A: Planning Process

Plan Strengths:

- There is documentation of both the planning process and public / stakeholder outreach activities, including sign-in sheets, a description of the topics discussed at the two planning meetings, the public notice, a screenshot of the City website, and a copy of the e-mail invitation sent to surrounding municipalities.
- The planning team included stakeholders from a variety of local City departments and other organizations relevant to mitigation, including the Interim City Manager, Planning and Zoning Director, and the Public Works Director. This variety ensured a more comprehensive planning process.
- Stakeholder involvement included the participation of Dartmouth-Hitchcock Hospital, a major employer and important facility. Other major employers were also invited to participate, with Dartmouth College and Hypertherm Inc. attending the first planning meetings.
- Public notices were posted at multiple locations (two City libraries, City website, and City Hall), increasing visibility and the likelihood of public participation. The public notice included a link to where the 2010 plan could be accessed online, meaning that residents could review the plan without attending a planning meeting in person.
- The planning team utilized a wide range of existing technical studies and plans. Examples include the Master Plan, FEMA's 1980 Flood Insurance Study, statistics on previous disaster declarations, FEMA's *Understanding Your Risks: Identifying Hazards and Estimating Losses*, NOAA information on previous hazard events, and inundation maps for upstream high hazard dams. Local histories such as *History in a Nutshell: A Brief History of Lebanon, NH 1761-1961* were also used. This comprehensive incorporation of resources created a thorough plan that carefully assesses risk and mitigation.

Opportunities for Improvement:

- As part of the narrative of the planning process on page 3, identify how major employers were invited to participate (personalized e-mail invitation, phone call, etc.). Also state the specific major employers that participated in the first meeting (i.e. Dartmouth College and Hypertherm Inc).
- As part of the notice sent to neighboring communities, include a link to where the 2010 plan can be found on the City website. This will make it easier to review the plan and provide comments.
- In future updates, as part of the public notice, explain how residents can provide feedback without attending a planning meeting in person. For example, include contact information for a municipal official to which residents can convey feedback. Consider also including more general information about the importance of hazard mitigation and topics to be discussed at planning meetings, so that residents will better understand what the planning process is about.
- For the next plan update, consider sending a press release to local media inviting them to attend a planning meeting. The press release could include general information about hazard mitigation, such as FEMA's *Local Hazard Mitigation Planning Fact Sheet*.
- Consider holding at least one planning meeting at night, in order to provide the public and stakeholders with more opportunities to participate.
- During future updates of the plan, consider distributing a survey to the public asking for their input on hazards, current mitigation efforts, and proposed new mitigation actions.
- As part of the description of continued public and stakeholder involvement on page 84, identify how the plan will be shared with Select Boards of neighboring towns and the City's Conservation Commission.

Element B: Hazard Identification and Risk Assessment

Plan Strengths:

- Dam failure is extensively analyzed, with information from the NH DES Dam Bureau used to determine which upstream dams are considered a risk. Inundation zones are included on the hazard map in Appendix D. Extensive information is provided about dams, including their impoundment area, height, and drainage area in acres. The number of structures and their assessed value is estimated for each inundation area.
- The map of hazard areas and critical facilities is easy to read. Inset maps with a lower scale allow for a more detailed understanding of the risk in downtown and West Lebanon.
- Hazard profiles are presented in an organized manner, with tables, maps, and figures enabling readers to understand each hazard and its impacts.
- There is an extensive history of most hazards with a large amount of supporting information about previous occurrences. Examples include Connecticut River discharge data, rainfall and snowfall accumulation data, FEMA disaster declarations, estimated damages, and wind speeds. Information is provided both for the region and specifically for Lebanon. There is extensive information on the 2013 microburst.

- The number of structures in the 1% floodplain, and their assessed value, are identified.
- Estimated flood losses are based on the 28% structural damage figure identified in FEMA's *Understanding Your Risks: Identifying Hazards and Estimating Losses*. For hazards that could affect the entire community, estimates are based on local, regional, or national data.

Opportunities for Improvement:

- Consider including additional maps that convey the information presented in the plan. For example, consider mapping the location of the 2013 downburst and the recent flooding locations listed on pages 20 and 21. Include any localized flooding locations that are not in the 1% floodplain.
- As part of the hazard analysis, describe the impact that climate change will have on the magnitude of future hazard events, and how this will affect the community's overall vulnerability.
- To provide more context about the potential damages from hurricanes, consider including a table of the impacts associated with each category of the Saffir-Simpson Hurricane Wind Scale.
- Include base flood elevations in the plan in order to better convey the extent of the 1% floodplain.
- Include more information on the extent of erosion by describing the approximate length of roadways affected by previous occurrences, or including erosion locations on the hazard map.
- As part of the risk assessment, the scoring for the probability of future occurrences uses a 10-year timeframe, and the overall risk score is defined for a 25-year timeframe. Consider using the same timeframe in both categories.

Element C: Mitigation Strategy

Plan Strengths:

- Mitigation activities initiated as a result of the 2013 microburst are described, with information about what work has been completed, challenges associated with the work, and cost estimates.
- The table of existing mitigation programs identifies the hazards and vulnerabilities addressed by each action. There is a description of the progress that has been made to improve existing actions.
- The plan documents an extensive list of public education and outreach topics, with specific mitigation actions that residents can implement and how the information will be disseminated to residents.
- The planning team analyzed a comprehensive set of possible mitigation actions for each hazard. Pages 71 and 72 document which hazards are sufficiently addressed by existing capabilities, which are beyond the City's resources, and which the City would like to address with additional mitigation actions.

- The table of proposed new mitigation actions includes problem statements that describe the vulnerability associated with each action and explain why it is needed.
- A range of different types of mitigation actions were selected for implementation. In developing its prioritized implementation schedule, the planning team considered public outreach, local plans and regulations, structural projects, and natural systems protection.
- The plan describes current efforts to incorporate the plan into other planning mechanisms, including the Capital Improvement Process, Emergency Operations Plan, and Master Plan. There are details about how incorporation will occur, such as the plan being addressed annually by the City Council.

Opportunities for Improvement:

- As part of the evaluation of existing mitigation actions, the effectiveness of the current tree inventory and maintenance program was determined to be "low." Provide more information about why the program is considered to not work as intended, and any actions that the planning team considered for improving the program. Include the evaluation of this program as part of the assessment for new hazard mitigation actions that are identified on pages 71 and 72.
- For mitigation actions that are physical projects, consider mapping the locations of work that has been and will be completed.
- As part of the STAPLEE analysis, consider explaining why actions received low scores in certain categories. For example, for the action of improving drainage on Eastman Hill Road, explain why a score of 1 was given in the category of "reduce damage" (i.e. only a small area would be improved, it is uncertain whether additional work would resolve drainage issues, etc.). Additional documentation will make it easier to understand the planning team's decision making process and to evaluate the success of the plan's actions during future updates.

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

Plan Strengths:

- The plan thoroughly assessed the impact of recent development on the community's vulnerability. There is information on the 2013 microburst storm and subsequent mitigation efforts that have resulted in reduced vulnerability. The plan states the location of other development and indicated it is not in a significant hazard area. Information on recent population trends in Lebanon and nearby communities, as well as recent building permits issued, provides further context about changes in development.
- The vulnerability of specific future development locations is assessed on page 60. The plan also provides an overall evaluation of the likelihood of new development, taking into consideration the economy, the City's priority on redevelopment over new development, and projected population trends.

Opportunities for Improvement:

- **D1** - As part of the discussion of development trends on page 10, consider also mentioning the potential future development locations that are listed on page 60.

B. Resources for Implementing Your Approved Plan

State Sources of Technical Assistance & Funding:

The New Hampshire State Hazard Mitigation Officer (SHMO) and State Mitigation Planner can provide guidance regarding grants, technical assistance, available publications, and training opportunities. Contact the New Hampshire **Division of Homeland Security and Emergency Management** (NH HSEM) for further assistance. View agency website for contact information at https://www.nh.gov/safety/divisions/hsem/index.html. Refer to the New Hampshire State Hazard Mitigation Plan (page 185) which identifies a number of potential funding sources for various mitigation activities at https://www.nh.gov/safety/divisions/hsem/HazardMitigation/planning.html. Communities are encouraged to work with the State to maximize use of every 406 Hazard Mitigation opportunity when available during federally declared disasters. A better alignment and increasing the effectiveness of 406 and 404 Mitigation funds, greatly benefit the community in the long run.

Federal and Non-Profit Sources of Technical Assistance & Funding:

Federal Grants Resource Center and Grants.gov
Federal agencies may support integrated planning efforts such as rural development, sustainable communities and smart growth, climate change and adaptation, historic preservation, risk analyses, wildfire mitigation, conservation, Federal Highways pilot projects, etc. The Federal Grants Resource Center is located on the website of the national non-profit Reconnecting America, and provides a compilation of key funding sources for projects in your community. Examples are HUD, DOT/FHWA, EPA, and Sustainable Communities grant programs. For more information visit:
http://reconnectingamerica.org/resource-center/federal-grant-opportunities/ or www.grants.gov.

GrantWatch.com
The website posts current foundation, local, state, and federal grants on one website. When seeking funding opportunities for mitigation, consider a variety of sources for grants, guidance, and partnerships, including academic institutions, non-profits, community organizations, and businesses, in addition to governmental agencies. Examples are The Partnership for Resilient Communities, the Institute for Sustainable Communities, the Rockefeller Foundation *Resilience*, The Nature Conservancy, The Kresge Climate-Resilient Initiative, the Threshold Foundation's *Thriving Resilient Communities* funding, the RAND Corporation, and ICLEI *Local Governments for Sustainability*.
http://www.grantwatch.com

FEMA Hazard Mitigation Assistance
FEMA's Hazard Mitigation Assistance provides funding for projects under the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA). Individuals and businesses are not eligible to apply for HMA funds; however, an eligible applicant or subapplicant may apply on their behalf.
http://www.fema.gov/hazard-mitigation-assistance

Recommended FEMA Publications & Websites:

Hazard Mitigation Planning Online Webliography, FEMA Region I
This compilation of government and private online sites is a useful source of information for developing and implementing hazard mitigation programs and plans in New England.
http://www.fema.gov/about-region-i/about-region-i/hazard-mitigation-planning-webliography

FEMA Library
FEMA publications can be downloaded for free from its Library website. This repository contains a wealth of information that can be especially useful in public information and outreach programs. Search by keyword to find documents related to a particular topic. Examples include building and construction techniques, the NFIP, integrating historic preservation and cultural resource protection with mitigation, and helpful fact sheets.
http://www.fema.gov/library

FEMA RiskMAP
Technical assistance is available through RiskMAP to assist communities in identifying, selecting, and implementing activities to support mitigation planning and risk reduction. Attend any RiskMAP discovery meetings that may be scheduled in the state (or neighboring communities with shared watersheds boundaries) in the future.
https://www.fema.gov/risk-mapping-assessment-and-planning-risk-map

FEMA Climate Change Website
Provides resources that address climate change.
http://www.fema.gov/climate-change

Other Recommended Publications & Websites:

U.S. Climate Resilience Toolkit
Scientific tools, information, and expertise are provided to help manage climate-related risks and improve resilience to extreme events. This aid assists planning through links to a wide-variety of web-tools covering topics, including coastal flood risk, ecosystem vulnerability, and water resources. Experts can be located in the NOAA, USDA, and Department of Interior.
https://toolkit.climate.gov

EPA's Resilience and Adaptation in New England (RAINE) Climate Change Program
A collection of vulnerability, resilience and adaptation reports, plans, and webpages at the state, regional, and community levels. Communities can use the RAINE database to learn from nearby communities about building resiliency and adapting to climate change.
http://www.epa.gov/raine

USDA Rural Community Development Grant Programs
USDA operates over fifty financial assistance programs for a variety of rural applications.
http://www.rd.usda.gov/programs-services

NOAA Sea Grant
Sea Grant's mission is to provide integrated research, communication, education, extension and legal programs to coastal communities that lead to the responsible use of the nation's ocean, coastal and Great Lakes resources through informed personal, policy and management decisions. Examples of the resources available help communities plan, adapt, and recovery are the *Community Resilience Map of Projects* and the *National Sea Grant Resilience Toolkit*, both located on this website.
http://seagrant.noaa.gov

USDA, Natural Resources Conservation Service (NRCS)
Provides conservation technical assistance, financial assistance, and conservation innovation grants.
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/

The Rockefeller Foundation
Helping cities, organizations, and communities better prepare for, respond to, and transform from disruption.
https://www.rockefellerfoundation.org/our-work/topics/resilience/

U.S. Department of Homeland Security
FEMA Region I
99 High Street, Sixth Floor
Boston, MA 02110-2132

FEMA

DEC 06 2016

Heather Dunkerley
State Hazard Mitigation Officer
Homeland Security & Emergency Management
33 Hazen Drive
Concord, NH 03303

Dear Ms. Dunkerley:

We would like to congratulate the City of Lebanon and the State of New Hampshire for their dedication and commitment to mitigation planning. The Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) Region I Mitigation Planning Team has completed its review of the City of Lebanon New Hampshire Hazard Mitigation Plan Update 2016 and determined it meets the requirements of 44 C.F.R. Pt. 201.

With this plan approval, the City of Lebanon is eligible to apply to the New Hampshire Homeland Security and Emergency Management for mitigation grants administered by FEMA. Requests for mitigation funding will be evaluated individually according to the specific eligibility requirements identified for each of these programs. A specific mitigation activity or project identified in your community's plan may not meet the eligibility requirements for FEMA funding; even eligible mitigation activities or projects are not automatically approved.

Approved mitigation plans are eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Complete information regarding the CRS can be found at http://www.fema.gov/national-flood-insurance-program-community-rating-system, or through your local floodplain administrator.

The City of Lebanon New Hampshire Hazard Mitigation Plan Update 2016 must be reviewed, revised as appropriate, and resubmitted to FEMA for approval within **five years of the plan approval date of December 1, 2016** in order to maintain eligibility for mitigation grant funding. We encourage the City to continually update the plan's assessment of vulnerability, adhere to its maintenance schedule, and implement, when possible, the mitigation actions proposed in the plan.

DEC 06 2016

Once again, thank you for your continued dedication to public service demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please do not hesitate to contact Melissa Surette at (617) 956-7559.

Sincerely,

Paul F. Ford
Regional Administrator

PFF: ms

cc: Fallon Reed, Chief of Planning, New Hampshire
Whitney Welch, Hazard Mitigation Planner, New Hampshire
Jennifer Gilbert, Asst. New Hampshire State NFIP Coordinator

Enclosure