City of Claremont
New Hampshire

# HAZARD MITIGATION PLAN

## Update 2016

*Foisy Hill Road, June 2013*

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

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# I. INTRODUCTION

## A. BACKGROUND

The New Hampshire Division 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 Claremont, to update their local Hazard Mitigation Plan. UVLSRPC wrote the first Claremont Hazard Mitigation Plan that was approved in 2004, and then a 2011 update. The *Claremont Hazard Mitigation Plan Update 2016* serves as a strategic planning tool for use by the City of Claremont in its efforts to reduce future losses from natural and/or man-made hazard events before they occur. This *Plan* does *not* constitute a section of the Master Plan.

In the previous plan of 2011, much of the focus was on emergency management though this is a hazard mitigation plan. Due to greater focus on hazard mitigation, the update 2016 plan includes an inventory of emergency management improvements, but the heart of the plan is now hazard mitigation. Changes to the City have been made since 2011 as will be noted in the *Development Trends* section of Chapter II.

The Claremont Hazard Mitigation Committee updated the *Claremont 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 Claremont City Offices, the Claremont City Council adopted the updated plan on October 12, 2016 as shown in Appendix F.

## B. PURPOSE

The Claremont Hazard Mitigation Plan is a planning tool for use by the City of Claremont in its efforts to reduce future losses from natural and/or man-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 update their plans at least every five years 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 *Claremont Hazard Mitigation Plan* includes the identification of natural hazards affecting the City, as identified by the Claremont 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
- Wildfire
- Natural Contaminants
- Hazardous Materials Spill
- Terrorism

## E. METHODOLOGY

Using the *Local Mitigation Planning Handbook by FEMA (2013*), the Claremont Hazard Mitigation Committee, in conjunction with the UVLSRPC, developed the content of the *Claremont Hazard Mitigation Plan Update 2016* by tailoring the nine-task process set

forth in the handbook appropriate for the City of Claremont. Many FEMA resources and multiple State and Federal websites were also used as well. The Committee held two posted meetings in 2016. The meeting was posted inviting the general public and notices were sent to the city Offices of neighboring towns to invite town officials. A public notice was placed in two places in the City of Claremont and the city web site to invite the public to attend. An e-mail was sent to all surrounding municipalities to also invite them to the meeting or to request a copy of the draft plan. These notices are provided in Appendix C. No members of the public attended the meetings. Special invitations to the large employers of the City were sent out and two companies attended the second meeting as noted in Appendix C. They did not feel it was beneficial to attend the meeting.

The Claremont City Council held a public meeting and adopted the Plan after FEMA conditional approval on October 12, 2016 as shown in Appendix F. Prior to the City of Claremont adopting the updated Plan, a public meeting was held to gain additional input from the citizens of Claremont and to raise awareness of the ongoing hazard mitigation planning process.

To complete this updated Plan, the Hazard Mitigation Committee followed the planning tasks below to re-evaluate the plan sections of the existing 2011 plan and to update it to reflect current information and issues:

**Task 1: Determine the Planning Area and Resources (June 2016)**

Claremont is a rural 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 (June 2016)**

Members of the Committee included all relevant personnel. This included the Town Manager, the Fire Chief/EMD, a Police Chief, the Planning & Zoning Administrator, the Finance Director, and the Public Works Director.

**Task 3: Create an Outreach Strategy (June 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 municipalities 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 City adoption.

**Task 4: Review Community Capabilities (June 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 Claremont 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 (June-July 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 (June-July 2016):**

The Committee evaluated the goals in the previous plan and determined they were still appropriate with minor revisions for clarification. 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:**

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. This includes review of goals, existing and proposed actions, and prioritizing those actions. Updates of other City documents and regulations and ordinances will be part of this updating process.

**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-Natural Hazard Mitigation Plan Update 2013*, which served as a resource for the *Claremont Hazard Mitigation Plan Update 2016*.

## F. HAZARD MITIGATION GOALS

The Claremont 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 Claremont from natural and human-made hazards.

3. To reduce the potential impact of natural and human-made disasters to:
   - the City of Claremont's Critical Support Services,
   - Critical Facilities in the City of Claremont,
   - the City of Claremont's infrastructure,
   - 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 developing the update of this plan as the Hazard Mitigation Committee:

- Rick Bergeron, Emergency Management Director and Fire Chief, City of Claremont
- Mark Brislin, Director Parks & Recreation, City of Claremont
- Steve Coombs, Building Inspector, City of Claremont
- Sean Glasscock, Building Inspector, City of Claremont
- Nancy Merrill, Planning and Development Director, City of Claremont
- Dorée Russell, Executive Assistant, City of Claremont
- Victor St. Pierre, Assistant Public Works Director, City of Claremont
- Alexander Scott, Police Chief, City of Claremont
- Scott Sweet, Public Works Director, City of Claremont
- Jane Taylor, City Solicitor, City of Claremont
- Mary Walter, Finance Director, City of Claremont

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

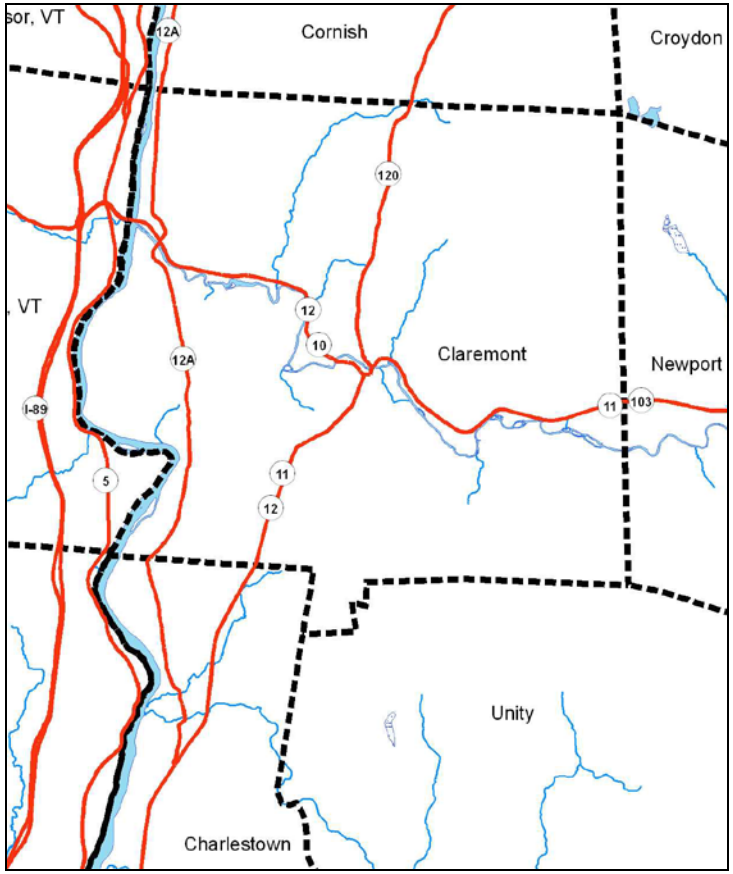
The Hazard Mitigation Committee was composed of local officials, many of whom are citizens of Claremont and a staff representative of the UVLSPRC for meeting facilitation and plan development. All abutting communities were invited to participate in the public meeting, submit comments, and request copies of the final plan. The general public and local businesses and industry were invited to attend the meetings by public postings at the city office and on the city website. See Appendix C. These were posted 10 days prior to the public meeting. Specific invitations were sent to area industry and major employees prior to the second meeting. Canam Group and Preferred Building representatives attended the meeting. They had no comments except they saw no value in their attendance. No city residents quired about the update process or attended the meeting.

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, agency representatives and public input and compiled the information to develop the Plan.

# II. COMMUNITY PROFILE

## A. INTRODUCTION[1]

Situated along the Connecticut River, Claremont is located in the New England upland region. Most of Claremont is composed of rolling topography where the highest points are between 1500 and 2000 feet above sea level. The highest point is Green Mountain at approximately 2000 feet. The lowest point in Claremont is at the banks of the Connecticut River at approximately 90 feet. Topography is an important factor in assessing development suitability. Due to the sensitivity of these areas, development should either be discouraged or carefully managed to maintain visual quality and minimize erosion concerns. Alternatively, low lying areas are typically associated with water resources such as river corridors and may be prone to flooding, and/or contain deposits of sand and gravel or rich farmland soils.




The City has a well developed distribution system for water and sewer services. The present total capacity of the City's water reservoirs is 245 million gallons per day. The backup water supply is the Sugar River, which is used several times each year. There are 70 miles of water distribution piping, two storage tanks, three reservoirs, and three dams. The system can supply about 4 million gallons of water per day with an excess capacity for a current demand that ranges from 0.9 to 1.5 million gallons per day. Waste water or sewer services also contain excess capacity. The systems can treat a total of 3.2 million gallons per day. Usage typically does not exceed 1.4 million gals/day, leaving the system with significant excess capacity. The City maintains about 50 miles of sewer collection pipe and six pump stations.

[1] City of Claremont Master Plan (2011)

Once slopes exceed 15 to 20% slope, there is greater chance for environmental impact and increased development costs. Most of these areas are found in the north of the Sugar River especially in the Cathole Road and Foisy Hill Road section of the community. There are approximately 4184 acres of slopes 20% and greater in Claremont *(Upper Valley Lake Sunapee RPC, 2007).*

Claremont is relatively rich in water resources—making up approximately 3,300 acres *(Upper Valley Lake Sunapee RPC, 2007).* Two of the region's major rivers flow through the community as well a number of smaller brooks. There are no major lakes, although there are several small ponds and manmade reservoirs such as the Rice and Dole Reservoirs north of the Sugar River. Regulatory measures such as shoreline set backs and conservation districts can help preserve the health of water resources.

Much of the transportation activity within the City is automobile-oriented. The City's existing 144 mile road system was initially developed to serve agricultural transactions between the City center and rural farms. Since the City's transportation system was designed to facilitate travel to the City center, many of Claremont's main arterial roads (including NH Routes 11, 12, and 103) intersect at what is now Opera House Square in the center of Claremont's downtown area. This convergence of major roadways provides good access to the City, but also has resulted in heavy traffic in the downtown area. Over the past 60 years, development has responded to the use of the automobile as the main means of transportation, resulting in dispersed land uses, varied travel demands, and a more complex transportation network. Claremont also has an important rail system, reflecting the City's early industrial prominence. The system is primarily oriented towards freight traffic, with limited passenger service to destinations between New York and Essex Junction, Vermont provided by Amtrak that uses a north-south trunk line of about seven miles connects Claremont to other northeastern destinations. A short two mile segment of rail spur extends into the City center parallel with Tylor Street and is operated by a private railroad company. This infrastructure has been used infrequently in recent years. Passenger service is also limited. Pedestrian travel is accommodated by a thirty-five mile sidewalk system in the core of the City. However, new development, for example will require the City to consider expanding the system.

The single most extensive land use in Claremont is forest land which covers over 55% of the City's area. The largest contiguous concentration of this land cover is in the north east quadrant of the City. It occupies more than twice the area of the next highest category of use which is low density residential which occupies 22% of the City's land area. This activity is located on the periphery of the downtown area with the highest concentration located north of the Sugar River. Open fields and agriculture represent 8% of the land area. High density residential occupies approximately 4% of the City's land area while both medium-density residential and industrial make up 2.08 % and 2.58%, respectively. The remaining uses are all under 2%.

## B. DEVELOPMENT TRENDS

With the current water and wastewater systems in place, Claremont could handle the demands from a population of about 20,000. Within the system's service area there is a considerable amount of land available for development. This suggests that expanding the extent of the existing system would be inefficient because it would make land available for development which may not be needed in the immediate future. Supporting a water and sewer system to serve a decentralized or thinly settled land use pattern would be more expensive for the City to maintain due to the increased amount of water and sewer lines. It is likely that an expansion of the service will be necessary in the future to support additional growth; however, at this time it would be most effective to expand the system by filling in unserved areas within the boundary of the existing system.

Other potential growth areas include along Route 12A/River Road and Grissom Lane. There is an industrial park on Grissom Lane near where the waste incinerator is located.

Claremont has adopted zoning and subdivision and site plan regulations to manage building activity and growth. At present, there are fourteen (14) zoning districts that control the types and density of uses. These generally fall into residential, business and industrial zones with separate zones for healthcare and mill use. There are also five (5) overlay districts including: Historic, Floodplain, Floodway, Streambank, and Airport Approach. Each of these provides additional standards beyond the underlying district.

**Table II-1: PERMITS FOR NEW STRUCTURES**

| Year of Permit | New Homes | New Mobile Homes | New Commercial | Floodplain? |
|---|---|---|---|---|
| 2015 | 0 | 2 | 2 | None |
| 2014 | 0 | 0 | 1 | None |
| 2013 | 3 | 5 | 0 | None |
| 2012 | 2 | 1 | 1 | None |
| 2011 | 2 | 3 | 5 | 1 mobile home |

The City does not feel that it is more vulnerable to hazards than it was five years ago as most of the new development in the hazard areas are replacements to previously existing buildings. Although a proposed development on Washington Street will partially be in the dam inundation area, the buildings will be outside this hazard.

**Table II-2: AREA POPULATION TRENDS**

| Area | 1970 | 1980 | 1990 | 2000 | 2010 |
|---|---|---|---|---|---|
| **Claremont** | **14,221** | **14,557** | **13,902** | **13,151** | **13,336** |
| Newport | 5,899 | 6,229 | 6,110 | 6,269 | 6,507 |
| Unity | 709 | 1,092 | 1,341 | 1,530 | 1,671 |
| Croydon | 396 | 457 | 627 | 661 | 764 |
| Cornish | 1,268 | 1,390 | 1,659 | 1,661 | 1,640 |
| Charlestown | 3,274 | 4,417 | 4,630 | 4,749 | 5,114 |
| Sullivan County | 30,949 | 36,063 | 38,592 | 40,458 | 43,713 |
| New Hampshire | 737,578 | 920,475 | 1,109,252 | 1,235,786 | 1,327,000 |

*Source: US Census*

**Table II-3: POPULATION GROWTH IN CLAREMONT**

| | 1970 | 1980 | 1990 | 2000 | 2010 |
|---|---|---|---|---|---|
| Population | **14,221** | **14,557** | **13,902** | **13,151** | **13,336** |
| Decade Change in Population | | 2.4% | -4.5% | -5.4% | 1.4% |

*Source: US Census*

**Table II-4: POPULATION PROJECTIONS FOR CLAREMONT**

| Area | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 |
|---|---|---|---|---|---|---|
| Claremont | **13,150** | **12,991** | **13,322** | **13,662** | **13,914** | **14,064** |
| Change in Population in 5 yrs. | -1.4% | -1.2% | 2.5% | 2.6% | 1.8% | 1.1% |
| Change in Population in 10 yrs | | -2.6% | | 5.2% | | 2.9% |

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

Despite an increase in the population in the earlier decades, Claremont remains a small city surrounded by rural communities. The rate of growth was moderate in the 1970's and 1980's, but has slowed significantly since then. In 2010, the total population was 13,336 persons. Population projections show Claremont to continue to grow at a very slow rate. See the population projections table.

# III. HAZARD IDENTIFICATION

The Claremont Hazard Mitigation Committee reviewed the list of hazards provided in the *State of New Hampshire Hazard Mitigation Plan*, and some hazard history for the State of New Hampshire and Sullivan County in particular. A list of past hazard events in Claremont, Sullivan 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 CLAREMONT?

Claremont is prone to a variety of natural and human-made hazards. The hazards that Claremont 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 Claremont are dam failure, flooding, hurricane, tornado & downburst, thunderstorm (including lightning and hail), severe winter weather, earthquake, drought, extreme heat, erosion/landslide, wild and structure fire, 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 Claremont 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 Claremont. Eliminated hazards include Land Subsidence, Landslides, Expansive Soils, and Snow Avalanches.

## B. DESCRIPTIONS OF HAZARDS

An assessment of each hazard relevant to Claremont 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
- 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. The map in Appendix D shows the location of active dams in Claremont.

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 Claremont or outside the City that would have affected the City.

**Table III-1 - DAMS**

| Dam # | Class | Dam Name | Water Body | Owner (Now or Formerly) | Status | Type | Impound-ment Area in Acres | Height of Dam (Ft) | Drainage Area in Acres |
|---|---|---|---|---|---|---|---|---|---|
| 047.30 | H | Whitewater Brook Dam | Whitewater Brook | City of Claremont | active | C | 20.000 | 95.00 | 4.20 |
| 047.11 | - | Whitewater Brook Dam | Whitewater Brook | City of Claremont | removed | C | 0.000 | 13.00 | 4.00 |
| 047.12 | - | Red Water Brook Dam | Red Water Brook | George Hubbard | breached | C/S | 0.250 | 14.00 | 7.70 |
| 047.50 | NM | West Dam | Unnamed stream | John West | active | E | 0.480 | 6.00 | 0.00 |
| 047.18 | - | Red Water Upper Dam | Red Water Brook | Gaffney Lumber Co. | ruins | T/S | 0.000 | 15.00 | 0.00 |
| 047.38 | NM | Farm Pond | Stevens Brook | Jack McKenzie | active | E | 0.900 | 11.00 | 0.00 |
| 047.31 | NM | Water Supply | Natural swale | Leonard Aiken | active | E | 0.140 | 8.00 | 0.00 |
| 047.16 | - | Fitch Reservoir Dam | Grandy Brook | City of Claremont | removed | E | 3.000 | 40.00 | 0.80 |
| 047.15 | - | McQuade Reservoir Dam | Grandy Brook | City of Claremont | removed | E | 1.000 | 17.00 | 0.98 |
| 047.36 | NM | Wildlife pond | Natural swale | M&M Sclafani | active | E | 0.130 | 8.00 | 0.00 |
| 047.46 | NM | Recreation pond | Natural swale | Robert Sicard | active | E | 0.250 | 7.00 | 0.03 |
| 047.10 | S | Sweetwater Hydro Dam | Sugar River | ENEL North America, Inc. | active | C | 46.000 | 44.00 | 270.00 |
| 047.56 | NM | Dole Reservoir Dike | Dole Reservoir | City of Claremont | active | C | 9.000 | 8.00 | 0.01 |
| 047.28 | L | Claremont Treatment Road Dam | Jarvis Hill Brook | City of Claremont | active | E | 0.900 | 20.00 | 0.50 |
| 047.17 | H | Dole Reservoir Dam | Trib. Stevens Brook | City of Claremont | active | E | 9.200 | 43.00 | 0.05 |
| 047.20 | NM | Stevens Brook | Stevens Brook | Edward Wagner | removed | C | 0.500 | 8.00 | 0.00 |
| 047.13 | - | Straw Reservoir | Trib. Grandy Brook | City of Claremont | removed | C | 1.500 | 25.00 | 0.20 |
| 047.21 | - | Grandy Brook Ice Pond Dam | Grandy Brook | Jack McKenzie | ruins | E | 0.000 | 12.00 | 2.20 |
| 047.22 | L | Grandy Pond Recreation Pond Dam | Grandy Brook | Roger Chicoine | active | E | 1.500 | 12.00 | 2.40 |
| 047.39 | NM | Wildlife pond | Natural swale | Cindy Coupal | active | E | 0.400 | 10.00 | 0.04 |
| 047.45 | NM | Wildlife pond | Natural swale | Elsie Schneider | active | E | 0.200 | 18.00 | 0.02 |
| 047.41 | NM | Farm pond | Natural swale | Doris Pederson | active | E | 0.420 | 8.00 | 0.00 |
| 047.43 | - | Recreation pond dam | Natural swale | August Allhen | not built | E | 0.200 | 18.00 | 0.00 |
| 047.24 | - | Grandy Brook Lumber Co. Dam | Grandy Brook | Elliott Rose Co. | breached | C | 0.250 | 16.00 | 2.80 |
| 047.04 | - | Sullivan Machinery Co. Dam | Sugar River | John Bourdon | ruins | - | 0.000 | 1.20 | 250.00 |
| 047.05 | - | Claremont Flock Corp. Dam | Sugar River | Claremont Flock Corp. | removed | T/S | 0.000 | 15.00 | 250.00 |
| 047.08 | - | Lower Village Dam | Sugar River | Family Homestead Ind. | ruins | T/S | 1.000 | 15.00 | 251.00 |
| 047.03 | NM | Sugar River Foundry Dam | Sugar River | City of Claremont | active | C | 1.500 | 15.00 | 250.00 |
| 047.07 | L | Lower Village Dam | Sugar River | Lower Village Dam | active | - | 1.100 | 14.00 | 252.00 |
| 047.06 | S | Lower Valley Hydro | Sugar River | ENEL North America Inc. | active | C | 8.000 | 34.00 | 252.00 |
| 047.02 | - | Monadnock Mills Hydro Dam | Sugar River | Monadnock Mills Co. | ruins | T/S | 0.000 | 16.50 | 250.00 |
| 047.01 | NM | Sugar River | Sugar River | City of Claremont | active | C | 2.000 | 8.00 | 250.00 |

| Dam # | Class | Dam Name | Water Body | Owner (Now or Formerly) | Status | Type | Impound-ment Area in Acres | Height of Dam (Ft) | Drainage Area in Acres |
|---|---|---|---|---|---|---|---|---|---|
| 047.09 | - | Dartmouth Woolen Mills Dam | Sugar River | Dartmouth Woolen Mills | breached | T | 0.000 | 13.00 | 251.00 |
| 047.47 | NM | Roy Recreation Pond | Natural swale | Leo Roy | active | E | 0.150 | 18.00 | 0.01 |
| 047.26 | NM | Farm pond | Natural swale | Doris Pederson | active | E | 0.660 | 5.00 | 0.00 |
| 047.40 | L | Hood Trout Pond Dam | Trib. to Sugar River | David & Kathleen Hood | active | E | 0.400 | 10.00 | 0.05 |
| 047.51 | - | Fletcher Recreation Pond | NA | Winterhawk Land Development | not built | E | 0.670 | 6.20 | 0.16 |
| 047.37 | NM | Wildlife pond | Gully Brook | Brian Dutile | active | E | 0.100 | 10.00 | 0.00 |
| 047.29 | NM | Recreation pond | Natural swale | Claremont Country Club | active | E | 0.500 | 9.00 | 0.00 |
| 047.49 | NM | Fleury Dam | Natural swale | Dennis Fleury | active | E | 0.500 | 13.00 | 0.00 |
| 047.33 | NM | Water supply | Trib. Sugar River | Shugah Vale, Inc. | active | E | 0.330 | 16.00 | 0.00 |
| 047.54 | NM | Fleury Stock Pond | NA | Dennis Fleury | active | E | 1.100 | 5.60 | 0.11 |
| 047.23 | NM | Lane Farm Pond Dam | Natural swale | M&M Gader | active | E | 0.700 | 4.00 | 0.00 |
| 047.19 | - | Tyler Pond Dam | Bible Hill Brook | Dr. Rowland Freeland | ruins | T/S | 0.000 | 20.00 | 1.50 |
| 047.27 | NM | Farm pond | Natural swale | Rosinski Builders | active | E | 0.100 | 9.00 | 0.00 |
| 047.25 | NM | Farm pond | Natural swale | Freeport Development Inc. | active | E | 0.440 | 13.00 | 0.00 |
| 047.42 | NM | Recreation pond | Natural swale | Nathan Ainsworth | active | E | 0.220 | 9.00 | 0.00 |
| 047.32 | NM | Fire pond | Natural swale | Betty Rich | active | E | 0.100 | 8.00 | 0.01 |
| 047.34 | NM | Wildlife pond | Natural swale | Rober Easter | active | E | 0.220 | 8.00 | 0.00 |
| 047.35 | NM | Wildlife pond | Natural swale | Sydney Lorendeau | active | E | 0.300 | 14.00 | 0.00 |
| 047.58 | NM | Messina Pond | Sugar River trib. | Richard Messina | active | C | 1.300 | 10.00 | 0.61 |
| 047.52 | - | Ascutney View Manure Dam | runoff | Norman & Mary Jane Van Ord | exempt | C | 0.900 | 8.00 | 0.00 |
| 047.53 | L | Leskiewicz Recreation Pond | Unnamed stream | Ed Leskiewicz, Jr. | active | E | 1.300 | 10.00 | 0.03 |
| 047.44 | S | McGary Fletcher Dam | Trib. to Sugar River | Winterhawk Land Development | active | E | 2.100 | 18.00 | 0.15 |
| 047.14 | H | Rice Reservoir Dam | Stevens Brook | City of Claremont | active | E | 11.000 | 48.00 | 0.15 |
| 047.48 | NM | Bellevance Recreation Pond | Natural swale | Lillian M. Corp | active | E | 0.150 | 18.00 | 0.00 |
| 047.55 | NM | Sugar River | Sugar River | George Lagassa | active | C | 0.250 | 5.00 | 0.00 |
| 047.57 | NM | Claremont County Club Pond | Unnamed stream | Claremont Country Club | active | E | 0.270 | 13.00 | 0.04 |
| 047.59 | NM | Claremont Landfill Sediment Pond | runoff | City of Claremont | active | E | 0.250 | 18.00 | 0.04 |

*Class of potential hazard: NM – non-menace; L-low; S-significant; H-high* *Source: NH DES*
*Material: T-timber; S-stone; E-earth; C-concrete* **The Committee believed the status to be incorrect and has changed them.*

*Potential Future Dam Failure Damage*

Although there are 59 dams in Claremont (14 are ruins, removed, or breached), there are only three "high" hazard dams: Whitewater Brook Dam, Dole Reservoir Dam, and Rice Reservoir Dam; three "significant" hazard dams: Sweetwater Hydro Dam, Lower Valley Hydro Dam, and McGary Fletcher Dam; and five "low" hazard dams: Claremont Treatment Road Dam, Grandy Pond Recreation Pond Dam, Lower Village Dam, Hood Trout Pond Dam, and Leskiewicz Recreation Pond Dam. Emergency action plans are required for dams of high or significant hazard to delineate inundation areas—with the exception of lagoons.

There are three other "high" hazard dams which could impact the City of Claremont which are located outside the city: the Gunnison Lake Site D2 Dam located in Goshen (Dam ID Number 95.25), the Wilder Dam in Lebanon on the Connecticut River (Dam ID Number 134.15), and the North Hartland Dam at the Connecticut River.

The Gunnison Lake Site D2 Dam could impact a substantial portion of Claremont along the Sugar River South Branch to the Sugar River flowing toward Vermont. The other two "out-of-city" dams are on the Connecticut River and could cause substantial damage.

The map of critical facilities and hazard areas (Appendix D) includes the dam inundation areas for the high and significant dams. The following table provides the number and value of structures within each of the dam inundation area. This provides the City with information about vulnerability in case of a particular dam failure. It should be noted that some dam inundation areas overlap each other. This is shown on the map in appendix D. The Committee determined that dam failure is a medium/high risk in Claremont.

**Table III-2: STRUCTURE ASSESSED VALUES IN DAM INUNDATION AREAS BY PROPERTY TYPE – 2016 (average values)**

| Dam Inundation Area | Houses | | Mobile Homes | | Non-Residential & Apartment Buildings | | Total | |
|---|---|---|---|---|---|---|---|---|
| | # | Value | # | Value | # | Value | # | Value |
| Dole Reservoir Dam | 28 | $3,247,188 | 1 | $13,027 | 9 | $1,390,329 | 38 | $4,650,544 |
| Gunnison Lake Dam | 111 | 12,872,781 | 4 | 52,108 | 57 | 10,589,336 | 171 | 23,514,225 |
| Lower Valley Hydro Dam | 10 | 1,159,710 | 5 | 65,135 | 12 | 1,853,772 | 27 | 3,078,617 |
| McGary Fletcher Dam | 2 | 231,942 | 0 | 0 | 0 | 0 | 2 | 231,942 |
| Rice Reservoir Dam | 15 | 1,739,565 | 3 | 39,081 | 5 | 772,405 | 23 | 2,551,051 |
| Sweetwater Dam | 1 | 115,971 | 2 | 26,054 | 0 | 0 | 3 | 142,025 |
| Whitewater Brook Dam | 61 | 6,030,492 | 4 | 52,108 | 7 | 1,081,367 | 72 | 7,163,967 |
| CT River Dams (2) | 26 | 3,015,246 | 0 | 0 | 12 | 1,853,772 | 38 | 4,869,018 |
| TOTALS | 254 | $23,010,510 | 19 | $1,251,835 | 101 | $16,185,372 | 374 | $52,022,145 |

*Source: Claremont Aerial Imagery, 2014 and Tax Assessment Information, 2016*

## 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 Claremont 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. There are several types of flooding.

Special Flood Hazard Areas Formerly called "100-year flood" zones, these areas have a one percent chance of a flood in any given year. These areas were mapped for all towns in New Hampshire by FEMA. Appendix D displays the "Special Flood Hazards Areas."
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.

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*

The Committee determined there are no other flood areas in the city other than the FEMA designated flood zones. Appendix D shows the Flood Insurance Rate Map of Special Flood Hazard Areas. The following tables provide a list of floods in the State, County, and Claremont. Other flooding issues are listed in the Erosion section—primarily for roads.

**Table III-3: FLOODING**

| FLOODING | | | | |
|---|---|---|---|---|
| **Hazard** | **Date** | **Location** | **Description of Areas Impacted** | **Damages** |
| Flood | 1927, 34, 36, 38, 50, 53, 73, 76 | Claremont | Per Claremont Flood Insurance Study, FEMA, February 15, 1984 | Unknown |
| Flood (Ice Jam in Claremont) | March 11-21, 1936 | NH State including Sugar River, W. Claremont | Damage to Road Network. Flooding caused by simultaneous heavy snowfall totals, heavy rains and warm weather. Run-off from melting snow with rain overflowed the rivers; ice jam on Sugar River below Red Water Brook (CRREL) | Unknown |
| Flood (Ice Jam) | January 22, 1959 | Sugar River, West Claremont | Backwater from ice (CRREL) | Unknown |
| Flood (Ice Jam) | March 19, 1968 | Sugar River, West Claremont | Ice jam. (CRREL) | Unknown |
| Flood (Ice Jam) | February 11, 1970 | Sugar River, West Claremont | Ice jam. (CRREL) | Unknown |
| Flood (Ice Jam) | January 8, 1976 | Sugar River, West Claremont | Ice jam. (CRREL) | Unknown |
| Flood (Ice Jam) | January 1, 1978 | Sugar River, Claremont | Highest stage from ice in 1978; 3' lower than in 1936 (CRREL) | Unknown |
| Flood (Ice Jam) | January 26, 1978 | Sugar River, West Claremont | Ice jam. (CRREL) | Unknown |
| Flood (Ice Jam) | March 7, 1979 | Sugar River, West Claremont | Ice jam. (CRREL) | Unknown |
| Flood (Ice Jam) | January 1, 1981 | Sugar River, Claremont | From Valley News: heavy flood damage in Beauregard Village; one woman died in the flood; the city received a federal grant to relocate residents of the trailer park. (CRREL) | Woman killed |
| Flood (Ice Jam) | February 12, 1981 | Sugar River, West Claremont | Ice jam. (CRREL) | Unknown |
| Flood (Ice | February 4, 1983 | Sugar River, West | Ice jam. (CRREL) | Unknown |

| FLOODING | | | | |
|---|---|---|---|---|
| **Hazard** | **Date** | **Location** | **Description of Areas Impacted** | **Damages** |
| Jam) | | Claremont | | |
| Flood (Ice Jam) | February 1, 1984 | Sugar River, Claremont | River flooded Route 12A in front of D'Amane's store. A wall of ice came over the Dartmouth Woolen Mill Dam plunging a dozen cars into the river. The cars had been in the mill parking lot; eight other cars were damaged. Water seeped into boiler room, causing plant to be evacuated. Evacuated several mobile homes in Beauregard Village, Cote's Motel, and homes along river. Police closed several roads and monitored river levels. (CRREL) | Estimated $1 million in Claremont |
| Flood (Ice Jam) | February 16, 1984 | Sugar River, West Claremont | Ice jam (CRREL) | Unknown |
| Flood (Ice Jam) | January 26, 1986 | Claremont, Sugar River | Jam formed on Coy Paper Company Mill pool finally breaking loose; 14 homes evacuated (CRREL) | Unknown |
| Flood / Severe Storm | April 16, 1987 | Cheshire, Carroll, Grafton, Hillsborough, Merrimack, Rockingham, & Sullivan Counties | 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 in State. |
| Flood (Ice Jam) | January 26, 1990 | Sugar River, Claremont | Ice jam (CRREL) | Unknown |
| Flood | August 7-11, 1990 | Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack & Sullivan Counties, NH | FEMA Disaster Declaration # 876. Flooding caused by a series of storm events with moderate to heavy rains. | $2,297,777 in damage in State. |
| Flood (Ice Jam) | March 11, 1992 | Sugar River, Claremont | Ice jam at bend near Main Street Bridge caused residential and road flooding, and disruption to electrical and gas utilities. A crane was used to break up the jam. The first jam was at a dam at Coy Paper in W. Claremont. Later, another jam formed upstream at a sharp bend in the river causing water to spill over the south bank and head for a group of homes near Cote's Motel. Several residents were evacuated. (CRREL) | Home and road flooding; Unknown cost |
| Flood (Ice Jam) | March 27, 1992 | Sugar River, West Claremont | Ice jam (CRREL) | No damage recorded |

| FLOODING | | | | |
|---|---|---|---|---|
| **Hazard** | **Date** | **Location** | **Description of Areas Impacted** | **Damages** |
| Flood (Ice Jam) | March 9, 1995 | Sugar River, West Claremont | Ice jam downstream from Red Water Brook (CRREL) | No damage recorded |
| Flood (Ice Jam) | January 19, 1996 | Sugar River, Claremont | Ice jam reported on right bank below Red Water Brook (CRREL) | No damage recorded |
| Flood | October 29, 1996 | Grafton, Hillsborough, Merrimack, Rockingham, Strafford & Sullivan Counties, NH | FEMA Disaster Declaration # 1144- DR. Flooding caused by heavy rains. | $2,341,273 in damage in State. |
| Flooding | 1998 | Half Mile Road | Drainage into undersized culvert under railroad trestle of very active railroad line; if this trestle is damaged, a 90-mile detour will be required | No damage recorded |
| Flood (Ice Jam) | January 25, 1999 | Sugar River, West Claremont | Ice jam; water discharge estimated at 3700 cubic feet per second (CRREL) | No damage recorded |
| Flood (Ice Jam) | December 28, 2000 | Sugar River, West Claremont | Peak annual stage at 8.31' due to ice jam (CRREL) | No damage recorded |
| Flood | October 7-18, 2005 | Cheshire, Grafton, Merrimack, Sullivan, and Hillsborough Counties, NH | FEMA Disaster Declaration # 1610. Severe storms and flooding. | $3,000,000 in damages in NH. |
| Flood | October-November 2005 | Grafton, Hillsborough, Merrimack, Rockingham, Strafford & Sullivan counties | FEMA Disaster Declaration # DR-1144- NH | No damage recorded in Claremont |
| Flood | April 16, 2007 | All counties, NH | FEMA Disaster Declaration # 1695. Severe storms and flooding; 2,005 home owners and renters applied for assistance in NH. | $27,000,000 in damages in NH |
| Storms, Tornado, and Flooding | July 24, 2008 | Central and Southern NH; Counties Declared: Belknap, Carroll, Merrimack, Rockingham, and Strafford | FEMA DR 1782 | No damage in Claremont |
| Flood | August 14, 2008 | Central Northern NH; Counties Declared: Belknap, Carroll, Coos, and Grafton | FEMA Disaster Declaration #1787 | $3 million in public assistance; primary damage to roads; no damage in Claremont |
| Flood (Ice Jam) | December 12, 2008 | Sugar River, Claremont | Possible ice jam in W. Claremont likely cause for river levels to be fluctuating (CRREL) | No damage recorded |

| FLOODING | | | | |
|---|---|---|---|---|
| **Hazard** | **Date** | **Location** | **Description of Areas Impacted** | **Damages** |
| Flood (Ice Jam) | December 18, 2008 | Sugar River, West Claremont | Ice jams apparent causing river to go above flood stage (CRREL) | No damage recorded |
| Flood (Ice Jam) | December 19, 2008 | Sugar River, West Claremont | Maximum peak state due to ice jam. (CRREL) | No damage recorded |
| Flood (Ice Jam) | January 26, 2010 | Sugar River, West Claremont | Preliminary information on 2/3/2010; can't access database 6/1/10 | No damage recorded |
| Flood | March 14-31, 2010 | Statewide | FEMA DR-1913; severe storms & flooding; Declared Counties: Hillsborough and Rockingham | No damage in Claremont |
| Flood/ Tropical Storm | August 28 – September 2, 2011 | Coos, Grafton, Carroll, Sullivan, Merrimack, Belknap, and Strafford Counties | FEMA DR-4026; Tropical Storm Irene; localized flooding including Cat Hole Road and Roberts Hill; Sugar River Drive in Claremont and Chandlers Mill Road in Newport | Received $95,500 from FEMA for flood damages; received $48,788 for damage to Sugar River Cone Valve during event; received $81,660 in 2014 for Sugar River Bank Stabilization |
| Flood | June 26-July 3, 2013 | Grafton, Sullivan and Cheshire Counties | FEMA DR-4139; severe storms, flash flooding, and landslides; lightning strike at City Hall; Cat Hole Road, Foisey Hill Road and Washington Street | Received $308,000 from FEMA for damages |
| Flood (within 100 yr zone)/ Ice Jams | Almost every year | Sugar River | In Beauregard Village area; Claremont Center parking area on Washington Street; HUD grant purchased properties in Beauregard Village | Cost varies each year and some would be encumbered by local businesses |
| **Local Flooding Outside the FEMA determined A & AE Flood Zones:** | | | | |
| Flooding & Erosion | Once or twice a year | Sugar River Drive; Alden Road, and Case Hill Road | Logging and clear cut in southeast corner of city increased drainage to culvert on Sugar River Drive; must replace shoulder gravel each time | Standing water; low level flooding; high water table (Hitchcock Aquifer) |
| Flooding | Every 4-5 years | 67 Tyler Street (Desilets) | Storm drainage pipes go under building-inaccessible for proper maintenance, angle in pipes causing choke point under building; cannot move the building | Water from Tyler Brook plugs up under building and backs up |
| Flooding | Every 4-5 years usually in spring/ summer | East Street (beginning of Tyler Brook corridor) | Undersized culvert plugs up and backs up water into nearby beaver bog which flood homes; road has been closed, backyards damaged, and people moved out to safety | Home damage and city sewer back up into street |
| Flooding | 2-3 times a year | Beauregard Street | Floods over low point of Route 12/103 (Main Street); damaged motel | Motel damage; home basements flood; mobile homes at end of Beauregard Street become isolated by road flooding |

Claremont became a participating member of the National Flood Insurance Program on April 17, 1978. Updated maps (DFIRMS) and flood insurance studies for all municipalities within Sullivan County were finalized May 23, 2006. In January 2016, there are currently 61 policies in the city with $18.2 million of insurance: 34 are single-family homes, one 2-4 family home, one "other residential," and 22 non-residential properties. However, flood insurance purchase is not a reflection of the number of structures within the flood plain. Six of the 61 policies are not in the designated flood plain. Seventeen loss claims have been paid. One single family home is not insured but has received flood loss funds in 1981, 1984, and 1986 totally over $17,000. This is the only repetitive loss property. All claims totaled $109,592. Claremont's 1% (formerly 100-Year) Special Flood Areas are located within the A Zone, with no base flood elevations determined and the AE Zone where base flood elevations have been determined. See Appendix D for a map showing all Special Flood Hazard Areas.

As an NFIP participant, the City of Claremont has a floodplain ordinance which restricts building within the special floodplains to protect the flow of flood waters and not increase the needed land area for those waters. The City adopted the model ordinance provided by the NH Floodplain Management Office. This ordinance is reflected in the zoning ordinance, subdivision regulations, and site plan review regulations.

*Potential Future Flooding Events*

Future flooding is likely as noted in the above table based upon local knowledge of past flood events. According to the State's Mitigation Plan, Sullivan County has a high hazard risk for flooding. The Committee determined flooding is a High risk in Claremont.

**Table III-3: STRUCTURE VALUES IN FLOOD HAZARD AREAS BY TYPE – 2016 (average values)**

| Flood Zone | Houses | | Mobile Homes | | Nonresidential & Apt. Buildings | | Total | |
|---|---|---|---|---|---|---|---|---|
| | # | Value | # | Value | # | Value | # | Value |
| FEMA flood plain | 95 | $11,017,245 | 5 | $65,135 | 52 | $8,033.012 | 152 | $19,115,392 |
| Locally determined flood | 61 | 7,074,231 | 30 | 390,810 | 66 | 10,195,746 | 157 | 17,660,787 |
| TOTALS | 156 | $18,091,476 | 35 | $455,945 | 27 | $18,228,758 | 309 | $36,776,179 |

*Sources: FEMA floodplain map, HazMit Committee, Claremont Aerial Imagery 2014, and 2016 Tax Assessment values*

## 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. 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 Hazard Mitigation Plan*; 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.

**Table III-4: HURRICANES & TROPICAL STORMS**

| HURRICANES AND TROPICAL STORMS | | | | |
|---|---|---|---|---|
| **Hazard** | **Date** | **Location** | **Description of Areas Impacted** | **Damages** |
| Hurricane | August, 1635 | n/a | Unknown | None recorded in Claremont |
| Hurricane | October 18-19, 1778 | n/a | Winds 40-75 mph | None recorded in Claremont |
| Hurricane | October 9, 1804 | n/a | Unknown | None recorded in Claremont |
| Gale | September 23, 1815 | n/a | Winds > 50mph | None recorded in Claremont |
| Hurricane | September 8, 1869 | n/a | Unknown | None recorded in Claremont |
| Hurricane | September 21, 1938 | Southern New England | 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. | None recorded in Claremont |
| Hurricane (Carol) | August 31, 1954 | Southern New England | Category 3, winds 111-130 mph. Extensive tree and crop damage in NH, localized flooding | None recorded in Claremont |

| HURRICANES AND TROPICAL STORMS | | | | |
|---|---|---|---|---|
| **Hazard** | **Date** | **Location** | **Description of Areas Impacted** | **Damages** |
| Hurricane (Edna) | September 11, 1954 | Southern New England | Category 3 in Massachusetts. 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 for some areas. Heavy rain in NH | None recorded in Claremont |
| Hurricane (Donna) | September 12, 1960 | Southern and Central NH | Category 3 (Category 1 in NH). Heavy flooding in some parts of the State. | No damage in Claremont |
| Tropical Storm (Daisy) | October 7, 1962 | Coastal NH | Heavy swell and flooding along the coast | No damage in Claremont |
| Tropical Storm (Doria) | August 28, 1971 | New Hampshire | Center passed over NH resulting in heavy rain and damaging winds | No damage in Claremont |
| Hurricane (Belle) | August 10, 1976 | Southern New England | Primarily rain with resulting flooding in New Hampshire. Category 1 | No damage in Claremont |
| 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 | No damage in Claremont |
| Hurricane (Bob) | August 19, 1991 | Southern New England | 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. Federal Disaster FEMA-917-DR | No damage in Claremont |
| 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 | No damage in Claremont |
| Tropical Storm (Floyd) | September 16-18, 1999 | Southern New England | FEMA DR-1305-NH. Heavy Rains | No damage in Claremont |
| Hurricane (Katrina) | August 29, 2005 | East Coast of US and more | FEMA-3258-EM. Heavy rains and flooding devastating SE US | No damage in Claremont |
| 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 in some places in NH. | No damage in Claremont |

| HURRICANES AND TROPICAL STORMS | | | | |
|---|---|---|---|---|
| **Hazard** | **Date** | **Location** | **Description of Areas Impacted** | **Damages** |
| 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 | Claremont received $226,000 from FEMA for flood damages in 2011 and 2014; see flooding table |
| Hurricane (Sandy) | October 26 – November 8, 2012 | East Coast of US | FEMA-4095-DR-NH for Belknap, Carroll, Coos, Grafton and Sullivan Counties. | Claremont received $8,815 from FEMA for damages, debris cleanup and emergency response |

*Potential Future Hurricane Damage*

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, Sullivan County has a medium/high risk for hurricanes. The Committee determined the hurricane risk to be medium Claremont.

**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 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 EF0 to EF2 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.

*Past Tornado & Downburst Events*

The following table displays tornadoes occurring in Sullivan County between 1950 and 1995. The committee did not recall any tornadoes or downburst in which the city was impacted. The Committee recalled that around 2006, a severe microburst knocked down stands of trees in neighboring municipalities, but it missed Claremont. In 2015, there was a severe straight-line wind event (downburst) which greatly impacted Claremont.

**Table III-5: TORNADOES IN OR NEAR SULLIVAN COUNTY**

| TORNADOES & DOWNBURSTS – MEDIUM RISK | | | |
|---|---|---|---|
| | **Date** | **Scale** | **Damages** |
| Tornado | September 9, 1821 | Most intense in NH | Killed 6 people; crossed Lake Sunapee |
| Tornado | July 14, 1963 | F1 | No deaths or injuries; costs unknown; no damage in Claremont |
| Tornado | June 27, 1964 | F0 | No deaths or injuries; costs unknown; no damage in Claremont |
| Tornado | August 11, 1966 | F2 | No deaths or injuries; costs unknown; no damage in Claremont |
| Tornado | August 25, 1969 | F1 | No deaths or injuries; costs unknown; no damage in Claremont |
| Tornado | May 31, 1972 | F1 | No deaths or injuries; costs unknown (Merrimack County); no damage in Claremont |
| Tornado | July 21, 1972 | F1 | No deaths or injuries; costs unknown; no damage in Claremont |
| Tornado | May 11, 1973 | F2 | No deaths or injuries; costs unknown; no damage in Claremont |
| Tornado | June 11, 1973 | F0 | No deaths or injuries; costs unknown; no damage in Claremont |
| Tornado | August 15, 1976 | F1 | No deaths; 5 injuries; costs unknown (Merrimack County); no damage in Claremont |
| Tornado | August 13, 1999 | F1 | No deaths or injuries; costs unknown; no damage in Claremont |
| Tornado | July 6, 1999 | F2 | No deaths or injuries; costs unknown (Merrimack County); in New London two roofs blown off structures; power outages,; downed trees, utility pole, and wires; no damage in Claremont |
| Tornado | Summer 2006 | NA | Began in Barnet, VT and moved to Monroe, NH; trees knocked down in Claremont |
| Tornado | April 15, 2007 | NA | Numerous trees were knocked down in Enfield, NH; no damage in Claremont |
| Tornado | July 24, 2008 | (EF 2) | DR 1799: Numerous trees and utility poles down; damage to many houses; 1 fatality; $2.5 million from FEMA; no damage in Claremont |
| Downburst | July 19, 2015 | NA | Heavy rains and powerful winds knocked down trees and power lines in Claremont; electricity out for several days in places; damaged cars and houses; took over 3 weeks of cleanup; one person killed by tree falling on his car in Claremont; damage also in nearby towns |

Source: www.tornadoproject.com; NH Natural Hazard Mitigation Plan; Committee

**Table III-6 ENHANCED FUJITA SCALE**

| FUJITA SCALE (old model) | | | OPERATIONAL EF SCALE | |
|---|---|---|---|---|
| **F Number** | **Fastest ¼-mile (mph)** | **3 second gust (mph)** | **EF Number** | **3 second gust (mph)** |
| F0 | 40-72 | 45-78 | EF0 | 65-85 |
| F1 | 73-112 | 79-117 | EF1 | 86-110 |
| F2 | 113-157 | 118-161 | EF2 | 111-135 |
| F3 | 158-207 | 162-209 | EF3 | 136-165 |
| F4 | 208-260 | 210-261 | EF4 | 166-200 |
| F5 | 261-318 | 262-317 | EF5 | Over 200 |

Source: http://www.spc.noaa.gov/faq/tornado/ef-scale.html

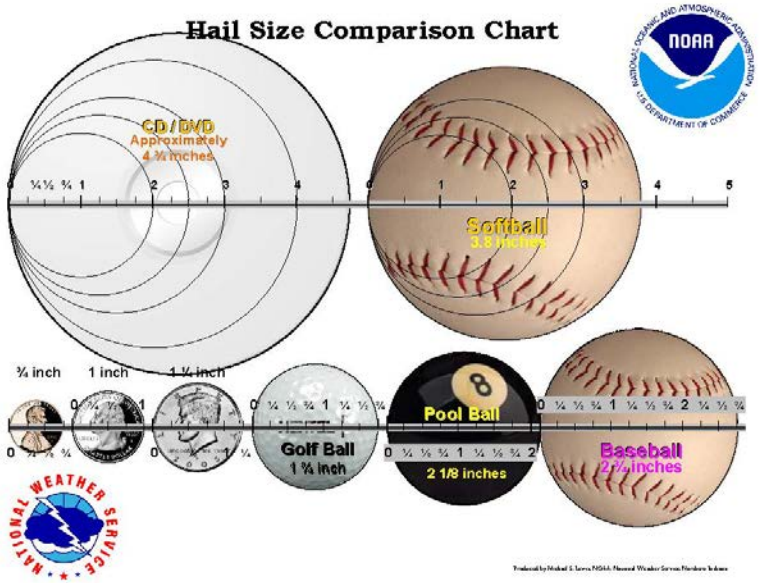
*Potential Future Tornado and Downburst Damage*

It is impossible to predict where a tornado or downburst will occur or what damage it will inflict. A tornado or downburst could happen anywhere in the city. The Claremont Committee does not recall tornadoes or downburst Claremont, but a severe straight winds event occurred in 2015 as noted in the above table. 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, Sullivan County has a medium risk for tornadoes. The Committee determined there is a medium risk for tornadoes and downbursts in Claremont.

**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. Below is a comparison chart for the various sizes of hail.

**Figure III-1: HAIL SIZE COMPARISON CHART**




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.

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

**Table III-7: 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 lightning strikes in Claremont including strikes to the communication towers on Green Mountain and to some municipal facilities damaging equipment: traffic lights, airport lights and beacons, municipal alarm systems, phone systems, and computers. Mitigation efforts have been made to reduce damage there. Some vulnerable equipment surfaces have been double and triple wrapped to prevent further damage.

Other occasional strikes have caused minor damage to businesses in the downtown. A thunderstorm with lightning or hail could impact the entire city, although lightning is more likely in isolated areas.

*Potential Future Thunderstorm Damage*

It is inevitable that thunderstorms will occur in Claremont'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, Sullivan County has a medium risk of a lightning hazard. The risk for future thunderstorm damage was determined by the Committee to be medium risk in Claremont

**Table III-8: THUNDERSTORMS/LIGHTNING, HAIL**

| Thunderstorms/Lightning/Hail | | | | |
|---|---|---|---|---|
| **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 Claremont |
| Hail | August 3, 2007 | Sullivan County | An isolated thunderstorm produced large hail in Sullivan County. | No damage in Claremont |
| Lightning | July 2, 2013 | Claremont | At end of flooding period, severe thunderstorm | Hit transformer on Mulberry Street and hit City Hall blowing out emergency services communications; shut down City Hall; other City facilities also impacted; started a house fire on Mulberry Street |

## 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). Therefore, intense Nor'easters, which occur in the winter months, are often referred to as blizzards. The definition 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.

**Table III-9: 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 any time between October and April, 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*

The following table provides a list of past extreme winter weather events in New Hampshire and Claremont.

**Table III-10: SEVERE WINTER WEATHER**

| SEVERE WINTER WEATHER/ICE STORMS | | | | |
|---|---|---|---|---|
| **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 damage in Claremont recorded |
| Blizzard | February 14-17, 1958 | New Hampshire | 20-30 inches of snow in parts of New Hampshire | No damage in Claremont recorded |
| Snow Storm | March 18-21, 1958 | New Hampshire | Up to 22 inches of snow in south central NH | No damage in Claremont recorded |
| Snow Storm | December 10-13, 1960 | New Hampshire | Up to 17 inches of snow in southern NH | No damage in Claremont |
| Snow Storm | January 18-20, 1961 | New Hampshire | Up to 25 inches of snow in southern NH | No damage in Claremont |
| Snow Storm | February 2-5, 1961 | New Hampshire | Up to 18 inches of snow in southern NH | No damage in Claremont |
| Snow Storm | January 11-16, 1964 | New Hampshire | Up to 12 inches of snow in southern NH | No damage in Claremont |
| 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 | No damage in Claremont |
| Snow Storm | December 26-28, 1969 | New Hampshire | Up to 41 inches of snow in west central NH | No damage in Claremont |
| Snow Storm | February 18-20, 1972 | New Hampshire | Up to 19 inches of snow in southern NH | No damage in Claremont |
| Snow Storm | January 19-21, 1978 | New Hampshire | Up to 16 inches of snow in southern NH | No damage in Claremont |
| Blizzard | February 5-7, 1978 | New Hampshire | New England-wide. Up to 25 inches of snow in central NH | No damage in Claremont |
| Snow Storm | February, 1979 | New Hampshire | President's Day storm | No damage in Claremont |
| Ice Storm | January 8-25, 1979 | New Hampshire | Major disruptions to power and transportation | No damage in Claremont |

| SEVERE WINTER WEATHER/ICE STORMS | | | | |
|---|---|---|---|---|
| **Hazard** | **Date** | **Location** | **Description of Areas Impacted** | **Damages** |
| Snow Storm | April 5-7, 1982 | New Hampshire | Up to 18 inches of snow in southern NH | No damage in Claremont |
| 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 | No damage in Claremont |
| Extreme Cold | November-December, 1988 | New Hampshire | Temperature was below 0 degrees F for a month | No damage in Claremont |
| Ice Storm | March 3-6, 1991 | New Hampshire | Numerous outages from ice-laden power lines in southern NH | No damage in Claremont |
| Snow Storm | 1996 | Regional | Two major storms with five feet of snow in a week | No damage in Claremont |
| Snow Storm | 1997 | New Hampshire | Power outages throughout region due to heavy snowfall | No damage in Claremont |
| Ice Storm | January 15, 1998 | New Hampshire; Substantial power in NH | 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 | No damage in Claremont |
| Snow Storm | 2000 | Regional | Heavy snow | No damage in Claremont |
| Snow Storm | March 5-7, 2001 | New Hampshire | Heavy snow. | No damage in Claremont |
| Snow Storm | December 6-7, 2003 | New Hampshire | Heavy snow. Federal Disaster Declaration FEMA-3193-NH | Claremont received funds from FEMA for damages; no City records at DPW for this event |
| Ice Storm | 2004 | Regional | Ice storm resulted in many trees down and loss of power. | No damage in Claremont |
| Snow Storm | January 22-23, 2005 | New Hampshire | Snow damage; FEMA EM-3207 | FEMA paid $7 million in damages; |
| Snow Storm | February 10-12, 2005 | New Hampshire | Heavy snow. Federal Disaster Declaration FEMA-3208-NH | Claremont received funds for damages from FEMA; no city records at DPW |
| Ice Storm | December 2008 | New Hampshire | Debris removal. FEMA DR-1812; power outages in region for up to 10 days; downed trees blocked roads and damaged utility lines | FEMA paid $15 Million in damages in New Hampshire; |

| SEVERE WINTER WEATHER/ICE STORMS | | | | |
|---|---|---|---|---|
| **Hazard** | **Date** | **Location** | **Description of Areas Impacted** | **Damages** |
| Wind Storm | February 23 – March 3, 2010 | New Hampshire | FEMA DR-1892; Federal funding to Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan Counties; power loss; trees & limbs down | Claremont received $16,600 in federal funding for snow & ice clean-up |
| Snow Storm | October 29-30, 2011 | Statewide | EM-3344; FEMA-4049 Hillsborough & Rockingham Counties | No damage in Claremont |
| Ice Storm | January 27, 2012 | Region | Isolated power outages in region; several limbs down | No damage in Claremont |
| Snow Storm | February 8-10, 2013 | New Hampshire | Heavy Snow (NEMO event). FEMA DR-4105 | Claremont received $23,473 from FEMA primarily for snow removal and tree clean-up |
| Snowstorm | January 26-28, 2015 | Hillsborough, Rockingham, and Strafford Counties, NH | Severe Winter Storm and Snowstorm DR-4209 | No damage in Claremont |

*Potential Future Severe Winter Damage:*

There is the potential for severe winter damage every year. An event would affect the entire city. The Committee determined there is no specific area in the City which is more vulnerable. According to the State's mitigation plan, Sullivan County has a high risk for severe winter weather. The Committee determined severe winter weather to be a High risk in Claremont.

## 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.

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

**Table III-11: EARTHQUAKES**

| EARTHQUAKES | | | |
|---|---|---|---|
| **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 | Off NH/MA coast | NA | Widespread damage Massachusetts to Maine: cost unknown |
| November 18, 1755 | Cape Ann, MA | 6.0 | Much damage: cost unknown |
| 1800s | Statewide | 83 felt earthquake in NH | No damage recorded in Claremont |
| 1900s | Statewide | 200 felt earthquake in NH | No damage recorded in Claremont |
| March 18, 1926 | Manchester, NH | Felt in Hillsborough Co | No damage recorded in Claremont |
| Dec 20, 1940 | Ossipee, NH | Both earthquakes 5.5 | Damage to homes, water main rupture: cost unknown; no damage in Claremont |
| December 24, 1940 | Ossipee, NH | NA | No damage in Claremont |
| December 28, 1947 | Dover-Foxcroft, ME | 4.5 | No damage in Claremont |
| June 10, 1951 | Kingston, RI | 4.6 | No damage in Claremont |
| April 26, 1957 | Portland, ME | 4.7 | No damage in Claremont |
| April 10, 1962 | Middlebury, VT | 4.2 | No damage in Claremont |
| June 15, 1973 | Near Quebec Border | 4.8 | No damage in Claremont |
| Summer 1977-1978* | Centered in Franklin | NA | No damage in Claremont |
| January 19, 1982 | West of Laconia | 4.5 | Structure damage 15 miles away in Concord: no damage in Claremont |
| October 20, 1988 | Near Berlin, NH | 4 | No damage in Claremont |
| September 26, 2010 | New Hampshire | 3.4 | Centered in Boscawen, NH, The Committee recalls feeling the earthquake; no damage in Claremont |
| August 23, 2011 | Central Virginia, East Coast | 5.8 | Felt in region; no damage in Claremont |
| 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 Claremont |
| October 16, 2012 | Southern Maine | 4.0 | The earthquake was located southern Maine and felt throughout the area and into southern NH; No damage in Claremont |

*Source: earthquake.usgs.gov/earthquakes/states/new_hampshire/history.php for earthquakes through 1964. NH Multi-Hazard Mitigation Plan, 2010 for 1973-1982; 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.<br>**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.<br>**X** – Some well-built wooden structures destroyed, most masonry and frame structures destroyed with foundations.<br>**XI** – Few if any masonry structures remain standing. Bridges destroyed.<br>**XII** – Total damage. Lines of sight and level are distorted. Objects thrown in air. |

*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 Claremont. This pga rating is equivalent to a Modified Mercalli Intensity of "V" with moderate perceived shaking and very light potential damage. An earthquake event would impact the entire city. According to the State's mitigation plan, Sullivan County has a medium risk for earthquakes. The Committee determined the risk to be low/medium in Claremont.

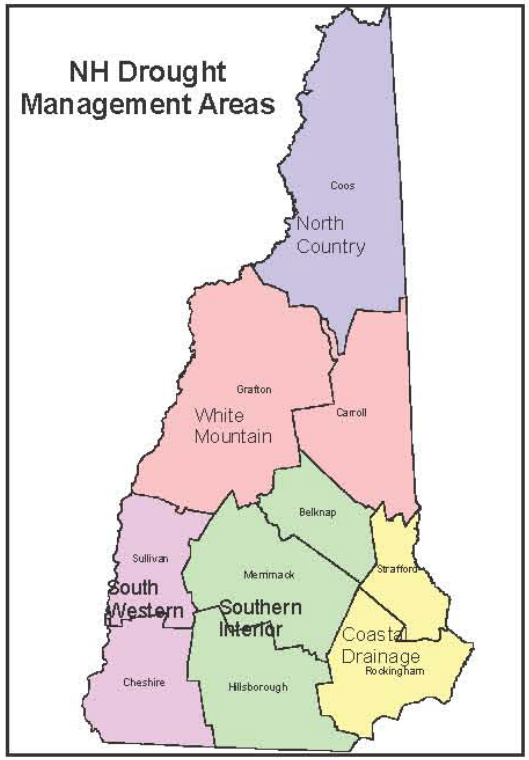
## Drought

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.

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

**Figure III-2: DROUGHT MAPS**



### *Past Drought Events*

Around 2001-2002, Claremont and other nearby towns had drought issues. This occurred again in 2010. In July 2016, southern NH was in the midst of a severe drought while central and northern NH were in either a moderate drought or abnormally dry.

**Table III-13: DROUGHT**

| Date | Location | Description | Damages |
|---|---|---|---|
| 1929-1936 | Statewide | Regional. Recurrence Interval 10 to > 25 years | No damage recorded in Claremont |
| 1939-1944 | Statewide | Severe in southeast and moderate elsewhere. Recurrence Interval 10 to > 25 years | No damage recorded in Claremont |
| 1947-1950 | Statewide | Moderate. Recurrence Interval 10 to > 25 years | No damage recorded in Claremont |
| 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 in Claremont recalled |
| 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 in Claremont |
| 2010 | Mostly southern counties | Affected dug wells and those in hillsides. | No known impact in Claremont |
| 2015 | Southern & Central NH | Concord currently 5.17" below the average precipitation from March 1 to May 21, 2015; considered a "moderate drought" by the US Dept. of Agriculture | Minor impact in Claremont with a couple wells drying up |
| July 2016 | Statewide | Southern NH in severe drought while areas in central (including Sullivan County) were in a moderate drought | Minor impact in Claremont |

*Source: NH DES through 2002; Concord Monitor August 22, 2010; WMUR.com May 21, 2015 and July 7, 2016*

### *Potential Future Drought Damage*

Drought will affect the entire city. 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, Sullivan County has a medium risk for drought. The Committee determined that drought is a low/medium risk in Claremont.

## 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.

**Table III-14: HEAT INDEX**

**NOAA's National Weather Service**

**Heat Index**

**Temperature (°F)**

| Relative Humidity (%) | 80 | 82 | 84 | 86 | 88 | 90 | 92 | 94 | 96 | 98 | 100 | 102 | 104 | 106 | 108 | 110 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | 80 | 81 | 83 | 85 | 88 | 91 | 94 | 97 | 101 | 105 | 109 | 114 | 119 | 124 | 130 | 136 |
| 45 | 80 | 82 | 84 | 87 | 89 | 93 | 96 | 100 | 104 | 109 | 114 | 119 | 124 | 130 | 137 | |
| 50 | 81 | 83 | 85 | 88 | 91 | 95 | 99 | 103 | 108 | 113 | 118 | 124 | 131 | 137 | | |
| 55 | 81 | 84 | 86 | 89 | 93 | 97 | 101 | 106 | 112 | 117 | 124 | 130 | 137 | | | |
| 60 | 82 | 84 | 88 | 91 | 95 | 100 | 105 | 110 | 116 | 123 | 129 | 137 | | | | |
| 65 | 82 | 85 | 89 | 93 | 98 | 103 | 108 | 114 | 121 | 128 | 136 | | | | | |
| 70 | 83 | 86 | 90 | 95 | 100 | 105 | 112 | 119 | 126 | 134 | | | | | | |
| 75 | 84 | 88 | 92 | 97 | 103 | 109 | 116 | 124 | 132 | | | | | | | |
| 80 | 84 | 89 | 94 | 100 | 106 | 113 | 121 | 129 | | | | | | | | |
| 85 | 85 | 90 | 96 | 102 | 110 | 117 | 126 | 135 | | | | | | | | |
| 90 | 86 | 91 | 98 | 105 | 113 | 122 | 131 | | | | | | | | | |
| 95 | 86 | 93 | 100 | 108 | 117 | 127 | | | | | | | | | | |
| 100 | 87 | 95 | 103 | 112 | 121 | 132 | | | | | | | | | | |

**Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity**

Caution | Extreme Caution | Danger | Extreme Danger

*Past Extreme Heat Events*

In the summer of 2008, Rescue personnel assisted several residents having breathing difficulties due to extreme heat. The following table lists the extreme heat events in the past which included the Northeast and New Hampshire.

**Table III-15: EXTREME HEAT**

| Date | Location | Description | Damage |
|---|---|---|---|
| July, 1911 | New England | 11-day heat wave in New Hampshire | No impact recorded in Claremont |
| Late June to September, 1936 | North America | Temps to mid 90s in the northeast | No impact recorded in Claremont |
| June - August, 1999 | Northeast | Mean temperatures well above long-term average | No impact recorded in Claremont |
| Early August, 2001 | New Hampshire | Mid 90s and high humidity | No impact in Claremont |
| August 2-4, 2006 | New Hampshire | Regional heat wave and severe storms | No impact in Claremont |
| 2008 | Claremont | Committee recollection of assisting several residents with breathing difficulties | Breathing difficulties of several residents |
| July 2010 | Northeast | Regional heat wave | Noticed residents about where to go for cooling station; minimal impact |
| July 2015 | New Hampshire | Regional heat wave | Claremont cooling station not opened; minimal impact |

*Source: Union Leader July 30, 2015*

*Potential Future Extreme Heat Events*

Extreme heat would impact the entire city 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 Hazard Mitigation Plan*. The Committee determined extreme heat to be a low risk in Claremont.

**Erosion**

Soil erosion is the process of removal and transportation of soil by wind or water to a new location.

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 flow from up-slope, and (4) Season of disturbance.

*Past Erosion Events*

There have been several erosion events in Claremont. There are about 90-100 miles of paved roads and 20 miles of gravel roads in Claremont. The area north of Maple Avenue to “the Bluff” has sandy soils and roads with adequate drainage and road subsurface. The remainder of the city has silt/clay-based soils and subsurface more susceptible to erosion.

**Table III-16: EROSION AREAS**

| Location/Hazard | Problem |
|---|---|
| **Sugar River Drive**/Flooding & Erosion | Logging and clear cut in southeast corner of city increased drainage to culvert on Sugar River Drive; now floods road once or twice a year; must replace shoulder gravel each time |
| **72 Sugar River Drive**/Erosion | Slope failure into Sugar River; have done some engineering and design work, but inadequate to mitigate hazard |
| **South of Beauregard Village at Route 12/103 (Main Street)**/ Erosion | Main artery 100' from Sugar River and road embankment slumping toward river |
| **Whitewater Brook**/Flooding & Erosion | The only access to the main reservoir for drinking water floods every spring and the road washes; one house and mostly woods |
| **Cat Hole Road**/Flooding & Erosion | Severe erosion off Foisey Hill, water from Green Mountain; drains down into Cat Hole Road, Foisey Hill Road, and Skyline Drive |
| **Ledgewood Road development**/ flooding and erosion | The Ledgewood Road development area drains to Charlestown Road to Buena Vista Road to Tyler Brook; undersized culverts cause water to bubble out of catch basins and wash edges of roads |
| **Tyler Brook Corridor:** | |
| A. **APC Building**, 129 Sullivan Street | Tyler Brook flows underneath building and is damaging the building structure and support |
| B. **Desilets Building**, 67 Tyler Street | Storm drainage pipes go under building-inaccessible for proper maintenance, angle in pipes causing choke point under building; cannot move the building; floods area every 4-5 years |
| C. **Myrtle Street** | Culvert is too small to contain water |
| D. **Mulberry Street Crossing** | Culvert is too small to contain water |
| E. **RR Crossing south of Prospect Street** | Culvert is too small to contain water and erosion is threatening the supports of the railroad trestle above; this is a heavily used trestle |
| F. **Pleasant Street** | Culvert is too small to contain water |
| G. **East Street** | Undersized culvert plugs up and backs up water into nearby beaver bog which flood homes; road is closed every 4-5 years usually in spring; road has been closed, backyards damaged, and people moved out to safety |

*Potential Erosion Events*

Due to the topography 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. Several roads need improvement as shown above to mitigate erosion from future rainstorms. The Committee determined that erosion is a low/medium risk in Claremont. In 2015, the NH Department of Environmental Services did a study on fluvial erosion of the Sugar River in Claremont. This information is provided in Appendix E.

## 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 few wildfire events in Claremont except the occasional brush fire.

*Potential Future Wildfire Events*

There are many large, contiguous forest tracts in Claremont. Where development interfaces with the forested areas is called the "urban interface." These are the areas where structures could be impacted by a wildfire; these areas are scattered throughout the city. The most likely areas for wildfire are where ice storm impact downs trees and branches providing fuel for a fire. During drought conditions, many areas may be at risk for wildfire. According to the State's mitigation plan, Sullivan County has substantial debris to fuel a wildfire remaining from the ice storm of 1998 and 2008 and heavy forest cover. In April 2016, there was a wildland fire on a ridge between Hanover and Winter Streets. It is assumed this was vandalism. It took two days to extinguish. There is typically a similar fire each year. The State plan gives the county a high risk of wildfire. The Committee determined that the risk of wild and structure fire risk in Claremont is low.

**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.

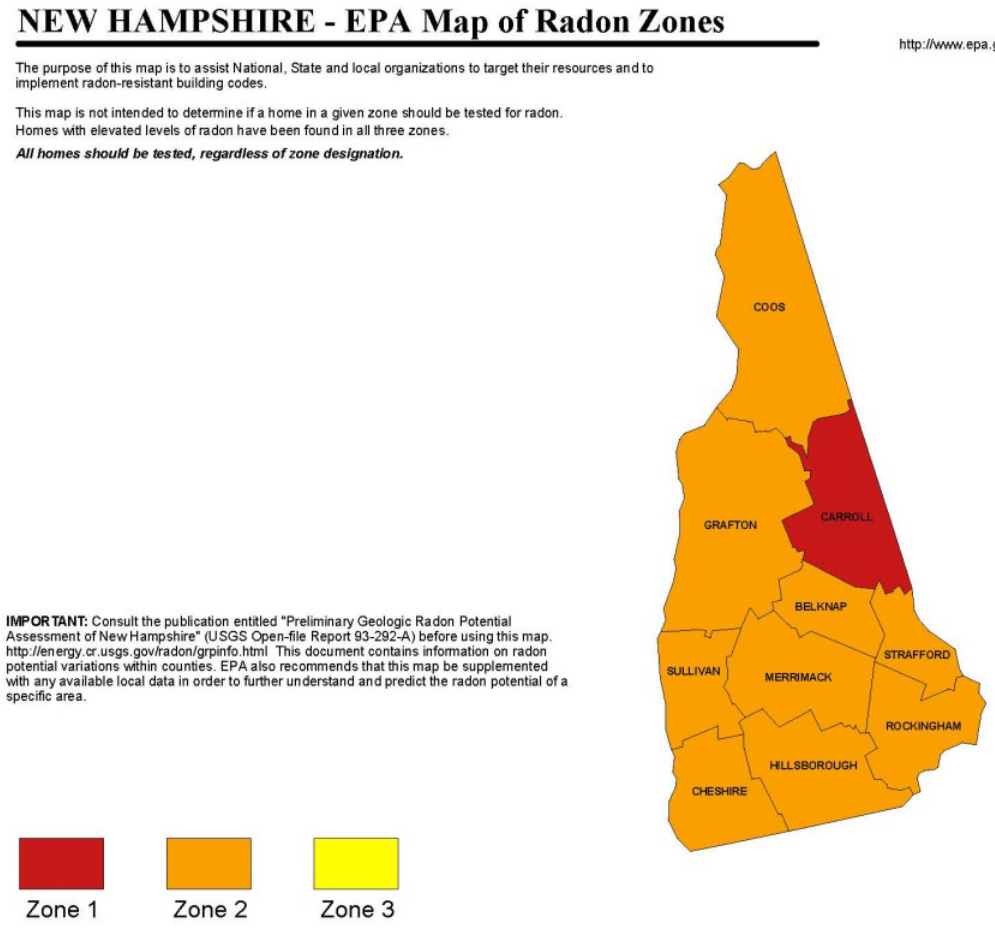
*Past Natural Water & Air Contaminant Events*

There have been no known events related to natural water and air contamination in Claremont. However, although the Hazard Mitigation Committee is not aware of radon contamination incidents in Claremont, 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 near Claremont.

**Table III-17: RADON – LOW/MEDIUM RISK**

| RADON | | | | | |
|---|---|---|---|---|---|
| **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** |

**Figure III-3: MAP OF RADON ZONES**




**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**

*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 Claremont, 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, Sullivan County radon levels are below average for the State. According to the State's mitigation plan, Sullivan County has a medium probability of a radon related hazard.

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.

**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. In Claremont, there are about 130 hazardous waste generators listed on the NH Department of Environmental Services (DES) "one-stop" list. Most of these are inactive and probably only produce small amounts of hazardous waste. However, there are also some larger producers. There are also large tanks for fuel such as propane, oil, and gas to service the various businesses and industries in city. Fourteen commercial entities have licensed tanks with NH DES. The City of Claremont is an active member of the Midwestern NH Regional Hazardous Materials Response Team.

*Past Hazardous Waste Spill Events*

No known recent and significant spills have occurred in Claremont, and there are currently close to 300 hazardous waste generators listed in the NH Department of Environmental Services database. This includes large and small quantity generators as well as facilities that may never generate hazardous waste again. However, the sheer volume of entries indicates that there is substantial hazardous waste generation in the City of Claremont.

Several minor spills have occurred in the past. Over the past five years, the Claremont Fire Department has responded to 109 hazardous spills. Of these, only one is listed as being reportable. That incident took place in February 2016. It was determined to have been caused by a ruptured heating oil tank in the basement of a home on Veteran's Park Road. The oil migrated outdoors and into a nearby brook. The fire department controlled the oil they could and the State was called in to complete the cleanup.

*Potential Future Hazardous Waste Spill Damage*

There conceivably could be spills near any home in Claremont due to home heating fuel delivery. The property owner is responsible for clean-up. The State oversees these reported spills. Larger spills are possible from non-residential fuel tanks as

shown above in Claremont. The cost for clean-up would be assigned to the transporter. However, there should be an emergency plan to immediately respond to the site to minimize water and ground contamination. Major routes through the city include Routes 11/103, 11/12, 12A, and 120.

The State did not determine county risk for hazardous waste spills in the *NH Hazard Mitigation Plan*. The Committee determined a hazardous waste spill is a low/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 Claremont in the past. In October 2015, the Planned Parenthood clinic vandalized and caused significant damage. In the spring of 2015, the Saint Mary's Church was vandalized the building causing significant damage.

*Future Terrorism Events*

Terrorism is not considered a major risk, although vandalism is an occasional problem. The Committee determined that the risk of terrorism is a low/medium risk in Claremont.

## C. HAZARD RISK RATINGS

The City of Claremont 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. The ratings were based on past occurrences of hazards affecting the State of New Hampshire, Sullivan County, and the City of Claremont. These ratings were reevaluated for change in 2015. Although severe winter and erosion/landslide hazards were determined to fall in the medium/high risk range, flooding is considered a high risk.

## 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. To ensure some balance with a more scientific measurement, the plan also identifies the probability of occurrence from the State Hazard Plan as shown in Table III-18. 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-19 and III-20.

**Table III-18: PROBABILITY OF HAZARD FOR SULLIVAN COUNTRY FROM STATE PLAN**

| Flood | Dam Failure | Drought | Wildfire | Earth-quake | Radon | Tornado | Hurricane | Lightning | Severe Winter |
|---|---|---|---|---|---|---|---|---|---|
| H | L | M | H | M | M | M | M | M | H |

## 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-19: 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 | 3 | 3 | 3 | 3.00 |
| Flooding | 2 | 3 | 2 | 2.67 |
| Hurricane | 2 | 2 | 2 | 2.00 |
| Tornado & Downburst | 2 | 2 | 2 | 2.00 |
| Thunderstorm/Lightning/Hail | 1 | 2 | 2 | 1.67 |
| Severe Winter/Ice Storms | 2 | 3 | 3 | 2.67 |
| Earthquake | 1 | 3 | 3 | 2.33 |
| Drought | 1 | 2 | 1 | 1.33 |
| Extreme Heat | 2 | 1 | 1 | 1.33 |
| Erosion | 1 | 2 | 2 | 1.67 |
| Wildfire | 1 | 2 | 2 | 1.67 |
| Natural Contaminants | 1 | 2 | 2 | 1.67 |
| HazMat Spills | 1 | 2 | 2 | 1.67 |
| Terrorism | 2 | 2 | 2 | 2.00 |

**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 to be high, medium, or low.

HIGH**:** There is 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 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-13: RISK ASSESSMENT**

| **Risk Assessment**<br>0-1.9 Low 2-3.9 Low/Med 4-5.9 Med 6-7.9 Med-High 8-9 High | | | | |
|---|---|---|---|---|
| **Hazards** | **Probability based on Committee Review** | **Vulnerability based on Committee Review** | **Risk Rating (Probability x Vulnerability)** | **Risk** |
| Dam Failure | 2 | 3.00 | 6.00 | Medium/High |
| Flooding | 3 | 2.67 | 8.01 | High |
| Hurricane | 2 | 2.00 | 4.00 | Medium |
| Tornado & Downburst | 2 | 2.00 | 4.00 | Medium |
| Thunderstorm/Lightning/Hail | 3 | 1.67 | 5.01 | Medium |
| Severe Winter | 3 | 2.67 | 8.01 | High |
| Earthquake | 1 | 2.33 | 2.33 | Low/Medium |
| Drought | 2 | 1.33 | 2.66 | Low/Medium |
| Extreme Heat | 1 | 1.33 | 1.33 | Low |
| Erosion | 2 | 1.67 | 3.34 | Low/Medium |
| Wildfire | 1 | 1.67 | 1.67 | Low |
| Natural Contaminants | 1 | 1.67 | 1.67 | Low |
| HazMat | 2 | 1.67 | 3.34 | Low/Medium |
| Terrorism | 1 | 2.00 | 2.00 | Low/Medium |

# IV. CRITICAL FACILITIES/LOCATIONS

The Critical Facilities list, identified by the Claremont 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 Claremont. The third category contains facilities/populations that the Committee wishes to protect in the event of a disaster. Values were retrieved from the city assessor's office in June 2016.

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

| Map # | Critical Facility | Tax Map & Lot # | Hazard Vulnerability | Value |
|---|---|---|---|---|
| 1 | Emergency Operations Center/Police Station/Courthouse/City Hall (one building) | 120/50 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | $2,636,500 |
| 2 | Fire Station | 120/161 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 763,400 |
| 3 | Golden Cross Ambulance building | 108/64 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 351,200 |
| 4 | Stevens High School (secondary shelter) | 132/5 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 6,785,000 |
| 5 | Claremont Savings Bank Community Center (primary shelter) | 132/173 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 5,772,500 |
| 6 | Maple Avenue School (secondary shelter) | 129/117 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 2,353,600 |
| 7 | Bluff School (secondary shelter) | 119/224 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 1,822,900 |
| 8 | Claremont Middle School (secondary shelter) | 132/175 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 9,745,000 |
| 9 | Disnard School (secondary shelter) | 95/114 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 1,930,000 |
| 10 | Valley Regional Hospital (private) | 95/97 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 13,537,400 |
| 11-15 | Water Treatment Facility, tanks, and pump stations | 84/18 Facility only | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills; | 1,938,400 |
| 16-24 | Sewer Plant and pump stations | 80/4 Plant only | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous | 5,763,300 |

| Map # | Critical Facility | Tax Map & Lot # | Hazard Vulnerability | Value |
|---|---|---|---|---|
| | | | Materials Spills; Flooding (sewer pumps); Dam Inundation | |
| 25 | Communication Towers – Green Mountain (City, County and Towns of Cornish, Unity, and Lempster) | 75/1 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake | Unknown |
| 26 | Department of Public Works Facility | 95/28 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 279,500 |
| NA | Evacuation Routes (major roads & bridges) | NA | Dam Failure; Flooding; Severe Winter Weather; Earthquake; Landslide; Erosion; Hazardous Materials Spills | Unknown |

*Sources: FEMA floodplain map, Dam Inundation Maps, HazMit Committee, Claremont Aerial Imagery 2014, and 2015 Tax Assessment average values*

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

| Critical Facility | Map & Lot # | Hazard Vulnerability | Value |
|---|---|---|---|
| Fiske Free Library | 120/155 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | $515,500 |
| Claremont Planning & Development Office | 108/1 | All Hazards | 340,600 |
| Food stores | NA | All Hazards | Unknown |
| Gas Stations | NA | All Hazards | Unknown |
| Banks | NA | All Hazards | Unknown |

*Sources: FEMA floodplain map, HazMit Committee, Claremont Aerial Imagery 2014, and 2016 Tax Assessment values*

**Table IV-3: FACILITIES & POPULATIONS TO PROTECT**

| Critical Facility | Map & Lot # | Hazard Vulnerability | Value |
|---|---|---|---|
| National Historic Register Districts (some buildings listed individually) | NA | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | Unknown |
| River Valley Community College | 60/12 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | $5,502,300 |
| Churches | NA | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | Unknown |
| Washington Street commercial district | NA | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | Unknown |
| Elm Wood Center (68 beds) | 72/22 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 1,637,000 |
| Silver Maples (10 beds) | 108/106 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 236,600 |
| Earl Bourdon | 143/1 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 2,620,700 |

| Critical Facility | Map & Lot # | Hazard Vulnerability | Value |
|---|---|---|---|
| Apartments (80 units) | | | |
| Hillside Terrace (79 units) | 108/56<br>108/63 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 3,220,300<br>658,200 |
| Marion Phillips Apartments (100 units) | 132/51 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 2,439,100 |
| Sugar River Mills (123 + 39 units) | 107/23 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 6,745,600 |
| Claremont Manor (90 units) | 130/59 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 3,076,400 |
| Claremont Village Apartments (67 unites) | 130/49 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 2,478,700 |
| Claremont Christian Academy | 130/74 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 557,300 |
| New England Classical Academy | 119/349 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 1,389,900 |
| Green Mountain Daycare | 154/69 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 123,400 |
| Ready Set Grow Childcare | 107/199 | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake; Hazardous Materials Spills | 277,700 |
| Mobile Home Parks | NA | Hurricane; Tornado & Downburst; Lightning & Hail; Earthquake | Unknown |

*Sources: FEMA floodplain map, HazMit Committee, Claremont Aerial Imagery 2014, and 2016 Tax Assessment values*

# 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. Values for houses (3,518) and mobile homes (441) were generated as average values from the total values by structure type for houses and manufactured housing from City tax assessment records for 2015. The values for non-residential and apartment buildings were generated as average values from the total value of "commercial/industrial" 2015 assessed valuation. There are currently 543 apartment building sites, 354 commercial sites, and 80 industrial sites. 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 (residential & non-residential) | Infrastructure | Natural Resources | Total Known Building Value |
|---|---|---|---|---|---|---|
| Dole Dam Inundation Area | Dam Failure | Evacuation routes | 28 houses; 1 mobile home; 5 commercial; 4 industrial | Roads | Vegetation | $5Million |
| Gunnison Dam Inundation Area | Dam Failure | Wastewater Treatment Plant and sewer pump stations; evacuation routes | 111 houses; 4 mobile homes; 57 non-residential and apartment buildings | Roads, bridges, other dams, railroad | River vegetated buffers; agricultural lands | $24 Million |
| McGary Fletcher Dam Inundation Area | Dam Failure | Evacuation Route | 2 houses | Roads, railroad | Vegetation | $232,000 |
| Rice Dam Inundation Area | Dam Failure | Sewer Pump Station (289 Elm St.) | 15 houses; 3 mobile homes; 5 nonresidential and apartment buildings | Roads, other dam, railroad | Vegetation | $2.6 Million |
| Sweetwater Dam Inundation Area | Dam Failure | Evacuation Route | 1 house and 2 mobile homes | Roads, other dam, railroad | River vegetated buffers | $142,000 |
| Whitewater | Dam Failure | Evacuation | 61 houses; 4 mobile homes; 7 non-residential | Roads, bridges, | Brook vegetated | $7.2 Million |

| Area | Hazard | Critical Facilities | Buildings (residential & non-residential) | Infrastructure | Natural Resources | Total Known Building Value |
|---|---|---|---|---|---|---|
| Brook Dam | | Routes | and apartment buildings | railroad | buffer; agricultural lands | |
| Connecticut River Dams: Wilder, North Hartland | Dam Failure | None | 26 residential, 12 non-residential and apartment buildings | Roads | Vegetated buffers and agricultural lands | $5 Million |
| FEMA Flood Zones | Flooding | Evacuation Routes | 95 houses, five mobile homes, and 52 nonresidential and apartment buildings | Roads, bridges, railroad | Vegetated buffers of CT River, Sugar R, and Redwater Brook, agricultural lands along Connecticut River | $19 Million |
| Locally Determined Flood Areas | Flooding | None | 61 houses, 30 mobile homes, and 66 nonresidential and apartment buildings | Roads, bridges, railroad | Vegetated buffer of Tyler Brook | $18 Million |

**Table V-2: VULNERABILITY OF POTENTIAL DEVELOPMENT**

| Area | Hazard | Critical Facilities | Projected Buildings | Projected Infrastructure | Projected Value |
|---|---|---|---|---|---|
| City infrastructure in-fill; industrial park on Grissom; Route 12A/River Road | All Hazards | None | Unknown | Built in city center areas | Unknown |

## B. IDENTIFYING VULNERABLE SPECIAL POPULATIONS

There are many centers of special populations in city including several schools, nursing homes, day care centers, senior center, churches, and senior housing. The elderly and physically or mentally impaired residents are also residing throughout the city in their homes. A list of known people with special needs is kept by elderly housing complexes, nursing homes, and home health services. The City does not maintain a list.

## C. POTENTIAL LOSS ESTIMATES

This section identifies areas in 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. These 2015 values are assessed tax values. In 2010, the "cost new" values were used. The land damage cost, structure content loss costs, and function loss cost were not determined.

**Dam Failure – Medium/High Risk - $15.5 Million Estimated Cost (not including roads, bridges, railroad)**
Nine dams are designated as "significant" or "high" hazard potential either within Claremont or areas upstream in a position to impact Claremont in the event of dam failure: Dole Reservoir, Gunnison Dam (in Goshen), Lower Valley Hydro Dam, McGary Fletcher Dam, Rice Reservoir, Sweetwater Dam, Whitewater Dam, Wilder Dam (Connecticut River, Wilder, VT), and the North Hartland Dam (North Hartland, VT at Connecticut River). If any of these dams failed, major economic loss to structures or property, structural damage roads, major environmental or public health losses would likely occur. It is estimated that there are 254 houses, 19 mobile homes and 101 non-residential and apartment buildings within these dam inundation areas—most within the Gunnison Dam inundation area. The total value of the buildings is approximately $51 million. Assuming a 28% structural damage to the buildings, the building damage would be over $14.3 million. There are also about 19 mobile homes within the dam failure inundation areas at a total value of about $1.2 million. Assuming a 78% structural damage to the mobile homes, the damage would be about $1 million. The nonresidential portion includes the sewage treatment facility which is also within dam failure inundation areas. These structures are valued at $6 million (replacement value would be substantially higher than the assessed value for these facilities). In addition, there are about 10 bridges within the dam inundation areas and several city and state roads, as well as portions of the railroad. No value estimate has been done for these structures. Since there are six dams classified as "high hazard" that could impact Claremont, there is also the probability that people could be killed if the dams fail.

**Flooding – High Risk - $10.5 Million Estimated Cost (not including roads, bridges, railroad)**
There are approximately 156 houses, 15 commercial structures and 27 nonresidential and apartment buildings within the FEMA and locally designated Special Flood Hazard areas. The total value of the buildings is about $36 million. Assuming a 28 % structural damage to the buildings, the damage would total close to $10 million. There are about 35 mobile homes with a value of $455,945 in the flood zones which would receive more substantial damage than buildings. Assuming an estimated 78% structural damage to the mobile homes, there could be as much as $356,000 in damage. There are 11 bridges and several sections of road and railroad in these flood areas. No value estimate has been done for these structures.

**Hurricane – Medium Risk – $6.6 Million Estimated Cost**
Damage caused by hurricanes can be severe and expensive. Claremont has been impacted in the past by both wind and flooding damage as a result of hurricanes. According to the 2015 MS1 form, the total assessed value of all structures within Claremont is approximately $658 million. It is random which structures would be impacted and how much. There is no standard loss estimation available and no record of past costs. If 10% of the buildings received 10% damage, the damage cost would be about $6.6 million. A hurricane could damage or demolish buildings; knock down utility lines causing breaks in water, sewer, and electricity service; cause heavy rain and flooding; and kill livestock and people.

**Tornado & Downburst – Medium 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.

**Thunderstorm/Lightning/Hail – 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.

**Severe Winter Weather – High Risk – No Recorded or Estimated Cost**
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. Municipal costs rise in severe winters as towns attempt to keep ice and snow off the roads. The purchase of salt and sand can greatly increase if the severity of winter weather is greater than anticipated.

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). 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.

**Earthquake – Low/Medium Risk - $6.6 million Estimated Cost if All Buildings Impacted**

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 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 and earthquake. Even a moderate rupture beneath a city with structures unprepared for shaking can produce many casualties. Although Claremont has building regulations to address these occurrences, there are many older buildings in the City which were not built to this specification.

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. According to the 2015 MS1 form, the total assessed value of all structures within Claremont is approximately $658 million. It is random which structures would be impacted and how much. There is no standard loss estimation available and no record of past costs. If 10% of the buildings received 10% damage, the damage cost would be about $6.6 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 Claremont as no drought has significantly affected Claremont 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.

**Extreme Heat – Low 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.

**Erosion – Low/Medium Risk – No Recorded or Estimated 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**.** Severe erosion has occurred along several roads in Claremont.

**Wildfire– Low Risk – $3.3 Million 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 Claremont interfaces with forest, where structures are potentially vulnerable to wildfire. The estimated value of all structures in the city is approximately $658 million. If 1% of the structures received 50% damage, the total estimated cost would be about $3.3 million.

According to the Sullivan County Forester, big wildfires are uncommon in Sullivan County as the weather here is generally not favorable for a high probability of ignition and rapid spread. Additionally, there are enough roads and people in the county that fires are generally spotted and addressed before they are too large.

**Natural Contaminants – Low 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 –Low/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 quality might be borne by the community. No cost estimate has been provided for this possible hazard. There are no significant hazardous waste generators in Claremont—so any spills would likely be from heating fuel delivery or transport of materials through the city on Routes 120, 12A, 103, and 11.

Many critical facilities are located in areas especially susceptible to hazardous waste spills as they are located on major routes.

**Terrorism – 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 Claremont.

# VI. EXISTING MITIGATION ACTIONS

## A. EXISTING HAZARD MITIGATION PROGRAMS

The following table provides the existing mitigation actions in Claremont. 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 not. 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 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 Hazard Mitigation Plan/Actions Taken to Meet Recommendations or Not Met | Proposed Improvements |
|---|---|---|---|---|---|
| **City Master Plan** - Most recent version is 2011 (currently being updated) | All Hazards/Entire City | Planning Board | Average | Reference HazMit Plan and importance of hazard mitigation in appropriate Master Plan sections/ NOT COMPLETED due to lack of communication | Add reference to Hazard Mitigation Plan and Emergency Operations Plan to Master Plan |
| **Claremont Municipal Airport Master Plan** – Plans for future use of airport; 10-year plan adopted by FAA and Bureau of Aeronautics | All Hazards/Airport | Airport Manager | Average | No recommendations in past plan | None (Limited capacity due to small size.) |
| **Emergency Power** – Provide emergency power at all shelters. | All Hazards/Entire City | EMD | Average | Provide emergency power at Stevens High School/COMPLETED in Claremont Savings Bank Community Center (primary shelter) instead of Stevens High School | Enhance Stevens High school with emergency power |
| **HazMat Truck Route** – Route trucks around center of city | HazMat/ Downtown | City Traffic Advisory Committee | Low | Establish route/Study completed in August 2009 with four alternative truck routes/INCOMPLETE due to opposition & difficulty in rerouting | Continue to evaluate options with State DOT |

| Existing Mitigation 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 | Proposed Improvements |
|---|---|---|---|---|---|
| **National Flood Insurance Program** - Provides insurance program for homes in or near the FEMA determined flood zones | Flooding/Entire City | City Council | High | Provide public awareness of NFIP/On-going education | Continue to provide public awareness; add link for hazard mitigation education to City web site; provide a map of the floodplains on the City web site. |
| **Water Department Emergency Plan** – Standard operating procedures to prevent and correct malfunctions | All Hazards/Portion of City with services | Water & Sewer Superintendant | Average | No recommendations in past plan | None |
| **Dam emergency plans and maintenance** - NH DES inspects dams; dam owners maintain to prevent failure; City maintains records of plans and DES inspections | Dam Failure/Dam Inundation Areas (See map in Appendix D & E) | State and individual property owners of dam sites | Average | No recommendations in past plan | None |
| **City Dam maintenance** – Maintain existing city dams as required by State law | Dam Failure/Dam Inundation Areas | Public Works Director | Average | No recommendations in past plan | Rice and Whitewater Dams being evaluated for repairs now |
| **Conservation Commission** – Advises City Boards about conservation concerns; reviews State wetlands applications | All Hazards/Entire City | CC Chair | Average | No recommendations in past plan | None |
| **Zoning Ordinance** – Regulates land use; regulates floodplain, floodway, and stream banks | Flooding, Erosion/Entire City | Planning Board; City Council | Average | Update ordinance/INCOMPLETE due to lack of communication | Amend Zoning Ordinance to include restrictions on steep slopes and wetland buffers |
| **Subdivision Regulations** – Regulates division of land | All Hazards/Entire City | Planning Board, City Council | Average | Update and reference Best Management Practices/INCOMPLETE due to lack of communication | Amend Subdivision Regulations to add the use of "Best Management Practices" in development |
| **Driveway Regulations** – Regulates driveway access on city roads. | Erosion/Entire City | Planning Board | Average | Update and reference Best Management Practices/ INCOMPLETE due to lack of communication | Add requirement for "Best Management Practices" in driveway construction |
| **Building Codes** – Regulates building structures and | All Hazards/Entire | Planning & Developmen | Average | Revisions needed/Adopted State-adopted codes and property | None |

| Existing Mitigation 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 | Proposed Improvements |
|---|---|---|---|---|---|
| reference Best Management Practices | City | t Office; Fire Chief | | maintenance codes | |
| **Site Plan Review Regulations** – regulates non-residential and multi-family development | All Hazards/Entire City | Planning Board; City Council | Average | Update and reference Best Management Practices/ INCOMPLETE due to lack of communication | Amend to require "Best Management Practices" in development |
| **Capital Improvements Program** – Plans for future major purchases | All Hazards/Entire City | Planning Board; City Council | Average | No recommendations in past plan | None; continual updates |
| **Water Ordinance** – Defines system design/construction if connections to public system | All Hazards/ Public water service areas | Public Works Director | High | No recommendations in past plan | None |
| **Sewer Ordinance -** Defines system design/construction if connected to public system | All Hazards/Entire City | Public Works Director | High | No recommendations in past plan | None |
| **Hazard tree trimming -** Program for cutting hazardous branches and trees as necessary; | All Hazards/Entire city | DPW (road rights of way); Airport Man; Parks & Rec Dir | Low | Identify hazardous trees and develop action strategies/ON-GOING | Continue program |
| **Winter Parking Ordinance** – ordinance to prevent blocking emergency parking | Severe Winter/Entire city | DPW Director | Average | No recommendations in previous plan | None |
| **Road Improvements -** Mitigate problem areas to prevent substantial future damage from natural hazards | Flooding, Erosion, Dam Inundation/ Entire city | DPW Director | High | Culvert and revetment work - see list of proposed improvements in following table | See Table VI-2 |
| **Water & Sewage Treatment Systems Improvement -** Mitigate problem areas to prevent failure of systems from natural hazards | Flooding, Erosion, Terrorism/Entire city | Water & Sewer Superintendent | High | Complete eng and design work to complete satisfactory mitigation of revetment work for sewage valve building at 72 Sugar River Drive which handles County facilities in Unity (river eroding bank and threatening to undermine bldg)/ COMPLETED in 2015 | No known mitigation improvements at this time other than those referenced in Table VI-2 for sewer and water through undersized culverts |

**Table VI-2: ROAD IMPROVEMENTS PROGRAM – PROPOSED IMPROVEMENTS**

| Location/Hazard | Problem | Mitigation Action/Status of Action |
|---|---|---|
| **Sugar River Drive**/Flooding & Erosion | Logging and clear cut in southeast corner of city increased drainage to culvert on Sugar River Drive; now floods road once or twice a year; must replace shoulder gravel each time | Upgrade culvert with appropriately sized culvert for increase in receiving runoff/NOT COMPLETED due to lack of resources |
| **72 Sugar River Drive**/Erosion | Slope failure into Sugar River; have done some engineering and design work, but inadequate to mitigate hazard | Complete eng and design work to complete satisfactory mitigation of revetment work for sewage valve building which handles County facilities in Unity (river eroding bank and threatening to undermine bldg)/COMPLETED 2015 |
| **Beaureguard Village**/Flooding & Ice Jams | Floods over Route 12/103 (Main Street) 2-3 times a year in residential area (HUD paid homeowners for homes but some have stayed and are not allowed to improve homes); damaged motel | Identify options to mitigate damage to or relocate existing sanitary sewer trunk line on Beauregard Street/NOT COMPLETED due to lack of resources |
| **South of Beauregard Village at Route 12/103 (Main Street)**/ Erosion | Main artery 100' from Sugar River and road embankment slumping toward river | Reinforce embankment which is eroding into river/NOT COMPLETED due to lack of resources |
| **Half Mile Road**/Flooding | Drainage into undersized culvert under railroad trestle of very active railroad line which is compromising trestle supports; if this trestle is damaged, a 90-mile detour will be required | Upgrade culvert to handle water/NOT COMPLETED due to lack of resources |
| B**ible Hill Road**/Flooding | Undersized culvert with water and sewer lines inside; floods every spring as located at bottom of hill; floods driveways and yards; if lines fail, many homes will be without water and sewer | Upgrade culvert with appropriately sized culvert/NEW to plan/NEW to plan |
| **Washington Street**/Flooding | Twin culverts jam with debris and flood the area after every major rain event; impacts business strip and box stores; 2nd busiest street in the State | Upgrade twin culverts with a box culvert/NEW to plan |
| **Whitewater Brook**/Flooding & Erosion | The only access to the main reservoir for drinking water floods every spring and the road washes; one house and mostly woods | Upgrade culvert with appropriately sized culvert/NEW to plan |
| **Girard Avenue at Lonesdale**/ Flooding | Floods road and a couple houses every spring due to an undersized culvert | Upgrade culvert with appropriately sized culvert/NEW to plan |
| **Cat Hole Road**/Flooding & Erosion | Severe erosion off Foisey Hill, water from Green Mountain; drains down into Cat Hole Road, Foisey Hill Road, and Skyline Drive | Upgrade culvert with appropriately sized culvert/NEW to plan |
| **Ledgewood Road development**/ flooding and erosion | The Ledgewood Road development area drains to Charlestown Road to Buena Vista Road to Tyler Brook; undersized culverts cause water to bubble out of catch basins and wash edges of roads | Enlarge enclosed stone drainage system/NEW to plan |

| Location/Hazard | Problem | Mitigation Action/Status of Action |
|---|---|---|
| **Tyler Brook Corridor: (flooding and erosion)** | | |
| A. **APC Building**, 129 Sullivan Street | Tyler Brook flows underneath building and is damaging the building structure and support | Consider re-routing the brook around the building/NEW to plan |
| B. **Desilets Building**, 67 Tyler Street | Storm drainage pipes go under building-inaccessible for proper maintenance, angle in pipes causing choke point under building; cannot move the building; floods area every 4-5 years | Consider re-routing the brook around the building/NOT COMPLETED due to lack of resources |
| C. **Myrtle Street** | Culvert is too small to contain water | Upgrade culvert with appropriately sized culvert/NEW to plan |
| D. **Mulberry Street Crossing** | Culvert is too small to contain water | Upgrade culvert with appropriately sized culvert/NEW to plan |
| E. **RR Crossing south of Prospect Street** | Culvert is too small to contain water is damaging the supports of the railroad trestle above; this is a heavily used trestle | Upgrade culvert with appropriately sized culvert/NEW to plan |
| F. **Pleasant Street** | Culvert is too small to contain water | Upgrade culvert with appropriately sized culvert/NEW to plan |
| G. **East Street** | Undersized culvert plugs up and backs up water into nearby beaver bog which flood homes; road is closed every 4-5 years usually in spring; road has been closed, backyards damaged, and people moved out to safety | Upgrade culvert with appropriately sized culvert; dredge beaver wetland/NOT COMPLETED due to lack of resources |

The City of Claremont 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.

**Table VI-3: 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 flyer in City Offices; Community TV; City e-News |
| 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; building inspection; 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; building codes |
| 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-4 summarizes this evaluation and notes where new programs could be implemented to address all hazards.

**Table VI-4: 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. The committee felt that any actions that could be taken regarding private dam failure were beyond the scope of their jurisdiction. The City assesses their reservoirs on a regular basis. |
| Drought | The Committee determined that the City will follow State recommendations and put out notices to the public to be careful during drought events. |
| Earthquake & Severe Wind | For earthquake and major wind events, the City already has building codes which take these events into account. The Committee did not feel they should adopt more stringent requirements since these events are rare and the available actions to take were outside the capacity and resources of the City. The City does plan to continue its tree trimming by the highway department to reduce damage by severe wind. |
| Erosion | Road maintenance and upgrades; Site Plan Review Regulations address stormwater; Driveway Regulations assure proper culvert size. |
| Extreme Temperatures | Open shelter for extreme weather events. |
| Flood | The city is an NFIP member and has adopted a floodplain ordinance; the highway department will continue to evaluate culverts and bridges for flooding impacts. |
| Thunderstorms, Lightning and Hail | The Committee discussed the hazards, but did not feel a particular area of city is more prone to lightning strikes, and there are no feasible mitigation strategies at this point. The City has completed mitigation strategies for the City buildings to minimize electrical damage. |
| Severe Winter Weather | The City does its best to maintain the roads in the winter to keep them clear of snow and ice. The City already adopted the State's International Building Code, International Residential Code, and Life Safety Code which are enforced by the Building Inspector and Fire Code Inspector. The City provides shelter during prolonged major storms and power outages. |
| Earthquake | The Committee felt the risk of a destructive earthquake was not sufficient enough to warrant expensive mitigation strategies. The building codes provide a standard to meet the risk of earthquakes in city. |

| Hazard | Committee Ideas and Assessment |
|---|---|
| Wildfire | The City requires fire permits to reduce unsafe fire practices. The Committee did not feel there were other strategies they should adopt. Constant outreach to reduce risks. |
| Natural Contaminants | The Committee discussed the different natural contaminants and noted that radon is always a risk living in a region on granite bedrock. They did not feel it appropriate for the city to take action other than educating its residents about the danger and how to test for radon. |
| Hazardous Materials | The Committee felt 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 | While the City is small surrounded by rural communities and terrorism is a low risk, City emergency departments continue to attend training for terrorism response and share that training with the business community. |

Table VI-5 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-5: PROPOSED NEW MITIGATION ACTIONS**

| Proposed New Mitigation Action Description | Hazard Type/Service Area | Responsible Local Agent | If Recommended in Previous Plan, why was it not put into place? |
|---|---|---|---|
| **Drainage Infrastructure Map** – Inventory and locate components of drainage infrastructure | Flooding/Entire city | DPW Director | Not enough staff time to pursue |
| **Sewer & Water Infrastructure** – Evaluate and assess existing infrastructure for condition and priority for repair or replacement | Hazardous Materials/Entire city | DPW Director & Public Health Inspector | Not in previous plan |
| **Public Education Program –** Multi-media program to educate public about emergency shelters, how to prepare for storms, NFIP…. | All Hazards/Entire city | EMD | Not assigned to particular person |

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

The Claremont 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 Claremont 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-6 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-6: PRIORITIZING EXISTING & NEW MITIGATION STRATEGY IMPROVEMENTS**

| Rank | Strategy Improvement | Reduce Damage | Community Objectives | Existing Regulations | Quickly Implemented | Socially Acceptable | Technically Feasible | Administration Possible | Benefit - Cost | TOTAL SCORE | Mitigate Existing or New Development or Both |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | **National Flood Insurance Program** - Continue to provide public awareness; add link for hazard mitigation education to City web site | 1 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 21 | Both |
| 5 | **Emergency Shelter** - Enhance Stevens High school with emergency power; obtain written agreement with Claremont Housing Authority to use Marion Phillips Apartments as a secondary shelter | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 20 | Both |
| 6 | **City Master Plan –** Reference hazard mitigation plan and importance | 1 | 2 | 3 | 1 | 2 | 3 | 3 | 3 | 18 | Both |
| 6 | **Subdivision Regulations** – Add the use of "Best Management Practices" in development | 2 | 3 | 3 | 1 | 2 | 2 | 3 | 2 | 18 | New |
| 6 | **Driveway Regulations –** Add the use of "Best Management Practices" in development | 2 | 3 | 3 | 1 | 2 | 2 | 3 | 2 | 18 | New |
| 6 | **Site Plan Review Regulations –** Add the use of "Best Management Practices" in development | 2 | 3 | 3 | 1 | 2 | 2 | 3 | 2 | 18 | New |
| 7 | **Zoning Ordinance Update –** Include restrictions on steep slopes and wetland buffers; add language for NFIP | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 17 | Both |
| 7 | **Drainage Infrastructure Map** – Inventory and locate components of drainage infrastructure | 2 | 2 | 3 | 1 | 3 | 2 | 2 | 2 | 17 | Both |
| 8 | **Truck Route** – Evaluate options to designate route for trucks to avoid city center | 3 | 3 | 1 | 1 | 2 | 1 | 2 | 2 | 15 | Both |
| 5 | **Sugar River Drive** - Replace culvert with appropriately sized culvert for increase in receiving runoff | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 20 | Both |
| 5 | **Beauregard Village** - Identify options to mitigate damage to or relocate existing sanitary sewer trunk line on Beauregard Street | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 20 | Both |
| 5 | **South of Beauregard Village at Route 12/103 (Main Street) -** Reinforce embankment which is eroding into river | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 20 | Both |
| 8 | **Half Mile Road** - Install appropriately sized culvert to handle water | 2 | 1 | 3 | 3 | 1 | 2 | 2 | 1 | 15 | Both |
| 1 | **Bible Hill Road** - Replace culvert with appropriately sized culvert | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 24 | Both |
| 1 | **Washington Street** – Replace twin culverts with box culvert | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 24 | Both |
| 2 | **Whitewater Brook** – Replace existing culvert w/larger box culvert | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 23 | Both |
| 6 | **Girard Avenue at Lonesdale** – Replace culvert with larger culvert | 1 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 18 | Both |
| 1 | **Cat Hole Road** – Replace culvert with appropriately sized culvert | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 24 | Both |
| 3 | **Ledgewood Road Development** – Enlarge enclosed stone drain system | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 22 | Both |
| 5 | **APC Building (Tyler Brook)** – Consider re-routing brook around building | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 3 | 20 | Both |

| Rank | Strategy Improvement | Reduce Damage | Community Objectives | Existing Regulations | Quickly Implemented | Socially Acceptable | Technically Feasible | Administration Possible | Benefit - Cost | TOTAL SCORE | Mitigate Existing or New Development or Both |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | **Desilets Building (Tyler Brook)** – Consider re-routing brook around building | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 3 | 20 | Both |
| 4 | **Myrtle Street (Tyler Brook)** – Replace culvert with larger culvert | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 21 | Both |
| 4 | **Mulberry Street Crossing (Tyler Brook)** – Replace culvert with larger culvert | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 21 | Both |
| 5 | **RR Crossing S of Prospect Street (Tyler Brook)** – Replace culvert with larger culvert | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 3 | 20 | Both |
| 5 | **Pleasant Street (Tyler Brook)** – Replace culvert with larger culvert | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 3 | 20 | Both |
| 4 | **East Street (Tyler Brook)** – Replace culvert with larger culvert; dredge beaver wetland | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 21 | Both |
| 3 | **Drainage Infrastructure Map –** Inventory and locate components of drainage infrastructure | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 22 | Both |
| 3 | **Sewer & Water Infrastructure** – Evaluate and assess existing infrastructure for condition and priority for repair or replacement | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 22 | Both |
| 1 | **Public Education –** Provide hazard mitigation strategies to the public | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 24 | 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-7 below is a list of the emergency preparedness actions that the Committee felt should be addressed and included in this plan.

**Table VI-7: EMERGENCY PREPAREDNESS ACTIONS**

| Existing Emergency Preparedness Action & Description | 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 |
|---|---|---|---|---|---|
| **Emergency Operations Plan** - Describes the preparation and response necessary for the City to address emergency situations | All Hazards/Entire City | EMD & EM Committee | Average | Needs periodic updating; add hazardous materials section for rail line; coordinate with Valley Regional Hospital/COMPLETED - Updated plan in 2015 including above concerns | None |
| **Emergency Communication** – emergency dispatch serves the City, County, and the Towns of Cornish, Unity and Lempster | All Hazards/Entire city | Police Chief | Average | Update the technology (dispatch consoles and radios) in the communication center (included in CIP)/ INCOMPLETE due to lack of resources | Update the dispatch consoles and radios in the communication center |
| **School Emergency Plan** – Addresses hazards, deficiencies, evacuation, relocation, lockdown | All Hazards/ public schools | School Superintendent | High | Provide emergency power/NOT COMPLETED as cost prohibitive | None<br>(Will update as needed.) |
| **Emergency Shelter** – Provide shelter to the public in the event of an emergency. Have agreement with the Upper Valley Humane Society for pet sheltering and assistance with large animal sheltering. | All Hazards/Entire City | EMD | Average | Provide emergency power/PARTIALLY DONE and shown in existing mitigation actions Table VI-1 | Obtain written agreement with Claremont Housing Authority to use Marion Phillips Apartments as a secondary shelter |

| Existing Emergency Preparedness Action & Description | 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 |
|---|---|---|---|---|---|
| **Haz/Mat Program** – Provides emergency response to hazardous materials spills | HazMat Spills/Entire City | Fire Chief | Average | No recommendations in past plan | None |
| **Mutual Aid – Police -** Agreements for assistance with surrounding towns in Sullivan County per RSAs | All hazards/Entire city | Police Chief | High | No recommendations in past plan | None<br>(will maintain consistency with State requirements) |
| **Mutual Aid – Fire** – Agreements with Southwest Fire Mutual Aid; CT River Valley FMA; and Upper Valley Emergency Services Organization | All hazards/ Entire city | Fire Chief | High | No recommendations in past plan | None |
| **911 Numbering** - City has ordinance to post 911 numbers at building | All Hazards/Entire city | Assessor's Office | Average | Continue encouraging people to post numbers/COMPLETED as most are posted. | Continue encouraging people to post and re-post numbers. |
| **Emergency Equipment & Training** - | All Hazards/Entire city | Fire and Police Chiefs | Average | Additional Fire & Police Departments training needed/COMPLETED as have continuous trainings | None<br>(Maintain certifications) |

# VII. PRIORITIZED IMPLEMENTATION SCHEDULE

The Claremont 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 PROGRAMS**

| Rank | Evaluation Score | Problem Statement | Mitigation Action | Hazard Addressed | Responsible Party | Anticipated Cost | Potential Funding Source | Timeframe |
|---|---|---|---|---|---|---|---|---|
| 1 | 24 | **Public Education** – Outreach to teach public about hazard mitigation strategies | Provide information on the web site, public TV and other appropriate media | All Hazards | EMD | $0 | NA | 1-2 years to provide and then ongoing* |
| 1 | 24 | **Bible Hill Road** – undersized culvert with water & sewer lines inside | Replace existing culvert with larger culvert | Flooding | Department of Public Works | $175,000 | Grants & Taxes | 1-2 years |
| 1 | 24 | **Washington Street** – twin culverts jam with debris and cause flooding in busy area | Replace twin culverts with a box culvert | Flooding | Department of Public Works | $300,000 | Grants & Taxes | 3-4 years |
| 1 | 24 | **Cat Hole Road** – extreme runoff from Foisey Hill impacting several roads | Replace existing culvert with larger culvert | Flooding & Erosion | Department of Public Works | $175,000 | Grants & Taxes | 3-4 years |
| 2 | 23 | **Whitewater Brook** – road to reservoir washed out every spring | Replace existing culvert with larger box culvert | Flooding | Department of Public Works | $435,000 | Grants & Taxes | 2-3 years |
| 3 | 22 | **Ledgewood Road development** – water bubbling up from catch basins and washing road edges | Enlarge enclosed stone drainage system | Flooding & Erosion | Department of Public Works | $600,000 | Grants & Taxes | 3-4 years |
| 3 | 22 | **Drainage Infrastructure Map** | Inventory and locate components of drainage infrastructure | Flooding & Erosion | Department of Public Works | $50,000 | Grants & Taxes | 2-3 years |

| Rank | Evaluation Score | Problem Statement | Mitigation Action | Hazard Addressed | Responsible Party | Anticipated Cost | Potential Funding Source | Timeframe |
|---|---|---|---|---|---|---|---|---|
| 3 | 22 | **Sewer & Water Infrastructure** | Assess problem areas for repair and replacement to prevent flooding and contamination | Flooding; Haz Mat | Department of Public Works | $50,000 | Grants & Taxes | 1-3 years |
| 4 | 21 | **National Flood Insurance Program** – Some people unaware of program and possibility to use if not in flood zone | Continue to provide public awareness; add link for hazard mitigation education to City web site | Flooding | Emergency Management Director | $0 | NA | Ongoing* |
| 4 | 21 | **Myrtle Street (Tyler Brook)** – flooding across street | Replace existing culvert with larger culvert | Flooding & Erosion | Department of Public Works | $202,500 | Grants & Taxes | 3-4 years |
| 4 | 21 | **Mulberry Street Crossing (Tyler Brook)** – flooding across street | Replace existing culvert with larger culvert | Flooding & Erosion | Department of Public Works | $450,900 | Grants & Taxes | 2-3 years |
| 4 | 21 | **East Street (Tyler Brook)** – culvert plugs up and backs up water into nearby beaver bog which floods homes; road closed every few years | Replace existing culvert with larger culvert and dredge bog | Flooding & Erosion | Department of Public Works | $227,400 | Grants & Taxes | 1-2 years |
| 5 | 20 | **Emergency Shelter** – Need additional options | Enhance Stevens High school with emergency power | All Hazards | Emergency Management Director | $225,000 | Taxes and Grants | 4-5 years |
| 5 | 20 | **Beauregard Village** – flooding area where sanitary sewer trunk line runs | Identify options for mitigation or relocate sewer line | Flooding and Ice Jams | Department of Public Works | $45,000 | Grants & Taxes | 3-4 years |
| 5 | 20 | **South of Beauregard Village at Main Street** – road slumping toward Sugar River | Reinforce embankment | Erosion | Department of Public Works | $300,000 | Grants & Taxes | 4-5 years |

| Rank | Evaluation Score | Problem Statement | Mitigation Action | Hazard Addressed | Responsible Party | Anticipated Cost | Potential Funding Source | Timeframe |
|---|---|---|---|---|---|---|---|---|
| 5 | 20 | **APC Building (Tyler Brook)** – brook runs under building damaging structure | Re-route brook around building | Flooding & Erosion | Department of Public Works | $823,500 | Grants & Taxes | 4-5 years |
| 5 | 20 | **Desilets Building (Tyler Brook)** – brook runs under building with choke point; no access for maintenance | Re-route brook around building | Flooding & Erosion | Department of Public Works | $491,000 | Grants & Taxes | 4-5 years |
| 5 | 20 | **RR Crossing south of Prospect Street (Tyler Brook)** – damage to trestle supports from below | Replace existing culvert with larger culvert | Flooding & Erosion | Department of Public Works | $326,700 | Grants & Taxes | 1-2 years |
| 5 | 20 | **Pleasant Street (Tyler Brook)** – flooding across street | Replace existing culvert with larger culvert | Flooding & Erosion | Department of Public Works | $432,000 | Grants & Taxes | 4-5 years |
| 6 | 18 | **City Master Plan** – Lack of reference to hazard mitigation and emergency management | Add reference to Hazard Mitigation Plan and Emergency Operations Plan to Master Plan | All Hazards | Planning & Development Department | $0 | NA | 1-2 years |
| 6 | 18 | **Subdivision Regulations** – Does not entirely address quality of development | Amend Subdivision Regulations to add the use of "Best Management Practices" in development | Erosion and Flooding | Planning Department and Planning Board | $0 | NA | 2-3 years |
| 6 | 18 | **Site Plan Review Regulations** – Does not entirely address quality of development | Amend Site Plan Review Regulations to add the use of "Best Management Practices" in development | Erosion and Flooding | Planning & Development Department and Planning Board | $0 | NA | 2-3 years |
| 6 | 18 | **Sugar River Drive** – flooding at culvert | Replace existing culvert with larger culvert | Flooding and Erosion | Department of Public Works | $45,000 | Grants & Taxes | 3-4 years |
| 6 | 18 | **Girard Avenue at Lonesdale** – floods every spring | Replace existing culvert with larger culvert | Flooding | Department of Public Works | $335,000 | Grants & Taxes | 3-4 years |

| Rank | Evaluation Score | Problem Statement | Mitigation Action | Hazard Addressed | Responsible Party | Anticipated Cost | Potential Funding Source | Timeframe |
|---|---|---|---|---|---|---|---|---|
| 7 | 17 | **Zoning Ordinance** – Does not address steep slopes or wetland buffer development | Amend Zoning Ordinance to include restrictions on steep slopes and wetland buffers | Erosion and Flooding | Planning & Development Department and Planning Board | $0 | NA | 2-3 years |
| 8 | 15 | **HazMat Truck Route** – Trucks currently going through City center | Continue to evaluate options with State DOT for rerouting | Hazardous Materials Spills | City Council | $0 | Taxes and Grants | 4-5 years |
| 8 | 15 | **Half Mile Road** – compromising RR trestle supports | Replace existing culvert with larger culvert | Flooding & Erosion | Department of Public Works | $57,000 | Grants & Taxes | 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 Claremont will revisit the Hazard Mitigation Plan *annually, or after a hazard event*. The Claremont 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

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 Claremont has provided a link to the Regional Planning Commission's web page, "A Citizen's Guide to Hazard Mitigation and Emergency Management" as well as other more city-specific information.

Municipalities have documents to convey city 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 or Driveway 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, major road improvements, 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.

## 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 (to be published at their discretion) will be distributed and information will be posted on the city website as well as the city office, library, and post office.

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

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

# RESOURCES USED IN THE PREPARATION OF THIS PLAN

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 Claremont Emergency Operations Plan*, 2015

*City of Claremont Master Plan*, 2011

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

www.fema.gov/disasters: Website for FEMA's Disaster List

http://www.ncdc.noaa.gov/: Website for National Oceanic & Atmospheric Administration Disaster List

www.tornadoproject.com: Website for The Tornado Project

http://www.erdc.usace.army.mil/Locations/CRREL.aspx: Website for Cold Regions Research and Engineering Laboratory Website

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

http://earthquake.usgs.gov/earthquakes/states/new_hampshire/history.php: Website for area earthquake information

# APPENDICES

**Appendix A:** **Technical Resources**

**Appendix B:** **Hazard Mitigation Assistance Grants**

**Appendix C:** **Meeting Documentation**

**Appendix D:** **Maps of Hazard Areas and Critical Facilities**

**Appendix E:** **Fluvial Erosion Study**

**Appendix F:** **City Adoption & FEMA Approvals of Hazard Mitigation Plan**

# 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.

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.

Potential eligible projects are shown in the following table by grant program. For further information on these programs visit the following FEMA websites:

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

# APPENDIX D:

## Maps of Hazard Areas and Critical Facilities

June 13, 2016

# Claremont Hazard Mitigation Plan

| | |
|---|---|
| Rick Bergeron | Fire Chief |
| Tim Hernon | Supt of Parks |
| Scott Sweet | Dir. of Public Works |
| Dorée Russell | City Manager's Office |
| Alexander Scott | Police Chief |
| Jane Taylor | City Solicitor |
| Shawna-Leigh Morton | Field Rep - HSEM |
| Nancy Merrill | Planning + Development |
| Mary Waite | Finance Director |
| Guy Santagate | City Manager |

**PLEASE SIGN IN –City of Claremont Hazardous Mitigation Plan Update Meeting – July 25, 2016**

| | Name (please print clearly) | Title | Mailing Address | Telephone | E-mail |
|---|---|---|---|---|---|
| 1 | Randy Williams | Ops Manager | | | rwilliams@preferredbuildings.com |
| 2 | Bryant Huot | Vice President | | | bhuot@preferredbuildings.com |
| 3 | Sean Glasscock | Building Inspector | | | SGlasscock@claremontnh.com |
| 4 | Erin Gallagher | Safety Coord. | | | erin.gallagher@canamgroupinc.com |
| 5 | Cody Fitzgerald | Safety Intern | | | cody.fitz@canamgroupinc.com |
| 6 | Mary Walker | Finance Director | | | mwalker@claremont.nh.com |
| 7 | Dorée Russell | Exec. Asst. City | | | drussell@claremontnh.com |
| 8 | VICTOR ST. PIERRE | ASS. PWD | | | VSTPIERRE@CLAREMONTNH.COM |
| 9 | Mark Brislin | Rec Dir | | | Mbrislin@claremontnh.com |
| 10 | SCOTT SWEET | DPW DIRECTOR | | | SSWEET@CLAREMONTNH.COM |
| 11 | Alex Scott | Police Chief | | | ascott@claremontnh.com |
| 12 | NORMA LIMOGES | DPW | | | NLIMOGES@CLAREMONTNH.COM |
| 13 | Nancy Merrill | P+D | | | nmerrill@claremontnh.com |
| 14 | RICK BERGERON | FIRE CHIEF | | | firechief@claremontnh.com |

## Vickie Davis

**From:** Vickie Davis
**Sent:** Wednesday, June 08, 2016 3:05 PM
**To:** Mary Curtis (townbos@comcast.net); Town of Croydon (croydon@myfairpoint.net); Shane O'Keefe (sokeefe@newportnh.net); Tracy Decker (tydunityplanningboard@gmail.com); dedkins@charlestown-nh.gov
**Cc:** Rick Bergeron (firechief@claremontnh.com)
**Subject:** Claremont Hazard Mitigation Plan Update Meeting

Greetings,

The City of Claremont will begin the update process of their 2011 hazard mitigation plan on Monday, June 13, 2016 at 11:00 am at the city offices.

Interested officials from neighboring towns are invited to attend. Natural hazards know no boundaries, so if there is an issue you would like to share, this is the time.

If you are unable to attend, feel free to send me a message to be shared at the meeting. I would also be glad to forward the draft plan to you.

Thank you.

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

Please consider the environment before printing this e-mail.

**Public Meeting Notice**

**For Work Session on Claremont Hazard Mitigation Plan Update**

When: Monday, June 13, 2016 from 11:00 am – 1:00 pm

Where: Claremont City Offices

Why: Update plan for hazard mitigation from natural hazards (flooding, hurricane…) and human-made hazards (hazardous waste spills…). This is a five-year plan that is required by the State of NH to obtain hazard mitigation grants.

CLAREMONT



LOCAL RESOURCES

News
Events
Photos and Videos

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# EVENTS

| < | June 2016 | | | | | > |
|---|---|---|---|---|---|---|
| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
| 29 | 30 | 31 | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |

June 13 2016

All Events

Search All Events

## UPCOMING EVENTS

**Jun 13** **HAZARD MITIGATION PLAN UPDATE**
11:00AM - Hazard Mitigation Plan Update - Council Chambers
DETAILS

**Jun 13** **CLAREMONT PLANNING BOARD**
7:00PM - June 13th meeting
DETAILS

**Jun 13** **PARKS AND RECREATION COMMISSION**
6:00PM - June 13th meeting
DETAILS

**Jun 14** **TRANSFER STATION AD HOC COMMITTEE MEETING - COUNCIL CHAMBERS**
5:00PM - Transfer Station Ad Hoc Committee Meeting - Council Chambers
DETAILS

# APPENDIX E:

# Fluvial Erosion Study

# City of Claremont, NH

# Fluvial Erosion Hazard Data

# Addendum to Hazard Mitigation Plan – September 2015

*Introduction*

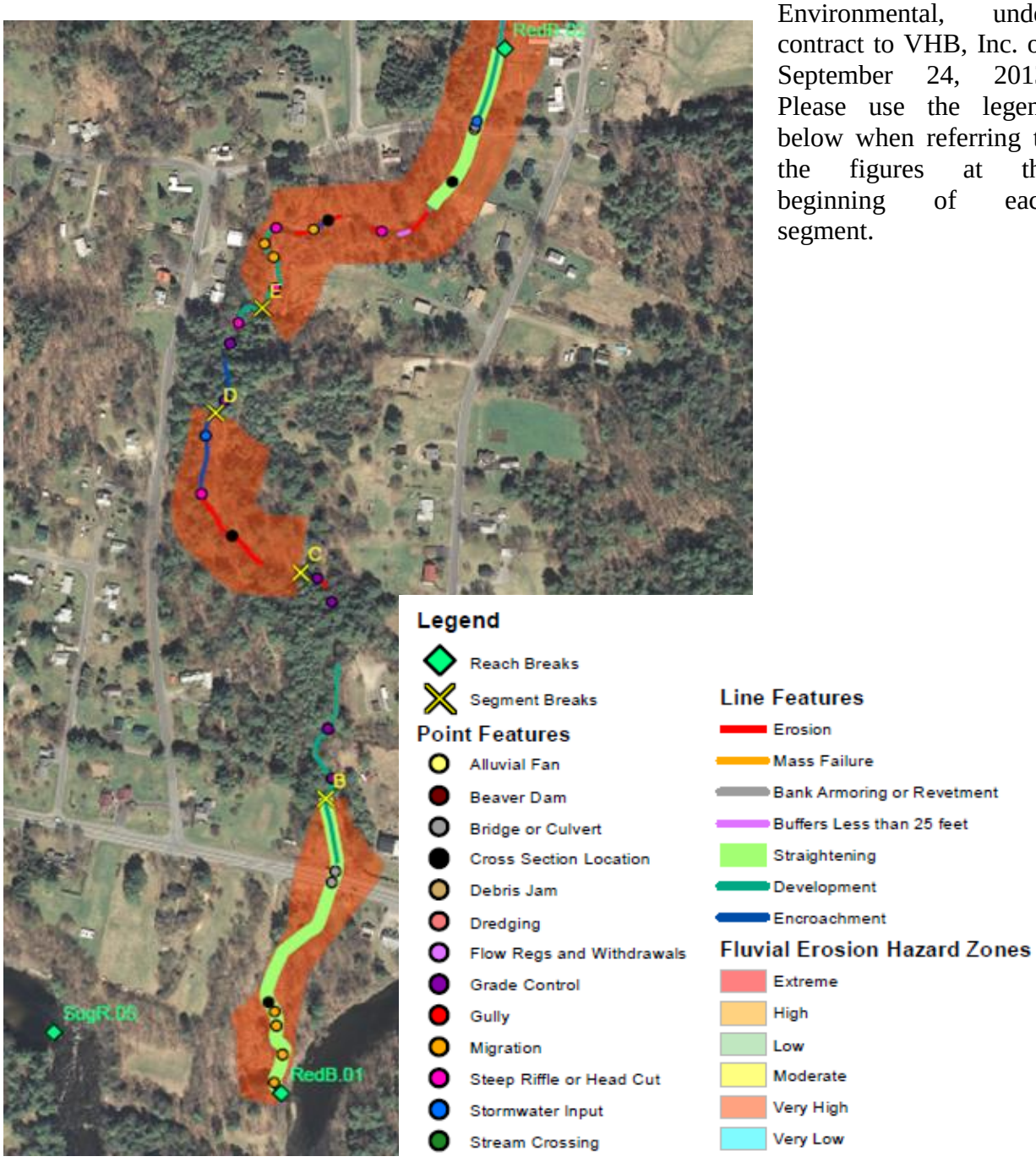
During the summer of 2013 the NH Department of Environmental Services hired a contractor to assess the conditions and attributes of many reaches of river and stream throughout the Sugar River Watershed. The results of that data provided the towns with information regarding vulnerabilities to erosion, or Fluvial Erosion Hazard (FEH) Sensitivity Rating, and the conditions that contribute to the rating. In Claremont there were three reaches in the Sugar River Watershed that were assessed. The Sugar River itself was assessed in the area adjacent to Sugar River Drive. Additionally, Grandy Brook was assessed from where it meets the Sugar River to approximately 1.6 miles north, Redwater Brook was assessed from the Sugar River north to the Cornish town line. The reaches on Redwater Brook were not continuous for the entire distance, they maps attached depict the specific study area.

*Results*

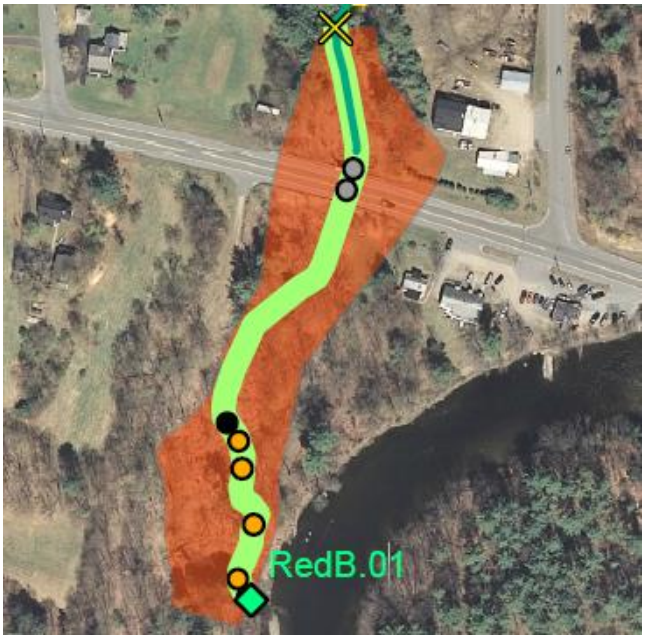
The following summaries of the results for Redwater Brook and Grandy Brook were prepared by the New Hampshire Department of Environmental Services.

**Summary of Geomorphological Information**
**Redwater Brook, Claremont**
**Reach 1; Segments A, B, C, D, E**
**March, 2015**

This document provides a narrative summary of the river geomorphology data that was collected on Redwater Brook, identified Reach 1, segments A through E, within the Town of Claremont, New Hampshire. Reach 1 of Redwater Brook extends for a length of 3,931 feet from the confluence with Sugar River (approximately 600 ft. south of Central Rd) to approximately 250 north of Thrasher Rd. This reach is broken down into 5 sub-segments. Segments A through E shown here. Redwater Brook, Reach 1 was surveyed by personnel from Bear Creek Environmental, under contract to VHB, Inc. on September 24, 2013. Please use the legend below when referring to the figures at the beginning of each segment.



**Segment A:** 923 feet




*Valley and River Corridor*
The average measured width of the valley that contains Redwater Brook though this reach is 242 ft. As can be seen in picture to the right, the channel has been historically straightened and is attempting to regain sinuosity. This section of the river has good access to the floodplain, therefore incision is not a concern. Development, extending 181 feet is encroaching upon the east bank of the river. The west bank is free of developmental impacts. Corridor slopes on the east side of the channel were flat with grades ranging from 0-3%. The west bank was steeper with slopes ranging from 9-15%.

*Stream Channel*
Based on a cross-section collected at a location that is representative of the reach overall, the channel width is 48 feet, with a maximum bankfull depth is 3.2 feet. The mean bankfull depth is 1.91 feet. The floodprone width, which is the width of the active floodplain at the floodplain elevation, is 177 feet. The floodprone width includes the active stream channel, and the floodplain on either side of the channel. This segment contains only two riffles (an area of shallow stream, over which the water flows swiftly with a wavy surface; viewed as an important component with pools for supporting good habitat), that are spaced an average of 171 feet apart.

With the representative cross-section information, this reach types out as a C4 stream in the Rosgen Stream Classification system (Rosgen, 1996). Typically, C4 streams have gravel beds (this reach has a bed dominated by gravel, based on the pebble count) with riffles, and that meanders through a mature floodplain. Streambanks in this segment are typically composed of non-cohesive material (boulder-cobble, sand). Consequently, these streams are often susceptible to increased bank erosion, which is present in some areas of the reach, as discussed in the next section.

*Riparian banks, Buffers and Corridors*
Bank slopes in Segment A are typically steep, and the channel canopy is open, meaning that the stream is not extensively shaded by trees adjoining the channel. Streambanks are comprised of a non-cohesive and unconsolidated sand mixture on both sides of the channel. On the east bank, the total length of bank erosion observed is 290 feet with average heights of 2 feet. The west bank has 300 feet of erosion, which are 3 feet in height. Streambanks are armored, with total lengths of 255 feet on the east, and 273 feet on the west.

Buffer widths are more than 100 feet on both sides of the channel and consist mostly of deciduous forest cover with some invasive Japanese knotweed. The riparian corridor is dominated by forest and secondarily by residential development.

*Flow Modifiers*

There are minimal flow modifiers in Segment A, meaning there are no stormwater inputs, beaver dams, flow regulations, or debris jams. There are a minimal amount of springs, seeps and tributaries that affect flow.

*Channel Bed and Planform Changes*

There are 4 flood chutes within Segment A. Flood chutes are side channels that cross the inside of a meander bend where flood waters will bypass the main channel, taking a shorter route through the chute. The presence of multiple sediment bars increases this segment's sensitivity scores. The following are the number of bars (depositional features) recorded in the reach:

| Bar Type | Number Present |
|---|---|
| **Mid-channel** | 1 |
| **Point** | 0 |
| **Side** | 6 |
| **Diagonal** | 2 |
| **Delta** | 0 |
| **Island** | 0 |

A total of 921 feet, or 99%, of the Segment A is identified as having been straightened in the past. The figure below shows an example of the historic straightening that has occurred in Segment A of Reach 1.

*Stream Crossing*
There is a 53 foot concrete bridge with abutments crossing the reach at Central Rd. At the time of assessment, there was no upstream bank erosion and the upstream bank armoring was intact. There is "low" bank erosion on the downstream side of the bridge. Field notes indicate that the downstream armoring is failing. There is evidence of aggradation (sediment accumulation) both upstream and downstream of the bridge. Sediment accumulations are occurring in the mid-channel on the upstream side of the bridge and on the side of the channel, downstream of Central Rd.

*Stream Channel Condition*
Segment A was given a score based on the data collected on the current channel condition. The condition of segment was considered to be Fair (the second lowest of a four condition scale). This was mostly due to the major channel widening that is evident with bank erosion on both sides and the 4 flood chutes. Field notes also indicate that major planform adjustment (meandering) is occurring which is likely a result of the historic straightening of this segment. The Central Rd. bridge is causing sediment to accumulate upstream and downstream of the abutments, which is probably accelerating the widening and planform changes. The condition score combined with the stream type translated into a sensitivity score of the reach. The score results placed this segment into the Very High sensitivity category (the second most sensitive of six categories of stream sensitivity).

**Segment B:** 731 feet

*Valley and River Corridor*
The average measured width of the valley that contains Redwater Brook though this reach is 68 feet and is narrowly confined. The corridor slopes are considered to be very steep (16-25%). Development, extending 417 feet is encroaching upon the east bank of the river. The west bank is free of developmental impacts.

*Stream Channel*
This segment of the reach has a low sinuosity value of 1.04, meaning that there are few bends. Field notes indicate that there is bedrock along the banks and cobble covering the in-channel bedrock, creating stable channel conditions.

*Riparian banks, Buffers and Corridors*
Bank slopes in the reach are typically steep, and the channel canopy is closed, meaning that the stream is shaded by trees adjoining the channel. Bedrock forms the base of the streambanks. Some non-cohesive sandy, unconsolidated material is found on top of the bedrock in the upper section of this segment. Total lengths of bank erosion observed are 148 feet on the east bank, and 21 feet on the west bank, with average heights of bank erosion of 5 feet on the both sides of the channel. There is no bank revetment on either bank of this segment.

On the east bank, buffer widths are more than 100 feet, consisting mostly of the coniferous tree species. The invasive, Japanese knotweed is also present. The riparian corridor on the east bank is dominated by residential land use and secondarily by forest. On the west bank is dominated by forest. Coniferous vegetation is dominant near the bank. Mixed trees, shrubs and sapling make up the 100 foot buffer.

*Flow Modifiers*

There are minimal flow modifiers in Segment B, meaning there are no stormwater inputs, beaver dams, flow regulations, or debris jams. There are a minimal amount of springs, seeps and tributaries at affect flow.

*Channel Bed and Planform Changes*

Field notes indicate bed form type is step-pool. There are no signs of channel alternations or migrations in Segment B. Sediments are not accumulating on the channel bed or being scoured from the bed to alter streambed elevations.

*The picture above shows and example of a step-pool in Segment B of Reach 1.*

The following are the number of bars (depositional features) recorded in the reach:

| Bar Type | Number Present |
|---|---|
| **Mid-channel** | 0 |
| **Point** | 0 |
| **Side** | 2 |
| **Diagonal** | 0 |
| **Delta** | 0 |
| **Island** | 0 |

*Stream Channel Condition*
Data from Segment B suggest that this section of the river is stable. However, 168 feet of the total length of the segment (731 feet), are showing signs of erosion. Development is present but it appears as though there are no human-caused disturbances in the channel or adjacent land. The segment was not assigned a sensitivity score because of its stable nature, as the reach is dominated by bedrock and is not likely to adjust laterally or vertically on time scales of concern to us.

**Segment C:** 654 feet

*Valley and River Corridor*
The average measured width of the valley that contains Redwater Brook though this reach is 294 feet and is broadly confined. Approximately 255 feet of Clay Hill Rd parallels the west bank of this segment. The corridor slope is mild and considered hilly with grades of 4-8 percent.

*Stream Channel*
Based on a cross-section collected at a location that is representative of the segment overall, the channel width is 44 feet, with a maximum bankfull depth is 3.05 feet. The mean bankfull depth (from each point on the cross-section) is 2.23 feet. The floodprone width, which is the width of the active floodplain at the floodplain elevation, is 113 feet. The reach contains does not contain riffles or steps.

With the representative cross-section information, this reach types out as a C4 stream in the Rosgen Stream Classification system. Typically, C4 streams have gravel beds (this reach has a bed dominated by gravel, based on the pebble count) with riffles, and that meanders through a mature floodplain. Streambanks are typically composed of unconsolidated and non-cohesive material that is finer than the bed material, which accurately characterizes the banks in this reach. Consequently, these streams are often susceptible to increased bank erosion, which is present in 70% of the segment.

*Riparian banks, Buffers and Corridors*
Bank slopes in the reach are typically steep, and the channel canopy is closed, meaning that the stream is extensively shaded by trees adjoining the channel. Streambanks are comprised of unconsolidated materials including boulder, cobbles, coarse gravel and sand on both sides of the channel. On the east bank the total length of bank erosion observed is 107 feet, with average heights of 2 feet. Erosion on the west bank is 453 feet in length with an average of 4 feet in height. There is no bank revetment in this segment.

Buffer widths on both sides of the channel are more than 100 feet, consisting mostly of the deciduous vegetation types, including the invasive, Japanese knotweed. The riparian corridor is dominated by forest on both sides of the channel.

*Flow Modifiers*
There are no beaver dams, flow regulations, or debris jams impacting flow in this segment. One road ditch (approximately 1300 feet north of the Central Rd and Clay Hill Rd junction) is contributing stormwater flow to the reach.

*Channel Bed and Planform Changes*
This segment of the reach falls into the category of a "plane" bedform, meaning that it has no distinct sequence of bed features. The following are the number of bars (depositional features) recorded in the reach:

| Bar Type | Number Present |
|---|---|
| **Mid-channel** | 0 |
| **Point** | 0 |
| **Side** | 2 |
| **Diagonal** | 2 |
| **Delta** | 0 |
| **Island** | 0 |

There has been no historic straightening or channel alterations within this segment of Reach 1.

*Stream Channel Condition*
Segment C was given a score based on the data collected on the current channel condition. The condition of segment was considered to be Fair, (the second lowest of a four condition scale). Factors that contributed to the Fair conditions of this reach included the bank erosion present throughout the segment. Bear Creek Environmental staff noted in their comments that "major to extreme" channel widening was occurring due to the bank erosion. Field notes also indicate that the streambed is also beginning to erode, causing a deepening of the channel. This score was combined with the stream type, to translate a sensitivity score of the reach. The score results placed this segment into the Very High sensitivity category (the second most sensitive of six categories of stream sensitivity).

*The picture to the left shows an example of the erosion and stream widening that is occurring at Segment C of Reach 1.*

**Segment D:** 367 feet

*Valley and River Corridor*

The average measured width of the valley that contains Redwater Brook though this reach is 119 feet and is broadly confined. Approximately 157 feet of Clay Hill Rd and 101 feet of development are encroaching upon the west bank of this segment. The east bank is free of encroachment. The corridor slope is very steep with grades of 16-25 percent.

*Stream Channel*

This segment of the reach has a sinuosity value of 1.13, meaning that there are few bends. Bedrock dominates the bed and banks in this segment, creating stable channel conditions.

*Riparian banks, Buffers and Corridors*

Bank slopes in the reach are typically steep, and the channel canopy is open, meaning that the stream is not extensively shaded by trees adjoining the channel. Streambanks are comprised of a non-cohesive and unconsolidated sand mixture on both sides of the channel. There is no evidence of erosion or bank revetment on either side of the channel.

Buffer widths are more than 100 feet on both sides of the channel. Vegetation is predominantly coniferous with some shrubs and saplings. The riparian corridor is dominated by forest on both sides of the channel.

*Flow Modifiers*
There are minimal flow modifiers in Segment A, meaning there are no stormwater inputs, beaver dams, flow regulations, or debris jams. There are a minimal amount of springs, seeps and tributaries that affect flow.

*Channel Bed and Planform Changes*
Field notes indicate that this segment of the river is a step-pool bedform. The following are the number of bars (depositional features) recorded in the reach:

| Bar Type | Number Present |
|---|---|
| **Mid-channel** | 0 |
| **Point** | 1 |
| **Side** | 0 |
| **Diagonal** | 1 |
| **Delta** | 0 |
| **Island** | 0 |

There has been no historic straightening or channel alterations within this segment of Reach 1. Given that the brook through this segment flows through a bedrock gorge, indicating channel integrity on time scales of concern, no cross-sections were collected.

*Stream Channel Condition*
This segment of the stream was not assigned a sensitivity score, given that it flows through a bedrock gorge, with no mapped bank erosion and no flow modifiers.

**Segment E:** 1256 feet

*Valley and River Corridor*
The average measured width of the valley that contains Redwater Brook though this reach is 592 feet, which is considered to be very broad and has good floodplain access. As can be seen in the figure to the right, about 39% of the segment length (490 feet) has been historically straightened. Corridor encroachments on the east bank include a berm, extending 63 feet in length and 7 feet in height as well as development, which extends 479 feet in length adjacent to the brook. The east side of the bank is flat with 0-3%

grades. The west bank also has development adjacent to the brook, extending 243 feet in length and is slightly steeper than the east bank with 4-8% grades.

*Stream Channel*
Based on a cross-section collected at a location that is representative of the segment overall, the channel is 78 feet, with a maximum bankfull depth is 2.8 feet. The mean bankfull depth (from each point on the cross-section) is 1.06 feet. The floodprone width, which is the width of the active floodplain at the floodplain elevation, is 175 feet. The reach contains riffles, that are spaced an average of 90 feet apart.

With the representative cross-section information, this reach types out as a C4 stream. Typically, C4 streams have gravel beds (this reach has a bed dominated by gravel, based on the pebble count) with riffles, and that meanders through a mature floodplain. Streambanks in this segment are typically composed of non-cohesive material (boulder, cobble, sand). Consequently, these streams are often susceptible to increased bank erosion, which is present in the reach, as discussed in the next section.

*Riparian banks, Buffers and Corridors*
Bank slopes in the reach are typically steep, and the channel canopy is open, meaning that the stream is not extensively shaded by trees adjoining the channel. Streambanks are comprised of a non-cohesive and unconsolidated sand mixture on both sides of the channel. Total length of bank erosion observed on the east bank is 408 feet with average heights of 3.5 feet. Erosion on the west bank is 125 feet in length and 3 feet in height. Streambank revetment has been installed on both the east bank (286 feet in length) and west banks (82 feet in length).

The buffer to the east of the stream is less than 25 feet and is a "residential" riparian corridor with some herbaceous vegetation, with deciduous vegetation present, though less dominant. Near bank vegetation is predominately comprised of invasive species on both sides of the channel. The west bank has a buffer greater than 100 feet in width, with deciduous forest dominating, though some residences are present within the corridor.

*Flow Modifiers*
There is 1 overland flow stormwater input in this segment. Springs, seeps and/or tributaries are abundant. There are no flow regulation impacts, debris jams or beaver dams.

*Channel Bed and Planform Changes*
This segment of Reach 1 falls into the "riffle-pool" bedform category. The following are the number of bars (depositional features) recorded in the reach:

| Bar Type | Number Present |
|---|---|
| **Mid-channel** | 1 |
| **Point** | 3 |
| **Side** | 5 |
| **Diagonal** | 0 |
| **Delta** | 0 |

| | |
|---|---|
| **Island** | 0 |

The presence of multiple sediment bars increases this segment's sensitivity scores. A total of 488 feet, or 39%, of this segment is identified as having been straightened in the past. There are a total of 3 flood chutes and 3 steep riffles present in this segment, which also increase the reach's sensitivity.

*Stream Crossing*

There is a 20 foot concrete bridge with abutments crossing the reach at Thrasher Rd. At the time of assessment, there was no upstream or downstream bank erosion and the armoring on both sides of the bridge was intact. There is no evidence of sediment accumulation on either side the bridge.

*Stream Channel Condition*

Segment E was given a score based on the data collected on the current channel condition. The condition of segment was considered to be Fair, (the second lowest of a four condition scale). Factors that contributed to the condition rating for the segment included the presence of channel straightening, erosion and flood chutes. This segment has multiple deposition features (sediment accumulation), with multiple diagonal bars and steep riffles present. Additionally, the segment is undergoing adjustment (as evidenced by the presence of the flood chutes and bars) as the river tries to regain sinuosity (meanders) in response to its historic straightening. The condition score was combined with the stream type, and translated into a sensitivity score of the reach. The score results placed this segment into the Very High sensitivity category (the second most sensitive of six categories of stream sensitivity).

**Summary of Geomorphological Information**
**Grandy Brook, Claremont**
**Reach 1; Segments A, B, C**
**March, 2015**

This document provides a narrative summary of the river geomorphology data that was collected on Grandy Brook, identified Reach 1, segments A through C, within the Town of Claremont, New Hampshire. Reach 1 of Grandy Brook extends for a length of 2703 feet from the confluence with the Sugar River (approximately 375 ft. south of Washington St/Route 103) to approximately 150 feet north of Veteran's Park Rd. This reach is divided into 3 segments, A through C shown here. Grandy Brook, Reach 1 was surveyed by personnel from Bear Creek Environmental, under contract to VHB, Inc. on September 10 and 14, 2013. For more detailed descriptions of the fluvial geomorphic terms, please see the attached document: Descriptions of Fluvial Geomorphology Data.

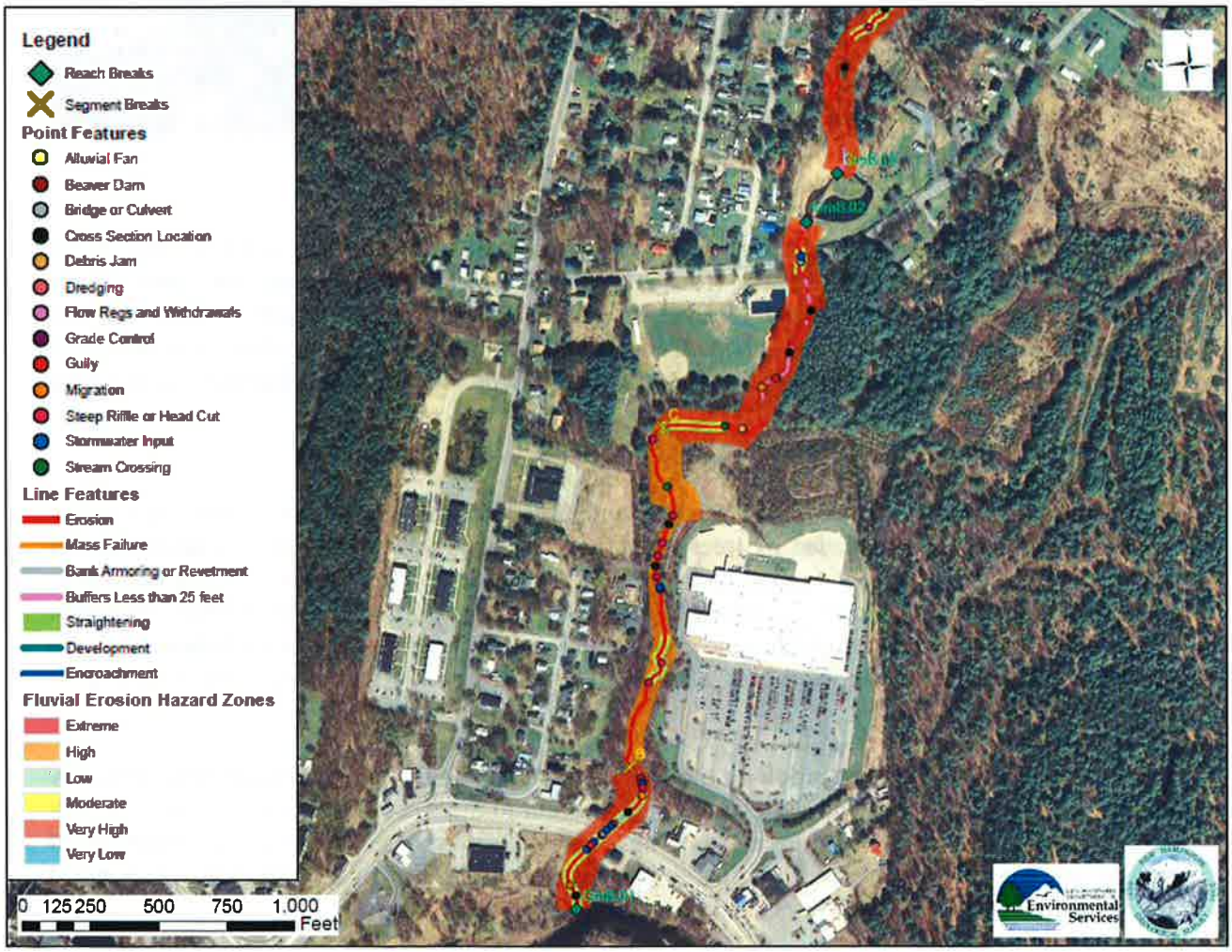
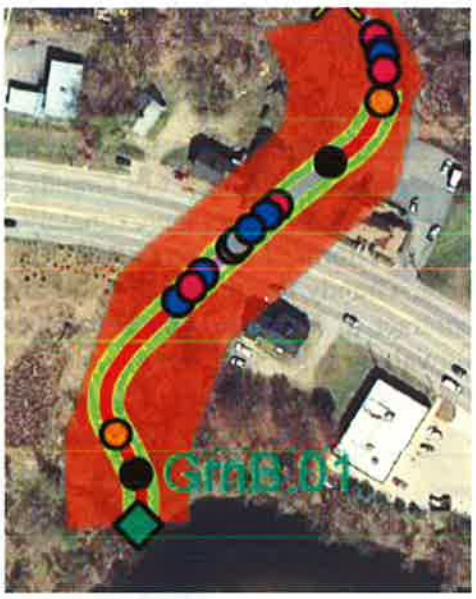


Figure 1 Reach 1 of Grandy Brook, including segments A, B and C, Claremont, NH.

**Segment A:** 671 feet

*Valley and River Corridor*

The average measured width of the valley that contains Grandy Brook though this reach is 448 feet and is considered to be very broad. As can be seen in the figure to the right, the channel has been historically straightened and is attempting to regain sinuosity. Development, extending 95 feet, is encroaching upon the east bank of the river. Development on the west bank extends for 162 feet in this segment. Land adjacent to the channel is hilly with slopes ranging from 4-8%.




*Stream Channel*

Based on a cross-section collected at a location that is representative of the reach overall, the channel width is 21 feet, with a maximum bankfull depth of 3.05 feet. The mean bankfull depth is 2.28 feet. The floodprone width, which is the width of the active floodplain is 160 feet. This segment contains four steep riffles, that are spaced an average of 100 feet apart.

With the representative cross-section information, this reach types out as a C4 stream in the Rosgen Stream Classification system (Rosgen, 1996). Typically, C4 streams have gravel beds (this reach has a bed dominated by gravel, based on the pebble count) with riffles, and that meanders through a mature floodplain. Consequently, these streams are often susceptible to increased bank erosion, which is present in some areas of the reach, as discussed in the next section.

*Riparian banks, Buffers and Corridors*

Bank slopes in Segment A are typically steep, and the channel canopy is open, meaning that the stream is not extensively shaded by trees adjoining the channel. Streambanks are comprised of non-cohesive materials, such as sand and gravel on both sides of the channel. On the east bank, the total length of bank erosion observed is 374 feet with average heights of 3.5 feet. The west bank has 313 feet of erosion, with an average of 2.5 feet in height. Field notes indicate that rip rap and hard-bank armoring have been installed, which extend 391 feet on the east bank and 95 feet on the west bank.

Buffer widths adjacent to the brook on the east bank are generally 26-50 feet and predominantly consist of shrubs, saplings and invasives. Land adjacent to the west bank has more than 100 feet of buffer, also consisting of shrubs and saplings. The vegetation near both banks is comprised of shrubs, saplings and invasives. The riparian corridor on both sides of the channel is dominated by residential development.

*Flow Modifiers*
There are several flow modifiers in Segment A. There is one road ditch and four urban stormwater inputs. At the time of the assessment, there was one debris jam. There are a minimal amount of springs, seeps, and tributaries and wetlands that affect flow. There is a dam upstream, in Reach 2.

*Channel Bed and Planform Changes*
There are two flood chutes within Segment A. The presence of multiple sediment bars increases this segment's sensitivity scores. The following are the number of bars (depositional features) recorded in the reach:

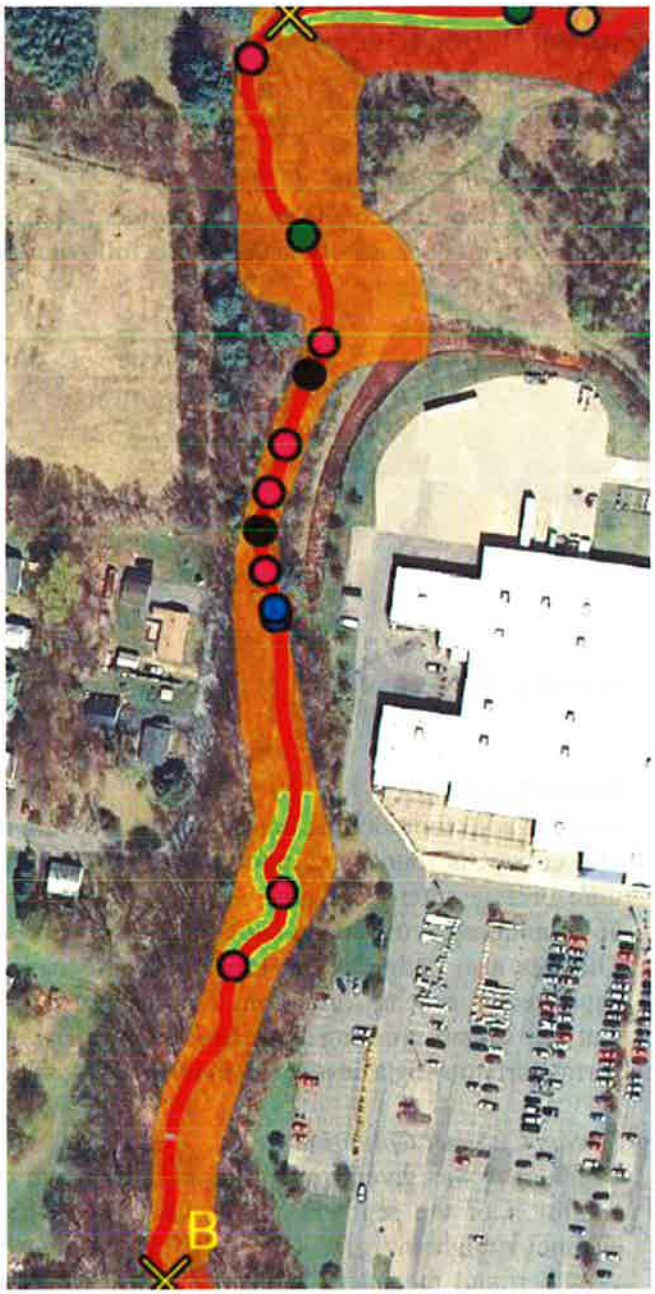
| Bar Type | Number Present |
|---|---|
| **Mid-channel** | 3 |
| **Point** | 0 |
| **Side** | 4 |
| **Diagonal** | 1 |
| **Delta** | 1 |
| **Island** | 0 |

A total of 557 feet, or 83%, of Segment A is identified as having been straightened in the past.

*Stream Crossing*
There is a 90 foot, double barrel culvert crossing under Washington St, next to Coldwell Banker. The culvert is round and made out of concrete headwalls with corrugated steel barrels. At the time of assessment, the upstream and downstream bank armoring was intact. There is "High" upstream bank erosion and evidence of aggradation (sediment accumulation) in the mid-channel. There is also "High" bank erosion downstream of the culvert, in which sediments are being deposited in a delta formation. This culvert is considered to be "fully incompatible," meaning that the stream crossing is at an increased risk of being unable to adequately pass river flow, particularly during a severe storm event. Redesign and replacement are recommended.

*Stream Channel Condition*
Segment A was given a score based on the data collected on the current channel condition. The condition of the segment was considered to be Fair. This was mostly due to the extensive channel straightening which caused historic deepening of the channel. The channel is beginning to widen and meander. There is significant deposition present where the valley has widened. There is also significant deposition at the Washington St. culvert, which is identified to be fully incompatible. There is high bank erosion throughout the segment, as evidenced by the island and the steep riffles. The condition score was combined with the stream type (C4), and translated into a sensitivity score of the reach. The score results placed this segment into the Very High sensitivity category (the second most sensitive of six categories of stream sensitivity).

**Segment B:** 1375 feet




*Valley and River Corridor*
The average measured width of the valley that contains Grandy Brook though this reach is 80 feet and is considered to be semi-confined. As can be seen in the figure to the right, a subset of the reach has been historically straightened and is attempting to regain sinuosity. Development, extending 712 feet, is encroaching upon the east bank of the river. Walmart's perimeter road is also encroaching upon the east bank, extending 199 feet. Development adjacent to the west bank extends for 149 feet in this segment. Land adjacent to the river is very steep with grades ranging from 16-25% on the both sides of the channel. There is exposed glacial till on the bed and valley walls.

*Stream Channel*
Based on a cross-section collected at a location that is representative of the reach overall, the channel width is 16 feet, with a maximum bankfull depth is 2.9 feet. The mean bankfull depth is 1.95 feet. The floodprone width is 23 feet. The riffles and steps in this segment are eroded and are generally spaced an average of 150 feet apart.

With the representative cross-section information, this reach types out as a B4 stream in the Rosgen Stream Classification system (Rosgen, 1996). B4 streams have gravel beds (this reach has a bed dominated by gravel, based on the pebble count) with step-pool and/or plane-bed and/or pool-riffle bedforms. Typically, A B4 stream is not susceptible to erosion but this segment is an exception because of historic activity in and near the channel, potentially combined with the presence of the dam upstream, at the start of Reach 2.

*Riparian banks, Buffers and Corridors*

Bank slopes in Segment B are typically steep, and the channel canopy is open. The east streambank is comprised of silt and clay, overlain by sand. The west bank is entirely comprised of silt. On the east bank, the total length of bank erosion is 1133 feet with an average height of 4.5 feet. The west bank has a total of 985 feet of erosion, with an average height of 3.5 feet. There are also multiple mass failures which indicate that the channel is widening. Additional riprap extends 229 feet on the east bank, with none on the west bank.

Figure 2 This picture shows an example of a mass failure in Segment B of Reach 1 of Grandy Brook in Claremont NH.

Buffer widths on both banks are generally 26-50 feet and predominantly consist of invasives and other herbaceous vegetation cover. The vegetation near the bank is comprised of invasives, with some shrubs and saplings. In some areas, there is no vegetation. The east riparian corridor is dominated by commercial and industrial development. The west riparian corridor is dominated by residential development.

*Flow Modifiers*

There is one urban stormwater input within this segment. There are a minimal amount of springs, seeps, and tributaries, with no adjacent wetlands or beaver dams. There is a dam upstream, in Reach 2.

*Channel Bed and Planform Changes*
Field notes indicate that this segment of the reach has a "plane" bedform, meaning that it has no distinct sequence of bed feature. There are no flood chutes within Segment B. The presence of multiple sediment bars increases this segment's sensitivity scores. The following are the number of bars (depositional features) recorded in the reach:

| Bar Type | Number Present |
|---|---|
| **Mid-channel** | 3 |
| **Point** | 1 |
| **Side** | 12 |
| **Diagonal** | 3 |
| **Delta** | 0 |
| **Island** | 1 |

In addition to the many depositional features, there are also three steep riffles and four head cuts in this segment of the reach. A total of 204 feet, or 15%, of the segment is identified as having been straightened in the past.

*Stream Channel Condition*
Segment B was given a score based on the data collected on the current channel condition. The condition of the segment was considered to be Fair, (the second lowest of a four condition scale). Other factors that contributed to the condition rating for the segment included the presence of channel straightening and road encroachment. This segment has multiple deposition features (sediment accumulation), with multiple diagonal and side bars and steep riffles present. The sensitivity score of the reach was calculated as Very High but field notes indicate that the sensitivity could be increased to Extreme due to the extensive erosion, mass failures, and active head cuts.

**Segment C:** 1253 feet

*Valley and River Corridor*
The average measured width of the valley that contains Grandy Brook though this reach is 795 feet and is considered to be very broad. As can be seen in the picture to the right, the channel has been historically straightened and is attempting to regain sinuosity. Development, extending 348 feet is encroaching upon the east bank of the river. Land adjacent to the east side of the river has slopes that range from 16-25% and are considered to be very steep. The land adjacent to the west has more gentle slopes and range from 9-15%. There is no development adjacent to the west bank.

*Stream Channel*

Based on a cross-section collected at a location that is representative of the reach overall, the channel width is 26 feet, with a maximum bankfull depth of 2 feet. The mean bankfull depth is 1.25 feet. The floodprone width is 88.5 feet. This segment contains four steep riffles, that are spaced an average of 112 feet apart.

With the representative cross-section information, this reach types out as a C4 stream in the Rosgen Stream Classification system (Rosgen, 1996). C4 streams are often susceptible to increased bank erosion, which is present in the reach, as discussed in the next section.

*Riparian banks, Buffers and Corridors*

Bank slopes in Segment C are steep, and the channel canopy is open. Streambanks are comprised of non-cohesive materials, such as sand and gravel on both sides of the channel. On the east bank, the total length of bank erosion observed is 584 feet with average heights of 2 feet. There is approximately 43 feet of hard bank armoring on the east bank. The west bank has 420 feet of erosion, which are 2 feet in height. The west bank also has 61 feet of bank armoring.

Figure 3 This picture shows the hard bank armoring that is present in Segment C of Reach 1 of Grandy Brook, Claremont, NH.

Buffer widths adjacent to the east bank are generally more than 100 feet in width and predominantly consist of mixed trees, shrubs and saplings. The buffer width adjacent to the west bank is 26-50 feet and consists of mixed and herbaceous vegetation. The riparian corridor adjacent to the east bank is dominated by forest and secondarily by residential development. The

riparian corridor adjacent to the west bank is dominated by residential development and secondarily by forest. The near bank vegetation on the east bank consists of coniferous and deciduous vegetation with a forest riparian corridor. Vegetation near the west bank is dominated by deciduous, shrubs and saplings.

*Flow Modifiers*
There is one stormwater input, which is located adjacent to Veteran's Park Rd. There is a minimal amount of springs, seeps, and tributaries and no beaver dams. At the time of the assessment, there was one debris jam. There are minimal wetlands present. There is a dam upstream, in Reach 2.

*Channel Bed and Planform Changes*
There is one flood chute within Segment C. The presence of multiple sediment bars increases this segment's sensitivity scores. The following are the number of bars (depositional features) recorded in the reach:

| Bar Type | Number Present |
|---|---|
| **Mid-channel** | 2 |
| **Point** | 3 |
| **Side** | 12 |
| **Diagonal** | 2 |
| **Delta** | 1 |
| **Island** | 1 |

A total of 320 feet, or 26%, of the segment is identified as having been straightened in the past. This straightened section has a plane bedform and large bars. The upstream section of this segment is becoming entrenched.

*Stream Crossing*
There is a 45 foot concrete, box culvert crossing under Veteran's Park Rd, just below the dam and adjacent to the Veteran's Park. At the time of assessment, both the upstream and downstream bank armoring was failing. There is "Low" upstream bank erosion and evidence of aggradation (sediment accumulation) along the side of the channel. There is "High" bank erosion downstream of the culvert, in which sediments are being deposited along the side of the channel.

*Stream Channel Condition*
Segment C was given a score based on the data collected on the current channel condition. The condition of segment was considered to be Fair. This was mostly due to the major historic degradation. The channel appears to be filled with sediment downstream of the pool at Veteran's Park. Sediment accumulations have also created a flood chute. There is high bank erosion throughout the segment, as evidenced by the island and the steep riffles. This is especially evident below the dam. The condition score was combined with the stream type (C4), and translated into a sensitivity score of the reach. The score results placed this segment into the Very High sensitivity category (the second most sensitive of six categories of stream sensitivity).

*Results continued,*

The segment in the main branch of the Sugar River that was assessed begins approximately 1,000 feet west of the intersection of Unity Road and Sugar River Drive and runs east about 1.3 miles, continuing adjacent to Sugar River Drive. This reach was broken into two segments with the wester segment being given a Fluvial Erosion Hazard (FEH) Zone sensitivity rating of "very high" and the eastern portion being rated "high". In the "very high" section, a migrating flood chute was noted in three located. A head cut was also noted as impact at the boundary of where the segment rating changes to "high". The segment rated as high also saw a migrating flood chute as a contributing impact in four spots along the reach, additionally, storm water input from a roadside ditch and a field ditch created impacts to the river.

*Mitigation Actions*

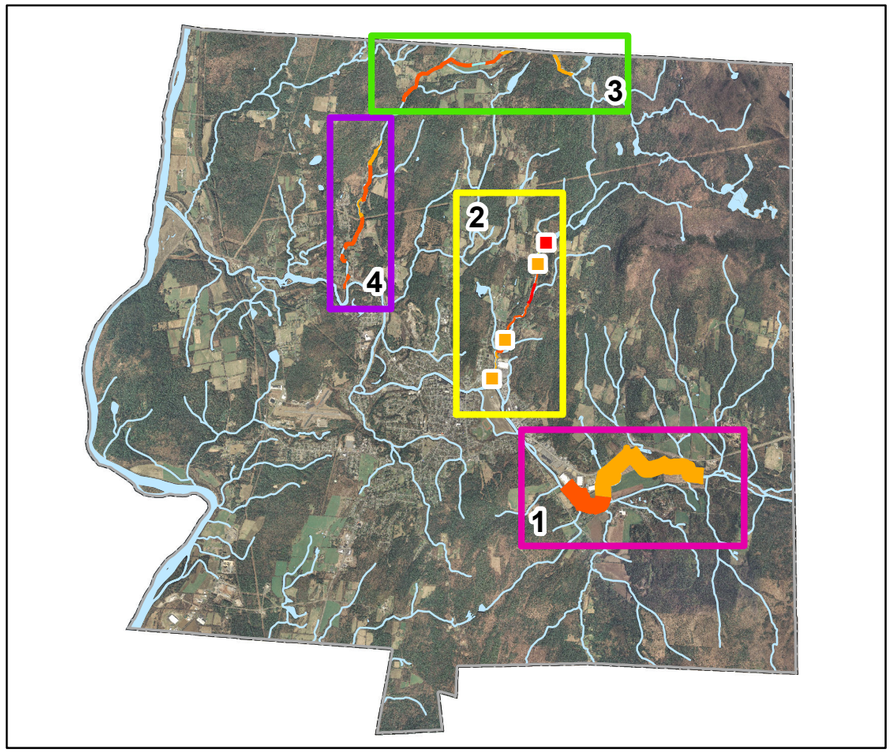
The City of Claremont felt that the most pressing mitigation action that needed to be taken from the results of this study was the upsizing of the culvert beneath Washington Street at the outflow of Grandy Brook into the Sugar River. Though this culvert is under a state road, the city is concerned that the undersized culvert could create substantial damage to the infrastructure should it fail during a storm event. Failure of the culvert that caused the road to be closed would cut off downtown Claremont to the main retail corridor and also severely impact east west travel on NH Route 11, which is the primary trucking/commercial route in the region. The City would like to replace the 90 foot twin culverts with a single span culvert of appropriate size to accommodate the flows on the brook.

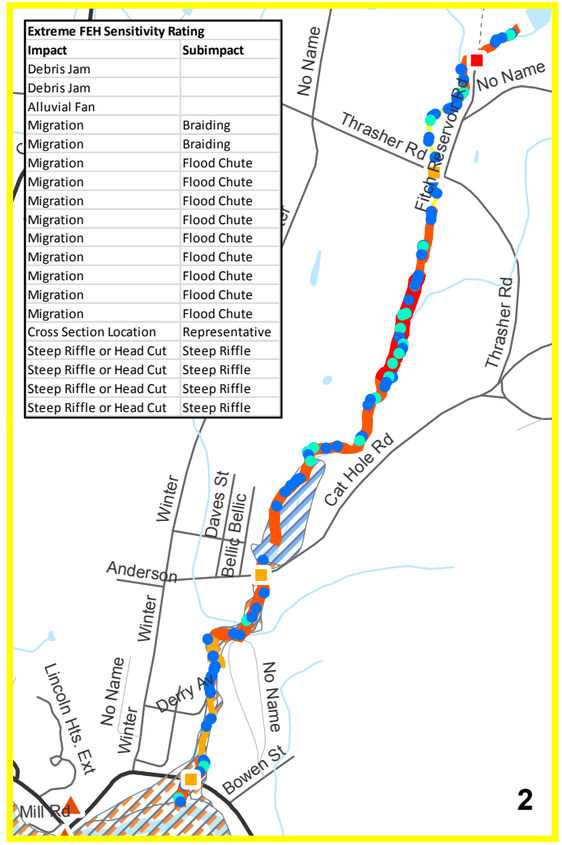
| Rank | Strategy Improvement | Reduce Damage | Community Objectives | Existing Regulations | Quickly Implemented | Socially Accentable | Technically Feasible | Administration Possible | Benefit - Cost | TOTAL SCORE | Mitigate Existing or New Development or Both |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Washington Street/Grandy Brook Culvert:** Replace the current undersized twin culvert with upgraded single span culvert with increased capacity. | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 21 | New |

| Rank | Evaluation Score | Problem Statement | Mitigation Action | Responsible Party | Timeframe | Potential Funding Source | Anticipated Cost |
|---|---|---|---|---|---|---|---|
| 1 | 21 | The currently undersized culvert can not accommodate the capacity of water that it needs to and | **Washington Street/Grandy Brook Culvert:** Replace the current undersized twin culvert with upgraded single span culvert | Claremont DPW & NH DES | Long Term | HMGP/PDM | $100,000 |

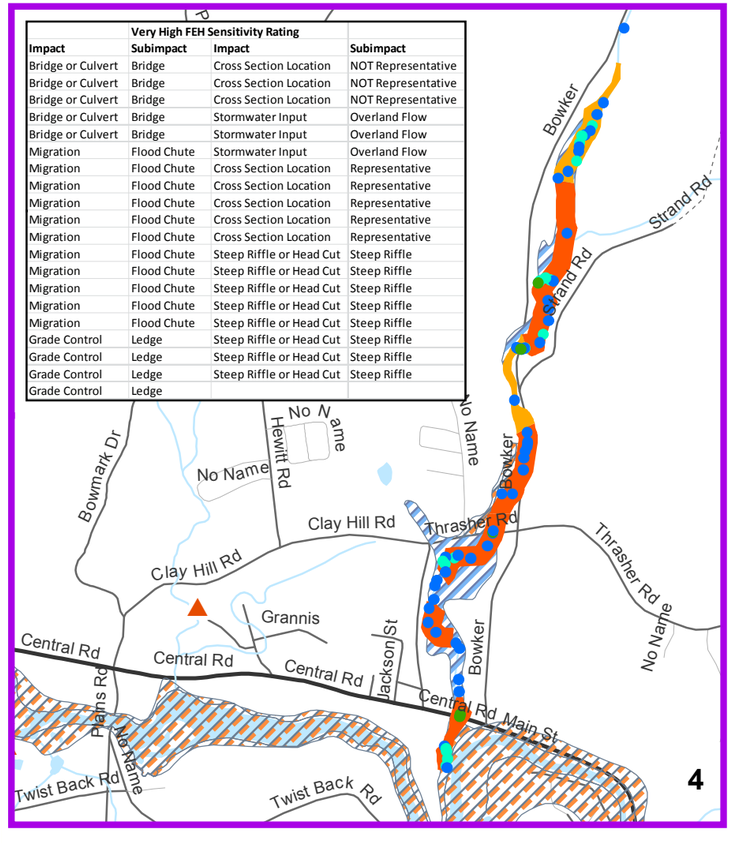
| Rank | Evaluation Score | Problem Statement | Mitigation Action | Responsible Party | Timeframe | Potential Funding Source | Anticipated Cost |
|---|---|---|---|---|---|---|---|
| | | is causing significant erosion and impacting the stream health and is a danger to infrastructure. | with increased capacity. | | | | |

# Fluvial Geomorphic Study - City of Claremont, Sugar River Watershed (HUC 10)

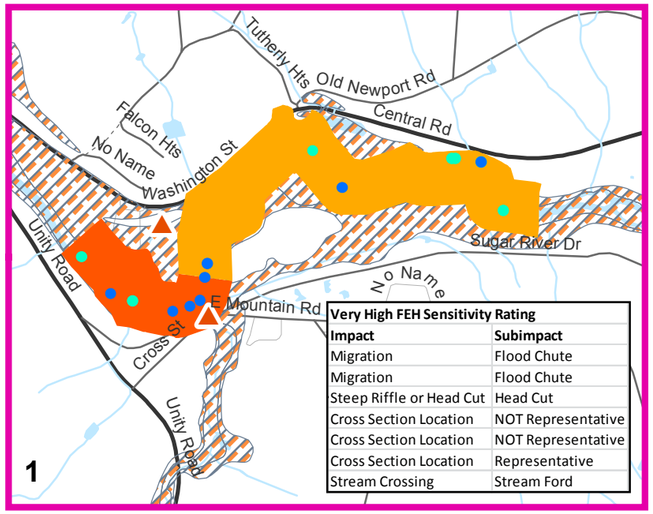


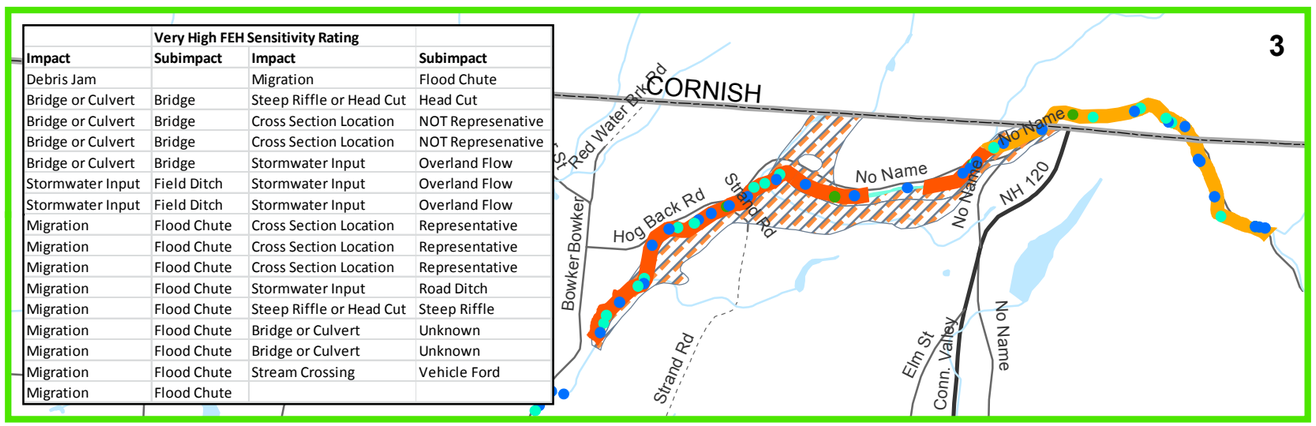

| Extreme FEH Sensitivity Rating | |
|---|---|
| Impact | Subimpact |
| Debris Jam | |
| Debris Jam | |
| Alluvial Fan | |
| Migration | Braiding |
| Migration | Braiding |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Cross Section Location | Representative |
| Steep Riffle or Head Cut | Steep Riffle |
| Steep Riffle or Head Cut | Steep Riffle |
| Steep Riffle or Head Cut | Steep Riffle |
| Steep Riffle or Head Cut | Steep Riffle |




| Very High FEH Sensitivity Rating | | | |
|---|---|---|---|
| Impact | Subimpact | Impact | Subimpact |
| Bridge or Culvert | Bridge | Cross Section Location | NOT Representative |
| Bridge or Culvert | Bridge | Cross Section Location | NOT Representative |
| Bridge or Culvert | Bridge | Cross Section Location | NOT Representative |
| Bridge or Culvert | Bridge | Stormwater Input | Overland Flow |
| Bridge or Culvert | Bridge | Stormwater Input | Overland Flow |
| Migration | Flood Chute | Stormwater Input | Overland Flow |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Steep Riffle or Head Cut | Steep Riffle |
| Migration | Flood Chute | Steep Riffle or Head Cut | Steep Riffle |
| Migration | Flood Chute | Steep Riffle or Head Cut | Steep Riffle |
| Migration | Flood Chute | Steep Riffle or Head Cut | Steep Riffle |
| Migration | Flood Chute | Steep Riffle or Head Cut | Steep Riffle |
| Grade Control | Ledge | Steep Riffle or Head Cut | Steep Riffle |
| Grade Control | Ledge | Steep Riffle or Head Cut | Steep Riffle |
| Grade Control | Ledge | Steep Riffle or Head Cut | Steep Riffle |
| Grade Control | Ledge | | |




| Very High FEH Sensitivity Rating | |
|---|---|
| Impact | Subimpact |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Steep Riffle or Head Cut | Head Cut |
| Cross Section Location | NOT Representative |
| Cross Section Location | NOT Representative |
| Cross Section Location | Representative |
| Stream Crossing | Stream Ford |




| Very High FEH Sensitivity Rating | | | |
|---|---|---|---|
| Impact | Subimpact | Impact | Subimpact |
| Debris Jam | | Migration | Flood Chute |
| Bridge or Culvert | Bridge | Steep Riffle or Head Cut | Head Cut |
| Bridge or Culvert | Bridge | Cross Section Location | NOT Representative |
| Bridge or Culvert | Bridge | Cross Section Location | NOT Representative |
| Bridge or Culvert | Bridge | Stormwater Input | Overland Flow |
| Stormwater Input | Field Ditch | Stormwater Input | Overland Flow |
| Stormwater Input | Field Ditch | Stormwater Input | Overland Flow |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Stormwater Input | Road Ditch |
| Migration | Flood Chute | Steep Riffle or Head Cut | Steep Riffle |
| Migration | Flood Chute | Bridge or Culvert | Unknown |
| Migration | Flood Chute | Bridge or Culvert | Unknown |
| Migration | Flood Chute | Stream Crossing | Vehicle Ford |
| Migration | Flood Chute | | |

## Map Features

- Critical Facilities
- Data Collection Sites

**Subimpact**

- Bridge
- Culvert
- Migration

FEMA 100 Year Flood Zone

- 100-Yr Flood - A
- 100-Yr Flood - AE

FEH Sensitivity Rating

- Extreme
- Very High
- High
- Moderate
- Very Low

Geomorphic Compatability

- Fully Incompatible
- Mostly Incompatible
- Mostly Compatible
- Partially Compatible

**Data Sources:** Data drawn from info provided by the NH DES as results from the Sugar River Watershed fluvial geomorphic study. Other data was provided by: NH GRANIT, the state's GIS clearinghouse, and represents the best available data. Critical Facilities developed by UVLSRPC with the Hazard Mitigation Committe.

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Fluvial Erosion Hazard Zone Sensitivity Rating

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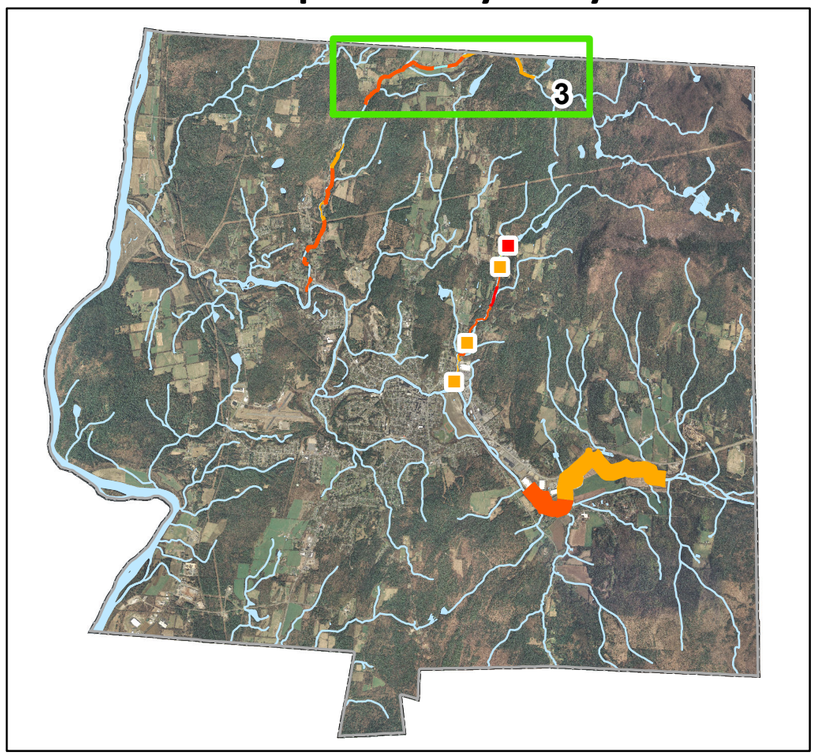
Culvert Compatability

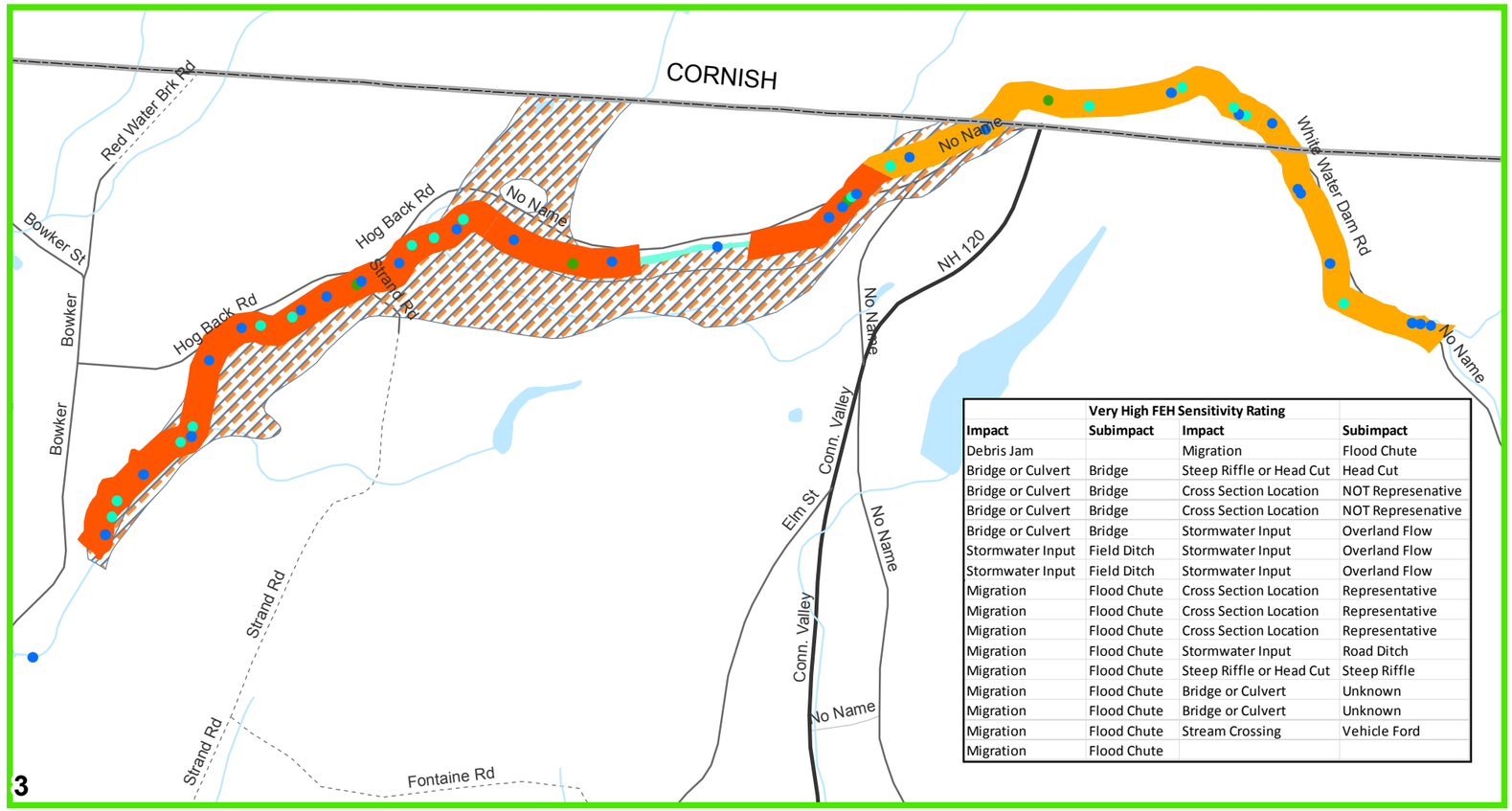
This data was rated and scored based on how the culvert will influence specific features that impact the compatability of a culvert with river/stream geomorphic processes, in general, the information provides guidance on what each rank tells us about the long-term compatability of a culvert with flow and sediment transport processes. The tables on each map indicate culvert data for the points in the selected area.

UVLSRPC NHDES

Map created by UVLSRPC January 2015.

# Fluvial Geomorphic Study - City of Claremont, Sugar River Watershed (HUC 10) - Redwater Brook




| | Very High FEH Sensitivity Rating | | |
|---|---|---|---|
| **Impact** | **Subimpact** | **Impact** | **Subimpact** |
| Debris Jam | | Migration | Flood Chute |
| Bridge or Culvert | Bridge | Steep Riffle or Head Cut | Head Cut |
| Bridge or Culvert | Bridge | Cross Section Location | NOT Represenative |
| Bridge or Culvert | Bridge | Cross Section Location | NOT Represenative |
| Bridge or Culvert | Bridge | Stormwater Input | Overland Flow |
| Stormwater Input | Field Ditch | Stormwater Input | Overland Flow |
| Stormwater Input | Field Ditch | Stormwater Input | Overland Flow |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Stormwater Input | Road Ditch |
| Migration | Flood Chute | Steep Riffle or Head Cut | Steep Riffle |
| Migration | Flood Chute | Bridge or Culvert | Unknown |
| Migration | Flood Chute | Bridge or Culvert | Unknown |
| Migration | Flood Chute | Stream Crossing | Vehicle Ford |
| Migration | Flood Chute | | |

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Culvert Compatability
This data was rated and scored based on how the culvert will influence specific features that impact the compatability of a culvert with river/stream geomorphic processes, in general, the information provides guidance on what each rank tells us about the long-term compatability of a culvert with flow and sediment transport processes. The tables on each map indicate culvert data for the points in the selected area.

Fluvial Erosion Hazard Zone Sensitivity Rating
This inforamtion is based on data collected for the Sugar River Watershed Area by the NH Geological Survey & the NH Department of Environmental Services. The Fluvial Erosion Hazard Zone (FEH), or meander belt, is provided for river reaches that have been assessed for this study. Sensitivity ratings are based on 6 categories of condition, ranging from Very Low to Extreme. Sensitivity is defined as the potential of a river to respond to flood events, through bank erosion and lateral migration (across the floodplain) processes.

Map Features

- Critical Facilities
- Data Collection Sites

**Subimpact**

- Bridge
- Culvert
- Migration

FEMA 100 Year Flood Zone

- 100-Yr Flood - A
- 100-Yr Flood - AE

FEH Sensitivity Rating

- Extreme
- Very High
- High
- Moderate
- Very Low

Geomorphic Compatability

- Fully Incompatible
- Mostly Incompatible
- Mostly Compatible
- Partially Compatible

**Data Sources:** Data drawn from info provided by the NH DES as results from the Sugar River Watershed fluvial geomorphic study. Other data was provided by: NH GRANIT, the state's GIS clearinghouse, and represents the best available data. Critical Facilities developed by UVLSRPC with the Hazard Mitigation Committe.

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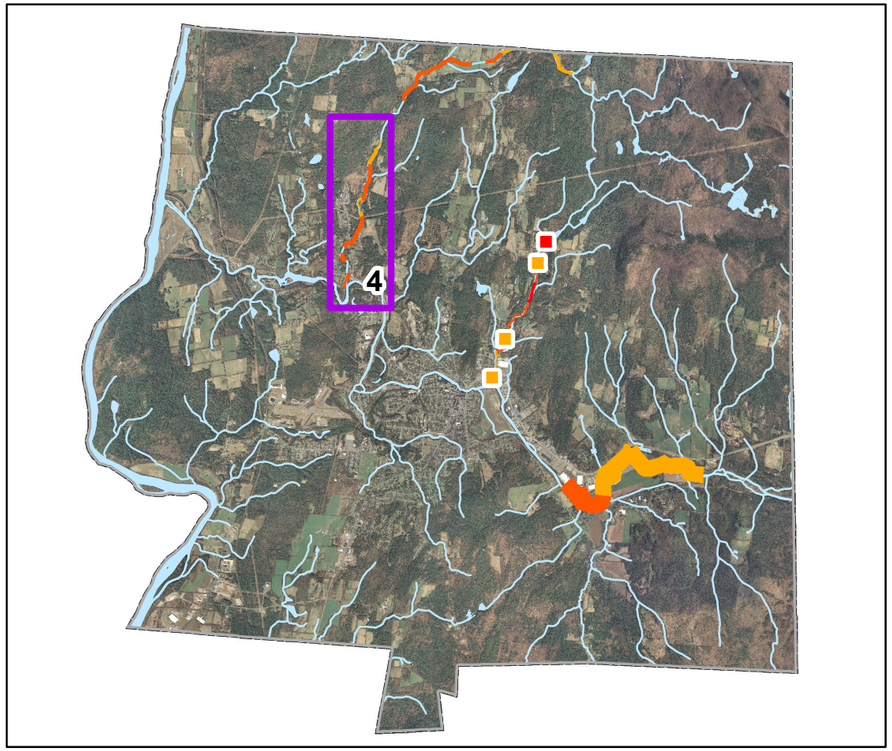
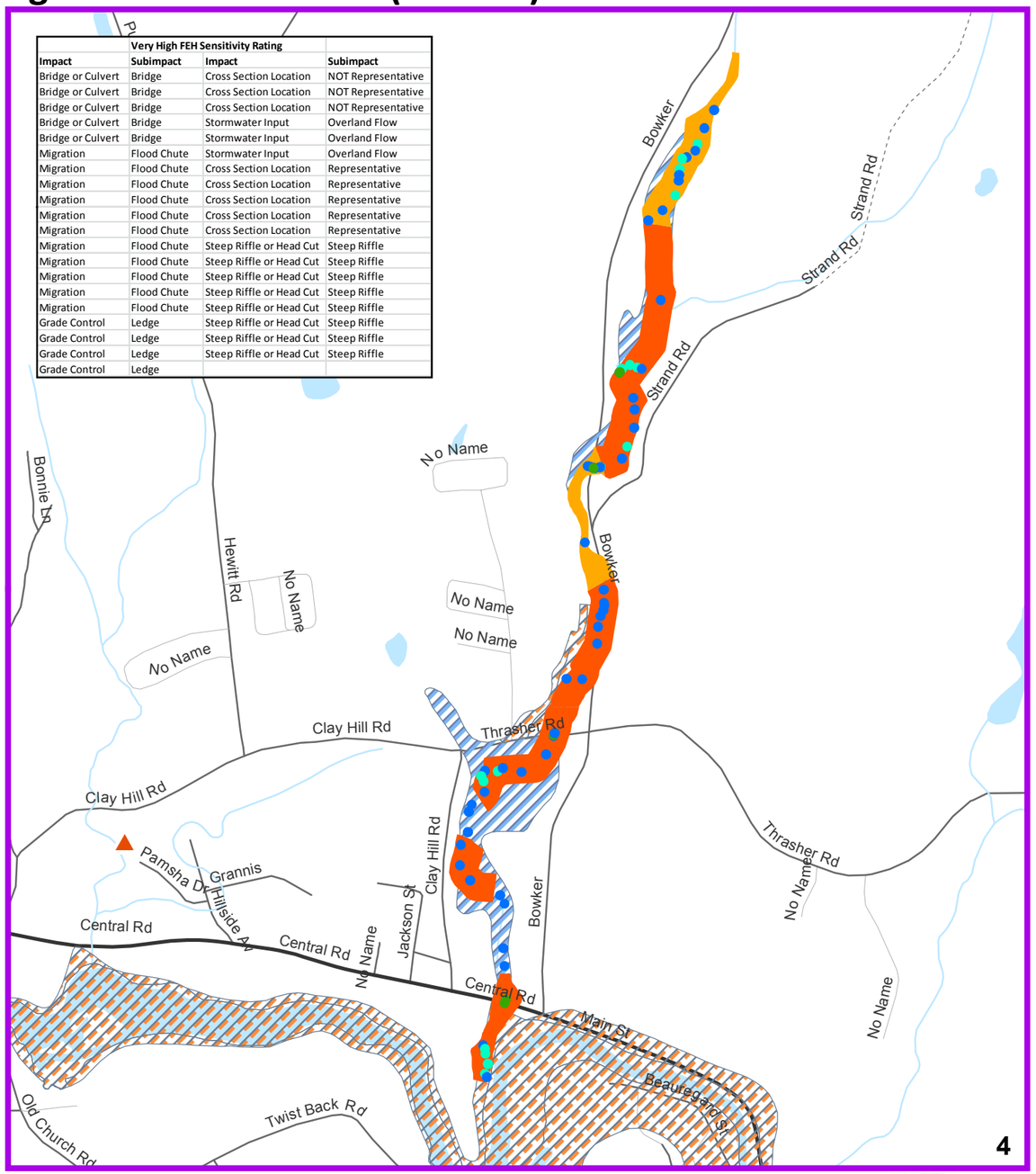
UVLSRPC NHDES

Map created by UVLSRPC January 2015.

# Fluvial Geomorphic Study - City of Claremont, Sugar River Watershed (HUC 10) - Redwater Brook




| | Very High FEH Sensitivity Rating | | |
|---|---|---|---|
| **Impact** | **Subimpact** | **Impact** | **Subimpact** |
| Bridge or Culvert | Bridge | Cross Section Location | NOT Representative |
| Bridge or Culvert | Bridge | Cross Section Location | NOT Representative |
| Bridge or Culvert | Bridge | Cross Section Location | NOT Representative |
| Bridge or Culvert | Bridge | Stormwater Input | Overland Flow |
| Bridge or Culvert | Bridge | Stormwater Input | Overland Flow |
| Migration | Flood Chute | Stormwater Input | Overland Flow |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Cross Section Location | Representative |
| Migration | Flood Chute | Steep Riffle or Head Cut | Steep Riffle |
| Migration | Flood Chute | Steep Riffle or Head Cut | Steep Riffle |
| Migration | Flood Chute | Steep Riffle or Head Cut | Steep Riffle |
| Migration | Flood Chute | Steep Riffle or Head Cut | Steep Riffle |
| Migration | Flood Chute | Steep Riffle or Head Cut | Steep Riffle |
| Grade Control | Ledge | Steep Riffle or Head Cut | Steep Riffle |
| Grade Control | Ledge | Steep Riffle or Head Cut | Steep Riffle |
| Grade Control | Ledge | Steep Riffle or Head Cut | Steep Riffle |
| Grade Control | Ledge | | |

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Culvert Compatability
This data was rated and scored based on how the culvert will influence specific features that impact the compatability of a culvert with river/stream geomorphic processes, in general, the information provides guidance on what each rank tells us about the long-term compatability of a culvert with flow and sediment transport processes. The tables on each map indicate culvert data for the points in the selected area.

Fluvial Erosion Hazard Zone Sensitivity Rating
This inforamtion is based on data collected for the Sugar River Watershed Area by the NH Geological Survey & the NH Department of Environmental Services. The Fluvial Erosion Hazard Zone (FEH), or meander belt, is provided for river reaches that have been assessed for this study. Sensitivity ratings are based on 6 categories of condition, ranging from Very Low to Extreme. Sensitivity is defined as the potential of a river to respond to flood events, through bank erosion and lateral migration (across the floodplain) processes.

## Map Features

- Critical Facilities
- Data Collection Sites

**Subimpact**

- Bridge
- Culvert
- Migration

## FEMA 100 Year Flood Zones

- 100-Yr Flood - A
- 100-Yr Flood - AE

## Geomorphic Compatability

- Fully Incompatible
- Mostly Incompatible
- Mostly Compatible
- Partially Compatible

## FEH Sensitivity Rating

- Extreme
- Very High
- High
- Moderate
- Very Low

**Data Sources:** Data drawn from info provided by the NH DES as results from the Sugar River Watershed fluvial geomorphic study. Other data was provided by: NH GRANIT, the state's GIS clearinghouse, and represents the best available data. Critical Facilities developed by UVLSRPC with the Hazard Mitigation Committe.

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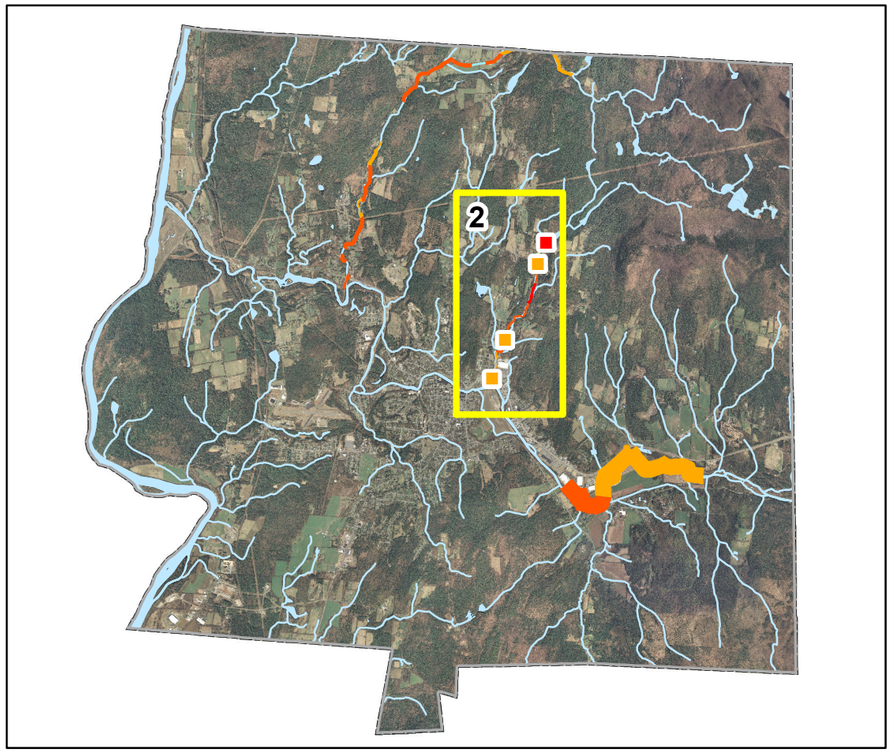
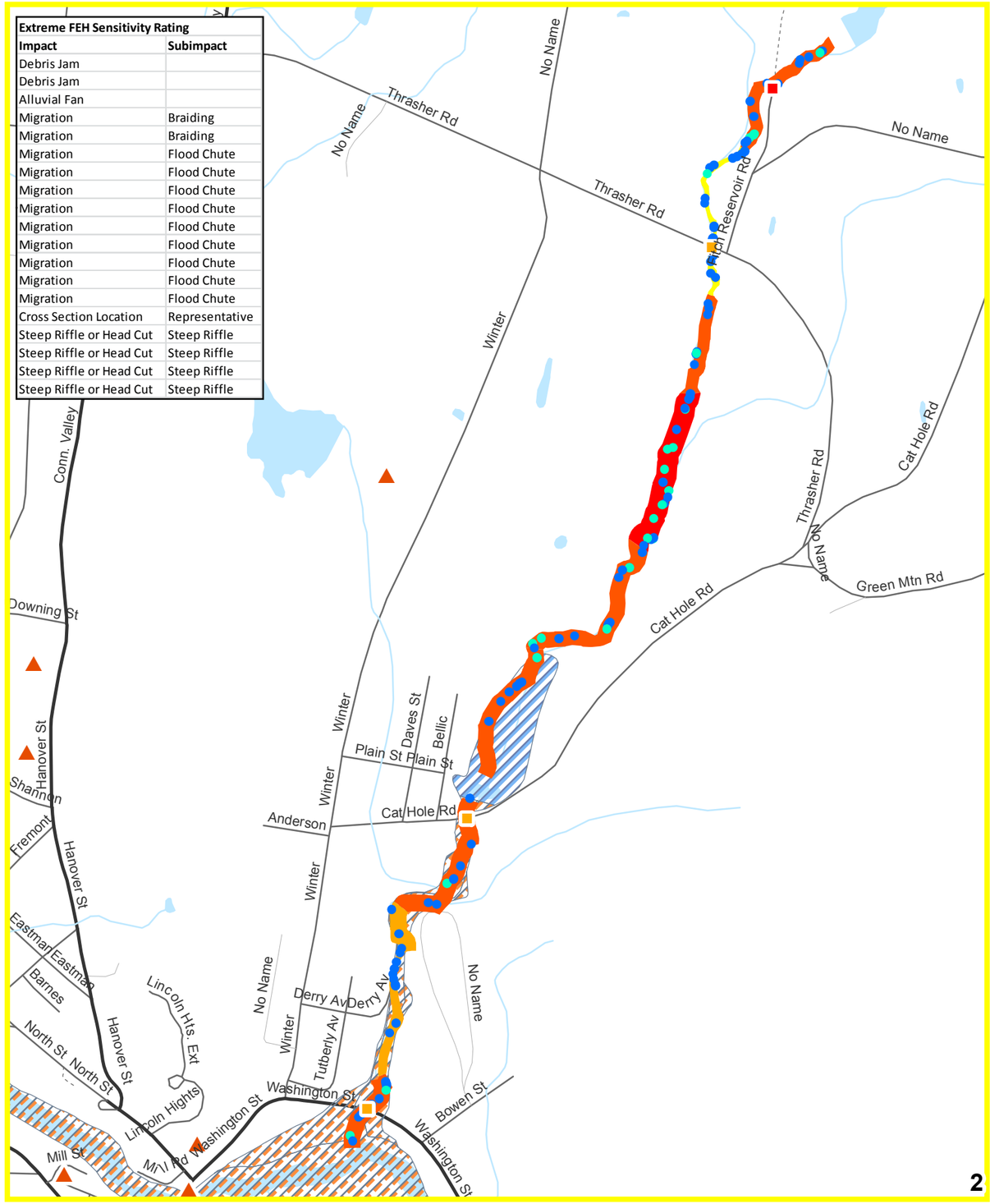
UVLSRPC NHDES

Map created by UVLSRPC January 2015.

# Fluvial Geomorphic Study - City of Claremont, Sugar River Watershed (HUC 10) - Grandy Brook




| Extreme FEH Sensitivity Rating | |
|---|---|
| **Impact** | **Subimpact** |
| Debris Jam | |
| Debris Jam | |
| Alluvial Fan | |
| Migration | Braiding |
| Migration | Braiding |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Migration | Flood Chute |
| Cross Section Location | Representative |
| Steep Riffle or Head Cut | Steep Riffle |
| Steep Riffle or Head Cut | Steep Riffle |
| Steep Riffle or Head Cut | Steep Riffle |
| Steep Riffle or Head Cut | Steep Riffle |




## Map Features

- Critical Facilities
- Data Collection Sites

**Subimpact**

- Bridge
- Culvert
- Migration

FEMA 100 Year Flood Zone

- 100-Yr Flood - A
- 100-Yr Flood - AE

## FEH Sensitivity Rating

- Extreme
- Very High
- High
- Moderate
- Very Low

## Geomorphic Compatability

- Fully Incompatible
- Mostly Incompatible
- Mostly Compatible
- Partially Compatible

Culvert Compatability
This data was rated and scored based on how the culvert will influence specific features that impact the compatability of a culvert with river/stream geomorphic processes, in general, the information provides guidance on what each rank tells us about the long-term compatability of a culvert with flow and sediment transport processes. The tables on each map indicate culvert data for the points in the selected area.

Fluvial Erosion Hazard Zone Sensitivity Rating
This inforamtion is based on data collected for the Sugar River Watershed Area by the NH Geological Survey & the NH Department of Environmental Services. The Fluvial Erosion Hazard Zone (FEH), or meander belt, is provided for river reaches that have been assessed for this study. Sensitivity ratings are based on 6 categories of condition, ranging from Very Low to Extreme. Sensitivity is defined as the potential of a river to respond to flood events, through bank erosion and lateral migration (across the floodplain) processes.

UVLSRPC NHDES

N W E S

Map created by UVLSRPC January 2015.

**Data Sources:** Data drawn from info provided by the NH DES as results from the Sugar River Watershed fluvial geomorphic study. Other data was provided by: NH GRANIT, the state's GIS clearinghouse, and represents the best available data. Critical Facilities developed by UVLSRPC with the Hazard Mitigation Committe.

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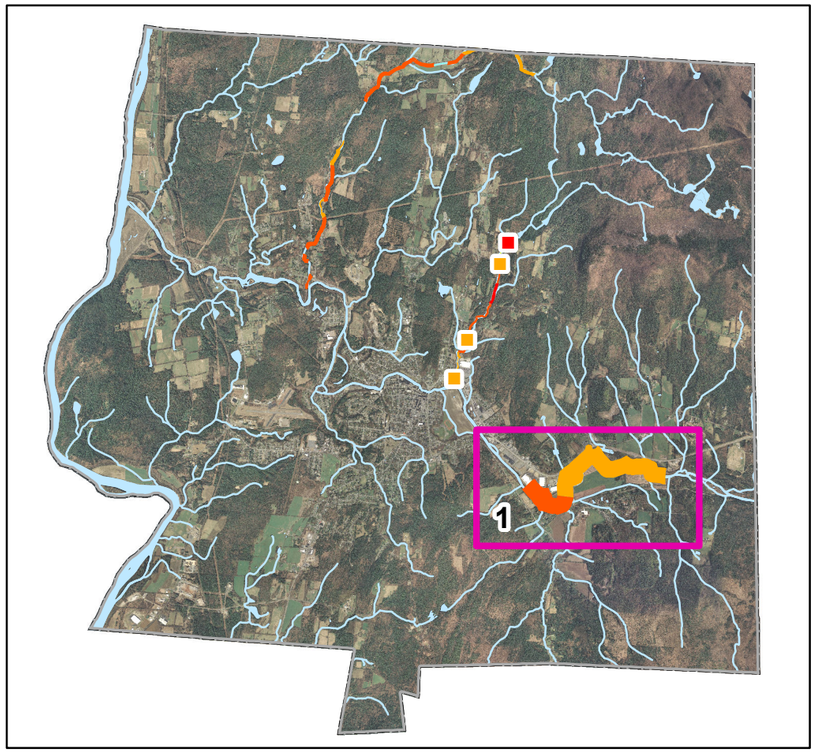
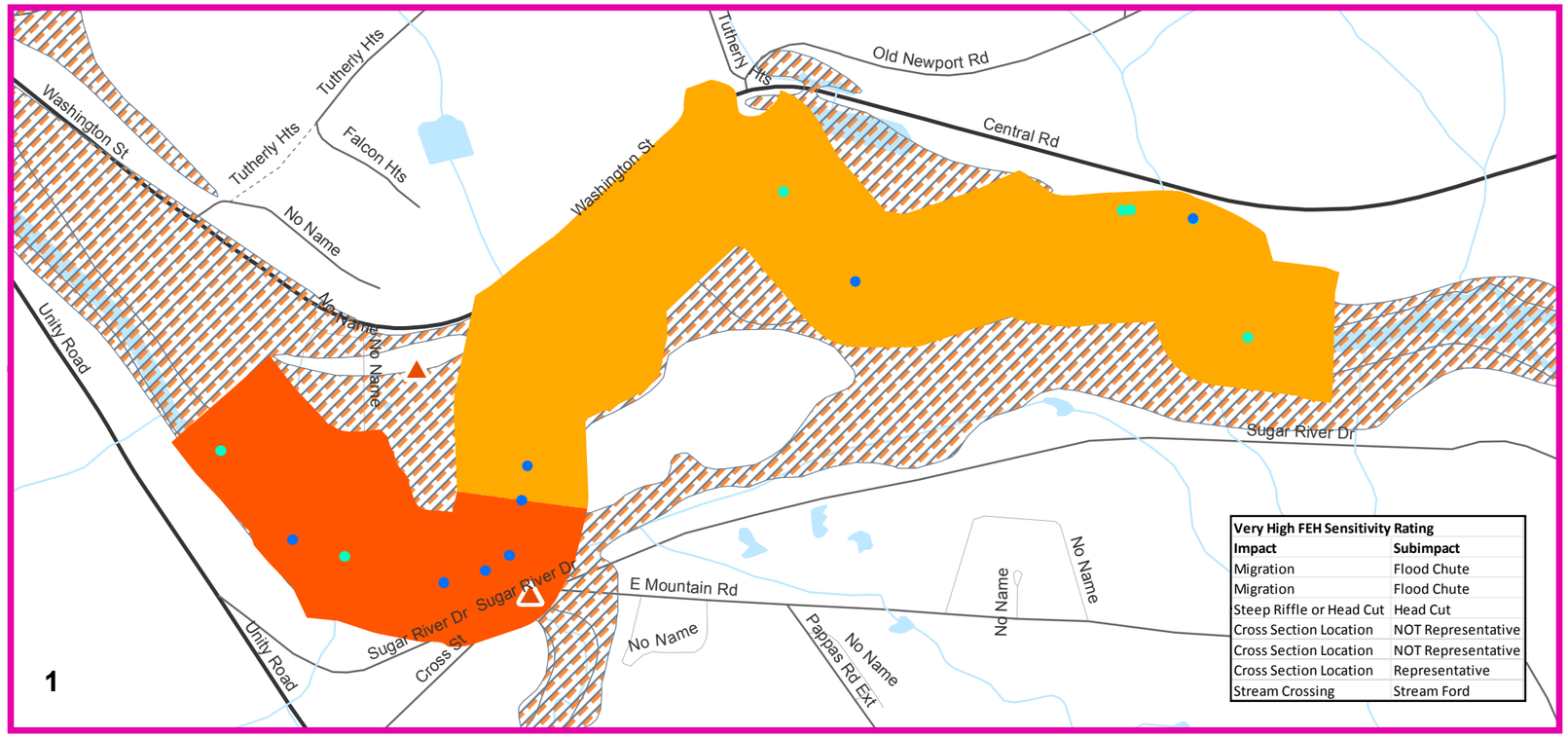
# Fluvial Geomorphic Study - City of Claremont, Sugar River Watershed (HUC 10) - Sugar River

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Culvert Compatability
This data was rated and scored based on how the culvert will influence specific features that impact the compatability of a culvert with river/stream geomorphic processes, in general, the information provides guidance on what each rank tells us about the long-term compatability of a culvert with flow and sediment transport processes. The tables on each map indicate culvert data for the points in the selected area.

Fluvial Erosion Hazard Zone Sensitivity Rating
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## Map Features

- Critical Facilities
- Data Collection Sites

**Subimpact**

- Bridge
- Culvert
- Migration

FEMA 100 Year Flood Zone

- 100-Yr Flood - A
- 100-Yr Flood - AE

FEH Sensitivity Rating

- Extreme
- Very High
- High
- Moderate
- Very Low

Geomorphic Compatability

- Fully Incompatible
- Mostly Incompatible
- Mostly Compatible
- Partially Compatible

**Data Sources:** Data drawn from info provided by the NH DES as results from the Sugar River Watershed fluvial geomorphic study. Other data was provided by: NH GRANIT, the state's GIS clearinghouse, and represents the best available data. Critical Facilities developed by UVLSRPC with the Hazard Mitigation Committe.

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UVLSRPC NHDES

Map created by UVLSRPC January 2015.

# APPENDIX F:

# FEMA Approvals and City Adoption of Hazard Mitigation Plan

CITY OF
CLAREMONT

**RESOLUTION 2017-11**

**Adopting the Claremont Hazard Mitigation Plan Update 2016**

**BE IT RESOLVED** by the Claremont City Council, after a public hearing duly noticed, that

**WHEREAS** the City of Claremont has received assistance from the Upper Valley Lake Sunapee Regional Planning Commission through funding from 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 June and July 2016; and

**WHEREAS** the hazard mitigation plan update was presented to the City Council for review, discussion and approval on October 12, 2016; and

**WHEREAS** the Claremont Hazard Mitigation Plan Update 2016 contains several potential future projects to mitigate hazard damage from various natural events in the City of Claremont; and

**NOW THEREFORE BE IT RESOLVED** by the City of Claremont City Council:

1. The Plan is hereby adopted as an official plan of the City of Claremont;
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.

**BE IT FURTHER RESOLVED** that the city manager, or his designees, are hereby authorized to undertake all actions and execute all documents necessary to implement this resolution. (*Majority Vote Required*)

Dated this 12th day of October, 2016, the City of Claremont, County of Sullivan, State of New Hampshire.

| | | | |
|---|---|---|---|
| AYES | 8 | ABSENT | 1 |
| NAYS | 0 | ABSTAIN | 0 |

CERTIFICATION

I, Dorée M. Russell, the undersigned officer, certify that the foregoing Resolution was adopted by the City Council of Claremont, New Hampshire, at meeting, duly noticed, and held on September 14, 2016.

Dorée M. Russell

Dorée M. Russell, Clerk to the Council

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

FEMA

NOV 07 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 Claremont 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 Claremont 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 Claremont 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 Claremont 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 October 31, 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.

NOV 07 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: Leigh Cheney, Chief of Planning, New Hampshire
Whitney Welch, Hazard Mitigation Planner, New Hampshire
Jennifer Gilbert, Asst. New Hampshire State NFIP Coordinator

Enclosure

# LOCAL MITIGATION PLAN REVIEW TOOL

## City of Claremont, 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:**<br>City of Claremont, NH | **Title of Plan:**<br>City of Claremont New Hampshire Hazard Mitigation Plan Updated 2016 | **Date of Plan:**<br>August 1, 2016<br>**Adopted:** Oct. 12, 2016 |
|---|---|---|
| **Single or Multi-jurisdiction plan?** Single | **New Plan or Plan Update?** Update | |
| **Regional Point of Contact:**<br>Victoria Davis<br>Planner<br>UVLSRPC<br>10 Water Street<br>Lebanon, NH<br>603-448-1680; vdavis@uvlsrpc.org | **Local Point of Contact:**<br>Guy Santagate<br>City Manager<br>City of Claremont<br>58 Opera House Square<br>Claremont, NH 03743<br>603-542-7002; citymanager@claremontnh.com | |

| **State Reviewer:** | **Title:** | **Date:** |
|---|---|---|
| Whitney Welch | HM Planner | 8/2/2016, 8/17/2016 |
| D. Parker Moore | EM Planning Specialist | 8/17/2016 |

| **FEMA Reviewer:** | **Title:** | **Date:** |
|---|---|---|
| Michael Flynn | CERC | 9/6/2016 |
| David Mendelsohn | Community Planner | 9/13/2016 |
| Jay Neiderbach | Community Planner | 9/19/2016; 10/31/2016 |
| Barbara Ellis | HM Community Planner, RSV | 10/29/2016 |
| **Date Received in FEMA Region I** | 8/17/2016 | |
| **Plan Not Approved** | | |
| **Plan Approvable Pending Adoption** | 9/20/2016 | |
| **Plan Approved** | 10/31/2016 | |

## 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**<br>**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 | 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, p. 3; p. 6 | 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, p.3; p. 6 | X | |
| A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3)) | Section I, p. 11; Section VI, pp. 63-65 | 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. 81 | 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. 81 | X | |
| **ELEMENT A: REQUIRED REVISIONS** | | | |

| 1. REGULATION CHECKLIST<br>**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. 11-48 | 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. 11-48 | 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. 11-50 | 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. 21 | 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. 63-67; Section IX, pp. 80-81 | 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 VI, p. 64 | 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. 63-70 | 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, pp. 70-73; Section VII, p. 76-79 | 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. 80-81 | X | |
| **ELEMENT C: REQUIRED REVISIONS** | | | |

| 1. REGULATION CHECKLIST<br>**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. 63-67 | X | |
| D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3)) | Section VI, pp. 71-79 | 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 F | 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 25, the plan states that, "The committee did not recall any tornadoes or downburst in which the city was impacted." Consider removing this sentence to reflect the 2015 downburst that is described on the bottom of page 25.

### Element A: Planning Process

**Plan Strengths:**

- The summary of the nine tasks that composed the planning process clearly describes the planning team's work flow. Documentation of the process also includes a meeting sign-in sheet, a public notice, and a screenshot of the City calendar. The summary and supporting materials will assist the community during future updates.
- The planning team included representation from a broad composition of local officials, including Building Inspectors, the City Solicitor, Finance Director, Assistant Public Works Director, and Director of Parks and Recreation. This range ensured a more comprehensive, robust planning process.

**Opportunities for Improvement:**

- For the next update, consider additional methods to increase public participation. For example, consider presenting about the plan at meetings of other City committees or boards, or holding at least one planning meeting at night to increase the opportunity for the public to attend.
- Consider distributing a survey on the City website asking residents for their input on the community's vulnerabilities and mitigation efforts. A survey may encourage participation from those who are interested in providing feedback on the plan, but are unable to attend a planning meeting in person. The survey could also be mailed directly to residents. For an example of the format and questions that could be used for the survey, see page A-11 of FEMA's *Local Mitigation Planning Handbook*.
- As part of the public notices for planning team meetings, consider including more information about what will be discussed at the meetings and the content to be included in the plan. Interested stakeholders and residents may not be familiar with the term "hazard mitigation," and providing more explanation will allow them to better understand why the plan is of interest to them.

- Post a copy of the 2011 plan on the City website, and include a link in the public notice so that residents are able to easily review and comment on it.
- During future plan updates, consider inviting a representative of the Planning Board to participate on the planning team. The Planning Board is responsible for several of the community's existing mitigation capabilities and proposed mitigation actions. Integrating them into the planning process will make future updates more complete.

### Element B: Hazard Identification and Risk Assessment

**Plan Strengths:**

- There is a comprehensive analysis of dam failure, with a listing of both all in-town dams and those outside the city limits. The analysis estimates the number of structures within the inundation area for significant and high hazard dams, and associated financial impacts.
- Multiple types of flooding are identified in the list of previous occurrences on pages 17 through 20, including localized, riverine, and ice jams. Data about the locations of flooding, as well as impacts and damages, are provided. The number of structures in the 1% floodplain are identified.
- A comprehensive list of erosion areas is identified on page 42, along with a description of the cause and whether vulnerable structures or infrastructure are affected. The identification of causes helps to set up the plan's mitigation strategy.
- An existing Fluvial Erosion Study was attached as an appendix, providing better context about erosion and better integrating existing technical reports into the plan.

**Opportunities for Improvement:**

- The planning team considered a 10-year time frame to estimate the probability of each hazard, which was then used to calculate a risk score that is based on a 25-year time frame. To make the risk assessment methodology more consistent, consider using the same time frame for both the probability estimate and risk calculation.
- In future planning updates, consider expanding the analysis of risk to vulnerable populations within the community. In particular, consider evaluating whether there are any schools, nursing homes, daycare centers, senior centers, churches, or senior housing facilities that are within the 1% floodplain or dam inundation areas.

### Element C: Mitigation Strategy

**Plan Strengths:**

- The table on pages 63 through 67 combines the description of the community's existing capabilities with the status of previously-proposed mitigation actions. This creates a better understanding of how previously-proposed actions have been better integrated with the community's current programs, policies, and plans during the past five years.

- The table of existing capabilities describes which hazards are addressed and the responsible party. This helps to document the purpose of each capability and how improvements would be implemented.
- There is a comprehensive description of how the City will undertake its outreach and education mitigation program, with an explanation of how information will be communicated to residents and the specific mitigation actions that will be highlighted. These details will help facilitate implementation of the outreach.
- The prioritized implementation schedule directly addresses the vulnerabilities identified in the risk assessment. For example, the erosion areas described on page 42 are addressed by specific mitigation actions. The prioritized implementation schedule also includes a brief problem statement associated with each mitigation action, which better explains its purpose.
- The planning team selected a variety of different types of mitigation actions, including plans and regulations, structural projects, natural systems protection, and education programs. This diverse range demonstrates the planning team's comprehensive evaluation of the most appropriate mitigation actions.

**Opportunities for Improvement:**

- Consider briefly explaining why the planning team scored actions with a 1 or 2 in certain categories of the STAPLEE analysis. Elaborating on the scores will better document any challenges associated with the action and allow for the action to be more realistically evaluated during future updates.
- Build upon the current discussion on pages 80 and 81 about implementing the plan through existing programs by specifying which programs, regulations, and plans exist in the City of Claremont. In addition, consider listing the specific planning mechanisms into which the City intends to incorporate the hazard mitigation plan, and what aspects of the plan (mitigation actions, hazard data, risk assessment, etc.) will be incorporated.

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

**Plan Strengths:**

- The overview of development trends includes detailed supporting data, such as the annual number of permits for new structures in the past five years, recent population trends in Claremont and neighboring communities, and population projections. There is also a description of which areas are most likely to experience additional future development.

**Opportunities for Improvement:**

- The City has completed several significant mitigation projects in recent years that address flooding and erosion. As part of the description on pages 9 and 10 of how recent development has affected the community's vulnerability, consider providing an assessment of whether recently completed mitigation actions have reduced the community's risk.

### B. Resources for Implementing Your Approved Plan

**Best Practices:**

- The State of New Hampshire Multi-Hazard Mitigation Plan Update 2013, Section VI and Appendix B identify a number of potential funding sources for various mitigation activities.
  More information about applying for grants, available publications and training opportunities can be obtained from Heather Dunkerley, the State Hazard Mitigation Officer, at heather.dunkerley@dos.nh.gov, or Whitney Welch, Hazard Mitigation Program Planner at whitney.welch@dos.nh.gov.
- The Town is encouraged to do everything possible 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.
- Consider what actions can be funded by various governmental agencies (federal and state), especially when meeting multiple community goals. Federal agencies may support integrated planning efforts such as rural development, sustainable communities and smart growth, wildfire mitigation, conservation, etc. Seek out other non-governmental or non-emergency management funding sources such as from private organizations and businesses, federal initiatives (Smart Growth, Sustainable Communities), Federal Highways pilot projects, and historic preservation programs.

**Publications:**

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

Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards
This document provide a resource that communities can use to identify and evaluate a range of potential mitigation actions for reducing risk to natural hazards and disasters. Ideas for mitigation actions are presented for: drought, earthquake, erosion, extreme temperatures, flood, hail, landslide, lightning, sea level rise, severe wind, severe winter weather, storm surge, subsidence, tornado, tsunami, and wildfire.
http://www.fema.gov/media-library/assets/documents/30627?id=6938

Hazard Mitigation Field Book – Roadways
This document assists local governments in choosing the best hazard mitigation solution(s) given their operational constraints and design considerations.
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=4271

Flood Hazard Mitigation Handbook for Public Facilities
This document assists communities in identifying a variety of feasible mitigation ideas that can be implemented during the rebuilding process.
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3724

FEMA 2015 Hazard Mitigation Assistance Guidance and Addendum
The Guidance includes information on requirements for HMGP, PDM, and FMA grants.
https://www.fema.gov/media-library/assets/documents/103279

Integrating the Local Natural Mitigation Plan into a Community's Comprehensive Plan
This guidebook explains and demonstrates how to integrate natural hazard mitigation concepts into local master plans. The guidebook describes the benefits of integration, provides examples of how it can be accomplished, reviews existing state authorities and regulations, and highlights successful best practices.
https://www.fema.gov/media-library/assets/documents/89725

Mitigation Planning How-To Series
This series of publications is meant to educate communities and planners on how to develop better mitigation plans and programs. Topics addressed include: using hazard mitigation plans to prepare successful mitigation projects, building community support for mitigation planning, integrating historic property and cultural resource considerations, using benefit-cost review, and incorporating manmade hazards into mitigation planning.
https://www.fema.gov/media-library/resources-documents/collections/6

Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials
This resource provides practical guidance on how to incorporate risk reduction strategies into existing local plans, policies, codes, and programs that guide community development or redevelopment patterns. It includes recommended steps and tools to assist with local integration efforts, along with ideas for overcoming possible impediments, and presents a series of case studies to demonstrate successful integration in practice.
http://www.fema.gov/media-library/assets/documents/31372?id=7130

Beyond the Basics: Best Practices in Local Mitigation Planning
This site, created by the DHS Science and Technology Coastal Hazard Center of Excellence and the University of North Carolina at Chapel Hill, is meant to assist communities in developing and improving their local hazard mitigation plans. It provides an overview of each step in the hazard mitigation planning process, with case studies, best practices, and FEMA requirements. The site also addresses social vulnerability and climate change.
http://mitigationguide.org/

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. Case studies in resilience are presented, including six within New England states.
https://toolkit.climate.gov