Multi-Hazard Mitigation Plan Update 2018

City of Rochester, NH

Expiration of Current Plan: November 29, 2023
Updated 2018
Submitted to the New Hampshire Homeland Security & Emergency Management
By the
City of Rochester, NH
with Strafford Regional Planning Commission

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The Rochester Multi-Hazard Mitigation Committee
New Hampshire Homeland Security Emergency Management (HSEM)
City of Rochester

The 2018 City of Rochester Multi-Hazard Mitigation Planning Committee

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Executive Summary

This Plan was revised and updated to meet statutory requirements and to assist the City of Rochester in reducing and mitigating future losses from natural and man-made hazardous events. An initial edition of this Plan was developed and presented to FEMA in 2005. The plan was revised in 2013, and was updated in 2018 to reflect the most recent information obtained through the evolution of the hazard mitigation program at the State. This update was developed by Strafford Regional Planning Commission (SRPC) and participants from the Multi-Hazard Mitigation Planning Committee, which was made up by the Fire Chief/EMD, City Manager, City Engineer, Planning Director, Assistant Fire Chief, Chief Information Officer, Building, Zoning, and Health Director; Community Development Director; Economic Development Specialist; Public Works Director; Economic Development Director; Police Chief; and Deputy Fire Chief/Fire Marshal. Valuable GIS support was also provided by Dan Camara of the City of Rochester.

The Plan references historical events, as well as identifies specific vulnerabilities that are likely to impact the city. Overall vulnerability to hazards includes:

High Vulnerability	**Moderate Vulnerability**	**Low Vulnerability**
Flooding (Including Dam Breach)	Large Crowd Events	Earhquake, Landslide, & Subsidence
Large Fires (Wildfire and Urban Fire)	Extreme Heat & Drought	Geomagnetic & Electromagnetic Events
Severe Winter Weather		
Severe Windstorms (Tornados, Thunderstorms, Downbursts & Hurricanes)		
Public Health Threats		
Hazardous Materials		
Cyber Security		

A description of each hazard and the extent, past events and impacts, potential future impacts to the community, and potential loss estimates associated with each hazard was included in the plan. As part of this analysis, the planning team reviewed past and existing mitigation strategies and made updates for improvement. Lastly, the planning team developed a series of new mitigation actions to be completed over the course of this plan's five-year cycle. Each mitigation action was prioritized using the STAPLEE Method and responsibilities for implementation were identified. This plan provides an updated list of Critical Infrastructure and Key Resources (CI/KR) categorized as follows: Emergency Response Facilities (ERF), Non-Emergency Response Facilities (NERF), Facilities and Populations to Protect (FPP), Water Resources (WR), and Potential Resources (PR). All critical assets were inventoried and mapped.

The revision process included reviewing other City Hazard Plans, technical manuals, federal and state laws, the State Hazard Mitigation Plan, research data, and other available mitigation documents from multiple sources. Combining elements from these sources, the Planning Team was able to produce this integrated multi-hazards plan and recognizes that such a plan must be considered a work in progress.

The City of Rochester received conditional approval on October 31, 2018. The plan was adopted by the City Council on November 13, 2018 after consultation with City leadership. The Plan received formal approval from FEMA on November 29, 2018.

In addition to periodic reviews there are three specific situations which require a formal review of the plan. The plan will be reviewed:

- Annually to assess whether the existing and suggested mitigation strategies have been successful and remain current in light of any changes in federal state and local regulations and statutes. This review will address the Plan's effectiveness, accuracy and completeness in regard to the implementation strategy. The review will address any recommended improvements to the Plan, and address any weaknesses identified that the Plan did not adequately address.
- Every five years. The Plan will be revised and updated using the same criteria outlined above. At that time it is expected to be thoroughly reviewed and updated as necessary. The public will be allowed and encouraged to participate in that five year revision process.
- After any declared emergency event, the EMD shall review the plan using the same criteria outlined above.
- If the City adopts any major modifications to its land use planning documents, the jurisdiction will conduct a Plan review and make changes as applicable.

Chapter 1: Multi-Hazard Mitigation Planning Process

Authority

Rochester's Multi-Hazard Mitigation Plan was prepared pursuant to Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the Act), herein enacted by Section 104 of the Disaster Mitigation Act of 2000 (DMA) (P.L. 106-390). This Act provides new and revitalized approaches to mitigation planning. Section 322 of DMA 2000 emphasizes the need for state, local and tribal entities to closely coordinate mitigation planning and implementation efforts. This revised multi-hazard plan will be referred to as the "Plan." Rochester's Plan has been prepared by the Multi-Hazard Mitigation Committee (the Committee) with the assistance and professional services of Strafford Regional Planning Commission (SRPC) under contract with New Hampshire Homeland Security Emergency Management (HSEM) operating under the guidance of Section 206.405 of 44 CFR Chapter 1 (10-1-2010 Edition). This plan is funded, in part, by HSEM through grants from FEMA (Federal Emergency Management Agency). Funds from city dues and matching funds for Committee member's time are also part of the funding formula.

Purpose and History

The ultimate purpose of Disaster Mitigation Act of 2000 (DMA) is to:

> *Establish a national disaster hazard mitigation program –*
>
> *To reduce the loss of life and property, human suffering, economic disruption and disaster assistance costs resulting from natural disasters; and*
>
> *To provide a source of pre-disaster hazard mitigation funding that will assist States and local governments (including Indian tribes) in implementing effective hazard mitigation measures that are designed to ensure the continued functionality of critical services and facilities after a natural disaster.*

DMA 2000 amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act by, among other things, adding a new section "322 – Mitigation Planning" which states:

> *As a condition of a receipt of an increased Federal share for hazard mitigation measures under subsection (e), a State, local, or tribal government shall develop and submit for approval to the President a mitigation plan that outlines processes for identifying the natural hazards, risks, and vulnerabilities of the area under the jurisdiction of the government.*

HSEM's goal is for all New Hampshire communities to complete a local multi-hazard plan as a means to reduce future losses from natural and man-made events before, during, or after they occur. HSEM has outlined a process whereby communities throughout the state may become eligible for grants and other assistance upon completion of this multi-hazard plan. The state's regional planning commissions are charged with providing assistance to selected communities to help develop local plans.

Rochester's Multi-Hazard Mitigation Plan is a planning tool for reducing future losses from natural and man-made disasters as required by the Disaster Mitigation Act of 2000.

The DMA places new emphasis on local mitigation planning. It requires local a local jurisdiction to prepare and adopt a FEMA approved jurisdiction-wide Hazard Mitigation Plan as a condition for receiving Hazard Mitigation Assistance (HMA) project grants and other grants every five years. In addition to updating their plans every five years to continue program eligibility, local governments should review the plan yearly.

Scope of the Plan

This Plan addresses only one jurisdiction: the City of Rochester, NH. The Plan addresses 11 types of natural and man-made hazards that may affect the City:

- Flooding (Including Dam Breach)
- Severe Winter Weather
- Severe Windstorms (Tornados, Thunderstorms, Downbursts, & Hurricanes)
- Large Fires (Wildfire and Urban Fire)
- Earthquake, Landslide, & Subsidence
- Large Crowd Events
- Public Health Threats
- Hazardous Materials
- Extreme Heat & Drought
- Geomagnetic & Electromagnetic Events
- Cyber Security

It describes each hazard and identifies past occurrences of hazard events and assesses probability of future hazard events in the City. The Plan assesses the vulnerability of key infrastructure and critical facilities; existing residential buildings and other structures within Rochester; and future development. The Plan also addresses the administrative, technical, and physical capacity of emergency response services and response coordination between federal, state, and local entities.

Multi-Hazard Mitigation Goals

The City's multi-hazard goals are based on the State of New Hampshire Multi-Hazard Mitigation Plan (2013) goals and include:

- Ensure the protection of the general population, citizens and guests of Rochester New Hampshire, before during and after a hazard.
- Protect existing properties and structures through mitigation activities.
- Provide resources to residents of Rochester, when needed, to become more resilient to hazards that impact the city's critical support services, critical facilities, infrastructure, economy, environment, historical & cultural treasures and private property.
- Support the Presidential Policy Directive (PPD-8) through prevention, mitigation, preparedness, response, and recovery actions.
- Work regionally to identify, introduce, and implement cost effective hazard mitigation measures in order to accomplish the city's goals.
- Develop and implement programs to promote hazard mitigation to protect infrastructure throughout the city to reduce liability with respect to natural and human-caused hazards generally.
- Address the challenges posed by climate change as they pertain to increasing risks in the city's infrastructure and natural environment.

Multi-Hazard Mitigation Planning Process

Overview

The Plan was developed and updated with substantial local, state, and federal coordination. The completion of this new multi-hazard plan required significant planning preparation and represents the collaborative efforts of the City of Rochester, an ad-hoc local Multi-Hazard Mitigation Planning Committee, and SRPC. The Committee followed an established ten step multi-hazard mitigation planning process (see box, right). The Committee met 4 times over a 3 month period to discuss the range of hazards included in this plan as well as brainstorm mitigation needs and strategies to address these hazards and their impacts on people, business, and infrastructure in the City. All meetings were geared to accommodate brainstorming, open discussion, and an increased awareness of potential threats to the City. This process results in significant cross talk regarding all types of natural and man-made hazards.

Ten Step Multi-Hazard Mitigation Planning Process

1. Establish and Orient a Hazard Mitigation Planning Committee
2. Identify Past and Potential Hazards
3. Identify of Hazards and Critical Facilities
4. Assess Vulnerability – Estimating Potential Losses
5. Analyze Development Trends
6. Identify Existing Mitigation Strategies and Proposed Improvements
7. Develop Specific Mitigation Measures
8. Prioritize Mitigation Measures
9. Prepare Mitigation Action Plan
10. Adopt and Implement the Plan

Public Involvement

Public involvement is an important part of the planning process. A local Multi-Hazard Mitigation Planning Committee (the Committee) was formed to guide and oversee the development of this Plan. Representatives from all City departments were recruited to participate on the Committee, Community officials were encouraged to contact as many people as they could to participate in the planning process. Members of the public and other stakeholders from neighboring communities were also informed of and encouraged to attend the Committee's meetings.

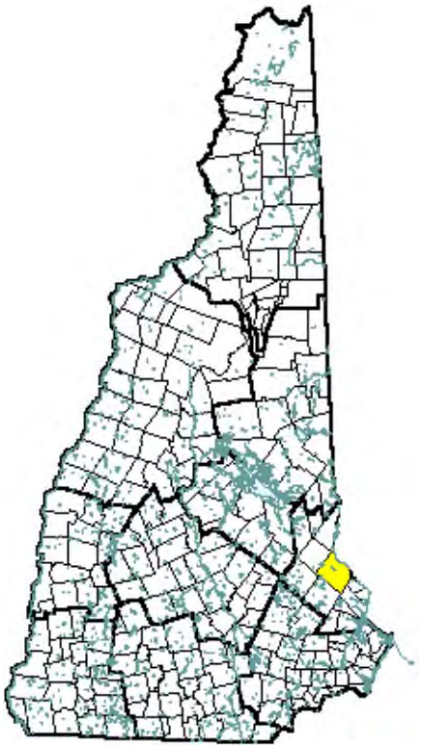
To build awareness of the Plan and opportunity to be involved, a public notice, stressing the public nature of the process, was posted on the City's website in advance of each Committee meeting. The Committee met 4 times between March 22, 2018 and May 3, 2018. A public notice was also posted on Strafford Regional Planning Commission's website, and information about the Plan was included in SRPC's news updates in order to ensure that adjacent communities were aware of Rochester's committee meetings and had the opportunity to attend.

Adoption and Integration

Once approved by the Planning Committee, the Plan will be forwarded to HSEM and FEMA for Conditional Approval. Upon review and conditional approval by HSEM and FEMA, the Administration will consider leadership and public comments and must promulgate a signed Resolution to Adopt the Plan.

Elements of the Plan will be incorporated into other planning processes and documents, such as the City's Master Plan, Capital Improvement Plan, and Emergency Operations Plan. The City will refer to this Multi-Hazard Mitigation Plan, as appropriate, in other documents.

Chapter 2: Community Profile



The City of Rochester is located in the southeast portion of Strafford County in southern New Hampshire. Rochester is bounded on the north by Farmington, on the east by Berwick, Maine, on the south by Somersworth and Dover and on the west by Barrington and Strafford. With a population of 29,752 (according to the 2010 Census), Rochester is one of the largest cities in the seacoast region and the sixth largest city in New Hampshire

The City of Rochester consists of 46 square miles and is located only 30 minutes from Lake Winnipesaukee and the Lakes Region, the Atlantic Ocean and the Great Bay National Estuary. The topography of Rochester consists of rolling hills and rivers. The Cocheco River runs through the heart of the city, and the Salmon Falls River forms the border between Rochester and Maine. Major highways include Routes 11, 108,125, 202 and the Spaulding Turnpike (Route 16), a four-lane, limited access highway with six exits providing access to the City.

Rochester's climate is temperate. Normal average temperature is 47 degrees F. The average rainfall is 41.9". The City is known as the "Lilac City" because of the extensive plantings of these flowering shrubs. Rochester has a 4-season climate that is conducive to outdoor activities. The city offers a variety of activities including swimming, boating, fishing and hiking.

The City Manager serves as the Chief Executive of the City Government and is responsible for the day-to-day supervision and direction of most City departments. The City Manager is appointed by the City Council on the basis of his/her qualifications and serves at their pleasure. In addition, the City Manager serves as chief policy advisor to the Council and represents the interests of the City in dealing with other municipalities, and the state and federal governments.

The Rochester Fire Department serves the City with a dedicated and well-trained staff of firefighters who use state of the art equipment and apparatus. The Fire Chief also serves as the Emergency Management Director. Other full time departments include the Police Department, Water and Sewer Departments, Public Works, Assessing, Code Enforcement, Information Systems, Planning, and Economic Development.

Frisbie Memorial Hospital is a 112-bed acute care community hospital located in Rochester. The medical staff includes approximately 250 physicians and other healthcare professionals, representing nearly 30 specialty care services. The hospital serves adults, children and infants from Rochester and the greater Strafford County and Southern Maine areas.

Historical Population Trends

In 1790, the first year the Census was taken, Rochester's population was 2,857 residents. From 1960 to 2010, the city's population increased from 15,927 to 29,752. The American Community Survey 5-Year population estimates indicate approximately 30,345 residents in 2016.

Projected Population Change

National population projections by the Census Bureau suggest that the United States will reach a population of approximately 380 million by 2040 (an 18% overall population growth). Although the Strafford Planning Region is not expected to grow on pace with the national rate, it is expected to grow by close to 10%, a significantly higher rate than projected for the state of New Hampshire (7.2%). Population projections completed by the New Hampshire Office of Strategic Initiatives and the state's Regional Planning Commissions, suggest that Rochester's population will increase by approximately nine percent to 32,579 people by 2040. This increase represents an average increase of 1082 residents per decade.

Migration

Data suggest that fewer New Hampshire residents are leaving the State of New Hampshire. Since 2005, the peak year of outmigration between 2000 and 2010, there has been a 17% decrease in residents exiting the state. Unfortunately, New Hampshire is also experiencing a declining rate of in-migration, meaning that fewer individuals are coming into the state.

Aging

Rochester, like many communities in the region, experienced a significant increase in its 65 and older population between 2000 and 2010. The percent of the population age 65 and older increased from 13.5% in 2000 to 14.8% in 2010.[1] This trend is occurring across both the state and much of the New England and is a product of aging Baby-Boom and Generation X populations. The City also saw a decrease in residents under age 18 from 25.3 percent in 2000 to 22.0 percent in 2010.[2]

In the whitepaper series *The Two New Hampshires: What does it mean?* Ross Gittell addresses the aging population, and how concentrations of older age cohorts vary across the state. In the report Gittell defines two New Hampshires, rural and metro. Rural NH includes Cheshire, Sullivan, Belknap, Carroll, Grafton, and Coos Counties, while Metro NH includes Rockingham, Hillsborough, Strafford and Merrimack Counties. As Gittell notes, Rural NH has a far older population (median age) than Metro NH, and if this was its own state it would be the second oldest in the nation. Even Metro NH, if considered by itself, would be older than Massachusetts, Connecticut, Rhode Island, and Vermont.

Population and Age

While data show the region growing at a faster rate than the state over the next 25 years, the slowed growth rate beginning in 1990 has, and will continue to have, an effect on the region. As the regional population ages, and in-migration continues to decrease, the percentage of school age children is declining. Out of the 161 districts in the state, 130 experienced a decline in enrollment between 2000 and 2010.

The aging population, combined with a decrease in population ages 18 to 55, may result in a labor force shortage in coming years. Additionally, the emigration of highly skilled or trained individuals to other states, could have potentially negative impacts on local, regional and state economic systems.

[1] US Census 2000 and 2010
[2] Ibid.

With the expected increase in demand for health care, assisted living facilities, and nursing home capacity, and the potential for a smaller labor force, a care-provider shortage may emerge. Local governments will likely need to create programs and strategies in order to provide adequate health and social services for increased numbers of aging seniors.

Table 2.1 Population in Rochester 1990, 2000, 2010

	1990	2000	2010	% Change 1990-2000	% Change 2000-2010
Population	26,630	28,461	29,752	6.9%	4.5%

Past Development Trends

The City of Rochester was founded in 1722. Like many historic municipalities in Strafford County, it relied on the Cocheco, Salmon Falls, and Isinglass Rivers to power an early industrial center. This business center included lumber, agriculture, and a variety of industrial businesses such as Spaulding Composites Inc., which has existed in the City for more than a century.

In 1806, several tanneries were in operation, as well as a saw mill, two grist mills, and one cloth fulling mill. By the mid 1830's, a cabinet maker, clockmaker and mechanics company specializing in the production of woolen blankets for the Union Army had located its operation to Rochester. The 1850's brought the establishment of the E.G. & E. Wallace Shoe Company, which eventually became the City's largest employer with over 700 employees by the turn of the twentieth Century.

As a result of steady industrial growth during the nineteenth Century, Rochester was able to incorporate as a city in 1891. Subsequently, workers were attracted from as far away as Canada, traveling to Rochester by way of four railroads, which conveniently passed through its borders.

During the Great Depression the New England economy was devastated, with the downturn rapidly spreading from urban centers to the countryside and affecting tens of thousands of people. Like many other New Hampshire municipalities, Rochester lost several large industries to bankruptcy and witnessed the relocation of many to southern states where operating costs were less expensive.

In more recent years, the City of Rochester benefited greatly from the development of Route 16 (Spaulding Turnpike), completed in the early 1950's. The turnpike has proved essential to the City's ability to attract large businesses as it has for the entire New Hampshire seacoast region.

Steady residential and commercial growth in the 1980's and 1990's, especially in the Gonic area on the south side of City, as well as explosive residential growth during the late 1990's and into the 2000's, have contributed to a progressive, bustling City which has, in many respects, withstood the country's most recent economic recession beginning in 2007.

Table 2.2 Change in land use from 2010 to 2015

Land Use	2010 (acres)	2015 (acres)	% of total area of the city	% change 2010-2015
Residential	5,823.7	6,206.4	21.3	6.6
Industrial/Commercial	1,055.5	1,197.7	4.1	13.5
Mixed Use Development	3.3	3.3	0.0	0.0
Other Development	608.4	675.4	2.3	11.0
Transportation and Utilities	1,785.9	2,009.6	6.9	12.5
Surface Water	485.8	498.9	1.7	2.7
Wetlands	2,469.3	2,441.4	8.4	-1.1
Undeveloped Land	16,848.7	16,048.0	55.2	-4.8
TOTAL	29,080.7	29,080.7	100.0	0.0

Current & Future Development Trends

The City of Rochester is located in southeastern New Hampshire's Strafford County, along the Spaulding Turnpike (NH Route 16) corridor within the New Hampshire and Maine seacoast region. Rochester's location ties it primarily to the economic influences of the greater Dover, Somersworth, and Portsmouth region, with secondary economic influences stemming from the Lakes Region (Alton/Wolfeboro), west to the Northwood and Deerfield area, south to Portsmouth, and east to the greater Sanford Maine area.

According to data provided by the City's Assessing Department, Rochester contains approximately 27,000 acres (42.18 square miles) of area, 638 acres of which is surface water (1 square mile). The City lies within the watersheds of the Salmon Falls, Piscataqua, and Cocheco River watersheds, with a dense network of tributary streams connected by large wetland complexes, lakes and ponds existing throughout. As stated within the City's 2009 Master Plan, significant portions of Rochester's land area (1,775 acres) is located within the 100 year floodplain as identified by the U.S. Federal Emergency Management Agency (FEMA) floodplain maps (2006). According to Geographic Information Systems (GIS) Flood Rate Insurance Mapping (FIRM) and aerial imagery (2010), there are only a limited number of structures located within this floodplain, greatly reducing potential impacts to municipal infrastructure. To ensure these protections continue, the City's Zoning Ordinance prohibits any development or encroachment which will result in an increase in flood levels during the base flood discharge. In addition, the Zoning Ordinance requires that new and replacement water systems to be located in flood prone areas be designed to eliminate infiltration of flood waters, avoid potential contamination, and requires documentation of flood proofing for all new or improved structures with the lowest floor of any new or renovated residential structures being no lower than the 100 year flood level.

Within the City's borders, 50% of the land is used for residential purposes, 17% is used for Commercial and industrial purposes and the final 33% currently remain undeveloped. Today, there are 259 miles of roadway that service Rochester, with access points at exits 11 - 16 along the Spaulding Turnpike, as well as from Routes 202, 11, 108 and 125. According to the City Engineer, 80 miles of municipal sewer, 120 miles of municipal water lines, 440 drainage outfalls and 2300 manholes are in place to service the City, its residents and future developments.

Since 1998, Rochester's population growth has fallen behind both the region and many surrounding communities (particularly those located north of Rochester). From 2000 to 2010, the City experienced a 1.22% average annual increase in housing units, a 0.79% average annual increase in households and a 0.43% average annual population

increase. However, this trend is beginning to change. As the supply of housing units in communities south of the City continues to decline, and average home prices continue to rise, Rochester is often seen as more "affordable" when compared with other communities. While new home construction is not at pre-recession levels, Rochester is currently working with several housing developers on projects throughout the City aimed at providing accessible, affordable housing for Rochester's highly mobile, young professional target market.

In addition to reasonable housing prices; the City offers a diversified economic base; including several advanced manufacturing companies, retailers, restaurants, hospitality, and health care providers. Like many local communities, the City was forced to adapt to a changing economy by investing funds in a variety of public programs to offset the impacts caused by the recession. City personnel worked throughout the past five years to revitalize the downtown and create a regional shopping destination attraction. In 2009, Rochester created a Small Business Retention Program for "at risk" retailers, restaurants, and other businesses. The program provided marketing services and scholarship programs with educational opportunities for local business owners and staff. This effort ties directly to the Rochester Economic Development Strategic Plan (August 2006) which brought forth the goal of assisting the City, Rochester School District, and local businesses to work together in training the public for the benefit of the local economy.

Based on an analysis of local retail and commercial listings, Rochester currently contains approximately 70,000 square feet of available space. The City's largest employment and establishment industrial sector is retail trade, which supports one in five of the community's jobs and businesses. Rochester completed a retail analysis with the goal of targeting developers and companies from across the country; an effort which resulted in thousands of City retail jobs over the past ten years. Recent retail development activity, such as the new Home Depot, Hannaford's, Kohl's and Lowe's, along with proposed retail developments within Rochester's permitting "pipeline", suggests that retailers currently seek to capture existing consumer demand from the greater Rochester region.

While the City has experienced some recent success with the addition of new businesses, it has witnessed very large, less diversified companies falling into dissolution. This fact has led many business owners to focus more closely on research and development activities that are essential to remaining viable in the twenty-first century economy. The City's ability to better control developable industrial land and utilize its vast transportation network, attract businesses to invest in the downtown and riverfront areas, improve educational attainment of students in the local school system, and cultivate a prosperous community image is essential to future growth.

Housing

In the period between 1990 and 2010, Rochester experienced an increase of 584 total housing units. Occupancy-type data show that in the same 20-year-period, total renter-occupied unit count increased by 20.4% while owner-occupied housing units increased by 26.3%. During this time period, the vacant housing units increased by 13.8% and occupied housing units increased by 23.7%.

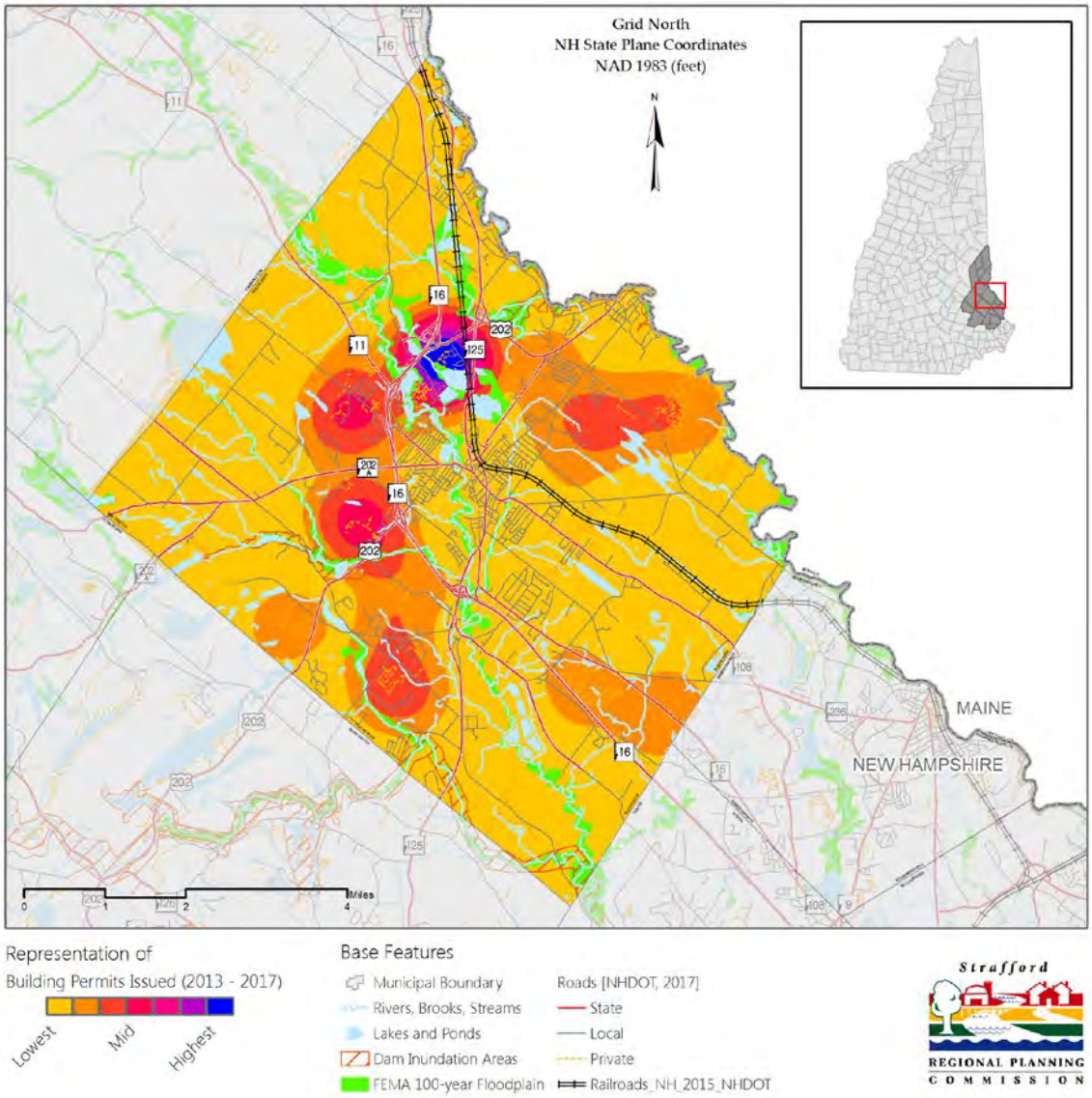
As of 2010, Rochester's occupied housing units are roughly 55% owner-occupied and 45% renter occupied. The city exhibits a 4.3% vacancy rate. With moderate population growth projected over the coming three decades, limited new housing unit development is expected.

Table 2.3 Housing units and tenure

	1990	2000	2010	% Change 1990-2010
Housing Units	11,076	11,836	13,372	20.7
Occupied Housing Units	10,221	11,434	12,378	21.1
Owner Occupied housing Units	7,051	7,643	8,359	18.6
Renter Occupied Housing Units	3,170	3,791	2,589	-18.3
Vacant Housing Units	855	402	994	16.3

Building trend data indicates that the number of building permits issued has increased in recent years. Rochester issued an average of 74 total building permits per year from 2013-2017, including twice issuing over 90 permits in a single year. As shown in Figure 2.1, these new building permits have been concentrated near exits to the Spaulding Turnpike. While some of these areas are in closer proximity to open water and floodplains, changes to the zoning ordinance in 2014 mean that new construction in these areas is less likely to be vulnerable to flooding than other historic development.

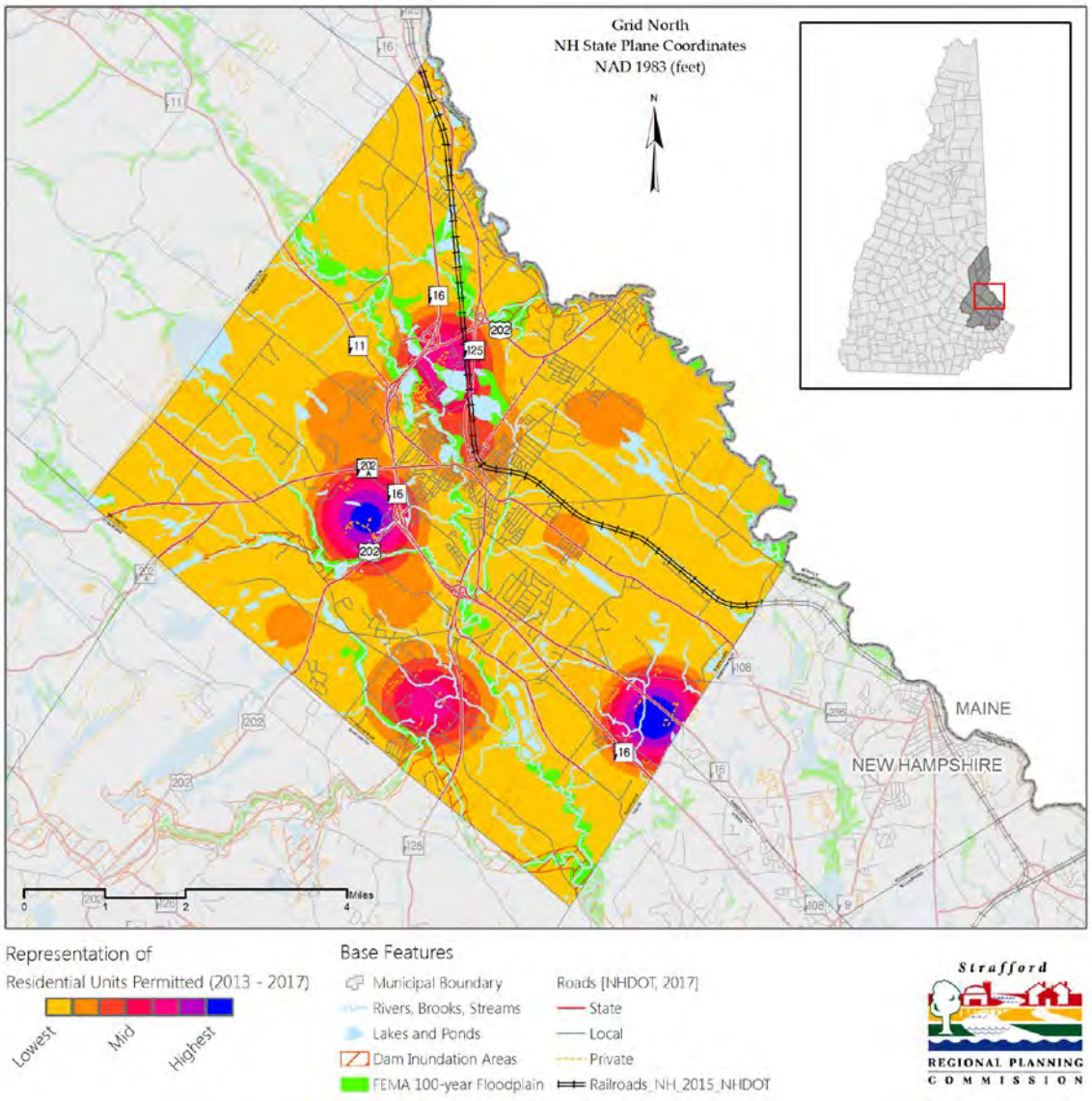
Figure 2.1 Total Building Permits Issued, 2013-2017[3]



[3] See Note 4 for source information

While many of these building permits were for new commercial or industrial establishments, the majority supported either single- or multi-family residential development. Rochester saw an average of 98 residential units permitted each year during this time period, including a maximum of 143 units permitted in 2015. The locations of these units are depicted in Figure 2.2 below.

Figure 2.2 Residential Units Permitted, 2013-2017[4]



[4] **Data Sources:**
Base features are from USGS 1:24,000 scale Digital Line Graphs, as archived in the GRANIT database. All base features distributed by Complex Systems Research Center, Durham, NH. Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center, under contract to the NH Office of State Planning and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. OSP, CSRC and the cooperating agencies make no claim as to the validity or reliability or to any implied uses of these data.

Maps prepared by Strafford Regional Planning Commission are for planning purposes only.

Conclusion

Rochester has seen a fair amount of growth and development since the last update to this plan. However, Rochester retains a significant amount of undeveloped land, and many of Rochester's most vulnerable structures discussed in this plan are the result of historic development. New development is subject to the most recent building and zoning regulations, including a comprehensive update to Rochester's zoning ordinance in 2014. Therefore, the community's overall vulnerability to potential hazards remains largely unchanged since the prior plan was completed, and several improvements have been made related to specific hazards.

Chapter 3: Asset Inventory

Critical Facilities and Key Resources

This chapter includes Critical Facilities and Key Resources (CF/KR) within the City of Rochester that were identified by the Committee during the update of this plan.

FEMA describes the term 'critical facilities' as all manmade structures or other improvements that, because of their function, size, service area, or uniqueness, have the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if they are destroyed, damaged, or if their functionality is impaired.[5] These facilities include all public and private facilities that a community considers essential for the delivery of vital services for the protection of the community, such as emergency operations centers, shelters, or utilities. [5]

> **"Critical facilities, and the functions they perform, are the most significant components of the system that protects the health, safety, and well-being of communities at risk."**
>
> **-FEMA Critical Facility Design Considerations**

Table 3.1 includes a list of Critical Facilities and Key Resources (CF/KR), including the type of facility or building. Map 3.1 displays the location of emergency Response facilities. Map 3.2 displays dams and bridges.

Table 3.1 Critical Facilities and Key Resources

Emergency Response Facilities (ERF)	
Facility Name	*Type of Facility*
Central Fire Station	Fire Station
Gonic Fire Station	Fire Station
Rochester Police Station	Police Station
Public Works Department Office	Public Works
Public Works Garage	Public Works
Non-Emergency Response Facilities (NERF)	
Facility Name	*Type of Facility*
City Hall	Government Office
City Hall Annex	Government Office
Post Office (Rochester)	Post Office
Post Office (East Rochester)	Post Office
Post Office (Gonic)	Post Office
Fairpoint Communications	Communications
Atlantic Broadband	Communications
Turnkey Landfill	Solid Waste Disposal

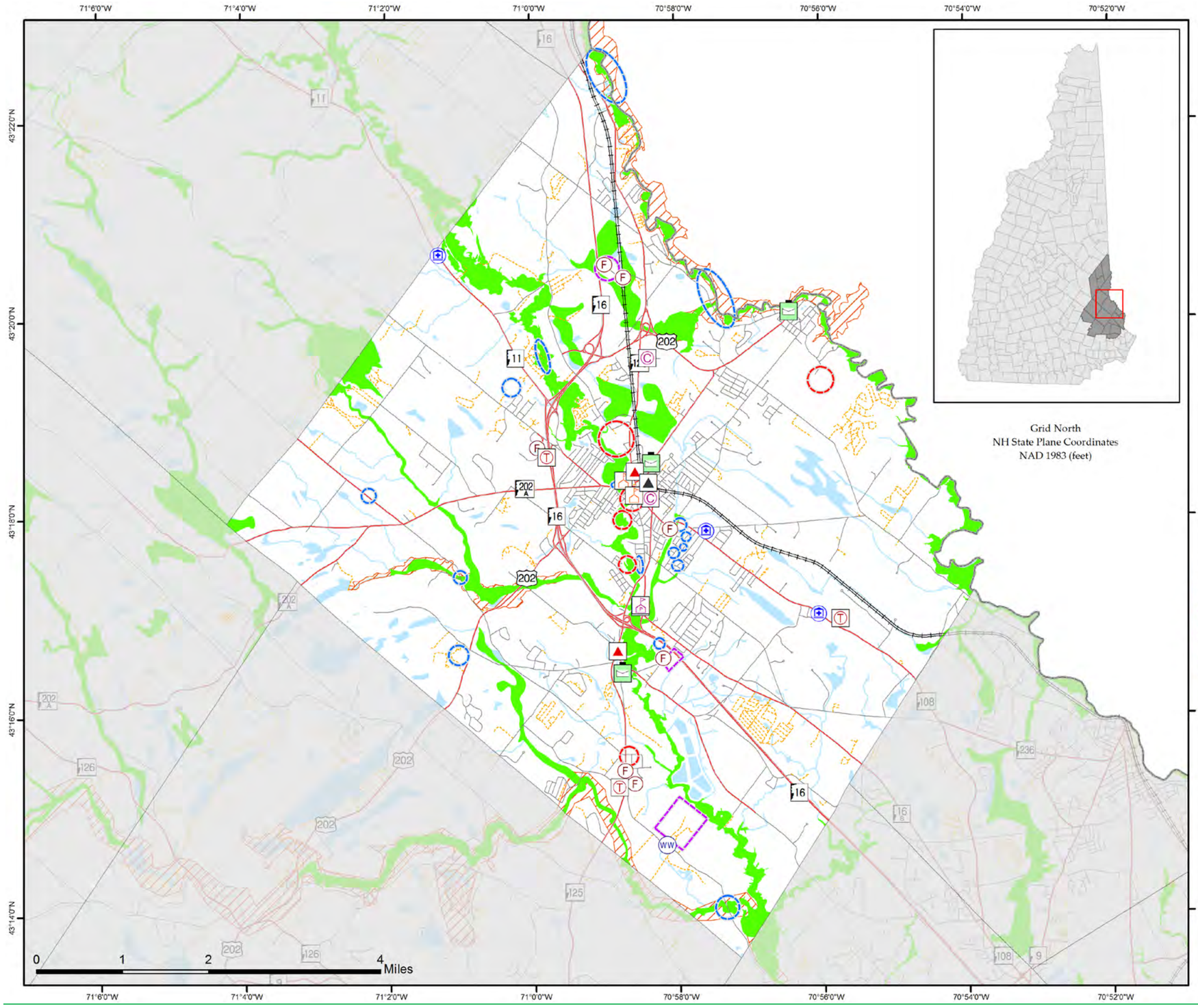
[5] https://www.fema.gov/media-library-data/20130726-1557-20490-2839/fema543_chapter1.pdf

Facilities and Populations to Protect (FPP)	
Facility Name	*Type of Facility*
Spaulding High School	School
Rochester Middle School	School
McClelland School	School
Nancy Loud School	School
Bud Carlson Academy	School
Chamberlain Street School	School
Monarch School of New England	School
East Rochester School	School
Maple Street School	School
Jack and Jill Kindergarten	School
Gonic School	School
William Allen School	School
School Street School	School
Richard W. Creteau Regional Technology Center	School
St. Elizabeth Seton School	School
Emmanuel Child Care Center	Child Care
Rochester Child Care Center	Child Care
Rochester Community Center	Community Center
Village at Riverside	Elderly and Special Needs Facilities
Cocheco River Estates	Elderly and Special Needs Facilities
Lilac View	Elderly and Special Needs Facilities
Rochester Manor	Elderly and Special Needs Facilities
Meadow View Manor	Elderly and Special Needs Facilities
Colonial Hill Care & Rehabilitation Center	Elderly and Special Needs Facilities
Studley Home	Elderly and Special Needs Facilities
Tara Estates	Mobile Home Park
Chestnut Hill	Mobile Home Park
Rochester Fairgrounds	Large Events Space
Myhre Equine Clinic	Animal Services
Broadview Animal Hospital	Animal Services
Animal Health Center	Animal Services
Granite State Business Park	Commercial and Industrial Development
NH Northcoast Industrial Park	Commercial and Industrial Development
Gonic Industrial Park	Commercial and Industrial Development
Granite Ridge Development District	Commercial and Industrial Development
Ten Rod Road Industrial Park	Commercial and Industrial Development
Crossroads Industrial Park	Commercial and Industrial Development
Gerrity Business/Industrial Park	Commercial and Industrial Development
Lydall Filtration/Separation	Commercial and Industrial Development
Lilac Mall	Commercial and Industrial Development

Potential Resources (PR)	
Facility Name	*Type of Facility*
Frisbie Hospital	Health Care Facility
Homemakers Health Services	Health Care Facility
Rochester District Visiting Nurse Association	Health Care Facility
Sky Haven Airport	Transportation
Rochester Truck	Transportation
Student Transportation of America	Transportation
Wal-Mart	Food, Water, Retail
Home Depot	Food, Water, Retail
Market Basket (Marketplace Boulevard)	Food, Water, Retail
Brock's	Food, Water, Retail
Lowes	Food, Water, Retail
Hannaford (Milton Road)	Food, Water, Retail
Hannaford (North Main Street)	Food, Water, Retail
Market Basket (Milton Road)	Food, Water, Retail
Irving	Emergency Fuel
Eastern Propane Storage Facility (Industrial Way)	Emergency Fuel
Eastern Propane Storage Facility (Railroad Avenue)	Emergency Fuel
Eastern Propane Storage Facility (Northcoast Drive)	Emergency Fuel
Just Oil	Emergency Fuel
Local Pride	Emergency Fuel
Public Works Gas Tanks	Emergency Fuel

Water Resources (WR)	
Facility Name	*Type of Facility*
Chesley Hill Road Tank	Water Tank
Salmon Falls Road Tank	Water Tank
Rochester Hill Road Tank	Water Tank
Richardson Street BPS	Water Pump Station
Granite Ridge BPS	Water Pump Station
Washington Street BPS	Water Pump Station
Salmon Falls Road BPS	Water Pump Station
Salmon Falls Road BPS	Water Pump Station
Industrial Way BPS	Water Pump Station
Industrial Way BPS	Water Pump Station
Gina Drive BPS	Water Pump Station
Cocheco Well Treatment Plant	Water Treatment Facility
Rochester Water Treatment Plant	Water Treatment Facility
Rochester Wastewater Treatment Plan	Wastewater Treatment Facility
Ryan Circle Pump Station	Sewer Pump Station
Old 125 Pump Station	Sewer Pump Station
Washington Street Pump Station	Sewer Pump Station
River Street Pump Station	Sewer Pump Station
Lowell Street Pump Station	Sewer Pump Station
South Main Street Pump Station	Sewer Pump Station
Front Street Pump Station	Sewer Pump Station
Salmon Falls Road Pump Station	Sewer Pump Station
Sawyer Avenue Pump Station	Sewer Pump Station
Autumn Street Pump Station	Sewer Pump Station
Route 11 Pump Station	Sewer Pump Station
Route 125 Pump Station	Sewer Pump Station
Headworks Pump Station	Sewer Pump Station
Wyandotte Falls Pump Station	Sewer Pump Station
Tara Estates Pump Station	Sewer Pump Station
Western Avenue Pump Station	Sewer Pump Station
Innovation Drive Pump Station	Sewer Pump Station
Airport Drive Pump Station	Sewer Pump Station
Ledgeview Pump Station	Sewer Pump Station
Thomas Street Pump Station	Sewer Pump Station
Capital Circle Pump Station	Sewer Pump Station
Main Street East Rochester Pump Station	Sewer Pump Station
Matilda Way Pump Station	Sewer Pump Station
Ray Drive Pump Station	Sewer Pump Station
Sterling Drive Pump Station	Sewer Pump Station
Weeping Willow Pump Station	Sewer Pump Station
Chestnut Hill Road Pump Station	Sewer Pump Station
Community Center Pump Station	Sewer Pump Station
Kirsten Avenue Pump Station	Sewer Pump Station
Norway Plains Pump Station	Sewer Pump Station

Figure 3.1 Emergency Response Facilities, Non-Emergency Response Facilities, and Potential Resources



Critical Infrastructure & Past and Potential Hazards

Hazard Mitigation Plan (2018)

ROCHESTER, NH

Critical Infrastructure Legend

Emergency Response

- Fire Station
- Police Station
- Public Works

Non-Emergency Response

- Communications
- Government Office
- Post Office
- Solid Waste

Potential Resources

- Emergency Fuel
- Health Care
- Transportation

Base Features

- Past Hazard Flooding
- Past Hazard Fire
- Potential Hazard Materials
- FEMA 100-year Floodplain
- Dam Inundation Areas
- Municipal Boundary
- Rivers, Brooks, Streams
- Lakes and Ponds
- Roads [NHDOT, 2017]
- State
- Local
- Private

Data Sources:

Base features are from USGS 1:24,000 scale Digital Line Graphs, as archived in the GRANIT database. All base features distributed by Complex Systems Research Center, Durham, NH. Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center, under contract to the NH Office of State Planning and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. OSP, CSRC and the cooperating agencies make no claim as to the validity or reliability or toany implied uses of these data.

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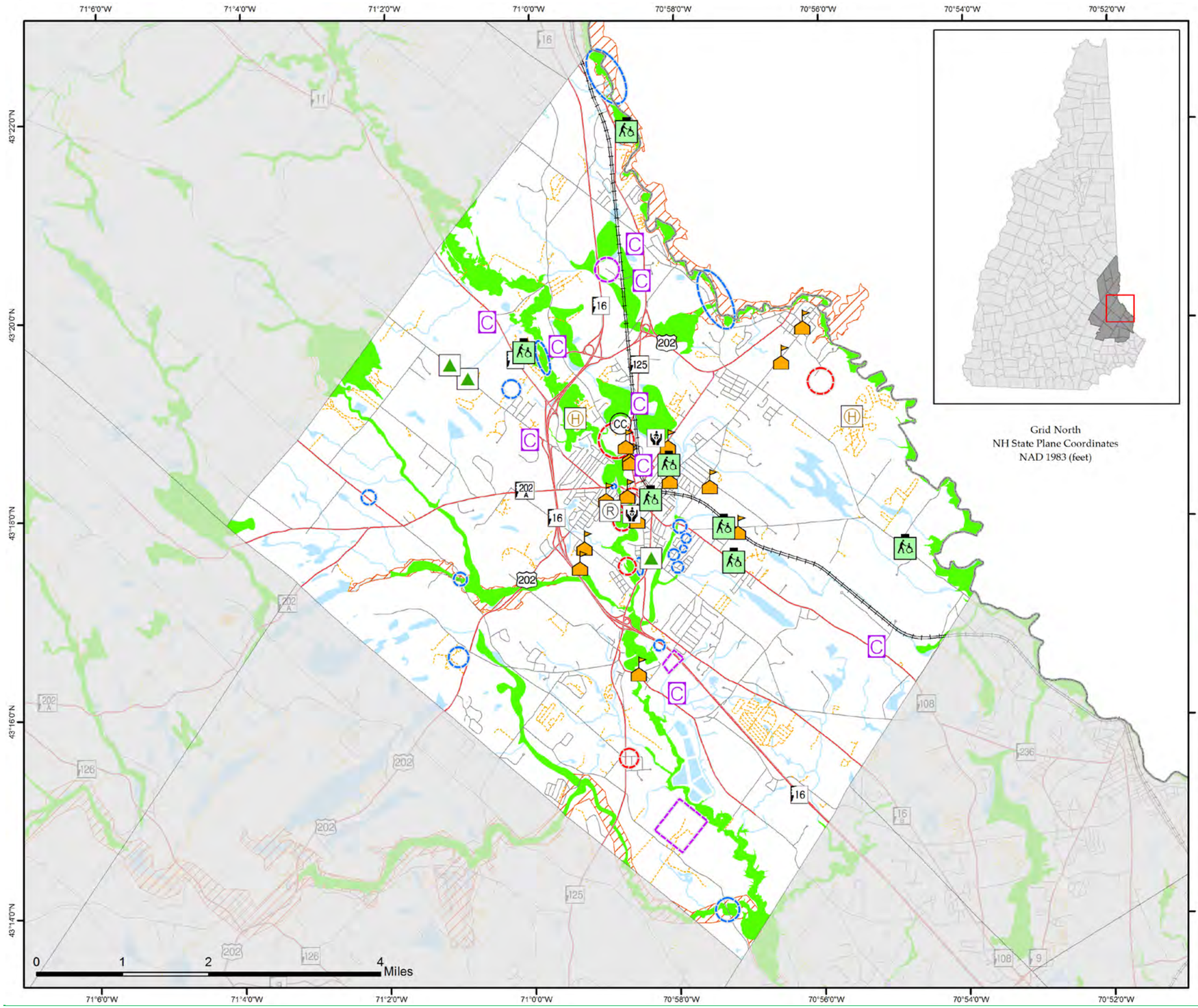
Date: October 2018

Maps prepared by Strafford Regional Planning Commission are for planning purposes only.

Strafford REGIONAL PLANNING COMMISSION

Figure 3.2 Facilities and Populations to Protect



Critical Infrastructure & Past and Potential Hazards

Hazard Mitigation Plan (2018)

ROCHESTER, NH

Critical Infrastructure Legend

Facilities and Populations to Protect

- Animal Services
- Child Care
- Commercial and Industrial Development
- Community Center
- Elderly and Special Needs Facilities
- Mobile Home Park
- Recreational Facility
- School

Base Features

- Past Hazard Flooding
- Past Hazard Fire
- Potential Hazard Materials
- FEMA 100-year Floodplain
- Dam Inundation Areas
- Municipal Boundary
- Rivers, Brooks, Streams
- Lakes and Ponds
- Roads [NHDOT, 2017]
- State
- Local
- Private

Data Sources:

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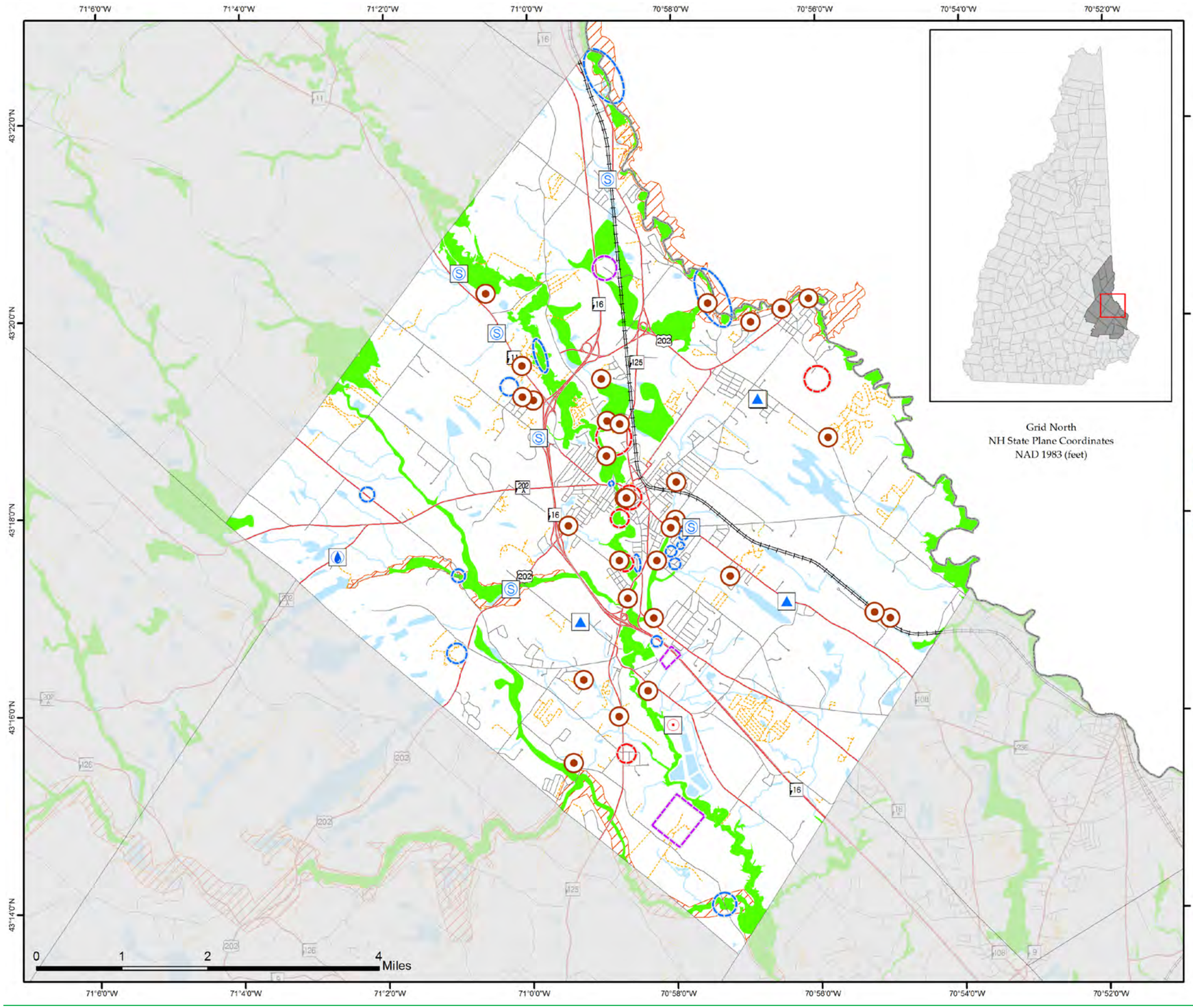
Strafford REGIONAL PLANNING COMMISSION

Figure 3.3 Water Resources



Critical Infrastructure & Past and Potential Hazards

Hazard Mitigation Plan (2018)

ROCHESTER, NH

Critical Infrastructure Legend

Water Resources

- Water Pump Station
- Water Distribution
- Water Tank
- Sewer Pump Station
- Wastewater Treatment Plant

Base Features

- Past Hazard Flooding
- Past Hazard Fire
- Potential Hazard Materials
- FEMA 100-year Floodplain
- Dam Inundation Areas
- Municipal Boundary
- Rivers, Brooks, Streams
- Lakes and Ponds

Roads [NHDOT, 2017]

- State
- Local
- Private

Data Sources:

Base features are from USGS 1:24,000 scale Digital Line Graphs, as archived in the GRANIT database. All base features distributed by Complex Systems Research Center, Durham, NH. Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center, under contract to the NH Office of State Planning and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. OSP, CSRC and the cooperating agencies make no claim as to the validity or reliability or toany implied uses of these data.

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Strafford REGIONAL PLANNING COMMISSION

Table 3.2 Bridges

Bridge ID	Location		Owner
109/090	US202,NH 16,SP TPK	.8 MI FROM JCT NH202-A	Turnpike Bureau, NHDOT
030/097	SALMON FALLS RIVER	MAINE SL	Municipality
127/110	COCHECO RIVER	0.03MI RTE 202A	Municipality
149/113	COCHECO RIVER	.7 MI JCT RT 16	Municipality
095/106	NHNCRR	.5 MI E OF SPAULDING TPK	Turnpike Bureau, NHDOT
102/096	CHESTNUT HILL ROAD	2.9 MI S OF MILTON TL	Turnpike Bureau, NHDOT
051/094	BETTS ROAD	1.1 MI S OF MILTON TL	Turnpike Bureau, NHDOT
093/110	NH125	NH 16 INTERCHANGE	Turnpike Bureau, NHDOT
095/097	NH 16 CONNECTOR	2.5 MI S OF MILTON TL	Turnpike Bureau, NHDOT
106/092	COCHECO RIVER	1.2 MI FROM JCT RT 16	Turnpike Bureau, NHDOT
117/086	TEN ROD ROAD	.4MI FROM JCT RT 11	Turnpike Bureau, NHDOT
121/121	WARDLEY BROOK	1 MI. WEST OF RTE. 11	Municipality
127/106	COCHECO RIVER	1.2 MI FROM JCT RT 16	Municipality
128/089	NH202A (WALNUT STREET)	1.0 MI FROM JCT RT 11	Turnpike Bureau, NHDOT
134/064	RICKERS BROOK	2.0 MI. E. BARRINGTON TL	NHDOT
139/094	US202	.6 MI FROM JCT RT 202A	Turnpike Bureau, NHDOT
147/099	AXEHANDLE BROOK	1.2 MI FROM JCT. RT 202A	Turnpike Bureau, NHDOT
148/113	COCHECO RIVER	1 MI EAST JCT SPAULDING	Municipality
082/083	COCHECO RIVER	0.71MI.N. NH 11	Municipality
152/083	RICKERS BROOK	0.6 MI JCT RTE 16	NHDOT
071/116	SALMON FALLS RIVER	0.08MI. MAINE SL	Municipality
079/144	SALMON FALLS RIVER	MAINE SL	NHDOT
103/094	RECREATION TRAIL	2.8 MI S OF MILTON TL	Turnpike Bureau, NHDOT
158/113	COCHECO RIVER	1.0 MI FROM RT 16	Turnpike Bureau, NHDOT
089/112	US202,NH 11 WB(RAMP A)	.7 MI FROM JCT NH 16	Turnpike Bureau, NHDOT
105/091	COCHECO RIVER	0.2 MI N JCT RT 11	Turnpike Bureau, NHDOT
158/114	WARDLEY BROOK	.57 MI. S. OF JCT. NH 125	Municipality
159/113	WARDLEY BROOK	0.15 MI JCT SP TPK	Turnpike Bureau, NHDOT
169/112	COCHECO RIVER	3.1 MI DOVER TL	Municipality
176/133	NH 16,SP TPK	1.7 MI FROM DOVER TL	Turnpike Bureau, NHDOT
155/110	AXE HANDLE BROOK	.1 MI FROM JCT SP. TPK.	Municipality
158/110	NH125	3.25 MI N DOVER T/L	Turnpike Bureau, NHDOT
152/086	AXE HANDLE BROOK	CITY ST	Municipality
194/149	BLACKWATER ROAD	.6 MI FROM DOVER T.L.	Turnpike Bureau, NHDOT
206/110	ISINGLASS RIVER	.1 MI BARRINGTON T.L.	NHDOT
225/139	ISINGLASS RIVER	1.95 MI RTE 125	Municipality
148/121	WILLOW (WARDLEY) BROOK	0.16MI E JCT NH125	Municipality
154/173	NHNCRR	0.3 MILES FROM JCT NH108	Municipality
156/185	HAVEN HILL ROAD	Rochester	Railroad
157/113	COCHECO RIVER	NB Off-ramp over Cocheco	Turnpike Bureau, NHDOT
161/111	COCHECO RIVER	.1 MILE SOUTH OF RT. 125	Turnpike Bureau, NHDOT
196/101	BROOK	600FT S JCT FLAGG RD	Municipality
081/124	HEATH BROOK	1.2MI S JCT NH125	Municipality
104/091	COCHECO RIVER	SB OFFRAMP OVER COCHECO	Turnpike Bureau, NHDOT
107/090	COCHECO R. BACKWATER	SB OFFRAMP/ COCHECO BKWTR	Turnpike Bureau, NHDOT
059/096	CROSS ROAD	1.4 MI S OF MILTON TL	Turnpike Bureau, NHDOT

*Municipal Red List **State Red List

Table 3.3 Dams and Hazard Class

Hazard Class	Name	River or Stream	Dam ID
H	ROCHESTER RESERVOIR DAM	HOWARD BROOK	204.13
S	GONIC DAM	COCHECO RIVER	204.02
S	UPPER CITY DAM	COCHECO RIVER	204.05
S	SPAULDING POND DAM	SALMON FALLS RIVER	204.08
S	ROCHESTER SEWAGE LAGOON	NA	204.23
S	BAXTER LAKE MAIN DAM	RICKERS BROOK	204.11
L	GONIC SAWMILL POND DAM	COCHECO RIVER	204.01
L	WYANDOTTE/HATFIELD DAM	COCHECO RIVER	204.04
L	BOSTON FELT DAM	SALMON FALLS RIVER	204.06
L	BAXTER LAKE EAST DIKE	RICKERS BROOK	204.09
L	BAXTER LAKE CENTER DIKE	RICKERS BROOK	204.10
NM	CRYSTAL POND DAM	CRYSTAL POND	204.14
NM	FARM POND DAM	NATURAL SWALE	204.18
NM	VICKERY FARM POND DAM	TR ROCKERS BROOK	204.21
NM	WILDLIFE POND DAM	NATURAL SWALE	204.22
NM	FARM POND DAM	NATURAL SWALE	204.25
NM	FRANKLIN HEIGHTS DETENTION POND I	RUNOFF	204.33
NM	FRANKLIN HEIGHTS DETENTION POND II	RUNOFF	204.34
NM	CABLETRON DET POND 2 DAM	RUNOFF	204.51
NM	PLAZA 202 DET POND II DAM	RUNOFF	204.54
NM	RAMSEY DET POND 1 DAM	RUNOFF	204.57
NM	RAMSEY DET POND 2A DAM	RUNOFF	204.58
NM	PRIME TANNING DET POND DAM	RUNOFF	204.62
NM	WALMART DET POND 1 DAM	RUNOFF	204.63
NM	LEDGEVIEW DRIVE DAM	RUNOFF	204.67
NM	ROCHESTER SHOPPES DET POND DAM	RUNOFF	204.69
NM	TURNKEY DETENTION PONDS	TRIB TO ISINGLASS RIVER	204.70
NM	PICKERING PONDS DAM	N/A	204.71

Table 3.4 Dams in Rochester by Classification

Dam Classification	Classification Definition	Number of Dams in Rochester	Inspection Interval (Years)
High	Dam that has a high hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in probable loss of human life.	1	2
Significant	Dam that has a significant hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no probable loss of lives but major economic loss to structures or property.	5	4
Low	Dam that has a low hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no possible loss of life and low economic loss to structures/property.	5	6
Non-Menace	Dam that is not a menace because it is in a location and of a size that failure or misoperation of the dam would not result in probable loss of life or loss to property.	17	6

Vulnerable Structures and Potential Loss

Critical Facilities/Key Resources and Other Assets

It is important to identify the critical facilities and other structures that are most likely to be damaged by hazards. Table 3.2 lists CF/KRs, bridges, and dams that are located within past and potential hazard areas. The majority of these structures are located within the 100-year floodplain or areas of past flooding, while one facility is located in an area that typically sees above-average negative impacts as a result of wind-related events.

Table 3.5

CF/KR and other Assets	Hazard	100% of Structure Value*
CF/KR		
Washington Street BPS	Flooding - Located in 100 yr Floodplain	$400,000
Lowell Street Pump Station		$300,000
South Main Street Pump Station		$950,000
Salmon Falls Road Pump Station		$400,000
Sawyer Avenue Pump Station		$300,000
Wyandotte Falls Pump Station		$300,000
Norway Plains Pump Station		$450,000
South Main Street Pump Station	Flooding – Located in Past Flooding Area	$950,000
Village at Riverside	Located in potential Dam Inundation Areas	$4,891,400
Front Street Pump Station		$800,000
Salmon Falls Road Pump Station		$400,000
Washington Street BPS		$400,000
Rochester Child Care Center	Area at risk of, or previously impacted by, large fires	$1,906,100
St. Elizabeth Seton School		$4,425,600
Rochester Community Center		(assessment includes Spaulding High School and Community Center) $85,019,800
Spaulding High School		
River Street Pump Station		$350,000
Wyandotte Falls Pump Station		$300,000
Community Center Pump Station		$300,000
Kirsten Avenue Pump Station		$300,000
Eastern Propane Storage Facility (Railroad Avenue)	Areas at risk of hazardous materials impacts	$1,002,900
Eastern Propane Storage Facility (Northcoast Drive)		$2,036,400
Turnkey Landfill		$47,244,757
CF/KR Total		$151,376,957
Bridges**		
030/097 Spaulding Avenue	Flooding – Located in 100 yr Floodplain	$3,200,000
127/110 Bridge Street		$3,780,000
149/113 NH 125		$2,120,000
127/106 Route 202A		$6,916,000
134/064 Route 202A		$572,000

147/099 NH 16, Spaulding Turnpike		$4,224,000
148/113 Recreation Trail		$2,849,000
082/083 Little Falls Bridge Road		$3,910,000
152/083 US 202		$1,056,000
079/144 US 202/NH 11		$4,264,000
158/113 NH 16, Spaulding Turnpike		$8,632,000
105/091 NH 16, Spaulding Turnpike		$7,300,000
106/092 US 202/NH 11, Spaulding Turnpike		$12,848,000
158/114 Old Dover Road		$595,000
159/113 Spaulding Turnpike Off Ramp		$560,000
169/112 Main Street		$5,016,000
155/110 NH 125		$1,650,000
152/086 Chesley Hill Road		$720,000
206/110 NH 125		$5,950,000
225/139 Rochester Neck Road		$2,412,000
148/121 Lowell Street		$378,000
157/113 Spaulding Turnpike Off Ramp		$6,255,000
161/111 Spaulding Turnpike Off Ramp		$7,532,000
196/101 Stillwater Circle		$2,784,000
081/124 Salmon Falls Road		$374,000
104/091 NH 16/ Spaulding Turnpike Ramp		$4,640,000
107/090 NH 16/ Spaulding Turnpike Ramp		$6,930,000
030/097 Spaulding Avenue	Flooding – Located in potential Dam Inundation Area	$3,200,000
152/083 US 202		$1,056,000
071/116 Flat Rock Bridge Road		$2,688,000
079/144 US 202/NH 11		$4,264,000
152/086 Chesley Hill Road		$720,000
206/110 NH 125		$5,950,000
225/139 Rochester Neck Road		$2,412,000
196/101 Stillwater Circle		$2,784,000
081/124 Salmon Falls Road		$374,000
127/110 Bridge Street	Area at risk of, or previously impacted by, large fires	$3,780,000
Bridges Total		$110,155,000
Dams		
BOSTON FELT DAM	Flooding – Located in 100 yr Floodplain	The Dam Bureau at NHDES has looked into assessing values for state-owned dams with marginal success. They considered bond ratings, market value, and construction costs. They also developed a formula that calculated the cubic feet of water impounded as a monetary value. Because dams serve different purposes (recreational, hydro-power), assessed values are hard to estimate and cannot be determined.
SPAULDING POND DAM		
ROCHESTER SEWAGE LAGOON		
FARM POND DAM		
PICKERING PONDS DAM		
BOSTON FELT DAM	Flooding – Located in potential Dam Inundation Area	
SPAULDING POND DAM		

WYANDOTTE/HATFIELD DAM	Area at risk of, or previously impacted by, large fires	
Total		$261,531,957

*Assessed values as of April 1, 2013. The City's next update of property assessments is scheduled for April 1, 2018.
**The approximate assessed value for the bridges was calculated by multiplying $1,000.00 per square foot of bridge deck area. This estimate was provided by the Bridge Design Bureau at NHDOT and includes all cost (engineering, consulting and in-house design, construction, etc.) to build a new bridge. The square footage was calculated by multiplying the length of the bridge by 20 feet.

In Rochester, 19 CF/KR, 28 bridges, and one dam were identified during the risk assessment as being located in potentially hazardous areas. The potential total loss of CF/KR and municipal bridges in at-risk locations is estimated at $14,401,000.

Buildings and Utilities

It is difficult to ascertain the amount of damage that could be caused by a natural or man-made hazard because the damage will depend on the hazard's extent and severity, making each hazard event somewhat unique. The assumption used here when calculating the damage to property is that a hazard may result in low (1% of structures damaged), medium (5% of structures damaged), or high (10% of structures damaged) economic loss depending on the nature of the hazard. Table 3.5 displays total assessed value and low, medium, and high economic loss.

Table 3.6

Local Assessed Valuation (2016)				
	Total Assessed Value (2016)	Economic Loss		
		Low	Medium	High
Buildings				
Residential	$1,031,904,104	$10,319,041	$51,595,205	$103,190,410
Manufactured Housing	$104,203,700	$1,042,037	$5,210,185	$10,420,370
Commercial Industrial	$316,319,296	$3,163,193	$15,815,965	$31,631,930
Total Buildings	**$1,452,427,100**	**$14,524,271**	**$72,621,355**	**$145,242,710**
Utilities				
Public Water*	$0*	$0*	$0*	$0*
Electric	$71,974,000	$719,740	$3,598,700	$7,197,400
Other	$15,061,100	$150,611	$753,055	$1,506,110
Total Utilities	**$87,035,100**	**$870,351**	**$4,351,755**	**$8,703,510**
Net Valuation Buildings and	**$1,539,462,200**	**$15,394,622**	**$76,973,110**	**$153,946,220**

Source: NH Department of Revenue Administration. 2017 Annual Report. Assessed value does not include value of land or local exemptions. *This report did not contain an assessment of the public water system. (http://www.revenue.nh.gov/publications/reports/documents/dra2016annualreport.pdf)

The total local assessed value included in this analysis is $1,539,462,200, including $1,452,427,100 for buildings and $87,035,100 for utilities. Based on this assumption, the potential loss from any of the identified hazards under a low, medium, and high damage scenario of buildings and utilities would range from **$0 to $15,394,622 (low)** or **$15,394,622 to $76,973,110 (moderate)** or **$76,973,110 to $153,946,220 (high)** based on the 2015 Rochester City valuation.

In order to stay consistent, the Committee made the decision to use the results derived from the hazard vulnerability assessment tool (Table 5.1). There was consensus that the overall threat rankings (severity x probability) associated with each hazard were an equal indicator to the percentage of damage and were therefore used to determine the potential

loss. Human loss of life was not included in the potential loss estimates, but could be expected to occur, depending on the severity and type of the hazard.

Chapter 4: National Flood Insurance Program

Communities that participate in the NFIP have adopted and enforce community floodplain regulations. One of the community's requirements is to require and obtain certain elevation data for all new and substantially improved structures located in a special flood hazard area. Community permitting officials must review this elevation data to ensure floodplain development complies with the regulations.[6]

Rochester National Flood Insurance Program (NFIP) Status & Compliance

Rochester has been a member of the National Flood Insurance Program (NFIP) since June, 1979. The City does have significant portions of land in the 100-year floodplain; along Rickers, Howard, Axe Handle, Heath, and Willey Brooks, areas along Hanson Pond, and portions of the Isinglass River. There are limited structures within this floodplain according to available GIS Flood Insurance Rate Map (FIRM) data and aerial imagery (2010). Rochester has two repetitive loss structures, both of which are single-family residential properties near the Cocheco River. Each was damaged in the "Mothers' Day Flood" in May 2006 and the "Patriots' Day Flood" in April 2007. Combined payments for these buildings totaled $33,771.72. Table 4.1 provides an overview of flood insurance policies in Rochester.

As noted in **Chapter 42.13 Flood Hazard Overlay District**[7]:

A. Purpose. This ordinance, adopted pursuant to the authority of RSA 674:16, shall be known as the City of Rochester Floodplain Development Ordinance. The regulations in this ordinance shall overlay and supplement the regulations in the City of Rochester Zoning Ordinance, and shall be considered part of the Zoning Ordinance for purposes of administration and appeals under state law. If any provision of this ordinance differs or appears to conflict with any provision of the Zoning Ordinance or other ordinance or regulation, the provision imposing the greater restriction or more stringent standard shall be controlling

Rochester has continued communication with FEMA to discuss NFIP compliance issues, especially with designated flood areas. In 2011, the New Hampshire Geological Survey conducted a fluvial erosion assessment on the Cocheco River. The study evaluated the physical conditions, adjacent floodplain, and identified problematic areas such as crossings, culverts and locations where erosion may be a hazard. These zones will be mapped and will be used to identify areas most at risk to erosion, flooding and future river adjustments through an understanding of the physical condition of the river, and to identify priorities for the replacement and rehabilitation of problematic culverts, and river restoration projects. The Flood Hazard Overlay District was updated in 2014 as part of a comprehensive amendment to the zoning code for consistency with the most recent model ordinances. In the future the City will continue to look into revising their zoning ordinances that would improve floodplain management in the community.

[6] https://www.nh.gov/oep/planning/programs/fmp/documents/fs-2-elevation-certificate.pdf

[7] Rochester Zoning Ordinance. City of Rochester, New Hampshire. Amended through 4/22/14.

Table 4.1 Rochester Insurance Zone Policies (Source: FEMA Community Information System)

Zone	Policies in Force	Premium	Insurance in Force	Number of Closed Paid Losses	$ of Closed Paid Losses	Adjustment Expense
A01-30 & AE Zones	9	$14,283	$1,576,500	6	$29,097.30	$3,275.00
A Zones	5	$18,210	$1,798,000	1	$5,000.00	$500.00
B, C & X Zone – Standard	6	$12,397	$1,978,000	2	$19,727.85	$1,275.00
B, C & X Zone – Preferred	30	$15,902	$7,530,000	5	$26,483.93	$3,125.00
Total	**50**	**$60,792**	**$12,882,500**	**14**	**$80,307.00**	**$8,175.00**

Chapter 5: Hazards & Mitigation Strategies

Overview

This section describes the location and extent of hazards that could impact the City of Rochester, presents past hazard events in the City or elsewhere in New Hampshire, and discusses their rank order placement. The Multi-Hazard Mitigation Planning Committee investigated past and potential hazards using a variety of sources and techniques, including but not necessarily limited to interviewing City historians and other citizens; researching historical records archived at the City Library; scanning old newspapers; reading published City histories; consulting various hazard experts; and extracting data from the NH Hazard Mitigation Plan and other state and federal databases. Past and potential hazards were mapped where spatial data was available.

Rating Probability, Severity, and Overall Risk of Future Disasters

The nature of each hazard type and the quality and availability of corresponding data made the evaluation of hazard potential difficult. The Multi-Hazard Planning Committee considered what data was at hand and used its collective experience to formulate statements of impact or potential. Each hazard type was rated using a hazard vulnerability assessment tool (refer to Table 5.1). This tool estimates the probability of occurrence, severity, and overall risk of an event using a projected number system answering questions, which answer High (3), Moderate (2), and Low (1). A zero (0) score meant that there is no likelihood the hazard would impact the City in the next 25 years. The ranges established for the average to determine severity were:

- **High** = 4 or higher
- **Moderate** = 2-3
- **Low** = 1 or below

The overall risk is a numeric indication developed by multiplying the total numbers of the probability and the severity.

Probability of Occurrence

Probability is based on a limited objective appraisal of a hazard's probability using information provided by relevant sources, observations and trends. The Planning Committee discussed and rated probability of each hazard.

- **High:** There is a very strong likelihood (67-100% chance) that Rochester will experience a hazardous event within the next 25 years. Score = 3
- **Moderate:** There is moderate likelihood (34-66% chance) that Rochester will experience a hazardous event within the next 25 years. Score = 2
- **Low:** There is little likelihood (0-33% chance) that Rochester will experience a hazardous event within the next 25 years. Score = 1

Severity

Severity is an estimate generally based on a hazard's impact human, property and business. The Planning Committee discussed the severity of each hazard. The severity was calculated by the average of human, property and business.

- **High:** The total population, property, commerce, infrastructure and services of the City are uniformly exposed to the effects of a hazard of potentially great magnitude. In a worst case scenario there could be a disaster of major to catastrophic proportions. Score = 3

- **Moderate:** The total population, property, commerce, infrastructure and services of the City are exposed to the effects of a hazard of moderate influence; or the total population, property, commerce, infrastructure and services of the community is exposed to the effects of a hazard, but not all to the same degree; or an important segment of population, property, commerce, infrastructure or service is exposed to the effects of a hazard. In a worst case scenario there could be a disaster of moderate to major, though not catastrophic, proportions. Score = 2
- **Low:** A limited area or segment of population, property, commerce, infrastructure or service is exposed to the effects of a hazard. In a worst case scenario there could be a disaster of minor to moderate proportions. Score = 1

Overall Risk

The risk number is one, which can help the City weigh the hazards against one another to determine which hazard is most detrimental. This is calculated by multiplying the ***Probability of Occurrence*** score by the average of the ***Severity*** score (human, property, and business impacts).

- **High:** There is a great risk of this hazard in Rochester. Score = 4 or greater
- **Moderate:** There is moderate risk of this hazard in Rochester. Score = 2-3
- **Low:** There is little risk of this hazard in Rochester. Score = 1 or less

Hazard Ratings in Rochester, NH

The Committee determined that the overall risk associated with the identified hazards is distributed as follows:

- 7 hazards rated as having a **High** overall risk in Rochester:
  - Flooding (Including Dam Breach)
  - Severe Winter Weather
  - Severe Windstorms (Tornados, Thunderstorms, Downbursts, & Hurricanes)
  - Large Fires (Wildfire & Urban Fire)
  - Public Health Threats
  - Hazardous Materials
  - Cyber Security

- 2 hazards rated as having a **Moderate** overall risk in Rochester:
  - Large Crowd Events
  - Extreme Heat & Drought

- 2 hazards rated as having a **Low** overall risk in Rochester:
  - Earthquake, Landslide, & Subsidence
  - Geomagnetic & Electromagnetic Events

Table 5.1 is the City's vulnerability assessment tool, which provides more information on the multi-hazard threat analysis that was completed during a brainstorming session with the Planning Committee.
Table 5.2 documents all presidentially declared disasters that have impacted the City of Rochester from 1990 through the preparation of this plan in 2017, including documentation of the local impacts of each event.
Table 5.3 documents all declarations of a state of emergency that have impacted the City of Rochester from 1990 through the preparation of this plan in 2017, including documentation of the local impacts of each event.

Hazard Vulnerability Table

Table 5.1: Hazard Vulnerability Assessment Tool - City of Rochester

Hazard Event	Human Impact	Property Impact	Business Impact	Severity	Probability	Overall Threat
Impact Rankings: 0 – N/a 1-Low 2-Moderate 3-High	*Probability of death or injury*	*Physical losses and damages*	*Interruption of service*	*Average of human, property, and business impacts*	*Likelihood this will occur within 25 years*	*(Severity x probability) (Rounded to the nearest whole number)* *Low = 0-1* *Moderate = 2-3* *High = 4<*
Flooding (Including Dam Breach)	3	3	3	3	3	9
Severe Winter Weather	1	2	1	1.33	3	4
Severe Windstorms (Tornados, Thunderstorms, Downbursts, and Hurricanes)	1	2	1	1.33	3	4
Large Fires (Wildfire and Urban Fire)	1	2	1	1.33	3	4
Earthquake, Landslide, & Subsidence	1	2	1	1.33	1	1
Large Crowd Events	1	1	1	1	3	3
Public Health Threats	3	2	2	2.33	3	7
Hazardous Materials	3	3	3	3	2	6
Extreme Heat & Drought	1	1	1	1	3	3
Geomagnetic & Electromagnetic Events	1	1	1	1	1	1
Cyber Threats	0	2	3	1.67	3	5

Declared Disasters and Emergency Declarations

Table 5.2: Presidentially Declared Disasters (DR) 1990- October 2018 impacting the City of Rochester

Date Declared	Event	Date of Event	Source	Program	Amount (Statewide)	Remarks
September 9, 1991	Hurricane Bob	August 18-20, 1991	FEMA 917-DR	PA	$2,293,449	Severe storm and wind; no power; trees knocked down
October 29, 1996	Severe Storms & Flooding	Oct 20-23, 1996	FEMA 1144-DR	PA	$2,341,273	Severe storms, flooding
January 15, 1998	Ice Storm	January 7-35, 1998	FEMA 1199-DR	PA/IA	$12,446,202	Major tree damage, electric power interrupted for many days; schools were closed
May 25, 2006	Severe Storm & Flooding	May 12-23, 2006	FEMA 1643-DR	PA/IA	$17,691,586	Severe storm causing massive flooding, road closures, and evacuations
April 27, 2007	Severe Storm & Flooding	April 15-23, 2007	FEMA 1695-DR	PA/IA	$26,826,780	Severe storms and flooding.
August 11, 2008	Severe Storms, Tornado, & Flooding	July 24, 2008	FEMA 1782-DR	PA	$3,673,097	Severe storms and wind damage
January 2, 2009	Severe Winter Storm	December 11-23, 2008	FEMA 1812-DR	DFA/PA	$14,898,663	Winter storm; snow removal; some people without power for a week
March 29, 2010	Severe Winter Storm	February 23-March 3, 2010	FEMA 1892-DR	PA	$6,841,093	Severe winter storm; minor power outages; no major damage
September 3, 2011	Tropical Storm Irene	August 26 – Sept 6, 2011	FEMA 4026-DR	PA	$17,684,244	Powerful gusts of wind and periods of heavy rain; no major damage; a few trees down, but no long-term power outrages or closures.

March 19, 2013	Severe Snow and Blizzard	February 9-11, 2013	FEMA 4105-DR	PA	$6,153,471	Governor requested snow assistance. The President's declaration made snow assistance available for a period of 48 hours for Strafford County and 7 other counties. Statewide Public Assistance included $5,824,040.89 for Categories A and B work and $298,796.60 for Categories C-G work. Per capita impact in Strafford County was $4.14. City received 48-hour assistance that was used for cleanup, snow removal, and minor infrastructure repairs.
March 25, 2015	Severe Snow & Snowstorm	January 26-29, 2015	FEMA 4209-DR	PA	$4,799,048	The primary impact was emergency protective measures. The per capita impact in Strafford County was $4.16. City received 48-hour assistance that was used for cleanup, snow removal, and minor infrastructure repairs.
June 8, 2018	Severe Winter Storm & Snowstorm	March 13-14 2018	FEMA 4371-DR	PA	$820,824	Severe winter storm; minor power outages; no major damage
12 declarations totaling approximately $116,469,730						
Program Key: **PA**: Public Assistance, **IA**: Individual Assistance, **DFA**: Direct Federal Assistance						

Table 5.3: Emergency Declaration (EM) 1990-March July 2017 impacting the City of Rochester

Date Declared	Event	Date of Event	Source	Program	Amount (Statewide)	Remarks
March 16, 1993	Heavy Snow	March 13-17, 1993	FEMA 3101-EM	PA	$832,396	Snow removal.
March 28, 2001	Snow Emergency	March 5-7, 2001	FEMA 3166-EM	PA	$3,433,252	
March 11, 2003	Snow Emergency	February 17-18, 2003	FEMA 3177-EM	PA	$2,288,671	
March 30, 2005	Snow Emergency	January 22-23, 2005	FEMA 3207-EM	PA	$3,611,491	Snow removal. School closures. Public Assistance for 48 hours.
December 13, 2008	Severe Winter Storm	December 11-23, 2008	FEMA 3297-EM	DFA/PA	$900,000	Snow removal. School closures. Public Assistance for 48 hours.
November 1, 2011	Severe Winter Storm	October 29-30, 2011	FEMA 3344-EM	PA	Data not available	Statewide Category B Public Assistance.
October 30, 2012	Hurricane Sandy	October 26-31, 2012	FEMA 3360-EM	PA	$643,660	Strong Storm surge and heavy rains across New England, NYC and New Jersey caused significant damage resulting in an emergency declaration EM-3360 for Direct Federal Assistance and Category B (Emergency Protective Measures).
7 emergency declarations totaling approximately $11,709,470 **Program Key: PA: Public Assistance, DFA: Direct Federal Assistance**						

Flooding (River & Dam Breach)

Table 5.4 Hazard Overview

Hazard Type	Flooding
Location/Extent	City-wide; Especially areas within the 100 year floodplain; other areas identified by committee
Vulnerability	
Severity	3
Probability	3
Overall Threat	9
Potential Loss	$76,973,110 - $153,946,220 (High)

Description of the Hazard

Riverine flooding is the most common natural disaster to impact New Hampshire. Riverine flooding occurs when surface water runoff introduced into streams and rivers exceeds the capacity of the natural or constructed channels to accommodate the flow. As a result, water overflows the river banks and spills out into adjacent low lying areas.[8] Floods are most likely to occur in the spring due to the increase in rainfall and the melting of snow; however, floods can occur at any time of the year because of heavy rains, hurricane, or a Nor'easter.

New Hampshire's climate ranges from moderate coastal to severe continental, with annual precipitation ranging from about 35 inches in the Connecticut and Merrimack River valleys, to about 90 inches on top of Mount Washington. Localized street flooding occasionally results from severe thundershowers, or over larger areas, from more general rain such as tropical cyclones and coastal "nor'easters." More general and disastrous floods are rare, but some occur in the spring from large rainfall quantities combined with warm, humid winds that rapidly release water from the snowpack.

Causes of flooding that could potentially affect Rochester include:

- 100-year rainstorm.
- Severe tropical storm (hurricane or tropical storm) that can bring torrential rainfall in excess of that from a 500-year storm.
- Rapid snow pack melt in spring can be a significant potential flooding source, given the northern, relatively cold location and climate of Rochester and has occurred multiple times in the past.
- River ice jams, which could occur although there are no records of ice jams in Rochester recorded in the USACE Ice Jam Database as of May 2018.

The "100-year flood" Term:

The "100-year flood" is a term often used to describe a flood that has a 1% chance of occurring in any year. But the phrase is misleading, and often causes people to believe these floods happen every 100 years on average. The truth is, these floods can happen quite close together, or not for long stretches of time, but the risk of such a flood remains constant from year to year. The 100-year-flood term was originated to delineate areas on a map to determine what properties are subject to the National Flood Insurance Program. Properties within the 100-year-floodplain, as defined by the Federal Emergency Management Agency, have special requirements and mortgage holders will require owners to carry flood insurance on these properties.

[Source: The Nurture Nature Center: Focus on Floods]

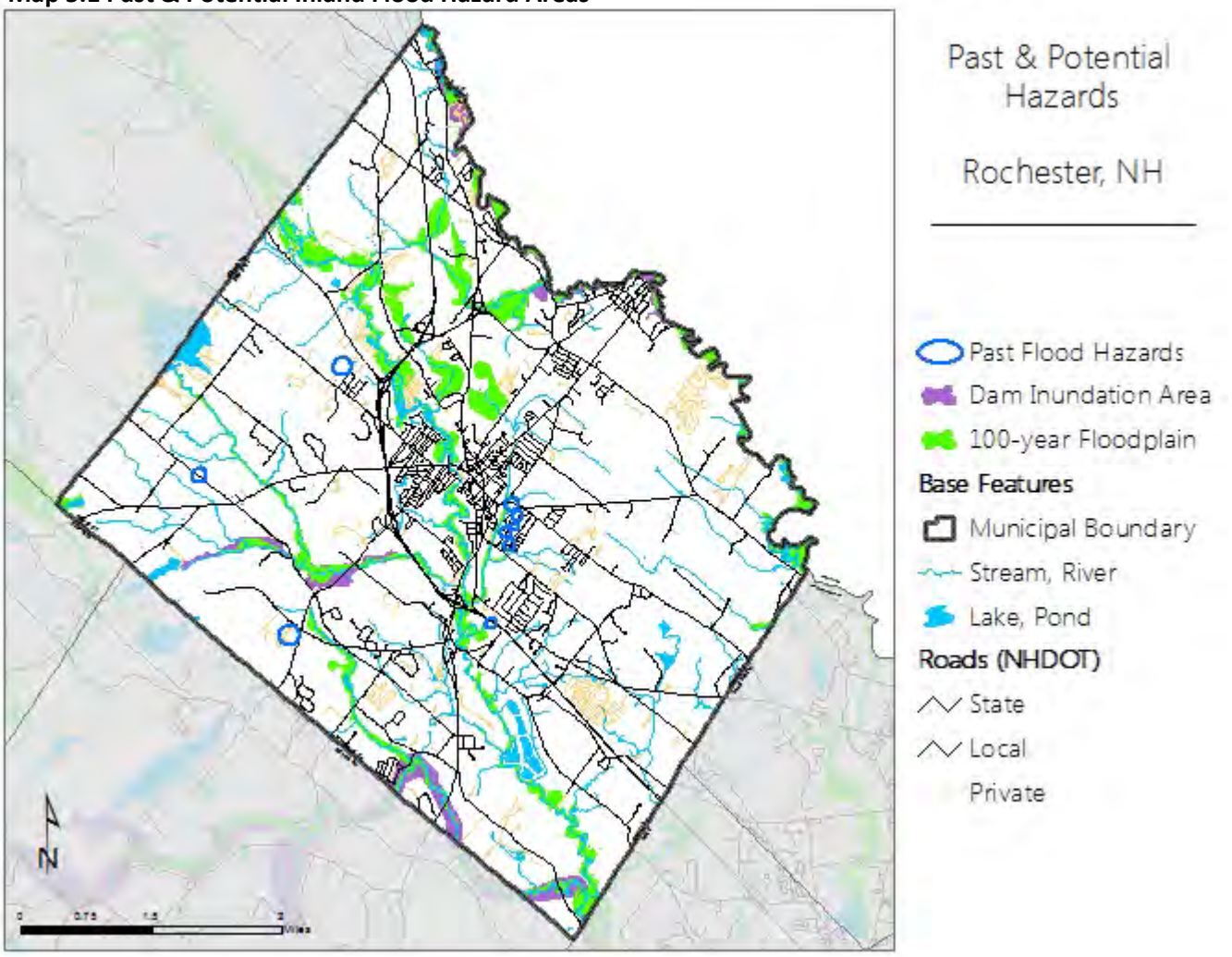
- Erosion and mudslide in steep slope areas or riverbanks resulting from heavy rainfall that can alter topology
- Dam breach or failure.

[8] FEMA Training Chapter 2 Types of Floods and Floodplains (https://training.fema.gov/hiedu/docs/fmc/chapter%202%20-%20types%20of%20floods%20and%20floodplains.pdf)

Extent of the Hazard

Based on extent of the floodplain, Rochester has significant flooding potential along the Salmon Falls River and its tributaries in the northeast of city, along the Cochecho River and its tributaries in the heart of the city, and along the Isinglass River and its tributaries in the southwest of city. Overall, Rochester has approximately 8.3% (2413 ac) of its land area in 100-yr. floodplain. Prior updates to this plan have indicated a large number of structures in the floodplain, placing these structures at risk to flood damage.

Map 5.1 Past & Potential Inland Flood Hazard Areas



Although flooding of the full extent of this floodplain by definition would require a 100-year storm, smaller storms with a higher annual probability of occurrence could still flood significant portions of that floodplain. Some structures that could be impacted by a 100-year storm could also be affected by smaller, more frequent flooding. It is likely that the 100-year floodplain will expand in area when flood maps are updated due to better mapping technology and current precipitation data.

A number of areas throughout Rochester have experienced localized flooding in the past. The Salmon Falls River causes flooding near houses on Autumn Street and portions of Salmon Falls Road, and has closed Autumn Street in the past. Flooding has also approached homes in the Chestnut Hill Mobile Home Park, and has even caused home propane tanks to float in bad conditions. Other areas discussed by the committee included Wilson Street, Estes Road, and the Cocheco Estates Mobile Home Park.

Dams

No dam breaches are on record in Rochester, but the potential for serious damage does exist from the Rochester Reservoir Dam, a Class S – Significant Hazard Structure. The inundation area is quite extensive, and a breach would especially affect areas along the Isinglass River, a major tributary of the Cocheco River, and immediately downstream of the Reservoir. Of further note is the overlap of the Rochester Reservoir Dam inundation area with that of the Bow Lake Dam, a Class H – High Hazard Structure in the Town of Strafford. The Isinglass River begins at the Bow Lake, so floodwaters from any breach would affect the same stretch of the Isinglass in Rochester that would a Reservoir breach. Damages, with the assumption of total loss, would probably be about the same.

Table 5.5 Dams in Rochester by Classification

Dam Classification	Classification Definition	Number of Dams in Rochester	Inspection Interval (Years)
High	Dam that has a high hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in probable loss of human life.	1	2
Significant	Dam that has a significant hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no probable loss of lives but major economic loss to structures or property.	5	4
Low	Dam that has a low hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in no possible loss of life and low economic loss to structures/property.	5	6
Non-Menace	Dam that is not a menace because it is in a location and of a size that failure of misoperation of the dam would not result in probable loss of life or loss to property.	17	6

Past Events and Impacts

The most notable recent flood events were the “Mother’s Day” floods of May 2006 and spring floods in April 2007. In both cases, severe rain and flooding damaged roads and caused road closures. This storm caused flooding in the vicinity of the Gonic Dam and Gonic Sawmill Dam in particular.

Potential Future Impacts on Community

The floods of 2006 and 2007 were estimated to be 100-year events, suggesting that there is approximately a 1% chance that equally disruptive flooding will occur in a given year. While the chance of dam failure can be difficult to predict, large amounts of rain increase the strain on dam infrastructure, making failure or planned release of water more likely. In addition to the impacts described above, the Spaulding Pond Dam, located on the Salmon Falls River, was identified has having potential for significant downstream impacts if it were to fail.

Estimated Loss

Based on the 2016 valuation and the hazard ranking, the estimated potential loss due to inland flooding is $76,973,110 - $153,946,220.

Severe Winter Weather

Table 5.6 Hazard Overview

Hazard Type	Severe Winter Weather
Location/Extent	City-wide
Vulnerability	
Severity	1.33
Probability	3
Overall Threat	4
Potential Loss	$76,973,110 - $153,946,220 (High)

Description of the Hazard

Winter snow and ice events are common in New Hampshire. The National Climatic Data Center (NCDC) Storm Events database reports 44 heavy snow events, 2 blizzards, 1 ice storm, and 6 winter storms (nor'easters) among large winter weather events impacting Strafford County from January, 1 2008 to December 31, 2017.[9] Heavy snow typically brings significant snow removal costs along with delays in transportation schedules. Wet snow can result in major infrastructure damage from heavy snow loads and has been the cause of human harm during long periods of shoveling, including back injuries and in some cases heart attacks to older individuals. The most severe damage, though, often comes from ice storms and winter nor'easters.

- The State's Multi-Hazard Mitigation Plan Update 2013 identifies four types of winter storms:
- *Heavy snowstorms:* A storm that deposits four or more inches of snow (or 10 cm) in a twelve-hour period
- *Blizzards:* A violent snowstorm with winds blowing at a minimum speed of 35 miles (56 kilometers) per hour and visibility of less than one-quarter mile (400 meters) for three hours
- *Nor'easter:* A large weather system traveling from south to north, passing along the coast. As the storm's intensity increases, the resulting counterclockwise winds which impact the coast and inland areas in a Northeasterly direction. Winds from a Nor'easter can meet or exceed hurricane force winds.
- *Ice Storms:* An event that occurs when a mass of warm, moist air collides with a mass of cold, arctic air. The less dense warm air will rise and the moisture may precipitate out in the form of rain. When this rain falls through the colder, denser air and comes in contact with cold surfaces, ice will form and may continue to form until the ice is as thick as several inches.

Extent of the Hazard

Snow and ice storms are a city-wide hazard.

The Sperry–Piltz Ice Accumulation Index, or SPIA Index, is a forward-looking, ice accumulation and ice damage prediction index that uses an algorithm of researched parameters that, when combined with National Weather Service forecast data, predicts the projected footprint, total ice accumulation, and resulting potential damage from approaching ice storms. It is a tool to be used for risk management and/or winter weather preparedness.

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	* AVERAGE NWS ICE AMOUNT (in inches) *Revised-October, 2011	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	< 0.25	< 15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 - 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	< 15	
2	0.10 – 0.25	25 - 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 - 25	
	0.50 – 0.75	< 15	
3	0.10 – 0.25	>= 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is extensive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 - 35	
	0.50 – 0.75	15 - 25	
	0.75 – 1.00	< 15	
4	0.25 – 0.50	>= 35	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 - 35	
	0.75 – 1.00	15 - 25	
	1.00 – 1.50	< 15	
5	0.50 – 0.75	>= 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.
	0.75 – 1.00	>= 25	
	1.00 – 1.50	>= 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

[9] NOAA Storm Event Database (https://www.ncdc.noaa.gov/stormevents/)

Past Events and Impacts

Three events of those listed in the NCDC database are of particular note for their severity:

The Ice Storm of 2008 (December 11th – 12th) was a major winter storm that brought a mixture of snow, sleet, and freezing rain. The greatest impact in the state was in southern and central New Hampshire where a significant ice storm occurred. Following the ice storm, recovery and restoration efforts were negatively impacted by additional winter weather events that passed through the state. The freezing rain and sleet ranged from 1 to 3 inches, ice accretion to trees and wires in these areas generally ranged from about a half inch to about an inch. The weight of the ice caused branches to snap, and trees to either snap or uproot, and brought down power lines and poles across the region. About 400 thousand utility customers lost power during the event, with some customers without power for two weeks. Property damage across northern, central and southeastern NH was estimated at over $5 million.

The Blizzard of 2013 – NEMO (February 8th-9th) was an area of low pressure developed rapidly off the Carolina coast late on the 7th and early on the 8th. The storm moved very slowly northeast during the 8th and 9th as it continued to intensify. By the morning of the 10th, the storm was located just to the east of Nova Scotia. The storm brought heavy snow, high winds, and blizzard conditions to the southeastern part of the state. Snowfall amounts were generally 18 inches or more in the southeast where blizzard conditions caused considerable blowing and drifting snow. In western and northern sections, snowfall amounts were in the 4 to 18 inch range. Southeastern New Hampshire had blizzard conditions for about 3 to 10 hours.

According to the NOAA Northeast Snowfall Impact Scale (NESIS), which ranks storms that have large areas of 10 inch snowfall accumulations or greater based on a function of the area affected, the amount of snow, and the number of people living in the path of the storm, Nemo was ranked as a 'major' event (http://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis).

The NCDC Regional Snowfall Index for the stations near Rochester reported between 18 and 24 inches of snow (Rochester and Nottingham) and 12 to 18 inches (between Epsom and Northwood) from February 8-February 10, 2013. According to the NH Union Leader, wind gusts of over 30-miles-per hour were expected to occur with the storm; however, the NH Electric Co-op reported only minor power outages.[10]

The Blizzard of 2015 – JUNO (January 26th – 28th) was area of low pressure developed off the Delmarva peninsula on Monday, January 26th, and intensified rapidly as it moved slowly northward through the 27th. Snow spread northward across the region Monday night and became heavy on Tuesday, the 27th. Winds became strong during the day Tuesday leading to blizzard conditions at times along and inland from the coast. The snow persisted into Tuesday night in many areas with blowing and drifting snow. Snowfall amounts ranged from 10 to more than 30 inches across much of the southeastern part of the state.

Juno was ranked on the NESIS as a 'major' event passed on the area affected, the amount of snow, and the number of people living in the path of the storm.

Other, less recent events were also damaging. The nor'easter of December 7, 1996 was especially damaging to power systems and is described in the NCDC database as "the most extensive and costliest weather related power outage in

[10] New Hampshire Union Leader. February 9, 2013.
http://www.unionleader.com/apps/pbcs.dll/article?AID=/20130209/NEWS1101/130209041/0/OPINION02

the state's history," at least until 1996 when that database entry was made. The 1998 ice storm probably surpassed this storm in power systems impact. This storm is thought to have been of the same magnitude as the one that occurred in the region in 1929, indicating a return period of approximately 70 years (CRREL 1998).

Extended power failure often occurs in conjunction with severe winter weather and has serious implications for lighting and visibility, heating, water supply, and communication during these events.

Potential Future Impacts on Community

Rochester will continue to receive impacts from severe, regional winter weather events. Due to its heavily forested nature, the City is most highly exposed in terms of damage to forest resources and the secondary impacts of those damages. Downed trees and extra plowing are likely the main concern associated with this hazard.

Estimated Loss

Based on the 2016 valuation and the hazard ranking, the estimated potential loss due to severe winter weather is $76,973,110 - $153,946,220.

Severe Windstorms (Tornados, Thunderstorms, Downbursts, and Hurricanes)

Table 5.9 Hazard Overview

Hazard Type	Severe Thunderstorms & Lightning
Location/Extent	City-wide
Vulnerability	
Severity	1.33
Probability	3
Overall Threat	4
Potential Loss	$76,973,110 - $153,946,220 (High)

Description of the Hazard

A ***tornado*** is a violent windstorm characterized by a twisting, funnel shaped cloud with winds in excess of 200 mph, often accompanied by violent lightning, peripheral high winds, severe hail, and severe rain. Tornadoes develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. The atmospheric conditions required for the formation of a tornado include great thermal instability, high humidity, and the convergence of warm, moist air at low levels with cooler, drier air aloft. Most tornadoes remain suspended in the atmosphere, but if they touch down they become a force of destruction. Tornadoes produce the most violent winds on earth, at speeds of 280 mph or more. In addition, tornadoes can travel at a forward speed of up to 70 mph. Violent winds and debris slamming into buildings cause the most structural damage. A tornado is usually accompanied by thunder, lightning, heavy rain, and a loud "freight train" noise. In comparison to a hurricane, a tornado covers a much smaller area but can be more violent and destructive.

As defined by NOAA, a **thunderstorm** is a rain shower during which thunder is heard. Because thunder comes from lightning, all thunderstorms have lightning. A thunderstorm is the result of convection, which is the upward atmospheric motion that transports whatever is in the air (such as moisture) with it. A thunderstorm is classified as *severe* if it has hail

one inch or greater, winds gusting in excess of 50 knots (57.5 mph), or a tornado. Thunderstorm-related hazards that could impact Rochester include: high winds and downburst, lightning, hail, and, torrential rainfall. Thunderstorms and severe thunderstorms are a city-wide hazard. They are most likely to occur in spring and summer.

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: microburst, which covers an area less than 2.5 miles in diameter and macroburst, which covers an area at least 2.5 miles in diameter.

According to the State Hazard Mitigation Plan (2013) **tropical cyclones** with maximum sustained winds of less than 39 mph are called **tropical depressions**. Once the tropical cyclone reaches winds of at least 39 mph, they are typically called a **tropical storm** and assigned a name. If the winds reach 74 mph or greater, they are upgraded and called a **hurricane**. Tropical cyclones originate over tropical or subtropical waters and are characterized by organized deep convection and a closed surface wind circulation about a well-defined center. These events are called typhoons if they occur west of the International Dateline. Hurricane season in the Atlantic runs from June 1 to November 30.

Extent of the Hazard

The Fujita Scale is the standard scale for rating the severity of a tornado as measured by the damage it causes. The scale measures wind speeds of 65 to greater than 200 miles per hour. The damage path of a tornado can be in excess of one mile wide and 50 miles long, whereas a downburst is typically less than 2.5 miles. Downbursts can have wind speeds of 150 miles per hour. Tornados, thunderstorms, and downbursts may impact all areas of City.

Enhanced Fujita Scale	
EF–0	65–85 mph winds
EF–1	86–110 mph
EF–2	111–135 mph
EF–3	136–165 mph
EF–4	166–200 mph
EF–5	>200 mph

Figure 5.5 Enhanced Fujita Scale

The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating system based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures. Hurricanes may impact all areas of the City.

Scale Number (Category)	Sustained Winds (MPH)	Damage	Storm Surge
1	74-95	**Minimal:** Unanchored mobile homes, vegetation and signs.	4-5 feet
2	96-110	**Moderate:** All mobile homes, roofs, small crafts, flooding.	6-8 feet
3	111-130	**Extensive:** Small buildings, low-lying roads cut off.	9-12 feet
4	131-155	**Extreme:** Roofs destroyed, trees down, roads cut off, mobile homes destroyed. Beach homes flooded.	13-18 feet
5	More than 155	**Catastrophic:** Most buildings destroyed. Vegetation destroyed. Major roads cut off. Homes flooded.	Greater than 18 feet

Figure 5.4 Saffir-Simpson Hurricane Wind Scale

Severe storms are often accompanied by lightning, which heats air to a temperature of 50,000 degrees Fahrenheit and causes the air to expand and contract rapidly, producing thunder. The duration of individual lightning strikes is very brief, but strikes can occur many times during a single storm.

Table 5.10: Lightning Activity Scale

Lightning Activity Level (LAL)	Conditions
LAL1	No thunderstorms activity
LAL2	Isolated thunderstorms
LAL3	Widely scattered thunderstorms
LAL4	Scattered thunderstorms
LAL5	Numerous thunderstorms
LAL6	Widely scattered, scattered, or numerous DRY thunderstorms

Past Events and Impacts

Between 1991 and 2010, the average annual number of tornadoes in New Hampshire was one.[11] Though the frequency of tornado events in New Hampshire is not great, the state has experienced large tornados throughout its history. An early example is the tornado that stuck the state in September 1821. This tornado was reported to have tracked from the Connecticut River, near Cornish, and terminating near Boscawen. When the skies cleared, 6 people were dead, hundreds injured and thousands homeless.

In 1998 an F2 tornado in Antrim, N.H. blew down a 45-foot by 12-foot section of the Great Brook Middle School. Witnesses reported seeing a funnel cloud, and the weather service, after an inspection, confirmed it was a tornado. According to the June 2, 1998 edition of the Eagle Tribune, John Jensenius from the National Weather Service in Gray, Maine estimated that the twister cut a path half a mile long, up to 100 yards wide, and was on the ground for several minutes.

In July 2008, an F2 tornado and high winds created a path of destruction through five New Hampshire counties that destroyed homes, displaced families, downed trees and forest lands and closed major state roadways. The impact to residents was extensive, with over 100 homes rendered uninhabitable. Phone and electric service was cut off to over 12,500 customers. One fatality is attributed to a building collapse, and local hospitals reported numerous physical injuries associated with this severe storm.[12]

Since the July 2008 tornado (through June 30, the most current data available at the time this chapter was drafted in October 2016), The NCDC Storm Events database reports that eight tornados have hit New Hampshire, however none have hit Strafford County. The most recent event occurred in July 2015 in Warner.

Thunderstorms are common in New Hampshire but can be considered generally less severe than in other areas of the country, such as the Great Plains states. Severe thunderstorms do occur in New Hampshire, though. The NCDC database lists 41 reported events (over 22 different days) of severe thunderstorm winds in Strafford County from January 1, 2008 to December 31, 2016 (the most current data available at the time this chapter was drafted in May 2017). During that time period there were two reported events in Rochester in June 2008 and August 2014.

Hail is a fairly common part of thunderstorms in New Hampshire, but damaging hail is apparently not. The damage that can result from hail is mostly to cars and windows. The NCDC Storm Events database lists 23 reported hailstorms in Strafford County from January 1, 2008 to December 31, 2016 (the most current data available at the time this chapter

[11] NOAA. U.S. Tornado Climatology (https://www.ncdc.noaa.gov/climate-information/extreme-events/us-tornado-climatology)
[12] New Hampshire Department of Safety. State of NH Natural Hazard Mitigation Plan 2013. Homeland Security and Emergency Management.

was drafted in May 2017). Two of these events took place in Rochester –on July 18, 2008 and August 1, 2012. The July 2008 events produced 0.75 inch hail but resulted in no direct or indirect injuries or death and no significant damage to property or crops. The June 2009 storm produced 1 inch hail. No injuries or significant damages were attributed to this event.

While the annual recurrence probability of thunderstorms in general is effectively 100%, the likelihood of severe thunderstorms is low. Rochester will continue to experience thunderstorms and should expect to sustain significant damage periodically.

Downburst activity is very prevalent throughout the State. However, the majority downburst activity is mostly unrecognized unless a large amount of damage has occurred. Several of the more significant and recent events are highlighted below:

- Central, NH – July 6, 1999 –Two roofs blown off structures, downed trees, widespread power outages, and damaged utility poles and wires; two fatalities.
- Stratham, NH – August 18, 1991 –$2,498,974 worth of damages; five fatalities.
- Moultonborough, NH – July 26, 1994 –Downed trees, utility poles and wires. Approximately 1,800 homes without power and 50-60 homes damages.
- Bow, NH – September, 6, 2011 –City Auto in Bow had 15 campers damaged and estimated $200,000 in damage.

While tornados are not common, they would cause significant impacts in the city, especially to older mobile homes that are not tied down properly. The probability of reoccurrence of a downburst may be higher. A tornado or downburst can impact the entire jurisdiction and may cause greater damage in the community center.

Tornadoes are rare in New Hampshire. The NCDC Storm Events database (NCDC 2004) lists only five tornadoes that have impacted Strafford County since 1950. One was an F1 event (73-112 mph) and the other four were F2 events (113-157 mph). These tornadoes also occurred one in each decade from the 1950's through the 1990's. The average annual probability of recurrence, therefore, is 10% (5/50 x 100). The probability would be slightly higher if local reports of tornadoes were considered; however, this 10% probability is for all of Strafford County, not just Rochester. The actual probability for Rochester should be much lower, considering the great dependence of impact upon the actual track of any tornado.

The NCDC Storm Events database lists 1 tropical storm event in Strafford County from January 1, 2008 to December 31, 2016 (the most current data available at the time this chapter was drafted in October 2016) that occurred on August 28, 2011 (Tropical Storm Irene).

> **Tropical Storm Irene** (August 28, 2011) - brought a prolonged period of strong and gusty winds and heavy rain to the state. The high winds snapped or uprooted numerous trees throughout the state causing more than 160,000 customers to lose electrical and/or communication services. The heavy rains caused rivers and streams throughout the state to flood causing damage to bridges, roads, and property. The strongest winds across the state began Sunday morning in southern areas and spread northward during the day. Winds continued to be gusty overnight as the storm moved away from the area. Observed maximum wind gusts included 63 mph at Portsmouth, 52 mph at Concord, and 51 mph at Manchester. On the top of Mt. Washington, winds gusted to 104 mph as the storm approached and 120 mph as it moved away. The combination of wet soil and the prolonged period of strong and gusty winds brought down numerous trees throughout the state. One person was killed and three people were injured across the state due to falling trees or branches. Rainfall amounts across the state ranged from 1.5 to 3 inches across southeastern New Hampshire. Local impacts included wind, downed trees, and moderate flooding in low-lying areas. Downed tree limbs and flooding caused minor infrastructure damage.

Other hurricanes have impacted the City — including Donna, Gloria, and Bob — bringing high winds but causing relatively little damage.

The NOAA National Climatic Data Center's Storm Events database (NCDC 2015) does not list any Hurricanes as directly affecting Strafford County from January 1, 2008 to December 31, 2016, however, Strafford County did experience impacts from Hurricane Sandy. Hurricane Sandy was the last hurricane to hit the region during the period of October 26 to November 8, 2012. Rochester experienced minimal impacts associated with rain and wind. Presidential Declaration FEMA-4095 requested funds for debris removal and emergency protective measures. Strafford County was not included in the public assistance or direct federal assistance declaration. Strafford County did received Emergency Declaration funds for Emergency Protective Measures.

While portions of Rochester are comparatively wooded, the utility companies have typically been proactive about trimming trees away from power lines, which has prevented any significant damage from recent storms.

Potential Future Impacts on Community

It is possible that a tornado could strike Rochester in the future and inflict significant damage to property, forest resources, and potentially cause injury to people. Downbursts are more likely to occur. Downbursts could cause downed trees that damage structures and property.

It is highly likely that the City will continue to experience thunderstorms and lightning, however the severity of those impacts is anticipated to be low to moderate depending on factors include the location of lightning strikes, wind, or other factors such as flash flooding or downbursts that may accompany a thunderstorm.

Rochester is vulnerable to hurricane hazards including wind, tornadoes, heavy rainfall, and inland flooding. Recurrence potential of hurricane and tropical storm hazards in Rochester is moderate. As many as 10 significant Hurricanes have impacted Rochester and the surrounding region and it is likely that that the region will be impacted by a significant storm of tropical origin within the foreseeable future

Based on historical data and statistical predictors, the Atlantic Basin averages approximately 12 total named storms per year. Six of those storms will become hurricanes with three becoming a category three or higher. With variability in sea-level pressure and sea-surface temperatures in the Atlantic Ocean, it is difficult to predict with certainty the number of storms in any given year. It is even more difficult to determine which of those storms will make landfall. Rochester is located inland from the New Hampshire coast, which may diminish wind speeds from their coastal strength. Any significant impact on the city would be dependent on the exact track of these concentrated storms.

Hurricanes and tropical storms will continue to affect Rochester and recurrence potential of hurricane and tropical storm hazards is, therefore, moderate. It is likely that the region will be impacted by a significant storm of tropical origin within the foreseeable future.

Estimated Loss

Based on the 2016 valuation and the hazard ranking, the estimated potential loss due to severe thunderstorms and lightning is $76,973,110 - $153,946,220.

Extreme Heat & Drought

Table 5.7 Hazard Overview

Hazard Type	Extreme Heat
Location/Extent	City-wide
Vulnerability	
Severity	1
Probability	3
Overall Threat	3
Potential Loss	$15,394,622 - $76,973,110 (Moderate)

Description of the Hazard

Extreme temperatures can be describes as heat waves. A *heat wave* is a prolonged period of excessively hot and sometimes also humid weather relative to normal climate patterns of a certain region. Heat kills by pushing the human body beyond its limits. In extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature. Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat. Conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality. Consequently, people living in urban areas may be at greater risk from the effects of a prolonged heat wave than those living in rural areas. Also, asphalt and concrete store heat longer and gradually release heat at night, which can produce higher nighttime temperatures known as the "urban heat island effect."[13]

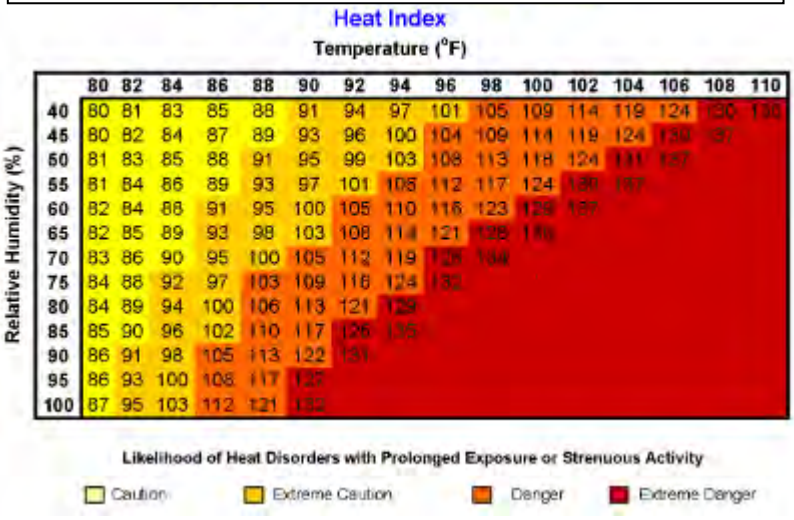
A drought is defined as a long period of abnormally low precipitation, especially one that adversely affects growing or living conditions. The impacts of droughts are indicated through measurements of soil moisture, groundwater levels, and stream flow. The effect of drought on these indicators is variable during any particular event. For example, frequent minor rainstorms can replenish the soil moisture without raising groundwater levels or increasing streamflow. Low streamflow also correlates with low ground-water levels because ground water discharge to streams and rivers maintains streamflow during extended dry periods. Low streamflow and low ground-water levels commonly cause diminished water supply.

Extent of the Hazard

Extreme heat events can be described as periods with high temperatures of 90°F or above. Figure 5.2 above displays the likelihood of heat disorders with prolonged exposure or strenuous activity. Extreme heat is a city-wide hazard.

The National Drought Monitor classifies the duration and severity of the drought using precipitation, stream flow, and soil moisture data coupled with information provided on a weekly

Figure 5.2 National Weather Service Heat Index Scale



[13] International Federation of Red Cross and Red Crescent Societies. Climatological hazards: extreme temperatures. http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/extreme-temperatures/

basis from local officials. There are five magnitudes of drought outlined in the New Hampshire State Drought Management Plan: Exceptional, Extreme, Severe, Moderate, and Abnormally Dry. Drought is a regional hazard and can impact the entire jurisdiction. Agricultural land and residents who use dug, shallower wells may be more vulnerable to the effects of drought.

Past Impacts and Events

According to a 2014 study of climate change by Climate Solutions New England, Climate Change in Southern New Hampshire, from 1970 to 1999, southern New Hampshire experienced an average of seven days per year above 90°F each year. This is projected to increase to 22 days per year under a low emissions scenario to nearly 50 days per year under a high emissions scenario. Between 1980 and 2009, an average of one day per year reached 95°F in southern New Hampshire. By the end of the century, the number of days per year over 95°F is expected to increase as much as six to 22 days per year. Additionally, the average daytime maximum temperature on the hottest day is expected to increase to as much as 98°F to 102°F (depending on the emissions scenario), compared to the historical average of 93°F.[14] Between 1960 and 2012, there was an average of 8.3 days per year (or 0.8 days/decade) greater than 90°F recorded in Rochester. During this time the hottest day of the year averaged 95.0°F.[15] Rochester has historically fared well during periods of drought. The water system pulls from a well-supplied aquifer, and drought conditions would need to be exceptional to experience widespread shortages.

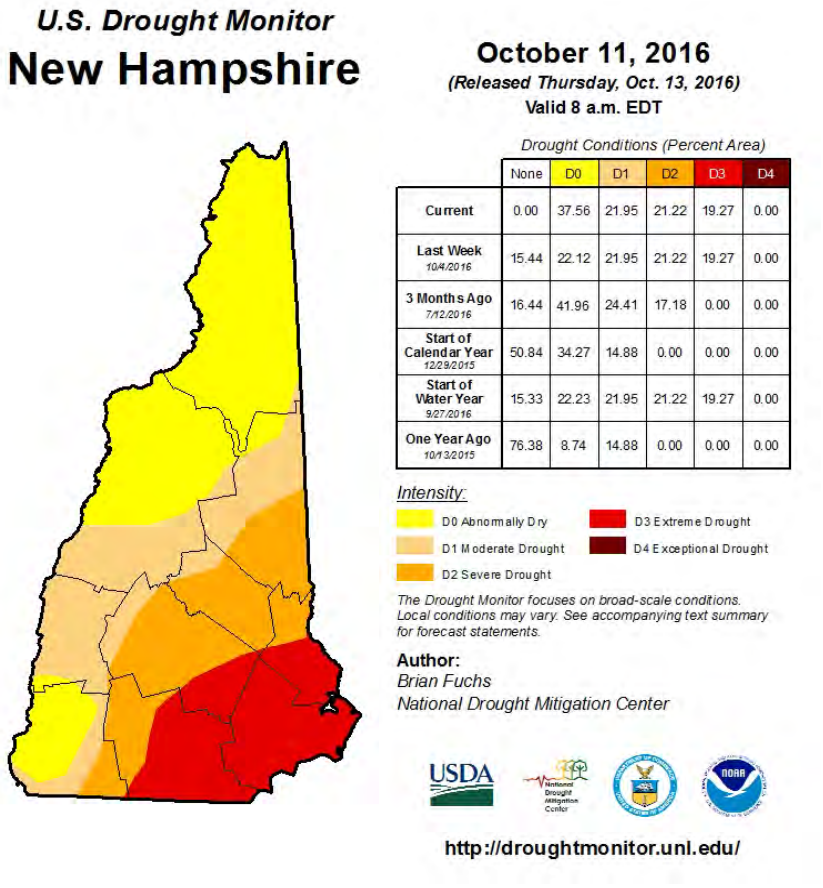


Figure 5.6 Peak Drought Conditions in NH, 2016

While the impacts of drought are typically not as damaging and disruptive as floods or storm events, the impacts of long term drought or near drought conditions can impact crops and the water supply. Periods of drought have occurred historically in New Hampshire. Six droughts of significant extent and duration were evident in the 20th century as noted below in Table 2.5. The most severe drought recorded in New Hampshire occurred from 1960 to 1969. This drought encompassed most of the northeastern United States (1956-1966). The drought of 1929-1936 was the second worst and

[14] Wake, C. et al. "Climate Change in Southern New Hampshire; Past, Present, and Future." Climate Solutions of New England. 2014
[15] Wake, C. et al. "Climate Change in Southern New Hampshire; Past, Present, and Future." Climate Solutions of New England. 2014

coincided with severe drought conditions in large areas of the central and eastern United States. The drought of 2001-2002 was the third worst on record.[16]

In more recent years, drought has again become a problem in New Hampshire. In 1999, a drought warning was issued by the Governor's Office. In March 2002, all counties in New Hampshire with the exception of Coos County were declared in Drought Emergency. This was the first time that low-water conditions had progressed beyond the Level Two, Drought Warning Stage. With extreme variation in environmental conditions due to global warming possibly on the rise, drought probability may grow in the future. Currently, drought possibility seems moderate. The large amount of water resources and relatively sparse population in New Hampshire have tended to minimize the impacts of drought events in the region, but this regional protection may be endangered in the future with increases in drought frequency or severity.

Normal precipitation for the state averages 40 inches per year. During the summer of 2015, most of central and southern New Hampshire experienced its most recent drought, the first since 2001 – 2002 (was the 3rd worst on record, exceeded only by the national droughts of 1956-1966 and 1941-1942). While many communities experienced record snowfall totals this past winter (2014-2015), the lack of rainfall and higher-than-average temperatures resulted in river and groundwater levels to be lower than average. This resulted in the implementation of local water conservation plans throughout the region.[17]

Drought conditions continued and intensified into 2016 in New Hampshire and in Southeast New Hampshire in particular. As of October 11, 2016, nearly 20% of the state was categorized as being in extreme drought. One hundred and sixty community water systems reported implementing a water restriction or ban, and 13 towns reported implementing voluntary or mandatory outdoor use bans in the state during the peak drought conditions. Conditions in New Hampshire largely returned to normal in the first half of 2017, with just over 2% of the state still experiencing abnormally dry conditions. This area covers the southern part of Strafford County, including the City of Rochester, illustrating the extent to which local drought conditions can vary both geographically and over time.

The City of Rochester has not reported any instances of dry wells as a result of drought. Water conservation protocols were enacted in response to the drought of 2016. However, Rochester has few agricultural or other intensive water users, so the overall local impacts of this drought were limited.

Table 5.13 New Hampshire Drought History & Conditions

Dates	Area Affected	Magnitude	Remarks
1929 – 1936	Statewide	-	Regional; recurrence interval 10 to > 25 years
1939 – 1944	Statewide	Severe Moderate	Severe in southeast NH and moderate elsewhere in the State. Recurrence interval 10 to > 25 years.
1947 – 1950	Statewide	Moderate	Recurrence interval 10 to >25 years
1960 – 1969	Statewide	Extreme	Longest recorded continuous spell of less than normal precipitation. Encompassed most of the northeast US. Recurrence interval >25 years.
2001 – 2002	Statewide	Severe	Recurrence interval 10 to >25 years
2015	Central & Southern NH	Moderate	Recurrence interval cannot yet be determined

[16] NHDES. Drought Management Program. Publications. *NH Drought Historical Events*. Viewed on 8/10/15. http://des.nh.gov/organization/divisions/water/dam/drought/documents/historical.pdf

[17] See: http://des.nh.gov/organization/divisions/water/dwgb/water_conservation/documents/waterban.pdf.

Potential Future Impacts on Community

Annual average temperatures may increase on average by 3-5°F by 2050 and 4-8°F by 2100.[18] This rise in annual temperatures is likely to coincide with a rise in days per year above 90°F.

The National Drought Mitigation Center website (NDMC 2004) emphasizes that reliable drought prediction for regions above 30°N latitude is effectively impossible. With extreme variation in environmental conditions due to climate change possibly on the rise, drought probability may grow in the future. Currently, drought possibility seems moderate. The large amount of water resources and relatively sparse population in New Hampshire have tended to minimize the impacts of drought events in the region, but this regional protection may be endangered in the future with increases in drought frequency or severity.

Historically, droughts in New Hampshire have had limited effect because of the plentiful water resources and sparse population. Since 1960, the population has more than doubled, which has increased demand for the State's water resources. Further droughts may have considerable effect on the State's densely populated areas along the seacoast and in the south-central area.

Estimated Loss Potential

Based on the 2016 valuation and the hazard ranking, the estimated potential loss due to extreme heat and drought is $15,394,622 to $76,973,110.

Earthquakes, Landslide & Subsidence

Table 5.14 Hazard Overview

Hazard Type	Earthquakes, Landslide, & Subsidence
Location/Extent	City-wide, Steep slopes and river banks
Vulnerability	
Severity	1.33
Probability	1
Overall Threat	1
Potential Loss	$0 to $15,394,622 (Low)

Description of the Hazard

The USGS defines an earthquake as a term used to describe both sudden slip on a fault, and the resulting ground shaking and radiated seismic energy caused by the slip, or by volcanic or magmatic activity, or other sudden stress changes in the earth. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines, and often cause landslides, flash floods, fires, avalanches, and tsunamis. Larger earthquakes usually begin with slight tremors but rapidly take the form of one or more violent shocks, and are followed by vibrations of gradually diminishing force called aftershocks.[19] Earthquakes in the Northeast are not associated with specific know faults.

Due to the geology of the region, the area impacted by an earthquake in the Northeast can be up to 40 times greater than the same magnitude event occurring on the West coast. Earthquakes can occur at any time without warning. An

[18] Wake, C. et al. "Climate Change in Southern New Hampshire; Past, Present, and Future." Climate Solutions of New England. 2014
[19] The Northeast States Emergency Consortium Earthquake Hazards. http://nesec.org/earthquakes-hazards/. Viewed on 8/10/15

earthquake can impact all areas of the jurisdiction. People at greatest risk from earthquakes are those who live in unreinforced masonry buildings build on filled land or unstable soil.[20]

Land subsidence, the loss of surface elevation due to removal of subsurface support, occurs in nearly every state in the United States. Subsidence is one of the most diverse forms of ground failure, ranging from small or local collapses to broad regional lowering of the earth's surface. The causes (mostly due to human activities) of subsidence are as diverse as the forms of failure, and include dewatering of peat or organic soils, dissolution in limestone aquifers, first-time wetting of moisture-deficient, low-density soils (hydrocompaction), natural compaction, liquefaction, crystal deformation, subterranean mining, and withdrawal of fluids (ground water, petroleum, geothermal). Subsidence poses a greater risk to property than to life. Damage consists of direct structural damage, property loss, and depreciation of land values.

Extent of the Hazard

The magnitude and intensity of an earthquake is measured by the Richter scale and the Modified Mercalli Intensity (MMI) scale, respectively. The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes.[21]

The Modified Mercalli Intensity (MMI) scale was developed in 1931 by the American seismologists Harry Wood and Frank Neumann. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects actually experienced at a given place and therefore has a more meaningful measure of severity.[21]

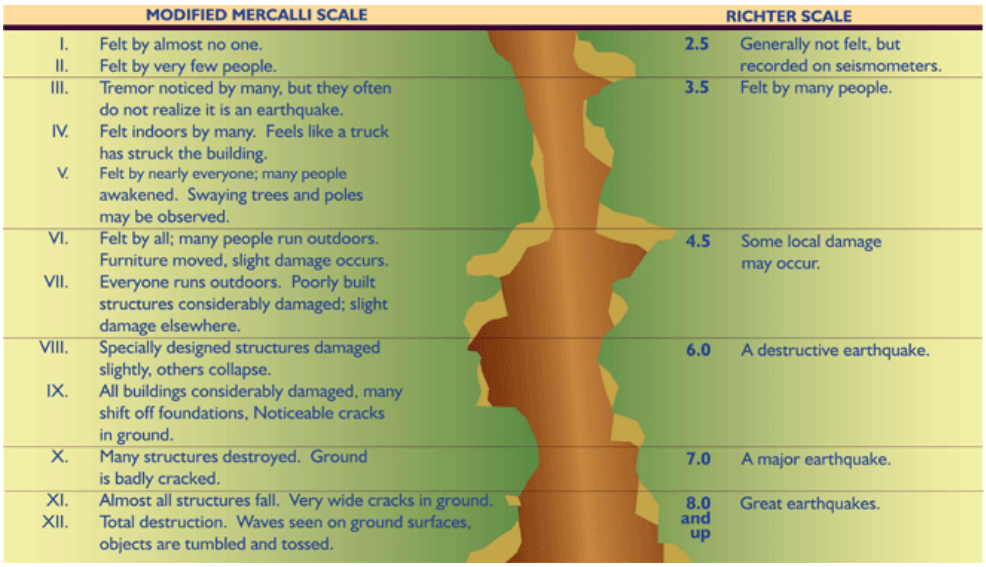


Figure 5.8 Measuring the magnitude and intensity of earthquakes

Past Impacts and Events

Due to the state's location in an area of moderate seismic activity earthquakes are a common event in New Hampshire, but significantly damaging earthquakes are not. The Northeast States Emergency Consortium (NESEC, 2016) website presents a history of earthquake in the Northeast and documents that New Hampshire is an area of high earthquake probability. Three hundred and sixty earthquakes occurred in New Hampshire from 1638 to 2007. Approximately 40-50 earthquakes are detected in the Northeast annually.[20] However, New Hampshire has only experienced nine earthquakes of significant magnitude (Richter Magnitude 4.0 or greater) in that time period. Rochester has experienced no major

[20] http://nesec.org/earthquakes-hazards/
[21] USGS. Earthquake Hazard Program. http://earthquake.usgs.gov/learn/glossary/?term=Richter%20scale., http://pubs.usgs.gov/gip/earthq4/severitygip.html.

earthquakes in recent years. Earthquakes are on average an annual occurrence but significant quakes have an annual probability of occurrence (based on the 1638 to 2007 period) of about 2.4%.

Earthquakes could readily cause landslides, as could ground saturation from extended heavy precipitation events. Given seismic or precipitation events that could initiate landslide, landslide hazard is likely in steep slope areas. However, these areas are extremely limited in scale. No local impacts of earthquakes or landslides have been reported for Rochester. Rochester has experienced some river-related erosion near Wilson Street that could pose a particular threat in flood situations.

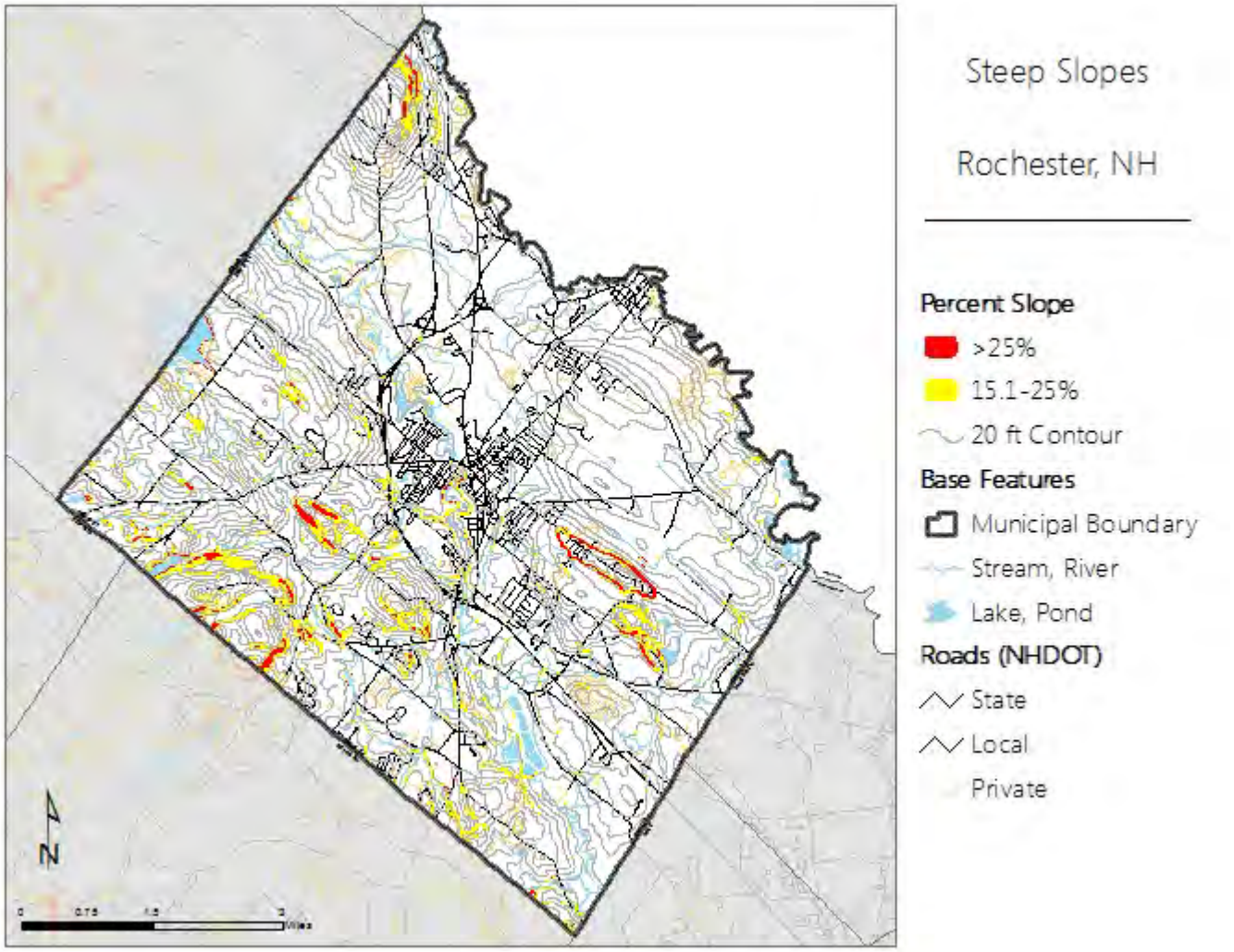
Table 5.15 Notable Historic Earthquakes in NH 1638-2007 (Magnitude 4.0 or Greater)

Location	Date	*Intensity MMI Scale*	Magnitude *Richter Scale*
Central New Hampshire	June 11, 1638	-	6.5
Portsmouth	November 10, 1810	V	4.0
Near Hampton	July 23, 1823	IV	4.1
Ossipee	October 9, 1925	VI	4.0
Ossipee	December 20, 1940	VII	5.5
Ossipee	December 24, 1940	VII	5.5
West of Laconia	January 19, 1982	-	4.7
Northeast of Berlin	October 20, 1988	-	4.0
Southeast of Berlin	April 6, 1989	-	4.1

Potential Future Impacts on Community

Landslides could occur in Rochester in areas with steep slopes, where soils and loose bedrock formations would tend to slough off and move en masse downhill under gravity. Earthquakes could readily cause landslides, as could ground saturation from extended heavy precipitation events. Given seismic or precipitation events that could initiate landslide, landslide hazard is likely quite high in steep slope areas. Areas of steep slopes are most prevalent in the southeastern portion of the city (see Map 5.2).

Map 5.2 Areas of Steep Slope



The USGS (1997) classifies landslide incidence regionally as very low (less than 1.5% of land area involved). The local probability in Rochester will depend on specific soil/rock types and upon the probability of initiating events. Potential impacts could include property damage, road closures, and increased erosion if forests were damaged.

Estimated Loss

Based the 2015 valuation and the hazard ranking, the estimated potential loss due to earthquakes and landslides is $0 to $7,094,949.

Public Health Threats

Table 5.16 Hazard Overview

Hazard Type	Public Health Threats
Location/Extent	City-wide; school population and families may be more susceptible to certain epidemics
Vulnerability	
Severity	2.33
Probability	3
Overall Threat	7
Potential Loss	$76,973,110 - $153,946,220 (High)

Description of the Hazard

The City of Rochester is an active member of the Strafford County Public Health Network (SCPHN): a collaborative of local governments and health and human service agencies preparing for and responding to public health emergencies on a regional level. A public health emergency is broadly defined as the occurrence of an event that affects the public's health and can be caused by a variety of communicable disease outbreaks or contaminants.

Epidemic Disease

As defined by the CDC, and epidemic is "the occurrence of more cases of disease than expected in a given area or among a specific group of people over a particular period of time."[22] In addition to being categorized by the type of transmission (point-source or propagated), epidemics may occur as outbreaks or pandemics. As defined in the State Hazard Mitigation Plan, an outbreak is a sudden increase of disease that is a type of epidemic focused to a specific area or group of individuals. A pandemic is an epidemic that spreads worldwide, or throughout a large geographic area.

Epidemics may be caused by infectious diseases, which can be transmitted through food, water, the environment or person-to-person or animal-to-person (zoonoses), and noninfectious diseases, such as a chemical exposure that causes increased rates of illness. Infectious disease that may cause an epidemic can be broadly categorized into the following groups[23]:

- Foodborne (Salmonellosis, Ecoli)
- Water and Foodborne (Cholera, Giardiasis)
- Vaccine Preventable (Measles, Mumps)
- Sexually Transmitted (HIV, Syphilis)
- Person-to-Person (TB, Aseptic meningitis)
- Arthropodborne (Lyme, West Nile Virus)
- Zoonotic (Rabies, Psittacosis)
- Opportunistic fungal and fungal infections (Candidiasis).

An epidemic may also result from a bioterrorist event in which an infectious agent is released into a susceptible population, often through an enhanced mode of transmission, such as aerosolization (inhalation of small infectious disease particles).[24] The Multi-Agency Coordinating Entity plan is responsible for emergency vaccination planning. For the purposes of this Plan, widespread drug and substance abuse may also be considered epidemics. New Hampshire continues to experience an opioid epidemic that has impacted communities across the state.

Tick-Borne Diseases

Lyme disease, which is spread to humans by the bite of an infected tick, is a growing threat in New Hampshire. New Hampshire has one of the highest rates of Lyme disease in the U.S. Other tick-borne illnesses that could impact New Hampshire include Babesiosis, Anaplasmosis, and Rocky Mountain Spotted Fever.

Radon

Radon is a radioactive gas which is naturally occurring as a result of the typical decay of uranium commonly found in soil and rock (especially granite). Radon has carcinogenic properties and is a common problem in many states; New Hampshire has some isolated areas that are among the highest levels of radon in the United States according to the US Environmental Protection Agency (EPA). Whether or not a particular type of granite emanates radon is dependent on the geochemistry of that particular granite, some types are a problem and some are not. In other parts of the country,

[22] Slate; http://www.slate.com/id/2092969/
[23] New Hampshire Department of Safety. State of NH Natural Hazard Mitigation Plan 2013. Homeland Security and Emergency Management.
[24] Ibid.

radon is associated with certain black shales, sandstones, and even limestones. The EPA has estimated that radon in indoor air is responsible for about 13,600 lung cancer deaths in this country each year (EPA document, EPA 811-R-94-001, 1994).[25]

Arsenic

Arsenic is a semi-metal element that is odorless and tasteless. Arsenic is a hazard because it can enter drinking water supplies, either from natural deposits in the earth or from agricultural and industrial practices.[26]

Wells drilled into New Hampshire's bedrock fractures have about a 1 in 5 probability of containing naturally occurring arsenic above 10 parts per billion. In addition, wells within short distances (~50 feet) can present very different water quality because of our highly fractured bedrock. Arsenic in water has no color or odor, even when present at elevated levels. Therefore, the only way to determine the arsenic level in your well water is by testing.

Extent of the Hazard

Public health threats are events or disasters that can affect an entire community.

Past Impacts and Events

Epidemic Disease

The Granite State College campus is a large population center that could be vulnerable to the rapid spread of disease. Additionally, Rochester is home to a number of commercial developments that attract visitors from neighboring communities. Other gathering places, such as City schools, the community center, or other municipal facilities could also contribute to the spread of diseases. Because of these factors, an epidemic or pandemic could present a possible threat to Rochester. With the occurrence of worldwide pandemics such as SARS, H1N1 and Avian Flu, Rochester could be susceptible to an epidemic and subsequent quarantine. While all individuals are potentially vulnerable to the hazard of an epidemic, epidemics often occur among a specific age group or a group of individuals with similar risk factors and exposure.[25]

Tick-Borne Diseases

The number of New Hampshire residents diagnosed with Lyme disease has increased over the past 10 years, with significant increases occurring since 2005.[27] In 2009, the rate of cases of Lyme disease reported in New Hampshire residents was 108 cases per 100,000 persons, which is significantly higher than the Healthy People 2010 science-based 10-year national objective for improving the health of all Americans objective of 9.7 cases per 100,000 persons.[28] From 2009 to 2013, reported cases of Lyme disease in New Hampshire increased by approximately 20% from 1416 cases per year to 1691 cases per year.[29] Rockingham, Strafford, and Hillsborough counties had the highest rates of disease in 2008-2009. In 2012, there were 172 reported cases of Lyme disease in Strafford County.[27]

Radon

Exposure is a significant hazard in New Hampshire. According to a NH Bureau of Environmental & Occupational Health (BEOH) study looking at >15,000 indoor radon test results in single-family dwellings, households in northern, eastern, and southeastern regions of New Hampshire especially tend to have nominally high concentrations of radon in air or

[25] New Hampshire Department of Safety. State of NH Natural Hazard Mitigation Plan 2013. Homeland Security and Emergency Management.
[26] EPA. Arsenic in Drinking Water. (http://water.epa.gov/lawsregs/rulesregs/sdwa/arsenic/index.cfm)
[27] 2011 New Hampshire State Health Profile; Improving Health, Preventing Disease, Reducing Costs for All. NH Division of Public Health Services Department of Health and Human Services. http://www.dhhs.nh.gov/dphs/documents/2011statehealthprofile.pdf
[28] HealthyPeople.gov. About Healthy People. Accessed April 2014. Available at: http://healthypeople.gov/2020/about/default.aspx
[29] NHDHHS. State of New Hampshire Tickborne Disease Prevention Plan. March 31, 2015. http://www.dhhs.state.nh.us/dphs/cdcs/lyme/documents/tbdpreventionplan.pdf)

water (BEOH 2004); however, values in excess of the US Environmental Protection Agency's 4.0 picocurie per liter (pCi/L) action guideline have been found in nearly every community in New Hampshire. Values exceeding 100 pCi/L have been recorded in at least eight of New Hampshire's ten counties. The highest indoor radon reading in New Hampshire known to NHDES is greater than 1200 pCi/L; higher values probably exist. The probability of significant radon exposure is apparently quite high. In the BEOH study, 44.0% of tests in Strafford County exceeded the 4.0 pCi/L action level and 13.0% even exceeded 12.0 pCi/L.

In Rochester, between 30 and 39.9% of homes tested by homeowners from 1987 to 2008 tested at or above the radon action level of 4.0 pCi/L. The probability of significant radon exposure is fairly high.[30]

Arsenic

From 1975 until 2001, the federal maximum contaminant limit (MCL) for arsenic in water supplied by public water systems was 50 parts per billion, because the health effects of exposure to lower concentrations was not recognized. Based on an exhaustive review of the new information about arsenic's health effects, in January 2001 EPA established a goal of zero arsenic in drinking water. At the same time, EPA adopted an enforceable MCL of 10 parts per billion (ppb) based on balancing treatment costs and public health benefits. Studies have shown that chronic or repeated ingestion of water with arsenic over a person's lifetime is associated with increased risk of cancer (of the skin, bladder, lung, kidney, nasal passages, liver or prostate) and non-cancerous effects (diabetes, cardiovascular, immunological and neurological disorders). The same studies found that dermal absorption (skin exposure) of arsenic is not a significant exposure path; therefore, washing and bathing do not pose a known risk to human health.[31]

Potential Future Impacts on Community

Exposure to radon and arsenic will continue to be a concern in Rochester and throughout the state. It is likely that exposure to tick-borne diseases will increase in the future due to warmer temperatures. The spread of epidemics is also plausible.

Estimated Loss

Based on the 2015 valuation and the hazard ranking, the estimated potential loss due to public health threats is $76,973,110 to $153,946,220.

Large Fires (Wildfire & Urban Fire)

Table 5.17 Hazard Overview

Hazard Type	Large Fires
Location/Extent	City-wide; forested or densely developed areas may be more vulnerable
Vulnerability	
Severity	1.33
Probability	3
Overall Threat	4
Potential Loss	$76,973,110 - $153,946,220 (high)

[30] NHDES http://des.nh.gov/organization/divisions/air/pehb/ehs/radon/documents/radon_by_town.pdf

[31] New Hampshire Environmental Services. Drinking Water and Groundwater Bureau. Arsenic in Drinking Water Fact Sheet.

Description of the Hazard

Wildfire is defined as an uncontrolled and rapidly spreading fire. A forest fire is an uncontrolled fire in a woody area. Forest fires occur during drought and when woody debris on the forest floor is readily available to fuel the fire. Grass fires are uncontrolled fires in grassland areas. Although Rochester is a developed city, it has managed to conserve large tracts of land that contribute to a predominantly forested landscape. Exposure to natural factors such as lightning that can cause wildfires is consequently high and can occur throughout the jurisdiction.

Extent of the Hazard

The National Wildfire Coordinating Group (NWCG) categorizes the size of a wildfire in six classes depending on acres burned, ranging from less than ¼ acre to greater than 5,000 acres (see box below). The US Forest Service's surface fire behavior fire characteristics chart illustrates primary fire behavior values including the spread rate and the intensity of the fire, which can be used to compare predicted and observed fire behavior and to describe potential fire behavior.[32]

Past Impacts and Events

Wildfires in New Hampshire historically have tended to run in 50-yr cycles, which can be observed starting from the 1800s. This 50-year cycle is partially based upon human activities and, therefore, may not prove to be accurate into the future.[33] The peak in wildfires in the late 1940's and early 1950's is thought to be related to the increased fuel load from trees downed in the 1938 hurricane. Rochester suffered from a large fire that began in Farmington on October 25, 1947 and spread through Rochester to the Salmon Falls River before it was finally extinguished on October 30. Here, 60 years later, New Hampshire officials are again concerned about the high fuel load created by the 1998 and 2008 ice storms that hit New Hampshire.

The NCDC Storm Events database lists 0 reported wildfires in Strafford County from January 1, 2008 to August 31, 2018 (the most current data available at the time this chapter was drafted in May 2017).

Potential Future Impacts on Community

The probability of occurrence of wildfires in the future is difficult to predict due to the dependence of wildfire on the occurrence of the causal hazards and the variability of numerous factors that affect the severity of a wildland fire. As indicated above, loading of dead brush and other fuels in forested areas can be cyclical, indicating that the risk of wildfire can grow over time if potential sources of fuel are not regularly removed. The density of historic building within downtown Rochester also poses a risk because many older buildings have not been upgraded to current fire codes. Downtown Gonic is also a possible risk area due to the large number of wooden buildings in close proximity.

Estimated Loss

Based on the 2015 valuation and the hazard ranking, the estimated potential loss due to wildfire is $76,973,110 to $153,946,220.

Hazardous Materials

[32] How to Generate and Interpret Fire Characteristics Charts for Surface and Crown Fire Behavior. (https://www.fs.fed.us/rm/pubs/rmrs_gtr253.pdf)

[33] New Hampshire Department of Safety. State of NH Natural Hazard Mitigation Plan 2013. Homeland Security and Emergency Management.

Table 5.20 Hazard Overview

Hazard Type	Hazardous Materials
Location/Extent	City-wide; Major transportation corridors likely to be most vulnerable
Vulnerability	
Severity	3
Probability	2
Overall Threat	6
Potential Loss	$76,973,110 to $153,946,220 (high)

Description of the Hazard

Hazardous materials in various forms can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, property, and the environment. Many products containing hazardous chemicals are used and stored in homes routinely. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines. Chemical manufacturers are one source of hazardous materials, but there are many others, including service stations, hospitals, and hazardous materials waste sites. Hazardous materials continue to evolve as new chemical formulas are created.

Transportation of chemicals and bio-hazardous materials to and from Canada or Maine by railroad or truck is a concern. New Hampshire North Coast rail line runs through Rochester, mostly carrying freight and crossing major city streets at signaled, street-level crossings in several locations. Potential for accidents exist at rail crossings. The Spaulding Turnpike (Route 16) is a main highway from southern New Hampshire to the Lakes Region and the White Mountains that passes through Rochester and close to the downtown area. Traffic accidents occur on this highway regularly, and hazardous materials are routinely carried on this road. There is also a methane gas pipeline that begins at the Turnkey landfill and follows the path of the Spaulding Turnpike through Rochester to the University of New Hampshire campus in Durham.

There are also several fuel storage locations in the City of Rochester, including Eastern Propane distribution facilities that act as a transportation hub for transferring fuel from rail cars to other distribution mechanisms. While many of these facilities have been identified as potential emergency fuel sources, an accident could also pose a potential threat to other nearby facilities and populations.

Extent of the Hazard

Incidents involving hazardous materials could potentially occur at any residence or business or along any road; however, it is more likely that a large-scale incident would occur in the form of a spill along the North Coast railway tracks or the Spaulding Turnpike. A leak in the methane gas pipeline that extends along the Spaulding Turnpike from the Turnkey landfill to the University of New Hampshire in nearby Durham is also a possibility. Finally, multiple fuel storage facilities, many of which are listed as potential resources in the critical facilities inventory, could pose a potential threat if an accident were to occur. The extent of such an incident can be difficult to predict and would depend upon the type and volume of materials involved.

Past Impacts and Events

No disastrous accidents on either the highway or rail system in Rochester have been recorded. Safety regulations and enforcement are fairly strict, so the likelihood of an accidental and seriously damaging release of harmful chemicals in Rochester is quite small. If an accident does occur, though, especially close to downtown, the percentage of the

population exposed to the hazard could be large. Rochester prefers to consider possible impacts proactively due to the presence of several facilities containing potentially hazardous materials, and vehicle and rail transportation corridors.

Potential Future Impacts on Community

Safety regulations and enforcement are fairly strict, so the likelihood of an accidental and seriously damaging release of harmful chemicals in Rochester is quite small. If an accident does occur, though, especially close to downtown, the percentage of the population exposed to the hazard could be large.

Estimated Loss

Based on the 2016 valuation and the hazard ranking, the estimated potential loss due to hazardous materials is $76,973,110 to $153,946,220.

Large Crowd Events

Table 5.21 Hazard Overview

Hazard Type	Large Crowd Events
Location/Extent	City-wide; downtown and fairgrounds likely more vulnerable
Vulnerability	
Severity	1
Probability	3
Overall Threat	3
Potential Loss	$15,394,622 - $76,973,110 (moderate)

Description of the Hazard

For the purposes of this plan, large crowd events refer to any large gathering of people that has the potential to require higher-than-usual levels of preparedness and/or response from emergency services. As one of the largest cities in the region, Rochester regularly experiences large crowds that require closing or redirecting streets, directing traffic, and increased emergency and/or medical services to ensure the safety of participants. The City of Rochester is also identified in the Seabrook Evacuation Plan as an evacuation destination and could expect to see a large influx of evacuating residents from coastal communities in an emergency.

Extent of the Hazard

Large crowd events are typically either scheduled in advance, as is the case with official city events, or coincide with particular holidays, sporting events, or other high-profile occurrences. This correlation makes crowd events easier to predict than most hazards.

Past Events and Impacts

The City of Rochester's civic involvement includes a variety of annual crowd events, such as the Rochester fair or various holiday celebrations. These events have historically been peaceful, and impacts are largely limited to the time and cost associated with providing heightened security and inconveniences to residents from increased traffic, road closures, and other direct results from the presence of large numbers of people. In many cases, negative impacts to the community as a result of these events are offset by increased business and civic engagement opportunities surrounding these events.

- Rochester Fair: This annual event takes place at the Rochester Fairgrounds, the largest single outdoor venue in the city. The event has the capability to attract thousands of people. The Rochester Agricultural and Mechanical Association did not hold the fair in 2017, but is expected to continue to host a fair of some form in future years.
- Rodger Allen Park: This park contains an assortment of athletic fields which are used daily by children and families for baseball, football, and soccer games. On any given day these fields are filled with people.
- Downtown Events: During the holidays there are parades and other celebrations. These types of events often change traffic patterns and signalization, which has an effect on impact response from both the fire and police departments.
- Regional Events: Large-scale events in nearby municipalities may result in increased traffic and other impacts in Rochester. For example, Bike Week in Laconia, NH could draw higher-than-usual motorcycle traffic through Rochester as attendees travel north on the Spaulding Turnpike and Route 11. Other examples include academic or sporting events at the University of New Hampshire in Durham, the Pease Air Show in Portsmouth, and a variety of speakers and political candidates traveling throughout the region, particularly in national election years, due to New Hampshire's status as an important swing state.

Potential Future Impacts on Community

Crowd events are likely to continue into the foreseeable future and in many cases the City of Rochester is an active partner in the event. While the City seeks to mitigate the negative impacts of such events, such as blocking or rerouting traffic, it has not indicated a desire to lessen the overall number of such events.

The Seabrook Evacuation Plan identifies Rochester as a reception site for evacuating the City of Portsmouth, NH in the event of an emergency at the Seabrook Station Nuclear Power Plant. Additionally, Rochester's proximity to the seacoast could make it a likely destination in the event of extreme coastal flooding in nearby coastal communities.

Estimated Loss Potential

Based on the 2016 valuation and the hazard ranking, the estimated potential loss due to large crowd events is $15,394,622 to $76,973,110.

Cyber Threats

Table 5.22 Hazard Overview

Hazard Type	Cyber Threats
Location/Extent	City-wide
Vulnerability	
Severity	1.67
Probability	3
Overall Threat	5
Potential Loss	$76,973,110 - $153,946,220 (high)

Description of the Hazard

The field of cyber security is primarily concerned with protecting against damage and disruption to or theft of hardware, software, or information. Due to the variety of services they provide, local government organizations collect, store, and work with large amounts of personal data and other sensitive information.

While the security of this information has always been important, increasing use of digital networks to store and transmit that information makes the security of those networks a priority. Furthermore, local governments provide critical services such as police, fire, utilities, and other services, and disruption to these services could be devastating for residents. Types of cyber threat include:[34]

- Malware: Malicious software that can damage computer systems, including monitoring system activity, transferring information, or even taking control of computers or accounts. This includes a wide variety of viruses, Trojans, ransomware, and other programs that are usually installed by clicking on infected links, files, or email attachments.
- Phishing: These attacks come in the form of emails, often disguised as a trusted or legitimate source, that attempt to extract personal data.
- Denial of Service: This is a large-scale attack designed to disrupt network service by overloading the system with connection requests. These attacks are more likely to impact large, high-profile organizations, but such attacks can occasionally have residual impacts on other organizations in the same network.
- Man in the Middle: By imitating an end user (e.g. an online bank), an attacker can extract information from a user. The attacker can then input that information to the end user to access additional information, including sensitive data such as personal or account information.
- Drive-by Downloads: Malware installed on a legitimate website causes a system to download a program simply by visiting that website. This program then downloads malware or other files directly to the user's system.
- Malvertising: This attack type downloads malware or other files to your computer when you click on an infected advertisement.
- Rogue Software: Attackers use pop-up windows to mimic legitimate anti-virus or other security software in order to trick users into clicking on links to download malware or other files.
- Sponsored Attacks: These threats, which could be perpetrated by state or non-state actors, include specific attacks to damage or disrupt infrastructure such as utilities or wastewater facilities.

Extent of the Hazard

Cyber threats are a city-wide hazard that have the potential to impact any location if critical services are disrupted, or any resident, business, contractor, or employee whose information is stored in city records in the event of a data breach. The severity of any impact depends upon the type of incident – targeted phishing attacks may be focused upon a single employee or account, while malware attacks could impact an entire department or gain access to an entire database of personal information.

Past Events and Impacts

A global ransomware attack began on May 12, 2017 that impacted more than 100,000 organizations in 150 countries.[35] Ransomware is a type of malware that encrypts a user's files, making them inaccessible, and demands a ransom to return access. While ransomware has existed for years, it is becoming more prevalent. An IBM study of the impacts of ransomware found that nearly 40% of all spam emails contain a ransomware attachment, up from 0.6% in 2015.[36] The

[34] Sullivan, Megan. 8 Types of Cyber Attacks Your Business Needs to Avoid (http://quickbooks.intuit.com/r/technology-and-security/8-types-of-cyber-attacks-your-business-needs-to-avoid/)
[35] http://www.npr.org/sections/thetwo-way/2017/05/14/528355526/repercussions-continue-from-global-ransomware-attack
[36] IBM X-Force. *Ransomware: How consumers and businesses value their data*. 2016

FBI estimates that over $1 billion in ransoms were paid by businesses and consumers in 2016 compared to $24 million in 2015.[37]

Potential Future Impacts on Community

A City of Rochester's size is most likely to be at risk from malware, phishing, and other methods of acquiring personal information. These threats may be targeted, as in the case of phishing emails sent to employee accounts, or threats that individuals encounter during their regular computer usage. Cyber threats are also constantly evolving in order to find new weaknesses in anti-virus software and other network defenses. As noted above, ransomware has become an increasingly prevalent form of malware in recent years, and is likely to continue to be a threat in years to come.

Estimated Loss Potential

Based on the 2015 valuation and the hazard ranking, the estimated potential loss due to cyber threats is $76,973,110 to $153,946,220.

Geomagnetic and Electromagnetic Events

Table 5.22 Hazard Overview

Hazard Type	Geomagnetic and Electromagnetic Events
Location/Extent	City-wide
Vulnerability	
Severity	1
Probability	1
Overall Threat	1
Potential Loss	$0 - $15,394,622 (low)

Description of the Hazard

A geomagnetic storm is a disturbance in the earth's magnetic field cause by interaction with solar wind. Serious geomagnetic disturbances have been rare; recent scientific research indicates an increasing cycle of sunspots and there are growing indications that the concept of EMP can be or has been used as a weapon. Effects could include electrical grid failure, complete communications failure, command control signaling and warning system failure and water distribution system failure, as well as failure of wireless, satellite, and landline telephone and data services throughout City.

Extent of the Hazard

Geomagnetic events are a city-wide hazard that have the potential to impact any location if critical services are disrupted. They would likely cause extended power failure that can negatively impact lighting, heating, water supply, and emergency services. Elderly populations and other populations to protect listed in Table 3.1 could also be particularly vulnerable if the extended power outage occurred in conjunction with extreme heat or severe winter weather.

Past Events and Impacts

[37] http://www.nbcnews.com/tech/security/ransomware-now-billion-dollar-year-crime-growing-n704646

A geomagnetic storm in March 1989 caused widespread disruption to the Hydro-Quebec power grid, leaving roughly six million people without power for nine hours.[38]

Potential Future Impacts on Community

Geomagnetic events, though rare, should be expected to continue in the future. While large-scale power outages or disturbances in communications equipment as a result of a geomagnetic storm are unlikely at any given time, such outages can occur as a result of other hazards or human interference.

Estimated Loss Potential

Based on the 2015 valuation and the hazard ranking, the estimated potential loss due to geomagnetic events is $0 to $15,394,622.

Hazards Not Included in this Plan

The State of New Hampshire identifies avalanches as a hazard in the State Multi-Hazard Mitigation Plan Update of 2013. Avalanches are not included in this Plan for the City of Rochester. Avalanches were not identified by the present or past Planning Committee as a local hazard due to the fact that there are no significant mountains or topographical features where avalanches would be likely to occur. The City will re-evaluate the need to include additional hazards to this Plan during subsequent updates of the Plan.

[38] http://www.hydroquebec.com/learning/notions-de-base/tempete-mars-1989.html

Chapter 6: Action Plan

Existing Programs and Policies

Table 6.1 displays existing, ongoing mitigation programs and policies in Rochester. This matrix was updated by the Planning Committee during the preparation of this report. The matrix includes the type of existing protection (Column 1), a description of the existing protection (Column 2), the type of hazard (Column 3), the type of activity (Column 4), the area of city impacted (Column 5), enforcement (Column 6), effectiveness of the strategy (Column 7), and a status update in 2017 (Column 8).

Table 6.1 Ongoing Programs and Policies

Existing Program/Activity	Description	Type of Hazard	Type of Activity	Area of City Covered	Enforcement	Effectiveness	2018 Update
Floodplain information on the website	Section 42.13 of the Rochester Zoning Ordinance has provisions regarding the Regulatory Floodway Zone, and FEMA FIRM maps are referenced and included in the City's online GIS.	Flooding	Prevention	City-wide	Department of Building & Safety	Good	Zoning information and floodplain information in the City's GIS are still available online and are updated regularly as changes are made. The City will continue to revise the zoning ordinance as needed and make updates accessible to residents.
Tree Program	Public Works clears trees from roads if they've become a hazard or been damaged by a storm.	Multi-Hazard	Prevention	City-Wide	Public Works	Good	The Public Works Department will continue to clear trees as needed if they become a hazard to safety and traffic flow.
Snow Removal Plan	Outline priorities during a snow event and where to put excess snow	Severe Winter Weather	Emergency Preparedness	City-wide	Public Works	Good	Public Works continues to prioritize which streets are plowed first in a storm event.
Dam Inundation Plan	Emergency Action plan in case of a dam failure	Flooding	Prevention	City Water Supply Reservoir	State	Good	EAPs in place for Rochester Reservoir and Upper City dam. City will continue to develop and assess EAPs as required by the state and conduct required tests.
Building Standards	State building codes require that all new "critical" buildings have to be constructed using current earthquake standards	Earthquakes	Prevention	City-wide	State	Good	All development will continue to follow the 2009 International Building Codes, including requirements for earthquake standards.

Effectiveness:

Excellent – The existing program works as intended and is exceeding its goals

Good – The existing program works as intended and meets its goals

Average – The existing program does not work as intended and/or does not meet its goals

Poor – This existing program is failing to do what it is intended to do and is negatively impacting the community

2017 Update:

Recommendations for improvement

Table 6.2 displays mitigation strategies identified during the development of Rochester's Multi-Hazard Mitigation Plan in 2007 and 2012. The Committee provided a status update for each mitigation strategy during the preparation of the current Plan. The Planning Committee members then ranked past mitigation actions from prior plan as high, medium, and low priority.

Table 6.2 Accomplishments since Prior Plan(s) Approval

Prior STAPLEE	Strategy	2018 Update
17	Complete a vulnerability/risk assessment study to help implement and facilitate the next hazard mitigation plan update.	Deferred. City will continue to evaluate possible opportunities and funding sources. City will consider hazards included in this plan to determine whether any hazards require more detailed study.
21	National Incident Management System (NIMS) & Incident Command System (ICS) training for elected and appointed officials.	Ongoing. Emergency Management Director distributes required training levels for various departments and officials, makes officials aware of training opportunities, and confirms that all officials reach necessary levels.
18	Comprehensive review of zoning ordinances and land use regulations to ensure compliance with best management practices and accepted emergency management practices.	Completed. Comprehensive zoning update occurred in 2014. Zoning ordinance will be reviewed periodically to ensure it is up to date with best management practices.
20	Improve relationship with the Federal Emergency Management Agency Region 1 to improve public awareness.	Ongoing.
18	Fire Department must be deployed, equipped, and trained pursuant to National Fire Protection Association standards and recommendations.	Ongoing. City is actively monitoring performance and resources for meeting targets for personnel and response needs.
19	Conduct an engineering feasibility study on raising roadway grade on Salmon Falls Road to reduce flooding.	Deferred. Further work needed to clarify original scope of project and degree of completion.
19	Identify & map evacuation routes throughout the City. Partner with Seacoast Evacuation Plan.	Removed. City has mapped some dam evacuation, but full-scale not completed. Seacoast Evacuation Plan should be sufficient to cover additional needs.
21	Comprehensive review of emergency communications systems.	Ongoing. Radio improvements are listed in the CIP for 2020 and phone improvements for 2019. IT will work to refine projects and assess additional needs.
19	Broadband/data capacity increase	Ongoing. Information Systems department reviews data and technology needs.
13	Land acquisition. Long-term goal to remove structures from 100-year floodplain.	Ongoing.
17	There is a need for critical emergency back-up transmission ability. Microwave radio communication equipment.	Ongoing. This action will be merged with CIP projects for radio and phone improvements mentioned above for 2019 and 2020.
18	Identify suitable location for North End Fire Station. Response times currently not meeting standards.	Deferred. Project has been delayed and site identification expected to be completed in 2020 at the earliest.
18	Removing overhead utilities from critical access roads. Long-term goal is to eliminate safety issues	Ongoing. City continues to communicate and negotiate with the utility company but little progress has been made to date.

Status Update:
Completed Action – This program continues to be an implemented mitigation action item since the last updated plan was developed
Deferred Action – At the time of developing this plan, more time is required for completion
Removed Action – This existing program is no longer a priority to the City
Ongoing Action – This program will occur throughout the life of the plan

New Mitigation Strategies

A technique known as a STAPLEE evaluation, which was developed by FEMA, was used to evaluate new mitigation strategies based on a set of criteria (see below). The STAPLEE method is commonly used by public administration officials and planners.

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

The Committee evaluated each mitigation strategy using the STAPLEE and ranked each of the criteria as poor, average, or good. These rankings were assigned the following scores: *Poor=1; Average=2; Good=3.*

The following questions were used to guide further prioritization and action:

- Does the action reduce damage?
- Does the action contribute to community objectives?
- Does the action meet existing regulations?
- Does the action protect historic structures?
- Can the action be implemented quickly?

The prioritization exercise helped the committee evaluate the new hazard mitigation strategies that they had brainstormed throughout the multi-hazard mitigation planning process. While all actions would help improve the City's multi-hazard and responsiveness capability, funding availability will be a driving factor in determining what and when new mitigation strategies are implemented.

Table 6.3 displays new and ongoing mitigation strategies identified by the Planning Committee.

Table 6.3 Future Mitigation Actions & STAPLEE

New Mitigation Project	S	T	A	P	L	E	E	Total
Develop and implement standardized Water rationing policies	2 - likely some pushbacks from end users	3	2 - might be some enforcement issues	3	3	2 - water bills funding water department will go down if use is curtailed	3	18
Integrating CDBG 5-year plan with other hazard mitigation planning efforts	2	3	3	2	3	3	3	19
Tri-City homelessness task force is investigating extreme weather response facilities to support vulnerable populations	3	2	2	2 - implementing /funding recommendations may be more difficult	3	1 - funding actions is likely to receive pushback	3	16
Updating stormwater regulations, including for compliance with MS-4	2	3	3	2	3	1 - new regulations could have implications for development	3	17
Implement disaster recovery site to meet city's response time objective	3	3	3	3	3	2	3	20
Information security training for users	3	3	3	3	3	3	3	21

Remove the Gonic Dam and Gonic Sawmill dam, which are deteriorating, to stabilize flooding and prevent failure. Restoring the river to its natural state would have other flooding and environmental benefits.	3	2	2	2	3	1 - high project cost would need multiple funding sources	3	16
*Land acquisition. Long-term goal to remove structures from 100-year floodplain.	1 – citizens may have concerns about private property rights	3	1	1	3	1	3	13
*Identify suitable location for North End Fire Station. Response times currently not meeting standards.	3	3	3	3	3	1	2	18
*Removing overhead utilities from critical access roads. Long-term goal is to eliminate safety issues	3	2	3	3	3	1	3	18
*Broadband/data capacity increase	3	3	3	3	3	1 – budget constraints	3	19
*Comprehensive review of emergency communications systems.	3	3	3	3	3	3	3	21
*Conduct an engineering feasibility study on raising roadway grade on Salmon Falls Road to reduce flooding.	3	3	3	3	3	1 – budget constraints	3	19

*Fire Department must be deployed, equipped, and trained pursuant to National Fire Protection Association standards and recommendations.	3	3	3	2	3	1 – budget constraints	3	18
*Improve relationship with the Federal Emergency Management Agency Region 1 to improve public awareness.	3	3	3	2	3	3	3	20
*National Incident Management System (NIMS) & Incident Command System (ICS) training for elected and appointed officials.	3	3	3	3	3	3	3	21
*Complete a vulnerability/risk assessment study to help implement and facilitate the next hazard mitigation plan update.	3	3	1 – possible capacity issues	3	3	1 – budget constraints	3	17
* Descriptions of Ongoing and Deferred actions were updated to reflect current status and existing STAPLEE scores from the 2013 update were reaffirmed.								

Implementation Schedule for Prioritized Strategies

After reviewing the finalized STAPLEE numerical ratings, the Team prepared to develop the Implementation Plan (Table 21). To do this, the Team developed an implementation plan that outlined the following:

- ∴ Type of hazard
- ∴ Affected location
- ∴ Type of Activity
- ∴ Responsibility
- ∴ Funding
- ∴ Cost Effectiveness; and
- ∴ Timeframe

The following questions were asked in order to develop an implementation schedule for the identified priority mitigation strategies.

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

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

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

In addition to the prioritized mitigation projects, Table 21, Implementation Plan, includes the responsible party (WHO), how the project will be supported (HOW), and what the timeframe is for implementation of the project (WHEN).

Table 6.4 New and Ongoing Mitigation Strategies

New Mitigation Project	Type of Hazard	Affected Location	Type of Activity	Responsibility	Funding	Cost Effectiveness	Timeframe
							**Ongoing/Continuous*
						Low = < $5,000	*6 months - 1 year*
						Medium = $5,000 - $10,000	*1 - 2 years*
						High = > $10,000	*2 - 5 years*
Develop and implement standardized Water rationing policies	Drought	City-wide	Strategy/ planning/ policy	Public Works and Water	Grant	Medium = $5,000 - $10,000	6 months - 1 year
Integrating CDBG 5-year plan with other hazard mitigation planning efforts	All	City-wide	Planning	Community Development Divisions	CDBG funds	Medium = $5,000 - $10,000	1 - 2 years
Tri-City homelessness task force is investigating extreme weather response facilities to support vulnerable populations	All	City-wide	Planning	City Manager/ Mayor	Operating Funds	Low = < $5,000	1 - 2 years
Updating stormwater regulations, including for compliance with MS-4	Flooding	City-wide	Planning and policies	Public Works	Operating Funds	Medium = $5,000 - $10,000	1 - 2 years
Implement disaster recovery site to meet city's response time objective	All	City-wide	Public information and outreach	IT	Operating Funds	High = > $10,000	2 - 5 years
Information security traning for users	Cyber threats	City-wide	Training	IT	Operating Funds	Low = < $5,000	1 - 2 years
Remove the Gonic Dam and Gonic Sawmill dam, which are deteriorating, to stabilize flooding and prevent failure. Restoring the river to its natural state would have other flooding and environmental benefits.	Flooding	Gonic	Infrastructure	Department of Public Works	Grant Funding, Partnership with State and Regional Agencies	High = > $10,000	2 - 5 years

National Incident Management System (NIMS) & Incident Command System (ICS). Training for elected & appointed officials	Multi-hazard	City-wide	Training	City Manager/Emergency Management Director	Resources available for free. Requires time commitment.	*Low = < $5,000*	**Ongoing/Continuous*
Improve relationship with the Federal Emergency Management Agency (FEMA) Region 1 to improve public awareness.	Multi-hazard	City-wide	Outreach & Awareness	Emergency Management Director	Resources available for free. Requires time commitment.	*Low = < $5,000*	**Ongoing/Continuous*
Fire Department must be deployed, equipped, and trained pursuant to National Fire Protection Association (NFPA) standards and recommendations.	Fire	City-wide	Training and Infrastructure	Fire & Rescue	Operating Budget and/or Capital Improvements Plan	*High = > $10,000*	**Ongoing/Continuous*
Comprehensive review of emergency communications systems.	Multi-hazard	City-wide	Planning & Prevention	Police, Fire & Rescue, and Information Systems	Capital Improvements Plan	*High = > $10,000*	*1 - 2 years*
There is a need for critical emergency back-up transmission ability. Microwave Radio communication equipment.	Multi-hazard	City-wide	Infrastructure	Police, Fire & Rescue, and Information Systems	Capital Improvements Plan	*High = > $10,000*	*1 - 2 years*
Land acquisition. Long-term goal to remove structures from 100-year floodplain	Flood	100-year floodplain	Planning & Prevention	City Council/Planning Board	Grant Funding, Public/Private Partnership, or Capital Improvements Plan	*High = > $10,000*	*2 - 5 years*
Identify suitable location for North End Fire Station. Response times not meeting standards.	Fire	Northern Rochester	Infrastructure	Fire & Rescue	Capital Improvements Plan	*High = > $10,000*	*2 - 5 years*

Removing overhead utilities from critical access roads. Long-term goal to eliminate safety issues	Severe Winter Weather /Windstorms	City-wide	Planning & Prevention	Department of Public Works/Private Utility	Public/Private Partnership	*High = > $10,000*	*2 - 5 years*
Broadband/data capacity increase.	Multi-hazard	City-wide	Infrastructure	Information Systems	Capital Improvements Plan	*High = > $10,000*	*2 - 5 years*
Complete a vulnerability/risk assessment study to help implement and facilitate the next hazard mitigation plan update.	Multi-hazard	City-wide	Planning & Prevention	Emergency Management Director	Grant Funding or Capital Improvements Plan	*High = > $10,000*	*2 - 5 years*
Conduct an engineering feasibility study on raising roadway grade on Salmon Falls Road to reduce flooding (mitigate).	Flood	Salmon Falls Road	Planning & Prevention	Department of Public Works	Capital Improvements Plan	*Medium = $5,000 - $10,000*	*2 - 5 years*

Chapter 7: Monitoring, Evaluating, and Updating the Plan

Introduction

A good mitigation plan must allow for updates where and when necessary, particularly since communities may suffer budget cuts or experience personnel turnover during both the planning and implementation states. A good plan will incorporate periodic monitoring and evaluation mechanisms to allow for review of successes and failures or even just simple updates.

Multi-Hazard Plan Monitoring, Evaluation, and Updates

To track programs and update the mitigation strategies identified through this process, the City will review the Plan annually and after a hazard event. Additionally, the Plan will undergo a formal review and update at least every five years and obtain FEMA approval for this update or any other major changes done in the Plan at any time. The Emergency Management Director is responsible for initiating the review and will consult with members of the Multi-Hazard Mitigation Planning Committee identified in this plan. The public will be encouraged to participate in any updates and will be given the opportunity to be engaged and provide feedback through such means as periodic presentations on the plan at city functions, annual questionnaires or surveys, and posting on social media/interactive websites. Public announcements will be made through advertisements in local papers, postings on the City website, and posters disseminated throughout the City. A formal public meeting will be held before reviews and updates are official.

Changes will be made to the Plan to accommodate projects that have failed or are not considered feasible after a review for their consistency with STAPLEE, the timeframe, the community's priorities or funding resources. Priorities that were not ranked high, but identified as potential mitigation strategies, will be reviewed as well during the monitoring and update of the plan to determine feasibility of future implementation. In keeping with the process of adopting this Multi-Hazard Mitigation Plan, a public meeting to receive public comment on plan maintenance and updating will be held during the annual review period and before the final product is adopted by the administration. Chapter 8 contains a representation of a draft resolution for Rochester to use once a conditional approval is received from HSEM.

Integration with Other Plans

The 2004 and 2012 Multi-Hazard Mitigation Plan was used during periodic updates to the Rochester Master Plan. Input on impacts to roads and other critical infrastructure from hazards was included in relevant master plan sections. Both plans were also used during capital improvements planning updates and prioritization of municipal culverts and stream crossings for repair and replacement schedules. Information from the City's Zoning Ordinance was utilized in the development of this Plan.

This Plan will only enhance mitigation if integrated with all other city plans and activities. Rochester will take the necessary steps to incorporate the mitigation strategies and other information contained in this plan with other city activities, plans and mechanisms, such as comprehensive land use planning, capital improvements planning, site plan regulations, and building codes to guide and control development in the City of Rochester, when appropriate. The local government will refer to this Plan and the strategies identified when updating the City's Master Plan, Capital Improvements Program, Zoning Ordinances and Regulations, and Emergency Operations Plan. The City Council and the Multi-Hazard Mitigation Planning Committee will work with City officials to incorporate elements of this Plan into other

planning mechanisms, when appropriate. In addition, the City will review and make note of instances when this has been done and include it as part of their annual review of the Plan.

Chapter 8: Plan Adoption

Conditional Approval Letter from HSEM

James Burdin

From:	Hazard Mitigation Planning <HazardMitigationPlanning@dos.nh.gov>
Sent:	Wednesday, October 31, 2018 2:34 PM
To:	'caroline.mccarley@rochestemh.net'; 'mark.klose@rochesternh.net'
Cc:	James Burdin; Morton, ShawnaLeigh; Henderson, Kayla
Subject:	Rochester, NH - Approvable Pending Adoption

Good afternoon!

The Department of Safety, Division of Homeland Security & Emergency Management (HSEM) has completed its review of the Rochester, NH Local Hazard Mitigation Plan and found it approvable pending adoption. Congratulations on a job well done!

With this approval, the jurisdiction meets the local mitigation planning requirements under 44 CFR 201 **pending HSEM's receipt of electronic copies of the adoption documentation and the final plan**.

Acceptable electronic formats include Word or PDF files and must be submitted to us via email at HazardMitigationPlanning@dos.nh.gov. Upon HSEM's receipt of these documents, notification of formal approval will be issued, along with the final Checklist and Assessment.

The approved plan will be submitted to FEMA on the same day the community receives the formal approval notification from HSEM. FEMA will then issue a Letter of Formal Approval to HSEM for dissemination that will confirm the jurisdiction's eligibility to apply for mitigation grants administered by FEMA and identify related issues affecting eligibility, if any. If the plan is not adopted within one calendar year of HSEM's Approval Pending Adoption, the jurisdiction must update the entire plan and resubmit it for HSEM review. If you have questions or wish to discuss this determination further, please contact me at Whitney.Welch@dos.nh.gov or 603.223.3667.

Thank you for submitting the Rochester, NH Local Hazard Mitigation Plan and again, congratulations on your successful community planning efforts.

Sincerely,

Whitney Welch

Hazard Mitigation Planning
NH Homeland Security and Emergency Management
33 Hazen Drive
Concord, NH 03301
NEW: 603-223-3650
603-223-3609 (fax)

Certificate of Adoption

It is further resolved that the Mayor and City Council of the City of Rochester, by adoption of this Resolution, accept the loan amount of up to Three Million Five Hundred Ninety Eight Thousand Dollars ($3,598,000.00) from the NHDES CWSRF Loan program.

Further, the Mayor and City Council of the City of Rochester, by adoption of this Resolution authorize the City Manager and/or the Finance Director to act as the City's representative(s) for the execution of all documents necessary to complete the application to the CWSRF.

To the extent not otherwise provided for in this Resolution, the Finance Director is hereby authorized to designate and/or establish such accounts and/or account numbers as necessary to implement the transactions contemplated by this Resolution and to establish special revenue, non-lapsing, multi-year fund account(s) as necessary to which said sums shall be recorded.

13.4 City of Rochester Hazard Mitigation Plan (Update) ***consideration for approval***

- **Link to the Updated Hazard Mitigation Plan from 2018 -2022 Click here**

Councilor Lachapelle **MOVED** to **ACCEPT** the updated Hazard Mitigation Plan for the City of Rochester, NH. Councilor Walker seconded the motion. The **MOTION CARRIED** by a unanimous voice vote.

13.5 Resolution Approving Cost Items Associated with Proposed City of Rochester Multi-Year Collective Bargaining Agreement with Rochester Middle Managers Group ***first reading, consideration for second reading and acceptance***

Councilor Lachapelle **MOVED** to read the resolution for the second first time by title only. Councilor Walker seconded the motion. The **MOTION CARRIED** by unanimous voice vote. Mayor McCarley read the resolution for the first time as follows:

RESOLUTION APPROVING COST ITEMS ASSOCIATED WITH PROPOSED CITY OF ROCHESTER MULTI-YEAR COLLECTIVE BARGAINING AGREEMENT WITH Rochester Middle Managers Group

Kelly Walters 11/27/2018

KELLY A. WALTERS, Notary Public
State of New Hampshire
My Commission Expires March 8, 2022

I attest this to be a true copy of the pertinent pages of the November 13, 2018 Regular City Council meeting minutes, which has been submitted for duplicaiton on November 27, 2018.
Kelly Walters, City Clerk, Rochester, NH

Final Approval Letter from FEMA

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

FEMA

JAN 07 2019

Whitney Welch
State Hazard Mitigation Officer
NH Department of Safety
Homeland Security and Emergency Management
33 Hazen Drive
Concord, NH 03303

Dear Ms. Welch:

We would like to acknowledge the City of Rochester and the State of New Hampshire for their dedication and commitment to mitigation planning.

As outlined in the FEMA-State Agreement for FEMA-DR-4316 your office has been delegated the authority to review and approve local mitigation plans under the Program Administration by States Pilot Program. On **November 29, 2018** our Agency was notified that your office completed its review of the Multi-Hazard Mitigation Plan Update 2018, City of Rochester, NH and determined it meets the requirements of 44 C.F.R. Pt. 201.

With this plan approval, the City of Rochester is eligible to apply to 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 Multi-Hazard Mitigation Plan Update 2018, City of Rochester, NH must be reviewed, revised as appropriate, and resubmitted to New Hampshire Homeland Security and Emergency Management for approval within **five years of the plan approval date of November 29, 2018** 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.

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 or Melissa.Surette@fema.dhs.gov.

Sincerely,

Paul F. Ford
Acting Regional Administrator

PFF: ms

cc: Fallon Reed, Chief of Planning, New Hampshire
Kayla Henderson, Hazard Mitigation Planner, New Hampshire
Jennifer Gilbert, New Hampshire State NFIP Coordinator

Appendices

Appendix A: Bibliography

Appendix B: Planning Process Documentation

Appendix C: Summary of Possible All-Hazard Mitigation Strategies

Appendix D: Technical and Financial Assistance for All-Hazard Mitigation
- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)

Appendix A: Bibliography

Documents

- Local Mitigation Plan Review Guide, FEMA, October 1, 2011
- Multi-Hazard Mitigation Plans
    - Town of Durham, 2017
    - City of Dover, 2018
    - City of Rochester, 2013
- State of New Hampshire Multi-Hazard Mitigation Plan (2013) - State Hazard Mitigation Goals
- Disaster Mitigation Act (DMA) of 2000, Section 101, b1 & b2 and Section 322a http://www.fema.gov/library/viewRecord.do?id=1935
- Economic & Labor Market Information Bureau, NH Employment Security, 2015; Census 2010 and Revenue Information
- NCDC [National Climatic Data Center, National Oceanic and Atmospheric Administration]. 2017. Storm Events

Appendix B: Planning Process Documentation

Agendas

City of Rochester, New Hampshire

Hazard Mitigation Committee Meeting #1

March 22, 2017
1:30PM – 3:30PM

City Hall Annex Cocheco Room
37 Wakefield Street
Rochester, NH 03867

Agenda

1. Introductions
2. Update process and the requirements of the grant
3. Responsibilities, in-kind match documentation, and the steps towards successful adoption
4. Review 2013 Excerpt – Asset Inventory (attachment)
5. Review 2013 Excerpt – Past Mitigation Strategies (attachment)
    a. What is the current status of actions and strategies?
6. Review 2013 hazard types
7. Review Chapter 2: Community Profile (attachment)
8. Review Chapter 4: National Flood Insurance Program (attachment)
9. Adjourn

City of Rochester, New Hampshire

Hazard Mitigation Committee Meeting #2

April 12, 2018
1:30PM – 3:30PM

City Hall Annex Cocheco Room
33 Wakefield Street
Rochester, NH 03867

Agenda

1. Introductions
2. Review Chapter 5: Hazard Descriptions (attachment)
    a. Update Hazard Vulnerability Assessment
3. Begin discussing new strategies and actions
4. Adjourn

City of Rochester, New Hampshire

Hazard Mitigation Committee Meeting #3

April 26, 2018
1:30PM – 3:30PM

City Hall Annex Cocheco Room
33 Wakefield Street
Rochester, NH 03867

Agenda

1. Introductions

2. Review Chapter 6: Implementation Plan (attachment)

    a. Brainstorm new mitigation actions and fill out implementation plan (New_Mitigation_Actions.xls)
        i. Go through STAPLEE Method to rank each new action
        ii. Ensure that implementation plan for ongoing actions has been updated correctly

3. Discuss process for finalizing and submitting plan

4. Adjourn

City of Rochester, New Hampshire

Hazard Mitigation Committee Meeting #4

May 3, 2018
1:30PM – 3:30PM

City Hall Annex Cocheco Room
33 Wakefield Street
Rochester, NH 03867

Agenda

1. Introductions

2. Brainstorm new mitigation actions and fill out implementation plan (New_Mitigation_Actions.xls)
    a. Go through STAPLEE Method to rank each new action
    b. Ensure that implementation plan for ongoing actions has been updated correctly

3. Discuss process for finalizing and submitting plan

4. Adjourn

Sign In Sheets

City of Rochester, New Hampshire

Multi-Hazard Mitigation Planning Committee Meeting #1

March 22, 2017
1:30PM – 3:30PM

City Hall Annex Cocheco Room
37 Wakefield Street
Rochester, NH 03867

Sign In

Name	Position/Affiliation	Email Address	Time Spent Preparing for Meeting	Is your attendance at this meeting paid for by federal funds?
Mark Klose	Fire Chief	Mark.Klose@rochesternh.net	4hrs	Yes/No
Blaine Cox	Deputy CM	blaine.cox@rochesternh.net		Yes/No
Tim Campbell	Director of Planning	jim.campbell@rochesternh.net	Ø	Yes/No
Tim Wilder	Fire Marshal	tim.wilder@rochesternh.net	Ø	Yes/No
Paul Toussaint	Police Chief	paul.toussaint@rochesternh.net		Yes/No
Karen Pollard	Econ+ Com Dev Mgr	karen.pollard@rochesternh.net	Ø	Yes/No
MICHAEL BEZANSON	CITY ENGINEER	michael.bezanson@rochesternh.net	Ø	Yes/No
Peter Nourse	DPW DIRECTOR	peter.nourse@rochesternh.net	0	Yes/No
Jim Grant	Building - Health	Jim.Grant@RochesterNH.net	Ø	Yes/No
Sonja Gonzalez	CIO	sonja.gonzalez@rochesternh.net	1hr	Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No

*Volunteer rate = $24.90

City of Rochester, New Hampshire

Multi-Hazard Mitigation Planning Committee Meeting #2

April 12, 2017
1:30PM – 3:30PM

City Hall Annex Cocheco Room
37 Wakefield Street
Rochester, NH 03867

Sign In

Name	Position/Affiliation	Email Address	Time Spent Preparing for Meeting	Is your attendance at this meeting paid for by federal funds?
Paul Toussaint	Police Chief	paul.toussaint@rochesternh.net		Yes/No
Jenn Marsh	Economic Development	jennifer.marsh@rochesternh.net	20 min	Yes/No
MICHAEL BEZANSON	CITY ENGINEER PUBLIC WORKS	michael.bezanson@rochesternh.net		Yes/No
Sonja Gonzalez	CIO	sonja.gonzalez@rochesternh.net	1hr.	Yes/No
James Grant	Building, Zoning, Licensing	Jim.Grant@RochesterNH.net	2.0 min	Yes/No
Mark Dupuis	Assistant Fire Chief	mark.dupuis@rochesternh.net		Yes/No
Tim Wilder	Fire Marshal	tim.wilder@rochesternh.net		Yes/No
Mark Klose	Fire Chief	mark.klose@rochesternh.net	30 min	Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No

*Volunteer rate = $24.90

City of Rochester, New Hampshire

Multi-Hazard Mitigation Planning Committee Meeting #2

April 26, 2017
1:30PM – 3:30PM

City Hall Annex Cocheco Room
37 Wakefield Street
Rochester, NH 03867

Sign In

Name	Position/Affiliation	Email Address	Time Spent Preparing for Meeting	Is your attendance at this meeting paid for by federal funds?
MICHAEL BEZANSON	CITY ENGINEER / DPW		∅	Yes/No
Julian Long	Comm. Dev. Coordinator	[redacted]	30 min.	Yes/No
Mark Dupuis	Asst Fire Chief		∅	Yes/No
Jim Grant	Director B2LS		∅	Yes/No
Tim Wilder	Fire Marshal		∅	Yes/No
Sonja Gonzalez	CLO		1hr.	Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No

*Volunteer rate = $24.90

City of Rochester, New Hampshire

Multi-Hazard Mitigation Planning Committee Meeting #4

May 3, 2018
1:30PM – 3:30PM

City Hall Annex Cocheco Room
37 Wakefield Street
Rochester, NH 03867

Sign In

Name	Position/Affiliation	Email Address	Time Spent Preparing for Meeting	Is your attendance at this meeting paid for by federal funds?
Paul Toussaint	Chief of Police	paul.toussaint@rochesterNH.net		Yes/No
Jim Campbell	Dir. of Planning & Devel.	jim.campbell@rochesternh.net	2 hrs	Yes/No
Mark Dupuis	Asst Chief Fire	mark.dupuis@rochesternh.net		Yes/No
Mark Klose	Fire Chief	mark.klose@rochesternh.net	1 hr	Yes/No
				Yes/No
Jim Grant	Director-Building Zoning	Jim.Grant@RochesterNH.net	1/2 hr	Yes/No
Tim Wilder	Fire Marshal	tim.wilder@rochesternh.net	0	Yes/No
Sonja Gonzalez	CIO	sonja.gonzalez@rochesternh.net	1/2hr.	Yes/No
Julian Long	Econ Dev/CDBG	julian.long@	—	Yes/No
Karen Pollard	Econ Dev.	karen.pollard@	—	Yes/No
				Yes/No
				Yes/No
				Yes/No
				Yes/No

*Volunteer rate = $24.90

Appendix C: Summary of Possible All-Hazard Mitigation Strategies

I. RIVERINE MITIGATION

A. Prevention

Prevention measures are intended to keep the problem from occurring in the first place, and/or keep it from getting worse. Future development should not increase flood damage. Building, zoning, planning, and/or code enforcement personnel usually administer preventative measures.

1. **Planning and Zoning**[39] **-** Land use plans are put in place to guide future development, recommending where - and where not - development should occur and where it should not. Sensitive and vulnerable lands can be designated for uses that would not be incompatible with occasional flood events - such as parks or wildlife refugees. A Capital Improvements Program (CIP) can recommend the setting aside of funds for public acquisition of these designated lands. The zoning ordinance can regulate development in these sensitive areas by limiting or preventing some or all development - for example, by designating floodplain overlay, conservation, or agricultural districts.

2. **Open Space Preservation -** Preserving open space is the best way to prevent flooding and flood damage. Open space preservation should not, however, be limited to the floodplain, since other areas within the watershed may contribute to controlling the runoff that exacerbates flooding. Land Use and Capital Improvement Plans should identify areas to be preserved by acquisition and other means, such as purchasing easements. Aside from outright purchase, open space can also be protected through maintenance agreements with the landowners, or by requiring developers to dedicate land for flood flow, drainage and storage.

3. **Floodplain Development Regulations -** Floodplain development regulations typically do not prohibit development in the special flood hazard area, but they do impose construction standards on what is built there. The intent is to protect roads and structures from flood damage and to prevent the development from aggravating the flood potential. Floodplain development regulations are generally incorporated into subdivision regulations, building codes, and floodplain ordinances.
    a. **Subdivision Regulations:** These regulations govern how land will be divided into separate lots or sites. They should require that any flood hazard areas be shown on the plat, and that every lot has a buildable area that is above the base flood elevation.
    b. **Building Codes**: Standards can be incorporated into building codes that address flood proofing for all new and improved or repaired buildings.
    c. **Floodplain Ordinances:** Communities that participate in the National Flood Insurance Program are required to adopt the minimum floodplain management regulations, as developed by FEMA. The regulations set minimum standards for subdivision regulations and building codes. Communities may adopt more stringent standards than those set forth by FEMA.
4. **Stormwater Management** - Development outside of a floodplain can contribute significantly to flooding by covering impervious surfaces, which increases storm water runoff. Storm water management is usually addressed in subdivision regulations. Developers are typically required to build retention or detention basins to minimize any increase in runoff caused by new or expanded impervious surfaces, or new drainage systems. Generally, there is a prohibition against storm water leaving the site at a rate higher than it did before the

[39] All zoning should be carefully reviewed on a consistent basis by municipal officials to make sure guidelines are up-to-date and towns are acting in accordance with best management practices.

development. One technique is to use wet basins as part of the landscaping plan of a development. It might even be possible to site these basins based on a watershed analysis. Since detention only controls the runoff rates and not volumes, other measures must be employed for storm water infiltration - for example, swales, infiltration trenches, vegetative filter strips, and permeable paving blocks.

5. **Drainage System Maintenance -** Ongoing maintenance of channel and detention basins is necessary if these facilities are to function effectively and efficiently over time. A maintenance program should include regulations that prevent dumping in or altering water courses or storage basins; regrading and filling should also be regulated. Any maintenance program should include a public education component, so that the public becomes aware of the reasons for the regulations. Many people do not realize the consequences of filling in a ditch or wetland, or regrading.

B. Property Protection

Property protection measures are used to modify buildings subject to flood damage, rather than to keep floodwaters away. These may be less expensive to implement, as they are often carried out on a cost-sharing basis. In addition, many of these measures do not affect a building's appearance or use, which makes them particularly suitable for historical sites and landmarks.

1. **Relocation -** Moving structures out of the floodplain is the surest and safest way to protect against damage. Relocation is expensive, however, so this approach will probably not be used except in extreme circumstances. Communities that have areas subject to severe storm surges, ice jams, etc. might want to consider establishing a relocation program, incorporating available assistance.

2. **Acquisition -** Acquisition by a governmental entity of land in a floodplain serves two main purposes: 1) it ensures that the problem of structures in the floodplain will be addressed; and 2) it has the potential to convert problem areas into community assets, with accompanying environmental benefits. Acquisition is more cost effective than relocation in those areas that are subject to storm surges, ice jams, or flash flooding. Acquisition, followed by demolition, is the most appropriate strategy for those buildings that are simply too expensive to move, as well as for dilapidated structures that are not worth saving or protecting. Acquisition and subsequent relocation can be expensive, however, there are government grants and loans that can be applied toward such efforts.

3. **Building Elevation -** Elevating a building above the base flood elevation is the best on-site protection strategy. The building could be raised to allow water to run underneath it, or fill could be brought in to elevate the site on which the building sits. This approach is cheaper than relocation, and tends to be less disruptive to a neighborhood. Elevation is required by law for new and substantially improved residences in a floodplain, and is commonly practiced in flood hazard areas nationwide.

4. **Floodproofing -** If a building cannot be relocated or elevated, it may be floodproofed. This approach works well in areas of low flood threat. Floodproofing can be accomplished through barriers to flooding, or by treatment to the structure itself.
    a. **Barriers:** Levees, floodwalls and berms can keep floodwaters from reaching a building. These are useful, however, only in areas subject to shallow flooding.
    b. **Dry Floodproofing:** This method seals a building against the water by coating the walls with waterproofing compounds or plastic sheeting. Openings, such as doors, windows, etc. are closed either permanently with removable shields or with sandbags.
    c. **Wet Floodproofing:** This technique is usually considered a last resort measure, since water is intentionally allowed into the building in order to minimize pressure on the structure. Approaches range

from moving valuable items to higher floors to rebuilding the floodable area. An advantage over other approaches is that simply by moving household goods out of the range of floodwaters, thousands of dollars can be saved in damages.

5. **Sewer Backup Protection -** Storm water overloads can cause backup into basements through sanitary sewer lines. Houses that have any kind of connection to a sanitary sewer system - whether it is downspouts, footing drain tile, and/or sump pumps, can be flooded during a heavy rain event. To prevent this, there should be no such connections to the system, and all rain and ground water should be directed onto the ground, away from the building. Other protections include:
    a. Floor drain plugs and floor drain standpipe, which keep water from flowing out of the lowest opening in the house.
    b. Overhead sewer - keeps water in the sewer line during a backup.
    c. Backup valve - allows sewage to flow out while preventing backups from flowing into the house.

6. **Insurance** - Above and beyond standard homeowner insurance, there is other coverage a homeowner can purchase to protect against flood hazard. Two of the most common are National Flood Insurance and basement backup insurance.
    a. ***National Flood Insurance:*** When a community participates in the National Flood Insurance Program, any local insurance agent is able to sell separate flood insurance policies under rules and rates set by FEMA. Rates do not change after claims are paid because they are set on a national basis.
    b. ***Basement Backup Insurance:*** National Flood Insurance offers an additional deductible for seepage and sewer backup, provided there is a general condition of flooding in the area that was the proximate cause of the basement getting wet. Most exclude damage from surface flooding that would be covered by the NFIP.

C. Natural Resource Protection

Preserving or restoring natural areas or the natural functions of floodplain and watershed areas provide the benefits of eliminating or minimizing losses from floods, as well as improving water quality and wildlife habitats. Parks, recreation, or conservation agencies usually implement such activities. Protection can also be provided through various zoning measures that are specifically designed to protect natural resources.

1. **Wetlands Protection** - Wetlands are capable of storing large amounts of floodwaters, slowing and reducing downstream flows, and filtering the water. Any development that is proposed in a wetland is regulated by either federal and/or state agencies. Depending on the location, the project might fall under the jurisdiction of the U.S. Army Corps of Engineers, which in turn, calls upon several other agencies to review the proposal. In New Hampshire, the N.H. Wetlands Board must approve any project that impacts a wetland. Many communities in New Hampshire also have local wetland ordinances.

   Generally, the goal is to protect wetlands by preventing development that would adversely affect them. Mitigation techniques are often employed, which might consist of creating a wetland on another site to replace what would be lost through the development. This is not an ideal practice since it takes many years for a new wetland to achieve the same level of quality as an existing one, if it can at all.

2. **Erosion and Sedimentation Control -** Controlling erosion and sediment runoff during construction and on farmland is important, since eroding soil will typically end up in downstream waterways. Because sediment tends to settle where the water flow is slower, it will gradually fill in channels and lakes, reducing their ability to carry or store floodwaters.

3. **Best Management Practices -** Best Management Practices (BMPs) are measures that reduce non-point source pollutants that enter waterways. Non-point source pollutants are carried by storm water to waterways, and include such things as lawn fertilizers, pesticides, farm chemicals, and oils from street surfaces and industrial sites. BMPs can be incorporated into many aspects of new developments and ongoing land use practices. In New Hampshire, the Department of Environmental Services has developed Best Management Practices for a range of activities, from farming to earth excavations.

D. Emergency Services

Emergency services protect people during and after a flood. Many communities in New Hampshire have emergency management programs in place, administered by an emergency management director (very often the local police or fire chief).

1. **Flood Warning -** On large rivers, the National Weather Service handles early recognition. Communities on smaller rivers must develop their own warning systems. Warnings may be disseminated in a variety of ways, such as sirens, radio, television, mobile public address systems, or door-to-door contact. It seems that multiple or redundant systems are the most effective, giving people more than one opportunity to be warned.
2. **Flood Response -** Flood response refers to actions that are designed to prevent or reduce damage or injury, once a flood threat is recognized. Such actions and the appropriate parties include:
   a. Activating the emergency operations center (emergency director)
   b. Sandbagging designated areas (Highway Department)
   c. Closing streets and bridges (police department)
   d. Shutting off power to threatened areas (public service)
   e. Releasing children from school (school district)

f. Ordering an evacuation (emergency director)
g. Opening evacuation shelters (churches, schools, Red Cross, municipal facilities)

These actions should be part of a flood response plan, which should be developed in coordination with the persons and agencies that share the responsibilities. Drills and exercises should be conducted so that the key participants know what they are supposed to do.

3. **Critical Facilities Protection -** Protecting critical facilities is vital, since expending efforts on these facilities can draw workers and resources away from protecting other parts of city. Critical facilities fall into two categories:
    a. **Buildings or locations vital to the flood response effort:**
        i. Emergency operations centers
        ii. Police and fire stations
        iii. Highway garages
        iv. Selected roads and bridges
        v. Evacuation routes
    b. **Buildings or locations that, if flooded, would create disasters:**
        i. Hazardous materials facilities
        ii. Schools

All such facilities should have their own flood response plan that is coordinated with the community's plan. Schools will typically be required by the state to have emergency response plans in place.

4. **Health and Safety Maintenance -** The flood response plan should identify appropriate measures to prevent danger to health and safety. Such measures include:
    a. Patrolling evacuated areas to prevent looting
    b. Vaccinating residents for tetanus
    c. Clearing streets
    d. Cleaning up debris

The Plan should also identify which agencies will be responsible for carrying out the identified measures. A public information program can be helpful to educate residents on the benefits of taking health and safety precautions.

E. Structural Projects

Structural projects are used to prevent floodwaters from reaching properties. These are all man-made structures, and can be grouped into the six types discussed below. The shortcomings of structural approaches are:

- Can be very expensive
- Disturb the land, disrupt natural water flows, & destroy natural habitats.
- Are built to an anticipated flood event, and may be exceeded by a greater-than expected flood
- Can create a false sense of security.

1. **Diversions -** A diversion is simply a new channel that sends floodwater to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During flood flows, the stream spills over the diversion channel or tunnel, which carries the excess water to the receiving lake or river. Diversions are limited by topography; they won't work everywhere. Unless the receiving water body is relatively close to the flood prone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive. Where topography

and land use are not favorable, a more expensive tunnel is needed. In either case, care must be taken to ensure that the diversion does not create a flooding problem somewhere else.

2. **Levees/Floodwalls -** Probably the best known structural flood control measure is either a levee (a barrier of earth) or a floodwall made of steel or concrete erected between the watercourse and the land. If space is a consideration, floodwalls are typically used, since levees need more space. Levees and floodwalls should be set back out of the floodway, so that they will not divert floodwater onto other properties.

3. **Reservoirs -** Reservoirs control flooding by holding water behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate the river downstream can handle. Reservoirs are suitable for protecting existing development, and they may be the only flood control measure that can protect development close to a watercourse. They are most efficient in deeper valleys or on smaller rivers where there is less water to store. Reservoirs might consist of man-made holes dug to hold the approximate amount of floodwaters, or even abandoned quarries. As with other structural projects, reservoirs:
    a. are expensive
    b. occupy a lot of land
    c. require periodic maintenance
    d. may fail to prevent damage from floods that exceed their design levels
    e. may eliminate the natural and beneficial functions of the floodplain.

4. **Channel Modifications -** Channel modifications include making a channel wider, deeper, smoother, or straighter. These techniques will result in more water being carried away, but, as with other techniques mentioned, it is important to ensure that the modifications do not create or increase a flooding problem downstream.

5. **Dredging:** Dredging is often cost-prohibitive because the dredged material must be disposed of in another location; the stream will usually fill back in with sediment. Dredging is usually undertaken only on larger rivers, and then only to maintain a navigation channel.

6. **Drainage Modifications:** These include man-made ditches and storm sewers that help drain areas where the surface drainage system is inadequate or where underground drainage ways may be safer or more attractive. These approaches are usually designed to carry the runoff from smaller, more frequent storms.

7. **Storm Sewers -** Mitigation techniques for storm sewers include installing new sewers, enlarging small pipes, street improvements, and preventing back flow. Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving body of water can absorb the increased flows without increased flooding. In many developments, streets are used as part of the drainage system, to carry or hold water from larger, less frequent storms. The streets collect runoff and convey it to a receiving sewer, ditch, or stream. Allowing water to stand in the streets and then draining it slowly can be a more effective and less expensive measure than enlarging sewers and ditches.

F. Public Information

Public information activities are intended to advise property owners, potential property owners, and visitors about the particular hazards associated with a property, ways to protect people and property from these hazards, and the natural and beneficial functions of a floodplain.

1. **Map Information -** Flood maps developed by FEMA outline the boundaries of the flood hazard areas. These maps can be used by anyone interested in a particular property to determine if it is flood-prone. These maps are

available from FEMA, the NH Homeland Security and Emergency Management (HSEM), the NH Office of Strategic Initiatives (OSI), or your regional planning commission.

2. **Outreach Projects -** Outreach projects are proactive; they give the public information even if they have not asked for it. Outreach projects are designed to encourage people to seek out more information and take steps to protect themselves and their properties. Examples of outreach activities include:
    a. Presentations at meetings of neighborhood groups
    b. Mass mailings or newsletters to all residents
    c. Notices directed to floodplain residents
    d. Displays in public buildings, malls, etc.
    e. Newspaper articles and special sections
    f. Radio and TV news releases and interview shows
    g. A local flood proofing video for cable TV programs and to loan to organizations
    h. A detailed property owner handbook tailored for local conditions. Research has shown that outreach programs work, although awareness is not enough. People need to know what they can do about the hazards, so projects should include information on protection measures. Research also shows that locally designed and run programs are much more effective than national advertising.
3. **Real Estate Disclosure -** Disclosure of information regarding flood-prone properties is important if potential buyers are to be in a position to mitigate damage. Federally regulated lending institutions are required to advise applicants that a property is in the floodplain. However, this requirement needs to be met only five days prior to closing, and by that time, the applicant is typically committed to the purchase. State laws and local real estate practice can help by making this information available to prospective buyers early in the process.

4. **Library -** Your local library can serve as a repository for pertinent information on flooding and flood protection. Some libraries also maintain their own public information campaigns, augmenting the activities of the various governmental agencies involved in flood mitigation.

5. **Technical Assistance -** Certain types of technical assistance are available from the NFIP Coordinator, FEMA, and the Natural Resources Conservation District. Community officials can also set up a service delivery program to provide one-on-one sessions with property owners. An example of technical assistance is the *flood audit*, in which a specialist visits a property. Following the visit, the owner is provided with a written report detailing the past and potential flood depths and recommending alternative protection measures.

6. **Environmental Education -** Education can be a great mitigating tool if people can learn what not to do before damage occurs. The sooner the education begins the better. Environmental education programs for children can be taught in the schools, park and recreation departments, conservation associations, or youth organizations. An activity can be as involved as course curriculum development or as simple as an explanatory sign near a river. Education programs do not have to be limited to children. Adults can benefit from knowledge of flooding and mitigation measures; decision makers, armed with this knowledge, can make a difference in their communities
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II. EARTHQUAKES

A. Preventive

1. Planning/zoning to keep critical facilities away from fault lines
2. Planning, zoning and building codes to avoid areas below steep slopes or soils subject to liquefaction
3. Building codes to prohibit loose masonry overhangs, etc.

B. Property Protection

1. Acquire and clear hazard areas
2. Retrofitting to add braces, remove overhangs
3. Apply Mylar to windows and glass surfaces to protect from shattering glass
4. Tie down major appliances, provide flexible utility connections
5. Earthquake insurance riders

C. Emergency Services

1. Earthquake response plans to account for secondary problems, such as fires and hazardous material spills

D. Structural Projects

1. Slope stabilization

III. DAM FAILURE

A. Preventive

1. Dam failure inundation maps
2. Planning/zoning/open space preservation to keep area clear
3. Building codes with flood elevation based on dam failure
4. Dam safety inspections
5. Draining the reservoir when conditions appear unsafe

B. Property Protection

1. Acquisition of buildings in the path of a dam breach flood
2. Flood insurance

C. Emergency Services

1. Dam condition monitoring
2. Warning and evacuation plans based on dam failure

D. Structural Projects

1. Dam improvements, spillway enlargements
2. Remove unsafe dams

IV. WILDFIRES

A. Preventive

1. Zoning districts to reflect fire risk zones
2. Planning and zoning to restrict development in areas near fire protection and water resources
3. Requiring new subdivisions to space buildings, provide firebreaks, on-site water storage, wide roads, multiple accesses
4. Building code standards for roof materials and spark arrestors
5. Maintenance programs to clear dead and dry brush, trees
6. Regulation on open fires

B. Property Protection

1. Retrofitting of roofs and adding spark arrestors
2. Landscaping to keep bushes and trees away from structures

3. Insurance rates based on distance from fire protection

C. Natural Resource Protection

1. Prohibit development in high-risk areas

D. Emergency Services

1. Fire Fighting

V. WINTER STORMS

A. Prevention

1. Building code standards for light frame construction, especially for wind-resistant roofs

B. Property Protection

1. Storm shutters and windows
2. Hurricane straps on roofs and overhangs
3. Seal outside and inside of storm windows and check seals in spring and fall
4. Family and/or company severe weather action plan & drills:
    a. include a NOAA Weather Radio
    b. designate a shelter area or location
    c. keep a disaster supply kit, including stored food and water
    d. keep snow removal equipment in good repair; have extra shovels, sand, rock, salt and gas
    e. know how to turn off water, gas, and electricity at home or work

C. Natural Resource Protection

1. Maintenance program for trimming trees and shrubs

D. Emergency Services

1. Early warning systems/NOAA Weather Radio
2. Evacuation plans

Appendix D: Technical & Financial Assistance for All-Hazard Mitigation

FEMA's Hazard Mitigation Assistance (HMA) grant programs provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. Currently, FEMA administers the following HMA grant programs[40]:

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)

FEMA's HMA grants are provided to eligible Applicants (States/Tribes/Territories) that, in turn, provide sub-grants to local governments and communities. The Applicant selects and prioritizes subapplications developed and submitted to them by subapplicants. These subapplications are submitted to FEMA for consideration of funding. Prospective subapplicants should consult the office designated as their Applicant for further information regarding specific program and application requirements. Contact information for the FEMA Regional Offices and State Hazard Mitigation Officers is available on the FEMA website, www.fema.gov.

HMA Grant Programs

The HMA grant programs provide funding opportunities for pre- and post-disaster mitigation. While the statutory origins of the programs differ, all share the common goal of reducing the risk of loss of life and property due to Natural Hazards. Brief descriptions of the HMA grant programs can be found below. For more information on the individual programs, or to see information related to a specific Fiscal Year, please click on one of the program links.

A. Hazard Mitigation Grant Program (HMGP)

HMGP assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities.

What is the Hazard Mitigation Grant Program?

The Hazard Mitigation Grant Program (HMGP) provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. Authorized under Section 404 of the Stafford Act and administered by FEMA, HMGP was created to reduce the loss of life and property due to natural disasters. The program enables mitigation measures to be implemented during the immediate recovery from a disaster.

Who is eligible to apply?

Hazard Mitigation Grant Program funding is only available to applicants that reside within a presidentially declared disaster area. Eligible applicants are:

- State and local governments
- Indian tribes or other tribal organizations
- Certain non-profit organizations

Individual homeowners and businesses may not apply directly to the program; however a community may apply on their behalf.

[40] Information in Appendix E is taken from the following website and links to specific programs unless otherwise noted; http://www.fema.gov/government/grant/hma/index.shtm

How are potential projects selected and identified?
The State's administrative plan governs how projects are selected for funding. However, proposed projects must meet certain minimum criteria. These criteria are designed to ensure that the most cost-effective and appropriate projects are selected for funding. Both the law and the regulations require that the projects are part of an overall mitigation strategy for the disaster area.

The State prioritizes and selects project applications developed and submitted by local jurisdictions. The State forwards applications consistent with State mitigation planning objectives to FEMA for eligibility review. Funding for this grant program is limited and States and local communities must make difficult decisions as to the most effective use of grant funds.

For more information on the **Hazard Mitigation Grant Program (HMGP),** go to:
http://www.fema.gov/government/grant/hmgp/index.shtm

B. Pre-Disaster Mitigation (PDM)
PDM provides funds on an annual basis for hazard mitigation planning and the implementation of mitigation projects prior to a disaster. The goal of the PDM program is to reduce overall risk to the population and structures, while at the same time, also reducing reliance on Federal funding from actual disaster declarations.

Program Overview
The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities 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 to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds.

C. Flood Mitigation Assistance (FMA)
FMA provides funds on an annual basis so that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the National Flood Insurance Program.

Program Overview

The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP).

FEMA provides FMA funds to assist States and communities implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program.

Types of FMA Grants

Three types of FMA grants are available to States and communities:

- Planning Grants to prepare Flood Mitigation Plans. Only NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project grants
- Project Grants to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures. States are encouraged to prioritize FMA funds for applications that include repetitive loss properties; these include structures with 2 or more losses each with a claim of at least $1,000 within any ten-year period since 1978.
- Technical Assistance Grants for the State to help administer the FMA program and activities. Up to ten percent (10%) of Project grants may be awarded to States for Technical Assistance Grants