CITY OF MANCHESTER, NEW HAMPSHIRE

HAZARD MITIGATION PLAN 2018

CITY OF MANCHESTER
NEW HAMPSHIRE

HAZARD MITIGATION PLAN

October 2018

Prepared by the Southern New Hampshire Planning Commission

The preparation of this document has been financed in part by a grant from the State of New Hampshire Department of Safety, Homeland Security and Emergency Management

Acknowledgements

We would like to thank the following people for contributing their time and effort to complete the ***Manchester Hazard Mitigation Plan:***

Manchester Hazard Mitigation Committee Members

Kevin M. Healey - Captain, Emergency Mgmt. Coordinator-Manchester Fire Dept. and Elliot Health Systems
Brett French - Manchester Fire Department, Lieutenant
Phil Alexakos - Manchester Health Department
Jennie Angell - Director, Information Systems
Jeff Belanger - Planning and Community Development
Paul Blais - Emergency Manager Catholic Medical Center
Michael Carr - Manchester Health Department
Will Craig - Eversource, Community Relations Specialist
Heather Dunkerley - NH Homeland Security and Emergency Management Field Rep.
Bob Field - Manchester Fire Department, Training
Josh Gagne - Department of Public Works-Facilities
Hannah Koehler - Manchester Fire Department Intern
Mike Landry - Planning and Community Development
Peter Lennon - Manchester Fire Department, Fire Marshall
Eric Levesque - Information Systems
Sarah Morris - Manchester Health Department
Chris Proulx - Department of Public Works
TJ Rapson - Manchester Fire Department Intern
Melanie Sanuth - Economic Development Director, Manchester

Thanks also to:

- The New Hampshire Department of Safety, Homeland Security and Emergency Management, which developed the *New Hampshire Natural Hazards Mitigation Plan*;
- The Southwest Region Planning Commission, which developed *Hazard Mitigation Planning for New Hampshire Communities*; and
- The Bedford, Chester, Derry, Goffstown, Hooksett, New Boston, and Weare Hazard Mitigation Committees and their respective Hazard Mitigation Plans.
- Jacqueline Cardoza and Justin Kates of Nashua OEM.
- Sylvia von Aulock, Derek Shooster, Cameron Prolman, and Maddie DiIonno of Southern NH Planning Commission.

All the above publications served as models for this plan.

Preface

Hazard mitigation planning is a relatively new field of planning, spearheaded by the Federal Emergency Management Agency (FEMA) during the 1990's after Hurricane Andrew caused more than $20 billion in damage across several southern states. That event resulted in 54 fatalities and the disruption of millions of lives. The Disaster Mitigation Act of 2000, developed by FEMA, was intended to help both communities and states prepare for, and deal with, such disasters. While New England normally does not have hurricanes of Andrew's magnitude, this area does experience many types of natural disasters that cost both lives and money.

Natural disasters can occur during all four seasons in the Northeast: winter ice, snow, and nor'easters; spring flooding; summer downbursts and thunderstorms; and fall hurricanes. Planning to make a community *disaster-resistant* before these storms occur can help save lives as well as homes and infrastructure.

Several FEMA programs are designed to strengthen the nation's disaster resistance by reducing risks. This means changing conditions and behaviors prior to disasters to protect lives and prevent the loss of property. Such measures include building safely within the floodplain or removing homes altogether, engineering buildings and infrastructure to withstand earthquakes, and creating and enforcing effective building codes to protect property from floods, hurricanes and other natural hazards.

A community's eligibility for hazard mitigation funding will depend upon it having adopted a hazard mitigation plan. Mitigation measures contained within the *Manchester Hazard Mitigation Plan* may be sufficient to warrant a grant to help pay for the proposed measures.

It is hoped that this document will be a good first step toward analyzing natural hazards in Manchester, forecasting where potential disasters might occur, and reducing the impact on lives and the community.

Table of Contents

City of Manchester, New Hampshire
Hazard Mitigation Plan
Executive Summary

The ***Manchester Hazard Mitigation Plan*** has been developed to help Manchester become a disaster-resistant community by taking measures to reduce future losses from natural or man-made hazardous events, before they occur. The plan was developed by the Manchester Hazard Mitigation Committee (MHMC), made up of community members and City officials.

Natural hazards are addressed as follows:

A. Flooding
B. Wind
C. Fire
D. Ice and Snow Events
E. Seismic Events
F. Other Hazards

The Manchester Hazard Mitigation Committee identified critical facilities, areas at risk, commercial economic impact areas and hazardous materials facilities**.**

Critical Facilities:

- City, County and Federal Offices
- Police and Fire Stations
- Military Stations
- Emergency Operations Centers
- Public Works Garages
- Emergency Fuel Facilities
- Airport, Helicopter Landing, and Related Facilities
- Hospitals
- Ambulances
- Emergency Shelters/Schools
- Post Offices
- Wireless Communication Facilities and Radio Towers
- Water and Sewer Treatment Plants
- Public Water Systems
- Water Pump Stations

Areas at Risk:

- Sewer Systems
- Electrical Power Substations
- Telephone Facilities
- Media Communications
- Major Roads and Bridges
- Dams
- Transportation Systems
- Historic Properties
- Libraries
- Areas of Second Language Need
- Schools
- Child Care Facilities
- Elderly Housing, Nursing Homes and Adult Day Cares
- Special Needs and Group Homes
- Correctional Facilities
- Community Centers and Services
- Recreation Areas
- Hotels and Commercial Resources
- Medical Facilities
- Religious Facilities

Existing Hazard Mitigation Strategies

The Manchester Hazard Mitigation Committee identified existing strategies related to hazard mitigation as follows:

- Continue the separation of Combined Sewer Overflows as part of the Supplemental Environmental Projects Program (SEPP) in Manchester
- Continue to upgrade and increase communications infrastructure, including redundant rings of fiber for emergency backup purposes
- Revise and update Hazmat/Terrorism response as required
- Identify and remove hazardous trees
- Public Education and outreach
- Maintenance Program for underground utilities
- Community Warning System- planning and project development
- Replace aging highway department equipment
- Merrimack River Secondary Water Treatment Plant and water supply
- Hazard Mitigation for structural renovations to bridges to mitigate debris-impacted infrastructure
- Extend sewer service to areas with onsite sewage disposal systems
- Upgrade culverts at Ray Brook Crossing River Road and Elm Street
- Work with Eversource to get utilities underground
- Create an interdepartmental Public Safety Training Facility
- Flood proof specific buildings in the Amoskeag Millyard
- Upgrade bridges to meet seismic design standards

New Mitigation Programs and Policies

The Manchester Hazard Mitigation Committee identified 3 hazard mitigation strategies as follows:

- Install flood logs around Central High School between Amherst and Beech Streets to mitigate flooding
- Integrate smart city controls into the street and traffic light network
- Identify sites for video announcement signage and install

This plan is to be reviewed on an annual basis and updated every three to five years by the Manchester Hazard Mitigation Committee in coordination with the Manchester Board of Mayor and Alderman. The next review will be during 2019 updated prior to 2023.

SECTION I
INTRODUCTION

The Hazard Mitigation Planning Process

The City of Manchester Hazard Mitigation Plan 2018 Update was prepared in accordance with the Disaster Mitigation Act of 2000 (DMA), Section 322 Mitigation Planning, signed into law by President Clinton on October 30, 2000. This updated hazard mitigation plan was prepared by the Manchester Hazard Mitigation Committee for the City of Manchester under contract with the New Hampshire Homeland Security and Emergency Management (HSEM) operating under the guidance of Section CFR 201.6(b)(1) and with the assistance and professional services of the Southern New Hampshire Planning Commission. The Plan was funded by HSEM through a grant from FEMA (Federal Emergency Management Agency)—specifically the Emergency Management Performance Grant (EMPG)—and an in-kind 50% matching from the City of Manchester.

The primary purpose of the 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."[1]

It is HSEM's goal to have all New Hampshire communities complete a local hazard mitigation plan as a means to reduce future losses from natural or human-caused events before they occur. HSEM outlined a process whereby communities throughout the state may be eligible for grants and other assistance upon completion of this hazard mitigation plan.

The Manchester Hazard Mitigation Plan Update 2018 is a planning tool to use to reduce future losses from natural and human-caused hazards as required by the Disaster Mitigation Act (DMA) of 2000; this Plan does not constitute a section of the City's Master Plan; however, mitigation action items contained in this Plan may be incorporated into future Master Plan updates.

The DMA places a new emphasis on local mitigation planning. It requires local communities to have a FEMA-approved hazard mitigation plan as a condition to receiving Hazard Mitigation Assistance (HMA) funds. Local governments

[1] Disaster Mitigation Act (DMA) of 2000, Section 101, b1 and b2.

should review the plan yearly and must update the plan every 5 years to ensure compliance.

Jurisdiction

This 2018 Plan addresses one jurisdiction: the City of Manchester, NH.

Authority

The Manchester Hazard Mitigation Committee prepared the Manchester Hazard Mitigation Plan Update 2018 with the assistance of the Southern New Hampshire Planning Commission (SNHPC) under contract with the New Hampshire Homeland Security and Emergency Management (NHHSEM). After a public hearing held in the Manchester City Hall on August 14, 2018, the Manchester Board of Mayor and Aldermen formally adopted this Plan on September 4, 2018. Documentation of the Board of Mayor & Aldermen's adoption of the Plan is provided in Appendix J.

Scope of the Plan & Federal and State Participation

A community's hazard mitigation plan often identifies a large number of natural hazards and is somewhat broad in scope and outline. The scope and effects of this Plan were assessed based on the impact of hazards on: Critical Infrastructure and Key Resources within the community such as the city's public infrastructure (public water, sewer, roads, streets, drainage, etc.), existing residential buildings and other structures within the city; future development; administrative technical and physical capacity of emergency response services; and response coordination between federal, state and local entities.

In seeking approval as a Hazard Mitigation Plan, the planning effort included participation of Homeland Security and Emergency Management staff, floodplain management program at the NH Office of Strategic Initiatives (OSI), and notification of upcoming meetings to public agencies, communities, and officials. In addition, as required under Code of Federal Regulations (CFR), Title 44, Part 201.6(c)(2) (ii) and 201.6(c)(3)(ii), the Plan must address the Community's participation in the National Flood Insurance Program (NFIP), its continued compliance with the program and as part of vulnerability assessment, the Plan must address the NFIP insured structures that have been repetitively damaged due to floods.

What Is Hazard Mitigation?

Hazard mitigation is the practice of reducing risks to people and property from natural hazards. FEMA's Federal Response Plan defines hazard mitigation as "activities designed to alleviate the effects of a major disaster or emergency or long-term activities to minimize the potentially adverse effects of future disaster in affected areas (A-5)." It includes both structural interventions, such as flood control devices, and nonstructural measures, such as avoiding construction in the most flood-prone areas. Mitigation includes not only avoiding the development of vulnerable sections of the community, but also making existing development in hazard-prone areas safer. For example, a community could identify areas that are susceptible to damage from natural disasters and take steps to make these areas less vulnerable. It could also steer growth to less risky areas. Keeping buildings and people out of harm's way is the essence of mitigation.

Mitigation should not be seen as an impediment to growth and development. On the contrary, incorporating mitigation into development decisions can result in a safer, more resilient community, one that is more attractive to new families and businesses.

Why Develop a Hazard Mitigation Plan?

The full cost of the damage resulting from natural hazards—personal suffering, loss of lives, disruption of the economy, and loss of tax base—is difficult to measure. New Hampshire is subject to many types of natural disasters: floods, hurricanes, nor'easters, winter storms, earthquakes, tornadoes, and wildfires, all of which can have significant economic and social impacts. Some, such as hurricanes, are seasonal and often strike in predictable locations. Others, such as floods, can occur any time of the year and almost anywhere in the state.

Benefits of Hazard Mitigation

Hazard mitigation offers many benefits for a community. It can:

- **Save lives and property.** A community can save lives and reduce property damage from natural hazards through identifying risks and taking action, such as elevating structures in the floodplain.
- **Reduce vulnerability to future hazards.** By having a mitigation plan in place, a community is prepared to take steps that will permanently reduce the risk of future losses. This opportunity is often lost when communities are built without regard to natural hazards, or when they are rebuilt after a disaster "just like they were before." While it is natural to want to return things to the way they were, it is important to remember that, in many

cases, the disaster would not have been as severe if a mitigation plan had been implemented.

- **Facilitate post-disaster funding.** By identifying and ranking recovery projects before the next disaster, a community will be in a better position to obtain post-disaster funding because much of the background work necessary for applying for federal funding will already be done.
- **Speed recovery.** By developing a mitigation strategy, a community can identify post-disaster mitigation opportunities in advance of a disaster and be ready to respond quickly after a disaster.

Hazard Mitigation Planning Process & Methodology

The 2018 Updated Plan was prepared with substantial local, state, and federal coordination and assistance. Completion of this new hazard mitigation plan required significant planning preparation. In spring 2017, the Manchester Hazard Mitigation Committee was formed to begin updating the Plan. The Committee followed the process set forth in the Local Mitigation Planning Handbook (2013) and the 9 steps according to FEMA's *Local Mitigation Planning Handbook*, March 2013 is outlined on pages 4 and 5 of this Plan.

The Committee consisted of representatives from various city departments and partners, including Planning & Community Development; Health; Fire; Police; Emergency Management; Manchester Water Works; Economic Development; City Clerk; Eversource; Information Systems; Manchester Health; Elliot Hospital; and NH Homeland Security and Emergency Management. All meetings of the Manchester Hazard Mitigation Committee were geared to accommodate brainstorming, open discussion, and an increased awareness of potential hazardous conditions within the City.

All of the meetings were properly posted in two public places as required by NH state open meeting laws. The public was invited to attend meetings and provide input through such opportunities as viewing the City of Manchester and SNHPC websites, meeting agendas and minutes, public meeting notices, as well as press release and public media blasts and newsletter articles prepared by the SNHPC. Emergency Management representatives from abutting communities were invited to public meeting via email invite. All meetings were held at the Manchester Central Fire Station (100 Merrimack Street). Copies of all the meeting agendas, minutes and attendance sheets for this 2018 Updated Plan are provided in Appendix F.

The planning process included a complete review of the 2011 Manchester Hazard Mitigation Plan. Each section of the 2011 Plan was reviewed and updated according to new information and the events of the past eight years. Using the

2011 Plan as a base, each element of the old plan was examined and revised to reflect changes that had taken place in development and in the priorities of the community. In addition, referring to the 2011 Plan, the Manchester Hazard Mitigation Committee was able to reassess strategies from the past and to improve upon mitigation strategies for the future.

The following narrative explains how the 2011 Manchester Hazard Mitigation Plan was used during each step of the planning process to make revisions that resulted in this Plan.

Tasks to Complete the Plan Update were as follows:

Task 1: Determine the Planning Area & Resources: This task was conducted by city staff and the Regional Planning Commission. Information from the previous plan was reviewed and revised. The results of this research can be found in Section II, "Community Profile".

Task 2: Building the Planning Team: This task was conducted by city staff and the Regional Planning Commission. Commission staff contacted department heads and land use board volunteers. City staff made further inquiries and posted notices for residents and other stakeholders who might wish to volunteer their time and serve on a committee.

Task 3: Create an Outreach Program: This task was conducted by city staff and the Regional Planning Commission throughout the plan's update. Together multiple efforts were made to involve and educate the public regarding the process and input of the plan. Details of various outreach efforts can be found in this section of the plan.

Task 4: Review Community Capabilities: The Committee reviewed each type of hazard and which sections of the city were vulnerable to that type of hazard. The results were the Identified Hazards Map, which can be found in Appendix I. Furthermore, the Committee identified and catalogued all of the critical facilities and areas at risk within the city, see Section V and map in Appendix I.

Task 5: Conduct a Risk Assessment: The Committee conducted several assessments to help determine the gaps in coverage. These include Assessing Probability, Severity, and Risk (Section IV) and Vulnerability Assessment (Section V).

Task 6: Develop a Mitigation Strategy: The Committee reviewed all hazards and the existing mitigation strategies meant to address those hazards in Section VI. In addition, the Committee evaluated the effectiveness of the existing measures to identify where they can be improved. Section VII summaries the Committees efforts in reviewing "complete", "completed and ongoing", "deferred" and "new" mitigation action items. They evaluated all mitigation actions and prioritized them. The results are found in Section VIII, which provides the Committee's rank, the projects STAPLEE score,

problem statement, mitigation action, hazard addressed, responsible party, anticipated cost, potential funding source and timeframe.

Task 7: Keep the Plan Current: The City of Manchester understands the ramifications for ensuring that this plan be monitored and updated annually or after a presidentially declared disaster. Section IX addresses this issue.

Task 8: Review & Adopt the Plan: The Committee members reviewed and approved each section of the plan as it was completed. After acceptance by the Committee, the Plan was submitted to the New Hampshire Homeland Security and Emergency Management and the Federal Emergency Agency Region 1 Office, for review. At a public meeting, the Board of Mayor and Aldermen formally adopted the plan on September 4, 2018. The plan was then granted formal approval by FEMA the week of September 24, 2018.

Task 9: Create a Safe & Resilient Community: The committee discussed the mitigation actions in the Action Plan and the ways in which the implementation of the actions will be beneficial to the community. Annual reviews of the Action Plan by the committee are needed to maintain the timeframes identified for completion of activities. Incorporation of the plan into other land use plans and the Capital Improvement Plan help to ensure that the goals of the plan are met. This is also reviewed in this section as well as Section IX.

2018 Plan Update Public Committee Meetings

On the following dates, the Manchester Hazard Mitigation Committee held committee meetings at the Manchester City Hall: June 21, July 31, November 20, January 8, and May 14. All Committee meetings were made public and posted in two public places as required by New Hampshire state law for public meetings.

Minutes were kept for each meeting and brainstorming sessions were recorded. Each committee member received an E-mail that contained minutes of the previous meeting and an agenda. The minutes were available to the public. Copies of the meeting agendas, minutes and attendance sheets are provided in Appendix F.

Coordination with Other Agencies and Individuals

The Hazard Mitigation Committee members and their respective City Departments contributed the contents and reviewed the Plan drafts. Departments represented were:

- Planning and Community Development Department
- Fire Department
- Highway Department
- Infosystems

- Emergency Management Department
- Security Management, Human Resources Department
- Manchester Water Works
- Economic Development Department
- Health Department

Committee Chair Kevin Healey contacted the following individuals and agencies for their review and comment on the *Plan* during the week of April 16-20:

- The American Red Cross
- The Salvation Army
- Manchester Chamber of Commerce
- Manchester Board of Mayor and Aldermen
- Manchester Conservation Commission
- Manchester School Department
- Child and Family Service of NH
- Elliot Hospital
- Catholic Medical Center

Additionally, copies of the *Plan* were left at the City Library, City Planning Department, and SNHPC office, for public review and comment from April 16-20, 2018. Availability of the *Plan* and locations were publicized by public notice in the Union Leader, and postings on the City Hall bulletin board and Manchester Community Television's Community Bulletin Board. Comments were received and reviewed by the Manchester Hazard Mitigation Committee. Documentation of the public process and solicitation of comments from both the public and outside agencies may be found in Appendix G.

Existing Manchester Emergency Operations Plan

The City of Manchester last updated the *City of Manchester Emergency Operations Plan* in 2014. This Plan describes *preparedness* activities to improve the City's ability to respond to an incident; *response* activities, including rescue operations, evacuation, emergency medical care, and emergency personnel training; and *recovery* activities that begin after the disaster. *Mitigation* activities help to reduce or eliminate the damages from future disaster events, and can occur before, during and after a disaster.

Public and Stakeholder Involvement

Public and stakeholder involvement was stressed throughout the process. A list of stakeholders consisting of various public officials and emergency response personnel was developed (see Table A,). This group was emailed all public meeting agendas and review materials with invitations to participate. Over the course of five meetings, a total of twenty-two people representing Manchester,

NHHESM, Eversource, and NHEC participated in the review and development of the Plan

To seek public involvement and participation in the 2018 Plan Update, SNHPC released the following Press Release to the local media early on in the planning process. In addition, SNHPC prepared an article about the Hazard Mitigation Plans in its quarterly newsletter which is distributed electronically to every community and public official in the SNHPC Region, including local board members, volunteers and the general public (see following copy of the article). During the development of the Plan, SNHPC also posted meeting announcements and minutes on the SNHPC website and worked with city staff to post agendas and public notices of all the Manchester Hazard Mitigation Committee meetings at the Manchester Central Fire Department.

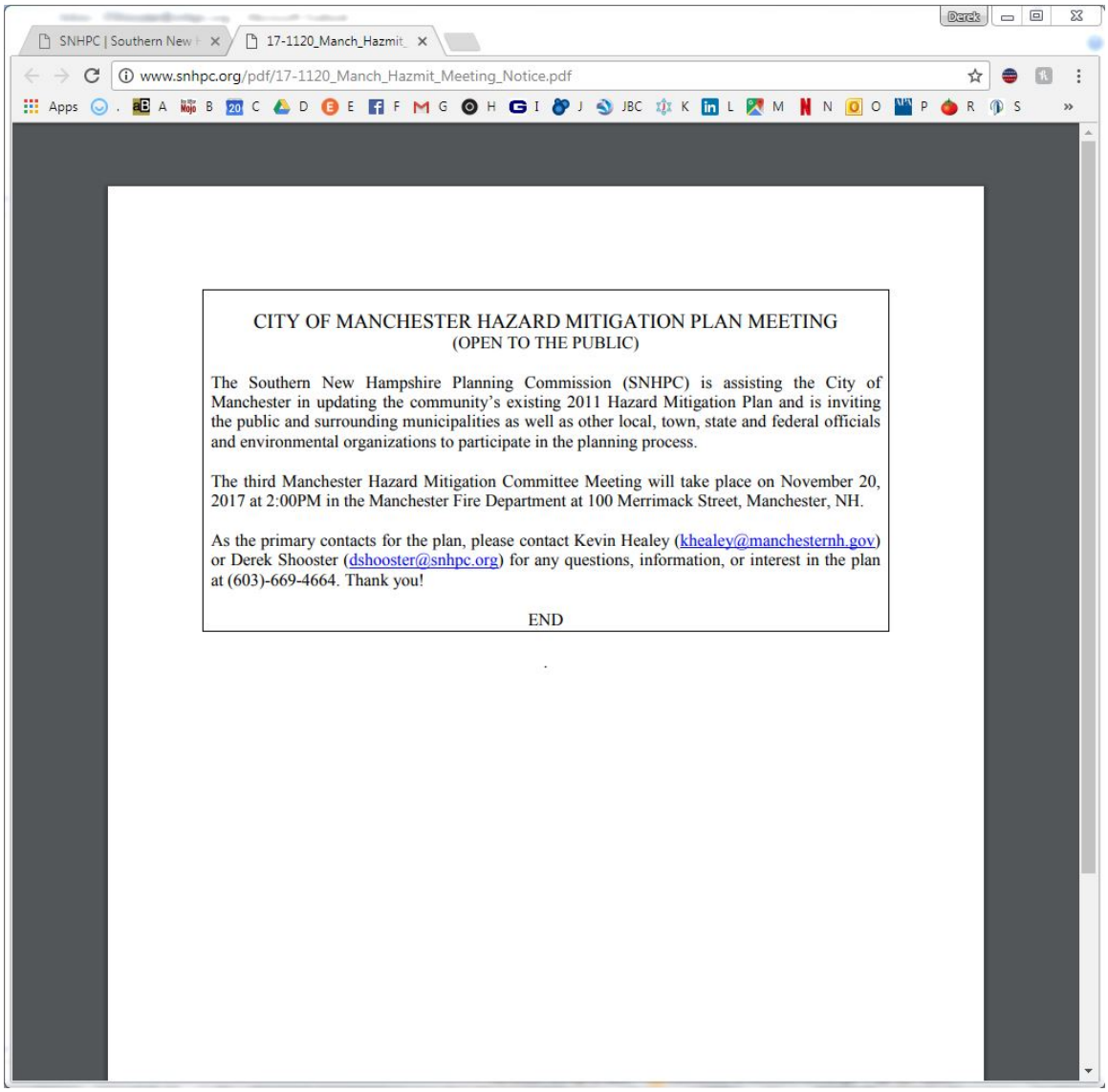


TABLE A: Stakeholder List			
	Contact	**Title**	**Org./Dept.**
STATE	Heather Dunkerley	Field Representative	NH HSEM
	Will Craig		Eversource
	Kayla Henderson	State Mitigation Planner	NH HSEM
LOCAL	Kevin Healey	Captain/EMC	Manchester Fire/Elliot Hospital
	Jennie Angell	Director	Information Systems
	Sarah Morris		Manchester Health Dept.
	Michael Carr		Manchester Health Dept.
	Phil Alexakos		Manchester Health Dept.
	Paul Blais	Emergency Management	Catholic Medical Center
	Josh Gagne	Facilities Manager	DPW – Facilities
	Jeff Belanger	Senior Planner	Planning + Comm. Dev.
	Michael Landry	Deputy Director – Building Regulations	Planning + Comm. Dev.
	Eric Levesque	Data/Telecommunication Specialist	Info. Systems
	Hannah Koehler	Intern	Manchester Fire
	Brett French	Lieutenant	Manchester Fire
	TJ Rapson	Intern	Manchester Fire
	Guy Chabot		Manchester Waterworks
	Peter Lennon	Fire Marshall	Manchester Fire
	Melanie Sanuth	Director	Economic Development
	Bryan Disko		City Clerk's Office
	Chris Crowley		EPD
	Chris Proulx		DPW
	Bob Field	Training	Manchester Fire

Hazard Mitigation Goals and Objectives of the City of Manchester

The *City of* ***Manchester Hazard Mitigation Plan***, which was prepared by the Southern New Hampshire Planning Commission and the Manchester Hazard Mitigation Committee, and is maintained by the Manchester Planning Department, sets forth the following hazard mitigation goals and objectives:

1. To improve upon the protection of the general population, citizens and guests of the City, from all natural and man-made hazards.

2. To reduce the potential impact of natural and man-made disasters on the City's Critical Support Services and Critical Facilities.

3. To reduce the potential impact of natural and man-made disasters on the City's infrastructure.

4. To improve the City's Emergency Preparedness, Disaster Response and Recovery Capability.

5. To reduce the potential impact of natural and man-made disasters on private property.

6. To reduce the potential impact of natural and man-made disasters on the City's economy.

7. To reduce the potential impact of natural and man-made disasters on the City's natural environment.

8. To reduce the City's liability with respect to natural and man-made hazards generally.

9. To reduce the potential impact of natural and man-made disasters on the City's specific historic treasures.

10. To identify, introduce and implement cost effective Hazard Mitigation measures so as to accomplish the City's Goals.

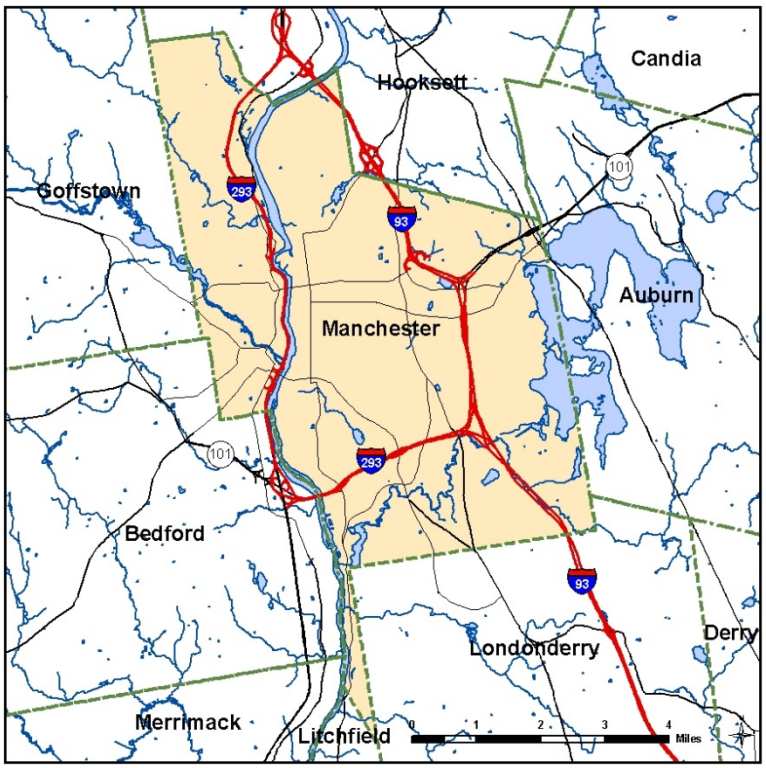
11. To address the challenges posed by climate change as they pertain to increasing risks in the City's infrastructure and natural environment.

The Manchester Hazard Mitigation Committee adopted the above goals and objectives, derived from the State of New Hampshire Hazard Mitigation Plan, for the City of Manchester, New Hampshire at their initial committee meeting.

SECTION II
COMMUNITY PROFILE

Location, Population, Topography, and Climate

The City of Manchester is located in the south-central portion of the State of New Hampshire in Hillsborough County. Manchester is bordered by the Town of Hooksett to the north; the Town of Auburn to the east; the towns of Londonderry and Litchfield to the south; and the towns of Merrimack, Bedford and Goffstown to the west. It is located 18 miles south of the City of Concord and about 18 miles north of the City of Nashua. U.S. 93, U.S. 293, along with N.H. Routes 3, 28, 101, and the F.E. Everett Turnpike provide primary highway access to the City.



Location Map of Manchester, New Hampshire

Manchester encompasses a total of approximately 34.9 square miles. The 2016 NH OSI population estimate of Manchester was 109,886, representing an increase of approximately 0.29% since 2010. The approximate population is 3,325 persons per square mile.

Manchester is located in the Merrimack River Valley. The City rises in elevation as it extends east and west from the River. The River bank elevations are approximately 125 feet near the Amoskeag Falls, decreasing to a low of 109 feet at the southern City limits.

The highest elevations are found in the northwest and northeast corners of the City. The highest point in the City is 573 feet at Wellington Hill (northeast). There are only two noted locations of slopes greater than 25% in Manchester, one is at Wellington Hill and the other is the area bordered by South Willow Street, Harvey Road and Sheffield Road. (City of Manchester, Master Plan, I4-6)

Three types of materials characterize Manchester's land surface. First, stratified sand and silt, are created from glacial outwash and recent stream deposits. The sand and silt covers nearly half of the City and surrounds the Merrimack River and Cohas Brook. The second, unstratified drift, composed of ground moraine and glacial till, almost covers the remainder of the City. This glacial fill is found in the northwest corner and eastern portion of the City upland from the Merrimack River and Cohas Brook, and the Lake Massabesic area. Lastly, a small portion of the City, near the Piscataquog River, Black Brook and a portion of Cohas Brook, is covered by stratified gravel and sandy gravel. (Ibid I2)

The major watercourses flowing through Manchester are the Merrimack River, bisecting the City east from west, and the Piscataquog River, a tributary of the Merrimack flowing to the City center from the west. Additionally, at the southern end of the City is the Great Cohas Brook, another Merrimack River tributary. The largest water body is Lake Massabesic to the east. Other smaller streams and water bodies include Crystal Lake, Dorrs Pond, Steven's Pond, Goldfish Pond, Maxwell Pond, Long Pond, Pine Island Pond, Mill Pond, Cemetery Brook, Christian Brook, Tannery Brook, Nutts Pond, Cohas Brook, Hogg Brook, Bald Hill Brook, Spring Valley Brook, Ray Brook, Black Brook, Millstone Brook, Watts Brook, Sleggo Brook, Mosquito Brook, and Long Pond Brook. (FEMA, FIS 2)

The climate of Manchester is typical of the Merrimack Valley, with warm summers and cool winters. Temperatures during the month of July range from an average high of 82.1 degrees Fahrenheit to an average low of 54.6 degrees. January temperatures range from an average high of 32.3 degrees to an average low of 5.2 degrees. Prolonged periods of severe cold are rare. Annual average precipitation is 39.82 inches. (Golden Gate Weather Services)

Current Land Use Development Trends in Manchester

The City of Manchester's land use development patterns have remained constant for nearly a half century. The city downtown and immediate surroundings are characterized by a dense mix of institutional, commercial, industrial, and multi-family residential to the east and west of the Merrimack River, radiating outward from the former Amoskeag Millyard. The City's density decreases as it moves out from this center, gradually being reduced to suburban single-family residences and some townhouse developments once beyond the interstate boundaries. At the eastern border,

the land surrounding Lake Massabesic is owned by Manchester Water Works and remains as a "greenbelt area" for the protection of the City's drinking water supply. (City of Manchester, Master Plan 1993 J1-2)

New commercial growth in the last 50 years has occurred outside the city center with commercial strips along South Willow Street, D.W. Highway and Second Street. Industrial parks have been created at East Industrial Park Drive and Brown Avenue, both with immediate access to the interstate. From approximately 1960-1980 residential growth typically occurred within the limits of the interstate ring but in the last 20 years residential growth is moving to the outer limits of the City where the is more land available for development. (City of Manchester, Master Plan 1993 J2)

Future development is expected to occur as:

- Infill within the interstate ring and the West Side;
- High density residential and civic at the southern end of the Millyard;
- Low density residential at the city periphery;
- Continued industrial growth around the interstate;
- Land preservation at Hackett Hill Road; and
- Adaptive reuse of existing buildings

Overall, approximately 80% of Manchester's 21,089 land area acres is developed.[2] There are an additional 1,195 acres of water in the City, totaling 22,284 acres. According to the City of Manchester's 2009 Master Plan (J1) catalysts of development change in Manchester are:

1. The road system;
2. Access to water and sewer;
3. Availability and suitability of undeveloped land; and
4. Zoning Ordinance, Subdivision and Site Plan Regulations.

All areas of the City have access to the municipal water system, which extends beyond the city to provide service to portions of Auburn, Bedford, Goffstown, Hooksett, Londonderry and Derry. Given the limits of sewer service any new development outside this area would be required to provide onsite treatment facilities, thus reducing the density and quantity of development in these regions. As a result, the largest remaining undeveloped areas of steep slopes (northwest Manchester) and special flood hazard areas (southeast Manchester) will have additional protection from significant future growth beyond Master Plan recommendations and ordinances controls.

In a 1985 land use study the City assessed the amount of undeveloped land suitable for development. The study defined moderate restrictions on development as "shallow-to-bedrock soils (0 to 2 feet), seasonal high water table (0 to 1 foot), and land within the 100

[2] SNHPC Land Use Report, 2009

year floodplain." Severe restrictions were defined as "steep slopes over 20 percent, and wetland areas." Taking these factors into consideration, 63 percent of undeveloped land was determined to be suitable for development, 23 percent had moderate restrictions, and 13 percent had severe restrictions. The majority of the City's remaining undeveloped land is located in northwest Manchester or outside the interstate loop to the north, south and east.

The Master Plan sets recommendations for future growth and ordinance standards that channels development away from natural constraints. The plan discourages development in the following areas:

- Special flood hazard areas;
- poor soil conditions for septic disposal systems;
- Slopes in excess of 20 percent, especially erosion prone areas due to a lack of vegetative cover or adequate soil depth
- Slopes of 15 to 20 percent;
- Aquifer and aquifer recharge areas;
- Wildlife habitats, ecological preserves, archaeological/historical sites; and
- Where man-made uses create health or safety concerns. (J11-13)

The City of Manchester's existing Zoning Ordinance, Floodplain Development District, and Subdivision and Site Plan Regulations all work to minimize the impacts, if not eliminate, any development in the flood and steep slope hazard areas. Within the floodway no new development is allowed, without a variance, which would increase flood levels during the occurrence of a 100-year flood event. Steep slopes in excess of 25% are determined to be unsuitable for development. These programs are further outlined in Section III "Existing Mitigation Strategies and Proposed Improvements."

Development has tended to occur outside of the flood hazard zones with the exception of the floodplains associated with the Piscataquog and Merrimack Rivers. The developed portion of the Merrimack River floodplain is typically historic mill buildings with limited area for new development. Additionally, the City has made efforts to acquire the remaining undeveloped land along the Piscataquog River for permanent open space. The areas of steepest slopes have also remained undeveloped, with the exception of the Wellington Hill area.

The land outside of the special flood hazard areas and areas of steep slopes remain the preferred development location of development in Manchester, by the City and developers. Future development may increase pressure to utilize these hazard areas, despite their inherent risks, given the scarcity of undeveloped land and near build out conditions. Nonetheless, any proposed new developments or significant improvements in these zones would require variances from the Zoning Board of Authority and the Planning Board. The City may assure low risk and impact future development in the hazard zones given these review opportunities. Despite the

development changes, the community's vulnerability is unchanged since the last plan update.

National Flood Insurance Program

Manchester has been participating in the National Flood Insurance Program (NFIP) since 1981. Digital Flood Insurance Rate Maps, all bearing the effective date of September 25, 2009, are used for flood insurance purposes and are on file with the Manchester Planning and Building Departments. In addition the City has implemented the following actions related to continued compliance with NFIP:

- Address NFIP monitoring and compliance activities
- Revise/adopt subdivision regulations, erosion control regulations, board of health regulations, etc. to improve floodplain management in the community
- Distribute or make available NFIP, insurance and building codes explanatory pamphlets or booklets
- Inspect foundations at time of completion before framing to determine if lowest floor is at or above Base Flood Elevation (BFE), if they are in the floodplain
- Require the use of elevation certificates
- Enhance local officials, builders, developers, local citizens and other stakeholders' knowledge of how to read and interpret the FIRM
- Work with elected officials, the state and FEMA to correct existing compliance issues and prevent any future NFIP compliance issues through continuous communications, training and education

According to FEMA's most recent Biennial Report for Manchester, there were approximately 597 residential and other structures located in the FEMA designated special flood hazard areas (100-year floodplain). (Source: NH Office of Strategic Initiatives, Floodplain Management Program)

The City currently has 191 NFIP policies. Thirty-two claims have been filed with NFIP since 1978 totaling $1,173,888.77. There is currently one commercial repetitive loss property insured under the NFIP within the City of Manchester. Repetitive loss *areas* are mapped on the Identified Hazards Map at the end of this chapter.

SECTION III
HAZARD IDENTIFICATION

Flooding

Flooding is an overwhelming cover or submergence of water, and can arrive in overwhelming amounts or quantities. The Manchester Hazard Mitigation Committee reviewed the following kinds of hazards related to flooding:

1. Riverine Flooding

Riverine flooding is the most common disaster event in the State of New Hampshire. In recent years some areas in the State have experienced multiple disastrous flood events at recurrence intervals of less than ten years. New Hampshire usually has a climate of abundant precipitation. Weather 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. (2013 State Multi-Hazard Mitigation Plan)

The City of Manchester developed along the Merrimack River that provided the Amoskeag Mills with a power and transportation source. As in other New Hampshire communities, when "[r]esidents moved to the floodplains … [s]uch encroachment has led to problems… Flood safety is a great concern along these watercourses and can be greatly enhanced by flood hazard mitigation planning (NH BEM 12-13)."

"The goal of flood hazard mitigation planning is to eliminate or reduce the long-term risks to human life and property from flooding by reducing the cause of the hazard or reducing the effects through preparedness, response and recovery measures. Hazard mitigation is the only phase of emergency management that can break the cycle of damage, reconstruction and repeated damage (Ibid 13)." Riverine flooding is the most common and significant hazard event in the State of New Hampshire as well as all of its municipalities.

Some of the more severe flooding in Manchester occurs during spring, fall, and winter seasons. The most severe riverine flooding event in Manchester, March 1936, along the Merrimack River, occurred due to heavy rainfall combined with rapid snowmelt and debris-impacted infrastructure. These factors led to catastrophic results. (FEMA, FIS 5)

From 1973 through the present (April 2018) there have been twenty-two flood-related declared disasters by FEMA. The most recent took place in September 2016. (FEMA, "Federally Declared Disasters by Calendar Year")

All special flood hazard areas (SFHAs) in the City of Manchester are potentially at risk in the event of riverine flooding. The SFHAs are located on the Identified Hazard Zones Map at the end of this section.

Low to moderate probability for this hazard to occur and cause damage in Manchester

2. Localized Flooding

Localized flooding can result from even minor storms. Runoff overloads the drainageways and flows into the streets and low-lying areas. Sewers back up; yards are inundated. Homes and businesses are flooded, especially basements and the lower part of first floors. Localized flooding poses most of the same problems caused by larger floods, but because it typically has an impact on fewer people and affects small areas, it tends to bring less State or Federal involvement such as funding, technical help, or disaster assistance. As a result, the community and the affected residents or business owners are left to cope with the problems on their own. Finally, flooding of this type tends to recur; small impacts accumulated over time can become major problems.[3]

Areas of Manchester that have experience localized flooding in the past are:

- Crosbie Street near Goldfish Pond
- The intersection of Clarke and Walnut Street near Livingston Park
- The intersection of Clarke and Elm Street, as well as Monroe Street from River Road to Elm Street
- The intersection of Ridge Road and River Road
- The area that runs parallel to I-93 between Hanover Street and Laydon Street
- The intersection of Weston Road and Jewett Street

These and additional areas that have had localized flooding issues in the past are identified on the *Identified Hazard Zones map* in Appendix I. They experience flooding annually.

Low to moderate probability for this hazard to occur and cause damage in Manchester

3. Hurricanes

The primary threats associated with hurricanes come from flooding due to a coastal storm surge, inland flooding due to heavy precipitation and severe winds. Hurricanes are known for their high winds and the damage they can cause, but about 80 percent of deaths during hurricanes are due to drowning.

Hurricane Bob dealt New Hampshire a glancing blow in 1991 yet still was responsible for $2.5 million in damage and three deaths. It is important to note that tropical storms

[3] FEMA 511. Reducing Damage from Localized Flooding. June 2005

below hurricane intensity have been responsible for some of the worst inland flooding experienced in the Northeast. Moving slowly and carrying lots of moisture, tropical storms can produce rain of several inches per hour. Even though hurricanes tend to lose intensity and their winds diminish as they move north, the heavy rain they bring can still be dangerous. (2013 State Multi-Hazard Mitigation Plan)

Potential effects of a hurricane include flooding, runoff not handled adequately, and disrupted travel. The most recent hurricanes were: September 1985 – Gloria, August 1991 – Bob, and September 1999 – Floyd. During these events trees and power lines came down, and there was minimal structural damage (none since last plan update).

HURRICANES AND TROPICAL STORMS FROM 1938 TO 2018

Name	Date	Category	Area Impacted	NH Damages
THE GREAT NEW ENGLAND HURRICANE	Sep 21, 1938	3	Southern New England	13 Deaths, 1,363 families received assistance, interruption of electric and telephone services for weeks, 2 billion feet of marketable lumber blown down, flooding throughout the State, in some cases equaling and surpassing the Flood of 1936. Total Direct Losses - $12,337,643 (1938 Dollars) This does not include indirect losses, such as loss of trade & impact to timber industry.
HURRICANE CAROL	Aug 31, 1954	3	Southern New England	Extensive amount of trees blown down and property damage, large crop loss, localized flooding.
HURRICANE EDNA	Sep 11, 1954	3	MA	This Hurricane moved off shore but still cost 21 lives and $40.5 million in damages throughout New England. Followed so close to Carol it made recovery difficult for some areas. Heavy rain in New Hampshire.
HURRICANE DONNA	Sep 12, 1960	3	Southern and Central NH	Heavy flooding in Massachusetts and Southern New Hampshire.
TROPICAL STORM DAISY	Oct 7, 1962	N/A	Southern and Central NH	Heavy swell and flooding coastal New Hampshire.
TROPICAL STORM DORIA	Aug 28, 1971	N/	Southern and Central NH	Center passed over NH resulting in heavy rain and damaging winds.
HURRICANE BELLE	Aug 10, 1976	1	Southern New England	Primarily rain with resulting flooding in New Hampshire.
HURRICANE GLORIA	Sept 27, 1985	2	Southern New England	This hurricane fell apart upon striking Long Island with heavy rains, localized flooding, and minor wind damage in NH.
HURRICANE BOB	Aug 19, 1991	2	Southern New England	Hurricane Bob struck southern New England then curved off the coast, to the east, causing it to miss New Hampshire. Yet 3 persons were killed and $2.5 million in damages were suffered along coastal NH.
TROPICAL STORM FLOYD	Sep 16-18, 1999	N/A	NH	This was originally a Hurricane that heavily impacted North Carolina and dumped heavy rains on New England, resulting in a federal Declaration of Disaster in NH; FEMA DR-1305-NH with the counties of Belknap, Grafton and Cheshire designated.
TROPICAL STORM IRENE	August 26, - Sept.6, 2011	N/A	New England	Storm dumped heavy rains on New England causing significant damage resulting in a Presidential Declaration of Disaster in NH; FEMA DR-4026-NH with the counties of Belknap, Carroll, Coos, Grafton, Merrimack, Strafford, and Sullivan designated.
HURRICANE SANDY	October 29, 2012	1	New England, NYC and New Jersey	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).

All areas of the City of Manchester are potentially at risk if a hurricane reaches Hillsborough County, New Hampshire. Hurricane Sandy had minimal associated flooding when it occurred in 2012, and was the last hurricane to impact Manchester since the last plan update.

Low probability for this hazard to occur and cause damage in Manchester

4. Debris-impacted infrastructure and river ice jams

Debris carried by floodwaters can significantly compromise the effectiveness of otherwise adequately designed bridges, dams, culverts, diverting structures, etc. Storm debris carried by floodwaters may exacerbate a given flooding hazard by becoming obstructions to normal storm water flow. Culverts and bridge crossings that are undersized in relation to the river or stream in which they are contained can lead to sedimentation and debris accumulation, potentially causing structural failures and major flooding downstream. (2013 State Multi-Hazard Mitigation Plan)

The potential effects of flooding are increased when infrastructure is obstructed either by debris or ice formations. These obstructions compromise the normal stormwater flow, creating an artificial dam or narrowing of the river channel causing a backup of water upstream and forcing water levels higher. Debris obstructions can be caused from vegetative debris, silt, soils, and other riparian structures that have been forced into the watercourse. Ice jams are caused by ice formations "in riverbeds and against structures." (NH BEM 13, 16) Bridges, culverts and related roadways are most vulnerable to ice jams and debris-impacted infrastructure.

Historically, floods in Manchester have been due to snow melt and heavy rains in conjunction with ice jams or debris-impacted infrastructure. If flooding occurs in the City of Manchester, there is the potential for debris-impacted infrastructure and ice jams to cause damage. The flood of 1936, previously mentioned, was severely exacerbated by the presence of 55,000 gallon oil tanks and other debris in the river that became lodged at the Granite Street Bridge.

A 100-year flood event is a large flood that has a 1% chance of occurring annually. In 2005, 2006, 2007 and in 2010 Manchester and much of Southern New Hampshire experienced significant flood events. The 2005, 2006, and 2007 events all exceeded 100-year flood recurrence intervals in some or all areas; the frequency of these events in the past 10 years is a major concern for the City of Manchester along with the rest of the State.

All special flood hazard areas in the City of Manchester are potentially at risk if there is an ice jam or debris-impacted infrastructure. Particular concern should be given to bridges along the Merrimack and Piscataquog Rivers.

Low probability for this hazard to occur and cause damage in Manchester

5. Erosion and mudslides

The Manchester Hazard Mitigation Plan Committee determined that Manchester had zero probability of this hazard to occur; therefore, it has been removed from this plan.

6. Rapid snowpack melt

The State's climate, mountainous terrain increases the susceptibility to flooding which may be accelerated by the seasonal rapid melting of the snowpack, coupled with moderate temperatures and heavy rains. The upland areas may be exposed to associated erosion and deposition issues in or near streambeds. The lower-lying areas of the State may experience either flash-flooding or inundation events accelerated by the rapid melting of the snowpack. (2013 State Multi-Hazard Mitigation Plan)

Structures and improvements located on, along, or at the base of steep slopes are most vulnerable to rapid snowpack melt. These areas can be seen on the Identified Hazard Zones GIS map's depiction of steep slopes.

All areas of steep slopes and erosion prone soils, as mapped in this *Plan*, are potentially at risk in the event of rapid snowpack melt.

Low to moderate probability for this hazard to occur and cause damage in Manchester

7. Dam breach or failure

Dams can sustain damage during an unusually heavy rain event or a rain event that occurs in conjunction with runoff produced during the spring thaw, which can stress a dam beyond its design capabilities. An example would be if a storm event produced more runoff than a dam's outlet works (spillways and gates, etc.) could pass. (2013 State Multi-Hazard Mitigation Plan)

The State of New Hampshire uses a hazard potential classification based on the impact of dam breach or failure. All class S (Significant) and H (High hazard) dams have the potential to cause damage if they breach or fail. Manchester has 12 Class NM dams (Non-menace), 5 Class L dams (low hazard potential), 1 Class S dam (Significant hazard potential) and 4 Class H dams (High hazard). potential).[4]

[4] For the 2010 update there are 2 less dams than there were in 2005 for the previous plan

New Hampshire Dam Bureau – Dam Classifications

Non-Menace structure means a 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, provided the dam is:

- Less than six feet in height if it has a storage capacity greater than 50 acre-feet; or
- Less than 25 feet in height if it has a storage capacity of 15 to 50 acre-feet.

Low Hazard structure means a 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 any of the following:

- No possible loss of life.
- Low economic loss to structures or property.
- Structural damage to a town or city road or private road accessing property other than the dam owner's that could render the road impassable or otherwise interrupt public safety services.
- The release of liquid industrial, agricultural, or commercial wastes, septage, or contaminated sediment if the storage capacity is less than two-acre-feet and is located more than 250 feet from a water body or water course.
- Reversible environmental losses to environmentally-sensitive sites.

Significant Hazard structure means a 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 any of the following:

- No probable loss of lives.
- Major economic loss to structures or property.
- Structural damage to a Class I or Class II road that could render the road impassable or otherwise interrupt public safety services.
- Major environmental or public health losses, including one or more of the following:
- Damage to a public water system, as defined by RSA 485:1-a, XV, which will take longer than 48 hours to repair.
- The release of liquid industrial, agricultural, or commercial wastes, septage, sewage, or contaminated sediments if the storage capacity is 2 acre-feet or more.
- Damage to an environmentally-sensitive site that does not meet the definition of reversible environmental losses.

High Hazard means a 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 as a result of:

- Water levels and velocities causing the structural failure of a foundation of a habitable residential structure or commercial or industrial structure, which is occupied under normal conditions.
- Water levels rising above the first floor elevation of a habitable residential structure or a commercial or industrial structure, which is occupied under normal conditions when the rise due to dam failure is greater than one foot.
- Structural damage to an interstate highway, which could render the roadway impassable or otherwise interrupt public safety services.
- The release of a quantity and concentration of material, which qualify as "hazardous waste" as defined by RSA 471-A:2 VI.
- Any other circumstance that would more likely than not cause one or more deaths.

"The Department of Environmental Services (DES), through its Dam Bureau, is charged with the responsibility of ensuring the public safety as it relates to the regulation of dams (NH BEM 17)." In 1988, the New Hampshire State Legislature recognized the need for dam owners to prepare a plan to assist the local community in responding effectively to a dam failure. The legislature amended RSA 482:2 and RSA 482:12 and

adopted RSA 482:11a to require that dam owners develop an Emergency Action Plan for all dams that may be a menace to public safety due to their condition, height, and location. (NH DES Dam Bureau, Environmental Fact Sheet DB-11)

One of Manchester's four Class H dams is the Amoskeag Dam, owned by the Eversource, located along the Merrimack River near the Amoskeag Bridge toward the northern part of the City. The inundation area includes both the east and west banks of the river south of the dam to a point approximately equal with Interstate-293 crossing between Bedford and Manchester. Additionally, the inundation area stretches west along the banks of the Piscataquog River to approximately the Nazaire-Biron Bridge, crossing into Goffstown.

Another of Manchester's Class H dams is the Massabesic Lake Dam, located at the confluence of Cohas Brook and Massabesic Lake. The Emergency Action Plan indicates the following areas would be at risk due to dam breach or flooding: Cohas Avenue from Bricket Road to the pumping station, Bodwell Road south of Mammoth Road, Sears Drive, Roycraft Road from Sears Drive to the end, Lebel Avenue, Edna Avenue, Come Street, and portions of Interstate 93.

The other 2 Class H dams in Manchester are the Kelley Falls Dam on the Piscataquog River and the Dorrs Pond Dam on Dorrs Pond. Both are considered High Hazard because they have the potential to result in probable loss of human life due to failure or misoperation. There has not been a dam failure since the last Plan update.

The SFHAs in proximity to Manchester's Class S and H dams as well as their designated floodways, would be impacted by a dam breach**.**

Low probability for this hazard to occur and cause damage in Manchester

8. Other water retention facility failure

Manchester Water Works is a regional water purveyor serving nearly 160,000 people in the greater Manchester area. The supply system has 32 million gallons of distribution storage situated in seven water storage tanks, and one reservoir. Manchester's water plant is a 50 million gallon per day conventional treatment facility utilizing intermediate ozone disinfection, deep-bed carbon and anthracite filtration. Water is pumped to the reservoirs for distribution through 505 miles of water main to 31,670 domestic services, 1,720 fire services, and 3,340 fire hydrants in Manchester and portions of the towns of Auburn, Bedford, Derry, Goffstown, Hooksett, and Londonderry and Litchfield. (Manchester Water Works)

Failure typically occurs in water storage tanks when a lateral force applied to the tower exceeds the structural capabilities of the tower. Examples of these sorts of events would be earthquakes or high force winds. Inadequate or weakened welds, insufficient

reinforcement at beam-column connections and the buckling of tall slender steel structural supports are other modes of failure. (U. Cal. Berkeley) If failure were to occur, potential impacts include high waves and flash floods. The surrounding environment is torn up by debris carried with the wave of water.

Water storage tanks owned by the Manchester Water Works are constructed using pre-stressed concrete and are designed to withstand seismic loading or forces. Therefore, the typical failure modes of water storage tanks would be inapplicable to this facility. There is only one privately owned and operational steel water storage tank within the City of Manchester. This tank is located at the VA Hospital.

For reservoirs or retention basins, hydrological failure could occur due to overtopping from excessive inflow or flooding as well as ice dam build up. Structural failure can be due to piping problems, seismic activity, slope instability or structural weakness. (World Bank) Reservoir failure would also be a secondary effect of dam failure for those with an associated dam.

Secondary effects of reservoir or water storage tank failures would include shortages of potable water and compromised fire services.

The VA Hospital and Wellington Hill areas would be impacted by a water storage tank failure.

Oak Hill (Derryfield Park) and the area between Island Pond Road, Cohas Avenue and Mammoth Road would be impacted by a reservoir or retention basin failure.

Low to moderate probability for this hazard to occur and cause damage in Manchester

Wind

The Manchester Hazard Mitigation Committee reviewed the following kinds of hazards related to wind:

1. Hurricanes

Severe hurricanes reaching south-central New Hampshire in the late summer and early fall are the most dangerous of the coastal storms that pass through New England from the south. Tropical depressions are considered to be of hurricane force when winds reach 74 miles per hour (see the following table for hurricane categorization according to the Saffir-Simpson Scale). Substantial damage may result from winds of this force, especially considering the duration of the event, which may last for many hours. Potential effects of hurricane force winds include fallen trees, telephone poles, and power lines.

Saffir-Simpson Hurricane Scale		
Category	**Winds (mph)**	**Potential Damage**
1	74-95	Minimal
2	96-110	Moderate
3	111-130	Extensive
4	131-155	Extreme
5	>155	Catastrophic

Winds from the Hurricane of 1938, previously mentioned, reached a high of 186 miles per hour, a category 5 on the Saffir-Simpson Scale. (NHBEM 1999 III-22)

All areas of Manchester are at risk if a hurricane reaches Hillsborough County, NH.

Low probability for this hazard to occur and cause damage in Manchester

2. Tornados

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. These events are spawned by thunderstorms and occasionally by hurricanes. They may also occur singularly or in multiples. Tornados develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. Most vortices remain suspended in the atmosphere. Should they touch down, they become a force of destruction. (NH 2013 State Multi-Hazard Mitigation Plan) Tornados are measured using the Fujita Tornado Damage Scale, as seen in the table below (National Oceanic and Atmospheric Administration).

Enhanced Fujita Tornado Damage Scale

FUJITA SCALE			DERIVED EF SCALE		**OPERATIONAL EF SCALE**	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	**EF Number**	**3 Second Gust (mph)**
0	40-72	45-78	0	65-85	**0**	**65-85**
1	73-112	79-117	1	86-109	**1**	**86-110**
2	113-157	118-161	2	110-137	**2**	**111-135**
3	158-207	162-209	3	138-167	**3**	**136-165**
4	208-260	210-261	4	168-199	**4**	**166-200**
5	261-318	262-317	5	200-234	**5**	**Over 200**

Source: NOAA

Since 1956 there have been 19 known tornados in Hillsborough County.[5] One of these was a F0, ten were F1, five were F2 (July 1961, June 1963, July 1968, July 1997 and May 1998), and one was a F3 (August 1968) (Two were not classified).[6]

All areas of Manchester are potentially at risk if a tornado reaches the City.

Low probability for this hazard to occur and cause damage in Manchester

3. Nor'easters

A Nor'easter is a large weather system traveling from South to North, passing along or near the seacoast. As the storm approaches New England and its intensity becomes increasingly apparent, the resulting counterclockwise cyclonic winds strike the coast and inland areas from a Northeasterly direction. In the winter months, oftentimes heavy snow conditions accompany these events. It can form over land or over the coastal waters. These winter weather events are notorious for producing heavy snow, rain, and tremendous waves that crash onto Atlantic beaches, often causing beach erosion and structural damage. Wind gusts associated with these storms can exceed hurricane force in intensity. A nor'easter gets its name from the continuously strong northeasterly winds blowing in from the ocean ahead of the storm and over the coastal areas NOAA. (National Weather Service. Glossary). " Hazards from nor'easters include icing and heavy snows which cause downed trees and power lines to go down.

"Unlike the relatively infrequent hurricane, New Hampshire generally experiences at least one or two "significant" events each year… with varying degrees of severity. These storms have the potential to inflict more damage than many hurricanes because … high winds can last from 12 hours to 3 days, while the duration of hurricanes ranges from 6 to 12 hours (Ibid)."

Nor'easters are measured on the Dolan- Davis scale, as is presented below.

Dolan-Davis Nor'easter Classification Scale				
Storm Class	**% of Nor'easters**	**Avg. Return Interval**	**Avg. Duration (hours)**	**Impact**
1- WEAK	49.7	3 days	8	No property damage
2- MODERATE	25.2	1 month	18	Modest Property damage
3- SIGNIFICANT	22.1	9 months	34	Local-scale damage and structural loss
4- SEVERE	2.4	11 years	63	Community Scale damage and structural loss
5- EXTREME	0.1	100 years	95	Extensive regional-scale damage and structural loss

Source: State of NH Natural Hazards Mitigation Plan & NC Division of Emergency Management

[5] NOAA Satellite and Information Service
[6] Tornado Project Online

All areas of Manchester are potentially at risk for property damage and loss of life due to nor'easters.

Low probability for this hazard to occur and cause damage in Manchester

4. Downburst

"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. Depending on the size and location of these events, the destruction to property may be devastating. Downbursts fall into two categories. Microbursts cover an area less than 2.5 miles in diameter, and macrobursts cover an area at least 2.5 miles in diameter (NH BEM 59)"

More recent downburst activity occurred on July 6, 1999 in the form of a macroburst within central New Hampshire; throughout Merrimack, Grafton and Hillsborough Counties. There were two fatalities as well as two lost roofs, widespread power outages, and downed trees, utility poles and wires. The following table is from the 2013 State Multi-Hazard Mitigation Plan.

State of New Hampshire Micro/Macroburst Historic Events

Location(Town or Counties)	Date	Type	Damages
Town of Stratham	08/18/1991	Microburst	11 Injured, 5 fatalities and $2,498,974 in damages
Town of Moultonborough	07/26/1994	Microburst	Downed trees, utility poles and wires, 1800 homes without power, and 50 – 60 houses damaged
Merrimack, Grafton, Hillsborough	07/06/1999	Macroburst	2 fatalities, 2 roofs blown off structures, downed trees, widespread power outages, and damaged utility poles and wires
Town of Bow	09/06/2011	Microburst	City Auto in Bow had 15 campers damaged and estimated $200,000 in damage
Lake Winnisquam, Tilton	07/04/2012	Microburst	Several large trees came down, many landing on homes or parked vehicles. No one was hurt, but there was a lot of damage. Thirty homes were damaged and 12 people spent the night sheltered at a local hotel.
City of Franklin, Webster Lake	10/30/2012	Microburst	Several large trees came down, landing on two summer homes, completely demolishing one. No injuries were reported.

All locations in Manchester are at risk for property damage and loss of life due to downbursts. The City is investigating a potential downburst in Manchester's Westside that occurred since the last plan update.

Low probability for this hazard to occur and cause damage in Manchester

5. Lightning

Lightning is a giant spark of electricity that occurs within the atmosphere, or between the atmosphere and the ground. As lightning passes through the air, it heats the air to a temperature of 50,000 degrees Fahrenheit, considerably hotter than the surface of the Sun. During a lightning discharge, the sudden heating of the air causes it to expand rapidly. After the discharge, the air contracts quickly as it cools back to ambient temperatures. This rapid expansion and contraction of the air causes a shock wave that we hear as thunder, a shock wave that can damage building walls and break glass. In the United States, it is reported that an average of 54 people are killed by lightning annually. (2013 State Multi-Hazard Mitigation Plan) Lightning can be measured to determine how likely it may be for starting fires. Using a Level system of 1 to 6 corresponding with storm development and the number of lightning strikes, the Lightning Activity level (LAL) measures the magnitude of lightning strikes as displayed in the below table. Though lightning storms happen often, there have been no records of notable damage from this hazard since the last Plan update.

Lightning Activity Level (LAL)

Level	LAL Cloud and Storm Development	Cloud to Ground Strikes per 5 Minutes	Cloud to Ground Strikes per 15 Minutes
LAL 1	No thunderstorms	n/a	n/a
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a five minute period.	1 to 5	1 to 8
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a 5 minute period.	6 to 10	9 to 15
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud to ground strikes in a 5 minute period.	11 to 15	16 to 25
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a 5 minute period.	>15	>25
LAL 6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.	6 to 10	9 to 15

Source: National Weather Service

All areas of Manchester are potentially at risk for property damage and loss of life due to lightning.

Moderate probability for this hazard to occur and cause damage in Manchester

Fires

The Manchester Hazard Mitigation Committee reviewed the following kinds of hazards related to fires:

1. Wildland and Urban-Wild Land Interface Fires

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

New Hampshire is a heavily forested state and is therefore vulnerable to this hazard, particularly during periods of drought and/or large- scale natural disturbances causing unusual fuel buildup. The proximity of many populated areas to the State's forested lands exposes these areas and their populations to the potential impact of wildfire. The Granite State is the second most forested state in the United States (trailing Maine). Forests occupy 84 percent, or 4.8 million acres. The southern portion of the State has seen rapid commercial and residential development which has extended into previously forested areas. Although this development has slowed, this sprawl has created its own concerns regarding the increased risk of damage in the wildland-urban interface. In a study conducted by the United States Forest Service in 2006, New Hampshire was ranked as having the highest percentage of homes in the wildland-urban interface of any state in the nation. Present concerns are that the Ice Storm of 2008 has also left a significant amount of woody debris in the forests of the region and may fuel future wildfires. (2013 State Multi-Hazard Mitigation Plan)

In the City of Manchester, data pertaining to brush, grass, and wild land fires is available on the Fire Department's website. The City of Manchester experienced $17,210,539 in property loss from fires between 2013 and 2017. The fire department responded to 300 wild land fires, 678 structure fires, and 752 fires involving vehicles, rubbish and other non-structural fires according to the City of Manchester Fire Department fire data. It's difficult to simply divide the number of fires by the property loss because wild land fires and "non-structural" fires have no property loss associated with them. A good way to assign a value is the city taxable assets are $9,004,365,407 in 2017. If it lose a substantial part of that due to fire or property damage, the City's property tax could sky rocket and cause financial insecurity.

In the City of Manchester, the following areas are susceptible to wild land fires:

- All new developments (when trees are cut, soil dries leaving dead grass)

- Rock Rimmon area- Kimball Street area from Bremmer Street soccer fields to Goffstown Back Road
- Hackett Hill Rd. and Dunbarton Road area
- Youth Development Center- River Road
- Manchester Water Works area- Lake Shore Road and Island Pond Road[7]
- Bodwell Road area- edge of new residential development
- Riverdale Avenue- near railroad tracks behind Pine Grove Cemetery

These areas have been identified on the Identified Hazard Zones GIS map.

The potential magnitude of a hazard event, also referred to as the extent, scale or strength of a disaster, provides a measurement of how large and significant a hazard can become. The Table below shows the National Wildfire Coordinating Group (NWCG) Size Fire Classification.

National Wildfire Coordinating Group (NWCG) Size Fire Classification	
Class A	1/4 acre or less
Class B	More than 1/4 acre, but less than 10 acres
Class C	10 acres or more, but less than 100 acres
Class D	100 acres or more, but less than 300 acres
Class E	300 acres or more, but less than 1,000 acres
Class F	1,000 acres or more, but less than 5,000 acres
Class G	5,000 acres or more

All areas surrounding the wild land fire zones are susceptible to urban-wild land interface fires, as mapped on the Identified Hazard Zones GIS map.

Low probability for this hazard to occur and cause damage in Manchester

2. Urban Fires

The State of New Hampshire Natural Hazards Mitigation Plan does not include a section on urban fires. However, the Committee selected to include urban fires in this *Hazard Mitigation Plan* because the City is more prone to urban fires as opposed to brush, grass and wild land fires. Included in this hazard category are fires within buildings, other structures, vehicles and any other reported non-wild land related fires.

Data pertaining to these fires can be found at the Manchester Fire Department's website. There was a total of 539 fires in 2008, including brush, grass and wild land fires. A summary of data from 2008 is provided below.

Urban Fires in Manchester, NH 2008				
	Building & Structure Fires	**Vehicle Fires**	**All Other Non-Wild Land Fires**	**Estimated Property Damage***

[7] The majority of Manchester Water Works' approximately 8,000 acres of protected land is located in the towns of Auburn, Candia, Chester and Hooksett. These areas are also vital to the protection of the potable water supply and are equally, if not more, susceptible to forest fires than the area within City limits. Manchester Water Works maintains an extensive network of fire roads and active forestry program within the watershed to assist in fire fighting and mitigation efforts.

Total Number of Fires/ Damages	271	58	122	$6,048,039.00

*Includes Wild Land Fires
Source: Manchester Fire Department, "Fire Data," http://www.manchesternh.gov/CityGov/MFD/firedata.html

The City of Manchester experienced $17,210,539 in property loss from fires between 2013 and 2017. The fire department responded to 300 wild land fires, 678 structure fires, and 752 fires involving vehicles, rubbish and other non-structural fires according to the City of Manchester Fire Department fire data.

It's difficult to simply divide the number of fires by the property loss because wild land fires and "non-structural" fires have no property loss associated with them. A good way that we could assign a value is the city taxable assets are $9,004,365,407 in 2017. If we loose a substantial part of that due to fire or property damage, our property tax could sky rocket and cause financial insecurity.

In the City of Manchester, the center city and West Side are predisposed to urban fires given their older housing stock and increased density. These locations are identified on the Identified Hazard Zones GIS Map.

Low to moderate probability for this hazard to occur and cause damage in Manchester

3. Isolated Homes
The Manchester Hazard Mitigation Plan Committee determined that Manchester had zero probability of this hazard to occur; therefore, it has been removed from this plan.

Ice and Snow Events

The Manchester Hazard Mitigation Committee reviewed the following kinds of hazards related to ice and snow events:

1. Heavy Snowstorms
A heavy snowstorm is generally considered to be one that deposits four or more inches of snow (or 10 cm) in a twelve-hour period. A blizzard is 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. A Nor'easter is 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. (2013 State Multi-Hazard Mitigation Plan)

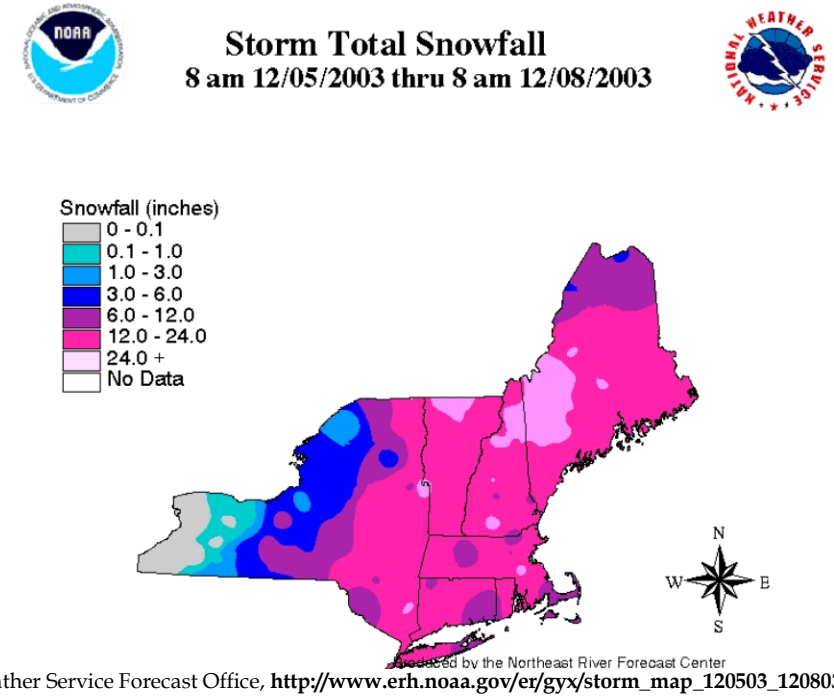
For the intents of this *Plan*, heavy snowstorms include all storms with four or more inches of snow in a twelve-hour period, including all blizzards and nor'easters with large snow accumulation.

In the past 28 years, the Federal Emergency Management Agency declared nine snowstorm-related Emergency Declarations for Hillsborough County. The first was declared by FEMA in March of 1993 for statewide heavy snow. (FEMA, "Federally Declared Disasters by Calendar Year")

The second was for snowstorms during March of 2001 covering seven of the state's 10 counties. Southern and central New Hampshire received approximately two feet of snow, on top of an existing base of about a foot, and many residents lost power. Wind speeds reached 24 miles per hour. (NOAA National Climatic Data Center and National Weather Service, Gray, Maine)

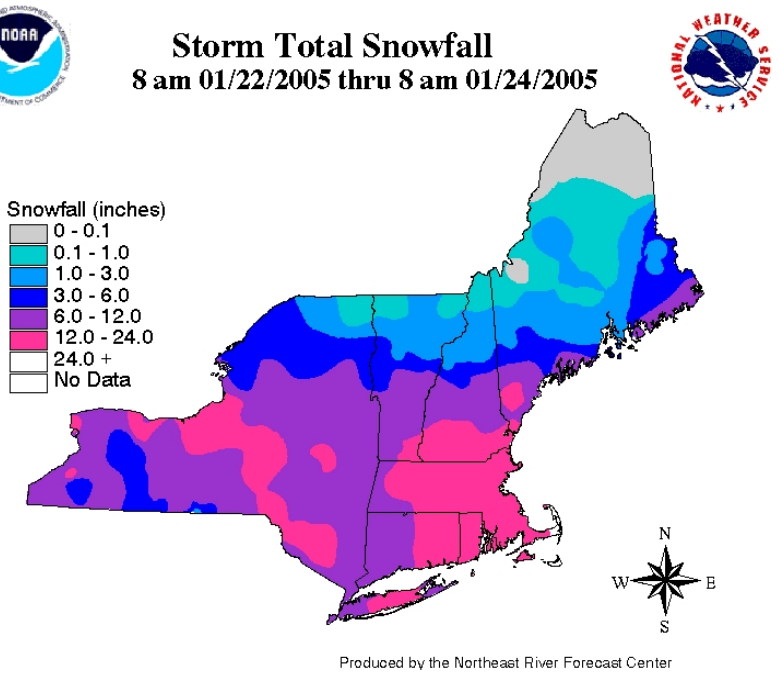
The third declared emergency was for a snowstorm on February 17-18, 2003. This storm accumulated approximately nine inches of snow, as reported in Henniker, added to an existing base of snow to create an approximate snow depth of 19 inches. Wind speeds reached a maximum of 14 miles per hour. (NOAA National Climatic Data Center and National Weather Service, Gray, Maine)

The fourth declared emergency was on December 6-7, 2003. This emergency was declared for eight of 10 New Hampshire counties. The storm accumulated approximately 23 inches of snow, as reported in Henniker, and winds were measured at up to 25 miles per hour. There was three inches or less of existing snow depth before the storm. (NOAA National Climatic Data Center and National Weather Service, Gray, Maine) Following is a map depicting snowfall during this storm.



Source: National Weather Service Forecast Office, **http://www.erh.noaa.gov/er/gyx/storm_map_120503_120803.jpg**

The fifth declared emergency was for January 22-23, 2005 and was declared for all New Hampshire counties, except Coos. The storm accumulated approximately 11 inches of snow, as recorded in Concord, on top of an existing nine-inch approximate snow depth. Maximum wind speeds were measured at 26 miles per hour. (NOAA National Climatic Data Center and National Weather Service, Gray, Maine)



Source: National Weather Service Forecast Office, http://www.erh.noaa.gov/er/gyx/storm_map_012405.jpg

The most recent declared emergency was for March 11-12, 2005 and was declared for four of New Hampshire's nine counties. **See list** The storm accumulated approximately six inches of snow, as recorded in Concord, on top of an existing 17-inch snow depth. Highest recorded winds were 15 miles per hour. (NOAA National Climatic Data Center and National Weather Service, Gray, Maine)

Recent heavy snowstorms affecting Manchester and the region include:

- October 29-31, 2011 – known as the Halloween Storm
- February 8-9, 2013, a Nor'easter, known as the Winter Storm NEMO
- November 25-30, 2014, known as the Thanksgiving Day Snowstorm
- January 26 – February 16, 2015, a series of frequent and heavy snowstorms

All areas of Manchester are potentially at risk for property damage and loss of life due to heavy snows.

Low probability for this hazard to occur and cause significant damage in Manchester

2. Ice Storms

Ice Storms occur 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.

Despite the beauty of ice events, the extreme weight of ice build-up may strain tree branches, power lines and even transmission towers to the breaking point, resulting in a loss of power, telephone service, or other services. Fallen trees, limbs, or utility poles may obstruct roads and restrict emergency vehicle passage. Additionally, ice creates treacherous conditions for highway travel and aviation.

The 1998 ice storm was a Federally Declared Disaster by FEMA for nine of the State's 10 counties, including Hillsborough County. The January 1998 ice storm was very similar in both its impact area and severity to a 1929 ice storm that caused unprecedented damage to the telephone, telegraph and power system. The 1998 storm significantly damaged the utility network, causing.

Manchester, including the rest of New Hampshire and much of the Northeast, experienced an intense ice storm from December 11-12, 2008. A major disaster declaration was declared for 10 counties in New Hampshire, including Hillsborough .The damage was widespread and approximately 400,000 residents of New Hampshire lost power from the storm. Restoring power to a majority of the State took approximately 14 days and in some extreme cases it took 17 days.

All areas of Manchester are potentially at risk for property damage and loss of life due to ice storms.

Moderate probability for this hazard to occur and cause significant damage in Manchester

3. Hailstorms

Hailstorms are characterized by showery precipitation in the form of irregular pellets or balls of ice more than five mm in diameter, falling from a cumulonimbus cloud.

Most hailstones are smaller in diameter than a dime, but stones weighing more than a pound have been recorded. Details of how hailstones grow are complicated but the results are irregular balls of ice that can be as large as baseballs, sometimes even bigger. While crops are the major victims, hail is also a hazard to vehicles and windows. Hail damage events can be severe to persons, property, livestock and agriculture (Ibid).

The Hail Size Description Chart developed by the National Oceanic and Atmospheric Administration (NOAA) and enhanced by other National Weather Service local sites depicts the potential size of hail during a hurricane or severe storm event. Some examples from the Hail Size Description chart include "1/2 inch=Pea Size" and "2 inches=Hen Egg Size."

Hail Size Description

Hailstone Diameter in Inches	Size Description
<1/4	Bb
¼	Pea Size
½	Mothball Size
¾	Penny Size
7/8	Nickel Size
Severe Criteria 1	Quarter Size
1 ¼	Half Dollar Size
1 ½	Walnut or Ping Pong Ball Size
1 ¾	Golf Ball Size
2	Hen Egg Size
2 ½	Tennis Ball Size
2 ¾	Baseball Size
3	Teacup Size
3 4/5	Softball Size
4	Grapefruit Size
4 ¾	CD/DVD
Note: Hail size refers to the diameter of the hailstone.	

The National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) online database has recorded 55 hail storms in Hillsborough County since 1950. Hailstone diameters recorded ranged from .75 to two inches.

All areas of Manchester are potentially at risk from this hazard.

Low probability for this hazard to occur and cause significant damage in Manchester

Seismic Events

The Manchester Hazard Mitigation Committee reviewed the following kinds of hazards related to seismic events:

1. Earthquakes

An earthquake is defined as a series of vibrations induced in the Earth's crust by the abrupt rupture and rebound of rocks in which elastic strain has been slowly accumulating. New Hampshire is considered to lie in an area of moderate seismic hazard with respect to other areas within the United States. New Hampshire has had and will continue to experience large damaging earthquakes; however, the intervals between such events are greater in New Hampshire than in high hazard areas.

Earthquakes in the New Hampshire cannot be associated with specific, known faults. Though there are no identified active faults in New Hampshire, no doubt that there are active faults located beneath the surface. With that said, there is a "zone" that extends from north of the Lakes Region south along the Merrimack River into Massachusetts where most New Hampshire earthquakes have occurred. New Hampshire is in the low attenuation of seismic waves in the eastern United States. Attenuation is a term in physics that means the slow loss of intensity of flow through any kind of medium. Seismic waves can cover an area 4 to 40 times greater in the east than they do in the west because of the cold hard rock geology of New Hampshire. The importance of this to emergency planning and response is that damages can be expected to be spread over a much greater area, and an earthquake's location does not have to be close to a particular point to cause damage. (2013 State Multi-Hazard Mitigation Plan)

There are two scales that measure earthquakes, the Modified Mercalli (MM) and the Richter scales. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.[8] The Modified Mercalli scale denotes the intensity of an earthquake, as it is perceived by humans, their reactions and damage created. It is not a mathematically based scale but a ranking of perception. (USGS)

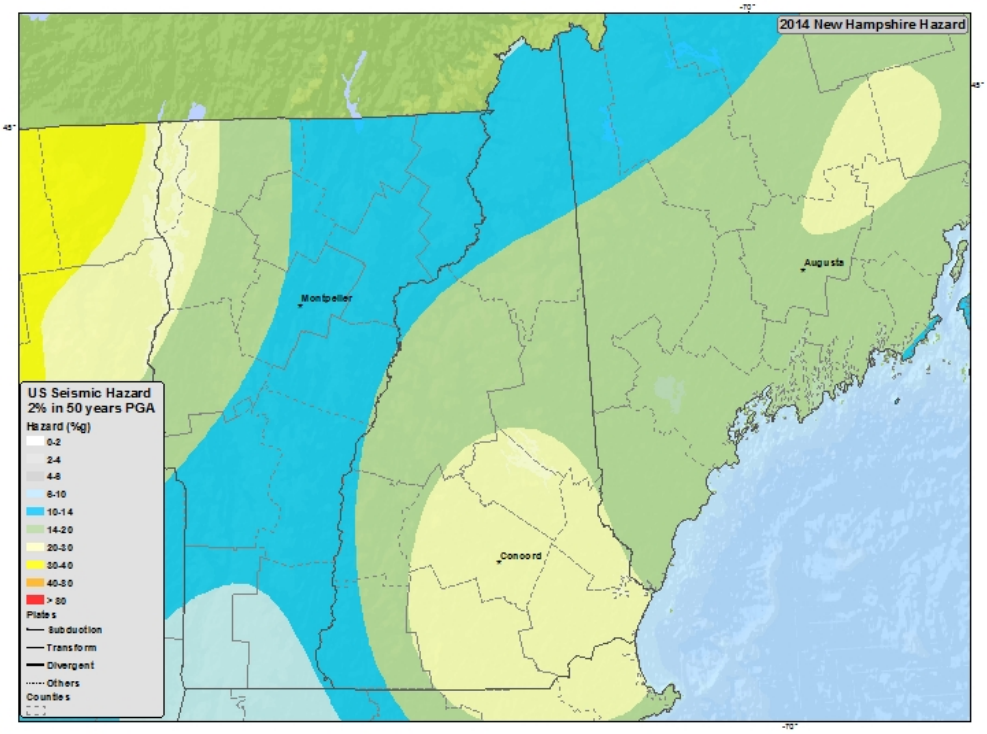
[8] USGS Earthquake Glossary: Richter Scale. Retrieved from https://earthquake.usgs.gov/learn/glossary/?term=Richter%20scale

Modified Mercalli Scale

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: United States Geological Survey (USGS)

2014 Seismic Hazard Map



Source: USGS

One of New England's more notable seismic zones runs from the Ossipee Mountain area of New Hampshire, through the Manchester area, and continues south toward Boston, Massachusetts. This particular area has a mean return time of 408 years for a 6.0 Richter scale earthquake or a 39% probability of occurrence in 200 years. Additionally for a 6.5 Richter scale quake there is a mean return time of 1,060 years or a 17% probability of occurrence in 200 years. (Pulli) When New England is generalized as a whole for earthquake probability estimation, the risk increases from the specific hazard zone noted above. For New England there is an estimated return time of every 10 years for an earthquake with a 4.6 Richter scale magnitude and 1000 years for 7.0 magnitude. (NH BEM 43)

From 1728-1989 there were 270 earthquakes in New Hampshire. This averages to approximately one quake every year. There have been six quakes over 4.0 on the Richter scale during the 1900s. (Ibid 39-42) There have not been any earthquakes since the last Plan update.

All areas of Manchester are potentially at risk for property damage and loss of life due to earthquakes.

Low probability for this hazard to occur and cause significant damage in Manchester

2. Landslides

The Manchester Hazard Mitigation Plan Committee determined that Manchester had zero probability of this hazard to occur; therefore, it has been removed from this plan.

Other Hazards

The Manchester Hazard Mitigation Committee reviewed the following other kinds of hazards:

1. Geomagnetism

The Manchester Hazard Mitigation Plan Committee determined that Manchester had zero probability of this hazard to occur; therefore, it has been removed from this plan.

2. Utility pipe failure

Failure of utility pipe systems, including water, gas and sewer, can be caused by joint leakage, contamination, pipe fracture or tuberculation. Pipe fractures are the most costly and potentially damaging of the failure modes. (Makar 2) Fractures can be caused by blunt force (e.g. construction digging) or ground shifting caused by the natural expansion and contraction of freezing and thawing soil during the winter months or from earthquakes. Pipe blocks in sewer systems can cause a buildup of harmful gasses and lead to explosions. (SCWA)

Potential effects of water main failures can include immediate loss of water supply in the surrounding area, flooding and road collapse. Leaks in gas mains can lead to fires or explosions if there is either an ignition source or pressure built up in the pipe. Explosions occurring in underground pipes can create craters, and possibly result in death, injuries and property damage. Sewer main failures can cause sewage backups and effluent leakage, and exposure to harmful bacteria.

There are approximately 354 miles of sewer, 190 miles of drainage pipe and 505 miles of water mains in Manchester. During the 1970s, shortly after the sewage treatment plant was built, methane gas was trapped inside a sewer system pipe at the plant and caught fire and had the potential to explode. As a result the plant was temporarily shut down and unable to process waste for the City and surrounding towns that utilize the plant. (Manchester Hazard Mitigation Committee)

From 2011 to 2017 there were 190 water main leaks, ranging from 19 to 43 leaks per year. Manchester Water Works main breaks occur at an approximate frequency of .06 breaks per mile compared to the national average of .20 breaks per mile.

All areas of Manchester should be considered at risk for utility system failures. Particular areas of concern include the wastewater treatment plant, sewer pumping stations and the water treatment facility.

Moderate probability for utility system failures to occur and cause damage in Manchester.

3. Drought

A drought is a natural hazard that evolves over months or even years and can last as long as several years to as short as a few months. Fortunately, droughts are rare in New Hampshire. The severity of the drought is gauged by the degree of moisture deficiency, its duration and the size of the area affected. The effect of droughts, or decreased precipitation, is indicated through measurements of soil moisture, groundwater levels, lake levels, stream flow and increased fire danger. Not all of these indicators will be minimal during a particular drought. For example, frequent minor rainstorms can replenish the soil moisture without raising ground water levels or increasing stream flow for a sustained period of time.

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

New Hampshire breaks the State into five Drought Management Areas: one in the north; one across the central region; and three along the southern portion of the State. Federal agencies have coordinated to develop the National Drought Monitor which classifies the duration and severity of the drought using precipitation, stream flow, and soil moisture data coupled with information provided on a weekly basis from local officials. The New Hampshire Drought Management Team, whose efforts are coordinated by the NH DES, utilizes these maps to help determine which areas are hit the hardest. NH DES also maintains a "Situation Summary" where precipitation, stream flow, groundwater level, lake level and fire danger data from all over the state can be accessed to assess if areas in New Hampshire are being impacted by drought.

There are five magnitudes of drought outlined in the New Hampshire State Drought Management Plan. The highest magnitude is Exceptional, followed by Extreme, Severe, Moderate and Abnormally Dry. Each level has varying responses. (2013 State Multi-Hazard Mitigation Plan)

In the past five years, New Hampshire has experienced a significant drought periods. In spring of 2012, New Hampshire experienced a statewide drought. In 2016, southern New Hampshire and Hillsborough County experienced a moderate to severe drought.

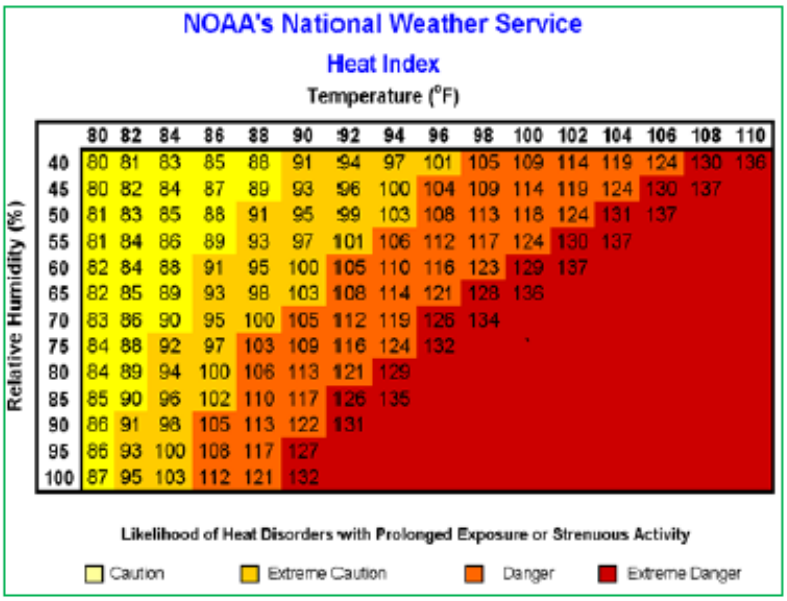
During the drought in 2016, the NH DES had issued a series of statements and tips for homeowner water conservation. As of September 2016, residents and municipalities were requested to voluntarily conserve water. Manchester Water Works (MWW) has a long-term supply of water via Lake Massabesic, which minimizes water scarcity concerns during drought conditions—all of Manchester is currently served by MWW.

All areas of Manchester would be affected by a drought; however, the impacts are minimal given the City water supply service coverage (i.e. no wells). To keep impacts minimal, MWW is exploring water treatment and additional supply opportunities from the Merrimack River, which is susceptible to drought conditions.

Low probability for this hazard to occur and cause significant damage in Manchester

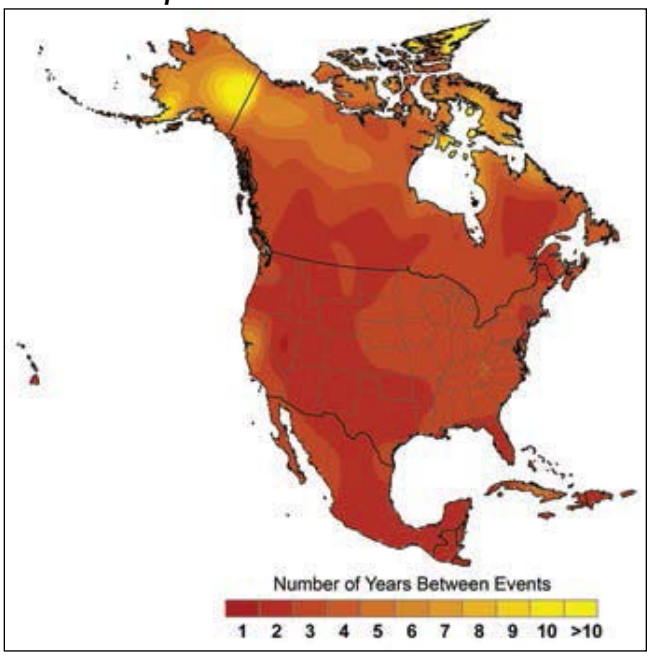
4. Extreme Heat

A Heat Wave is defined as a "Prolonged period of excessive heat, often combined with excessive humidity." 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 a night, which can produce higher nighttime temperatures known as the "urban heat island effect." NOAA's National Weather Service has prepared the following Heat Index identifying likelihood of heat disorders under prolonged exposure or strenuous activity.



Extreme heat is an occasional and short-lived event in Southern New Hampshire. While there have been no extended periods of extreme heat in Manchester, the state has seen a significant increase in mean annual temperature over the past 50 years. By the end of this century, an extreme heat event that currently occurs once every 20 years could occur every two to four years in most parts of the country. This example is based on how the climate is expected to change under a high greenhouse gas emissions scenario.

Projected Number of Years Between Extreme Heat Events in the U.S.



Source: Karl, T.R., J.M. Melillo, and T.C. Peterson (eds.). 2009.
Global Climate Change Impacts in the United States

All areas of Manchester would be affected by extreme heat, in its event. Particular areas and populations at a greater risk are:

- Elderly populations and day care centers;
- Power system that may become overburdened; and
- Communications negatively affected by power burden.

The City experienced Excessive Heat Warnings on July 19, 2013 and July 1, 2018. Additionally, it experienced multiple prolonged Heat Advisories in the summers of 2013, 2016, 2017, and 2018.

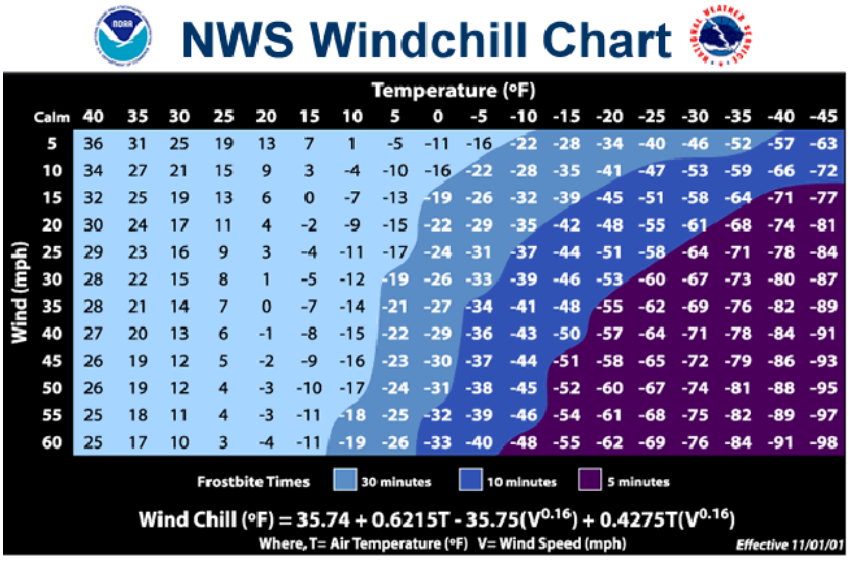
Low probability for this hazard to occur and cause significant damage in Manchester

5. Extreme Cold

Extreme cold in the north means temperatures well below zero degrees Fahrenheit. While most New Hampshire residents are rather habituated to the extreme cold

situations in the State, and this is not a section identified by the State of New Hampshire Natural Hazards Mitigation Plan, it was decided to include a statement in this *Plan*. For the purposes of this *Plan* we will refer to extreme cold in a general manner, without a scientific definition. Periods of extreme cold pose a life-threatening situation for Manchester's homeless and low-income populations. With the rising costs of heating fuel and electric heat, many low-income citizens are not able to adequately heat their homes, exposing themselves to cold related medical emergencies or death. This is an even greater concern for homeless persons who maybe unable to escape the extreme temperatures.

One metric the City of Manchester records to identify extreme cold events are wind chill warnings and advisories. Wind Chill is the term used to describe the rate of heat loss on the human body resulting from the combined effect of low temperature and wind. (National Weather Service) In Manchester, there were Wind Chill Warnings on 2/15/16, 2/16/15, and 2/14/16 There were multiple wind chill advisories



Source: National Weather Service

All areas of Manchester would be affected by extreme cold, in its event. Particular areas and populations at a greater risk are:

- elderly populations and day care centers;
- power system that may become overburdened; and
- homeless and low income populations.

Low probability for this hazard to occur and cause significant damage in Manchester

6. Avalanche

Low probability for this hazard to occur and cause significant damage in Manchester; therefore, it has been omitted from this plan.

7. Large Trees Down Blocking Roads

Low to moderate probability for this hazard to occur and cause significant damage in Manchester

8. Civil Disorder

Low probability for this hazard to occur and cause significant damage in Manchester therefore, it has been omitted from this plan.

9. Terrorism

Low probability for this hazard to occur and cause significant damage in Manchester therefore, it has been omitted from this plan.

10. Radon

Low probability for this hazard to occur and cause significant damage in Manchester therefore, it has been omitted from this plan.

A GIS-generated map was prepared to illustrate the Identified Hazard Zones. This map is included in Appendix I.

SECTION IV
ACCESSING PROBABILITY, SEVERITY, AND RISK

Past and Potential Hazards

The Manchester Hazard Mitigation Committee rated each hazard utilizing the following process.

1. Assigning Low (0 to 33%chance) , Medium (34-66% chance) , or High (67 to 10% chance) values (numerically 1, 2 or 3) to each hazard type for its possible impact to Human, Property, and Business factors (vulnerability). (A score of zero is given if the hazard is considered non-applicable).

2. The same process is used to assign Low (0 to 33% chance), Medium (34-66% chance), or High (34-66% chance) , values (numerically 1, 2, or 3) to each hazard type with respect to the probability that the hazard would occur in the next 25 years

3. The Severity is calculated by determining the average of the Human, Property, and Business impacts.

4. Risk is calculated by multiplying severity by probability.

5. Relative Threat Results: Low, Medium, High risk is assigned as follows:

(0-3.3 – Low) (3.4-6.6 Med) (6.7-10 High)

Hazard Vulnerability Assessment

0-N/A 1-Low 2-Moderate 3-High	Human Impact Probability of death or injury	Property Impact Physical losses and damages	Business Impact Interruption of Service	Probability Likelihood this will occur in 5 years	Severity Avg. of humans/ property business	Relative Threat Severity-x-Probability
Flooding						
Flooding (100-YR)	1	2	2	2	1.67	3.33
Riverine Flooding	1	2	2	2	1.67	3.33
Hurricanes	2	2	2	1	2	2
Debris Impacted Infrastructure	1	2	1	1	1.33	1.33
Erosion/Mudslides	0	0	0	0	0	0
Rapid Snow Pack Melt	1	2	2	2	1.67	3.33
Dam Breach/Failure	3	3	3	1	3	3
Road Wash Out/Culvert Crossings	1	1	3	1	1.67	1.67
Wind						
Hurricanes	2	2	2	1	2	2
Tornadoes/microbursts	3	3	3	1	3	3
Nor'easter	1	1	1	3	1	3
Downbursts	2	2	2	1	2	2
Lighting	3	2	1	3	2	6
Fires						
Wild Land Fires	1	2	1	1	1.33	1.33
Isolated Homes	0	0	0	0	0	0
Ice and Snow Events						
Heavy Snowstorms	1	1	1	3	1	3
Ice Storms	1	2	2	3	1.67	5
Hailstorms	1	1	1	1	1	1
Seismic Events						
Earthquakes	3	3	3	1	3	3
Landslides	0	0	0	0	0	0
Other Hazards						
Geomagnetism	0	0	0	0	0	0
Radon	0	0	0	0	0	0
Drought	1	1	1	1	1	1
Extreme Heat	1	1	1	1	1	1
Extreme Cold	1	1	1	1	1	1
Critical Infrastructure	0	0	0	0	0	0
Arsenic in Wells	0	0	0	0	0	0
Large Trees Down Blocking Roads	1	2	1	1	1.33	1.33
Civil Disorder	1	1	1	1	1	1
Terrorism	3	1	1	1	1.67	1.67

SECTION V
VULNERABILITY ASSESSMENT:
IDENTIFICATION AND ESTIMATION OF LOSS

Disaster Risk and Vulnerability Assessment

The City of Manchester is susceptible to a variety of natural hazards, including flooding, river ice jams, severe winter storms, and hurricanes. The following is an estimate of damage in dollars that may result when a natural hazard occurs in the City.

These estimates were calculated using FEMA's *Understanding Your Risks: Identifying Hazards and Estimating Losses,* August 2001. The publication's methodology was modified for this *Plan* based on the data available. The following calculations used available current or historical data and "Worksheet 4" in the Estimating Losses section of *Understanding Your Risks: Identifying Hazards and Estimating Losses*. Background, historical information, associated risks, and summary of assets considered in the estimation process are described in the following subsections to this chapter.

Human losses were not calculated during this exercise, but could be expected to occur depending on the type and severity of the hazard. The estimates typically represent only structural loss, unless sufficient data was available to incorporate contents, structure use and function loss. The tables below show current valuation of the City of Manchester.[9]

Note: Erosion/Mudslides, Landslides, Geomagnetism, Isolated Homes, and Arsenic in Wells were identified as a zero risk factor by the Manchester Hazard Mitigation Committee and, therefore, removed from the risk assessment valuation process.

	2009 Assessed Valuation		
Land Use Classification	**Land**	**Buildings**	**Total**
Current Use	$ 74,000	$ -	$ 74,000
Residential	$ 2,170,757,752	$ 4,306,853,827	$ 6,477,611,579
Manufactured Housing	$ -	$ 3,159,700	$ 3,159,700
Commercial/Industrial	$ 743,872,248	$ 2,662,199,473	$ 3,406,071,721
Utilities	$ -	$ -	$ 154,839,300
		Total Gross Assessed Valuation	**$ 10,041,756,300**

[9] From the NH Department of Revenue Administration, "2009 Property Tax Tables by County"

Flooding **$3.3 million – $12.3 million**

As of the most recent FEMA biennial report, the City of Manchester had 254 residential structures and 343 other structures located in the floodplain. The median citywide residential house price is $192,000[10] (NHHFA). Two scenarios were considered for residential losses with a low estimate assuming damage to 25% of the structures with a one-foot flood depth and a high estimate assuming damage to 50% of with a four-foot flood depth. These estimates also assume the residential structures are one- or two-story homes with basements. Standard values for percent damage, functional downtime and displacement time were used from FEMA's *Understanding Your Risks: Identifying Hazards and Estimating Losses* and its "Worksheet 4- Estimate Losses" was used to determine the actual estimates.

The low estimate was $1,828,800 in structural damages, $1,371,600 in contents loss, and $137,953 in structure use and function loss. The total low estimate loss was $3,338,353. The high estimate was $6,827,520 in structural damages, $5,120,640 in contents loss, and $342,913 in structure use and function loss. The total high estimate loss was $12,291,073.

Infrastructure damage could also be extensive, including roads, bridges, utilities, towers, etc. If a major devastating flood were to occur, the damage to properties located within the floodplain could be expected to exceed this estimated amount. The cost-benefit ratio for these items makes it clear that Manchester will benefit greatly from any flood mitigation measures that will help to reduce the losses that typically occur during a major flood event.

Hurricanes **up to $100 million**

Most of the damage from hurricanes is caused by high water and strong winds. However, less damage could be expected to occur in Manchester, which is located inland, than in a more vulnerable coastal area. Assuming a community-wide assessed structural valuation adjusted to market value of approximately $10 billion, damaging 1% of these structures could result in losses of up to $100 million. This does not include other damages expected to occur on public property within the community.

Debris-Impacted Infrastructure and River Ice Jams **$10,000 to $5 million**

Damage from these two hazards could be expected to occur not only to privately owned structures, but also to infrastructure such as roads, bridges and culverts. An estimate of damage, in dollars, from this type of hazard can range widely depending on the nature and severity of the hazard. Past debris-impacted infrastructure, in Manchester, occurred as a secondary effect of riverine flooding. Therefore, it is difficult to separate actual damages to represent this type of hazard. A small-to-medium-sized event could be expected to produce a loss from $10,000 to $5 million.

[10] NHHFA Purchase Price Trends, An average of all single and multi-family structures sold from January 2009 through July 2009

Rapid Snowpack Melt **up to $6.9 million**

Rapid snowpack melt damage usually affects infrastructure such as roads and bridges, but can also affect individual structures and businesses. The inventory of essential facilities located in the areas of steep slopes was used to prepare an estimate of this type of damage, since a complete inventory was not available. There are no value estimates for the 8 cell towers, 7 sewer pumps, 11 outfalls, 5 dams and 8 bridges that would be vulnerable to these hazards. However, data is available for the remaining structures in the hazard zone. For a moderate event, assuming from 1% to 5% structural damages, and from .5% to 2.5% content loss, damages could be expected between $1.4 million and $6.9 million. Since this hazard has not been widespread in Manchester, damages from this hazard should be minimal.

Dam Breach or Failure **$660,000 to $8,610,000**

Manchester has one class S dam that could cause serious failure damage. The Amoskeag Dam, in north Manchester on the Merrimack River, also poses a substantial threat to shorelines and adjacent land to the Merrimack and Piscataquog rivers, if the dam should breach or fail. The Massabesic Lake Dam is in a less developed area of Manchester, thus, less fiscal damage is expected. A map produced by Public Service of New Hampshire in 1999 shows the probable extent of inundation waters if the Amoskeag dam does breach or fail. Damage estimates could be expected to be from 20-70% of the flooding estimate, or $2,460,000 to $8,610,000.

Water Retention Facility Failure **$52,572 to $967,801**

Minimal information is available on the fiscal impacts of this type of event. Damages would vary depending on which of the three water towers, one reservoir or one retention basin failed and given the surrounding environment. One past event in Manchester involved basement flooding at a junior high school due to retention basin failure. Damages were estimated at $200,000. Otherwise, damages could be expected to impact from 1 to 20 houses, depending on the surrounding residential density. Assuming basement flooding equal to one foot below the first floor elevation, structural and contents damages could amount to $52,572 to $967,801.

Tornados **$500,000 to $15 million**

The Fujita Scale is used to determine the intensity of tornados. Most tornados are in the F0 to F2 Class, in a range that extends to F5 Class. Building to modern wind standards provides significant property protection from tornados. New Hampshire is located within Zone 2 for Design Wind Speed for Community Shelters, which is 160 mph. While it is difficult to assess the monetary impact a tornado may have on a community, as there are no existing standard loss estimation models, the dollar range shown above indicates an approximation of what might be expected. Tornados rarely occur in this part of the country, so damage from this hazard would be uncommon.

Nor'easters, Ice Storms, Heavy Snowstorms **$10,000 to $3 million**

Damage from nor'easters and ice storms vary greatly depending on the amount of snow and ice that accumulates during the storm. The ice storm of 1998 and 2008 caused much damage to power lines, structures and the agricultural economy in northern New England. These types of storms in Manchester could be expected to cause damage ranging from a few thousand dollars to several million, depending on the severity of the storm.

Lightning **$900 - $15,000**

Damage from lightning is typically minimal and occurs in isolated events without record of actual costs incurred. From 1997 to 2003 the City of Manchester sustained damage to two Fire Department facilities, one Highway Department facility, one Traffic Department facility, and one Water Works facility. Damages from these five events totaled $29,688.79, ranging from $918.60 to $14,678.87, an average of $5,937.76 per event.

Urban Fires, Wild Land & Urban-Wild Land Fires **$9,948 - $17,210,539**

A fire can strike at any time, but may be expected to occur during years of drought and particularly in the spring and fall months. The City of Manchester experienced $17,210,539 in property loss from fires between 2013 and 2017. The fire department responded to 300 wild land fires, 678 structure fires, and 752 fires involving vehicles, rubbish and other non-structural fires according to the City of Manchester Fire Department fire data. That is an average of $9,948 per event. Other damage—such as to utilities—was not included in these estimates.

Earthquakes **up to $45.8 million**

Assuming a moderate earthquake occurs in Manchester, where structures are not built to a high seismic design level and are mostly of wood frame construction, it is estimated that about 1% to 5% of the community-wide assessed structural valuation could be lost, including both partial and total damage.

This estimate used "Worksheet 4" and an inventory based on city wide assessed valuation of residential, commercial and industrial structures. The damage estimates for Manchester are based on a peak ground acceleration (PGA) of .07g. This represents an earthquake with a 10% probability of reoccurring in 50 years. Additionally, the estimate assumed low seismic design for all structures. This calculation yields $13,253,174 in structural damages, $4,289,626 in contents damages and $28,264,909 in structure use loss for a total estimate of $45,807,710 in damages.

Utility Pipe Failure **$3,000 to $170,000**

Information on water main failures is only available for damages incurred to city property. From 2011 to 2017 there was an average of 27.1 water main failures per year, ranging from 19 to 43. Typical repairs cost approximately $5,000 to $8,000 per event with the greatest share of cost from road repair and resurfacing.

Extreme Heat/Cold **$2,500**

Extreme heat and extreme cold weather events require the Manchester Health Department to setup shelters. These require staff and resource support, mainly for cooling station when hot, or blankets and other materials when cold. The City estimates this costs $2,500 per weather event, and that greater frequency of extreme temperature events is threatening to add up.

Downbursts, Hailstorms, and Drought

No major damage is known to have occurred in the City of Manchester related to these types of events. Therefore, no potential loss estimates have been prepared for these categories.

Note: The above figures are estimates only. The amount of damage from any hazard will vary from these figures depending on the time of occurrence, severity of impact, weather conditions, population density and building construction at the exact event local, and the triggering of secondary events.

Critical Facilities

The following are summary tables of the critical facilities located in each of the five identified hazard zones within the City. For the purposes of this *Plan* a critical facility is defined as a building, structure or location which:

- Is vital to the hazard response effort;
- Maintains an existing level of protection from hazards for the City; and
- Would create a secondary disaster if a hazard were to impact it.

These summaries were queried from a database of all essential facilities created for this *Plan*. The Hazard Mitigation Committee, based on its knowledge of the City, and SNHPC, using various directories, were the primary sources for the Critical Facilities listing. The 2009 assessed values presented are the total building value and total building plus land value, they do not include the cost of building contents.

The five identified hazard zones are:

- **City Wide Hazards-** includes wind damage from hurricanes, tornados, nor'easters, downbursts, lightning, heavy snow, ice storms, hailstorms, earthquakes, geomagnetism, utility pipe failure, drought, or extreme heat/cold.
- **Special flood hazard areas**- includes riverine flooding, hurricanes, debris impacted infrastructure, ice jams, rapid snowpack melt, or dam breach.
- **Steep Slopes-** includes erosion, mudslides or landslides.
- **Urban Fire Prone Locations-** includes urban fire hazards.
- **Wild Land and Urban-Wild Land Interface**- includes wild land fires and fires at the urban-wild land interface.

Summary of Critical Facilities by Hazard Zones			
Hazard Zone	**Number of Facilities**	**Building Value**	**Total Value (Land and Building)**
City Wide	86	$629,486,000	$787,552,900
Special Flood Hazard Zones	3	$82,420,800	$85,806,000
Steep Slopes Areas	5	$54,528,600	$72,000,600
Urban Fires	43	$384,892,000	$434,356,900
Wild Land & Urban-Wild Land Interface Fires	6	$22,900,400	$49,659,500

City Wide Hazards (Summary of all Critical Facilities)			
Facility Type	**No. of Facilities**	**Building Value**	**Total Value (Land & Building**
Airport	2	$0	$171,300
Ambulance	1	$480,700	$610,300
City Office	13	$69,118,900	$86,640,000
County Offices	1	$7,827,200	$7,990,600
Emergency Fuel Facilities	19	$123,470,000	$150,026,200
Emergency Operations Center	2	$5,267,000	$5,759,900
Emergency Shelter	15	$170,298,300	$193,872,500
Federal Offices	5	$61,660,200	$101,630,900
Fire Station	10	$7,126,300	$10,233,300
Hospital	3	$94,858,800	$112,251,000
Military	1	$10,660,300	$12,152,100
Police Station	1	$2,900,900	$3,004,000
Post Office	3	$12,154,100	$21,453,800
Public Water System	1	$1,925,500	$2,328,100
Public Works Garages	5	$13,570,800	$18,844,500
Water Pump Station	2	$320,600	$2,032,800
Water/Sewer Treatment Plant	2	$47,846,400	$58,551,600

Special Flood Hazard Areas			
Facility Type	**No. of Facilities**	**Building Value**	**Total Value (Land & Building)**
City Office	1	$41,051,300	$42,699,000
Water Pump Station	1	$318,200	$408,000
Water/Sewer Treatment Plant	1	$41,051,300	$42,699,000

Steep Slopes			
Facility Type	**No. of Facilities**	**Building Value**	**Total Value (Land & Building)**
City Office	1	$2,214,600	$5,664,900
Emergency Fuel Facilities	3	$43,221,200	$55,139,900
Emergency Shelter	1	$9,092,800	$11,195,800

Urban Fire Hazard Zone			
Facility Type	**No. of Facilities**	**Building Value**	**Total Value (Land & Building)**
City Offices	6	$ 5,788,300	$ 7,556,527
County Offices	1	$ 5,392,900	$ 7,040,339
Federal Offices	4	$ 8,847,400	$ 11,550,131
Police Station	1	$ 1,832,700	$ 2,392,559
Fire Stations	3	$ 1,092,700	$ 1,426,501
Military Stations	1	$ 4,731,900	$ 6,177,415
Emergency Operations Center	1	$ 2,881,600	$ 3,761,880
Public Works Garages	1	$ 954,300	$ 1,245,822
Hospitals	2	$ 85,945,400	$ 112,200,261
Ambulances	1	$ 254,900	$ 332,768
Emergency Shelters	8	NA	NA
Wireless Communication Facilities	1	NA	NA
Public Water Systems	1	$ 1,069,600	$ 1,396,345

Wild Land and Urban-Wild Land Interface Fire Hazard Zones			
Facility Type	**No. of Facilities**	**Building Value**	**Total Value (Land & Building)**
Ambulance	1	$480,700	$610,300
City Office	8	$18,935,100	$21,824,000
County Offices	1	$7,827,200	$7,990,600
Emergency Fuel Facilities	9	$89,806,200	$104,107,800
Emergency Operations Center	2	$5,267,000	$5,759,900

Areas at Risk

Manchester's Hazard Mitigation Committee has developed a Critical Facilities List identifying Areas at Risk into four categories:

1. The first category contains facilities needed for Emergency Response in the event of a disaster.
2. The second category contains Non-Emergency Response Facilities that have been identified by the Committee as non-essential. These are not required in an emergency response event, but are considered essential for the everyday operation of Manchester.
3. The third category contains Facilities/Populations that the Committee wishes to protect in the event of a disaster.
4. The fourth category contains Potential Resources, which can provide services or supplies in the event of a disaster.

Category 1 - Emergency Response Services:

The City has identified the Emergency Response Facilities and Services as the highest priority in regards to protection from natural and man-made hazards.

1. **Emergency Operations Center / Fire Station**
    a. Manchester Fire Department - 100 Merrimack Street
    b. Manchester Boston Regional Airport Fire Department - 402 Kelly Ave
2. **Police Station**
    a. Manchester Police Department - 405 Valley Street
3. **Primary Evacuation Routes**
4. **Bridges Located on Primary Evacuation Routes**
    a. Queen City Bridge
    b. Amoskeag Bridge
    c. Granite St. Bridge
    d. Notre Dame Bridge (Bridge St.)
5. **Power stations, sub-stations, transmission lines**
6. **Telephone facilities, transmission lines and cell towers**
7. **Hospitals**
    a. Elliot Hospital – 1 Elliot Way
    b. Veteran's Affairs Medical Center – 718 Smyth Road
    c. Catholic Medical Center – 100 McGregor Street
8. **Helicopter Landing Sites**
    a. Elliot Hospital – 1 Elliot Way
    b. Veteran's Affairs Medical Center – 718 Smyth Road

c. Manchester – Boston Regional Airport – 1 airport road
d. Catholic Medical Center – 100 McGregor Street

9. Schools

a. Bakersville School – 20 Elm St.
b. Beech Street School Community Center – 333 Beech St.
c. Central High School – 207 Lowell St.
d. Gossler Park Elementary School – 145 Parkside Ave.
e. Granite State College – 195 McGregor St.
f. Green Acres Elementary School – 100 Aurore Ave.
g. Franklin Pierce University – 670 North Commercial St.
h. Hallsville Elementary School – 275 Jewett St.
i. Highland-Goffe's Falls – 2021 Goffs Falls Rd.
j. Hillside Middle School – 112 Reservoir Ave.
k. Jewett Street School – 130 S. Jewett St.
l. Massachusetts College of Pharmacology & Health Sciences – 1260 Elm St.
m. Mcdonough Elementary School – 550 Lowell St.
n. Mclaughlin Middle School – 290 South Mammoth Rd.
o. Memorial High School – 1 Crusader Way
p. Manchester School of Technology – 530 S. Porter St.
q. New Hampshire Institute of Art – 148 Concord St.
r. Northwest Elementary School – 300 Youville St.
s. Parker-Varney Elementary School – 223 James A. Pollock Dr.
t. Parkside Middle School – 75 Parkside Ave.
u. Smyth Ride School – 245 Bruce Rd.
v. Southern New Hampshire University – 2500 N. River Rd.
w. Southside Middle School – 140 S. Jewett St.
x. Springfield College School of Human Services – 500 Commercial St.
y. St. Anselm College – 100 Anselm Dr.
z. University of New Hampshire at Manchester – 88 Commercial St.
aa. Webster Elementary School – 2519 Elm St.
bb. West High School – 9 Notre Dame Ave.
cc. Weston School – 1066 Hanover St.
dd. Wilson Elementary School – 401 Wilson St.

<u>Category 2 - Non Emergency Response Facilities:</u>

The city has identified these facilities as non-emergency facilities; however, they are considered essential for the everyday operation of Manchester.

1. Facilities

a. Victory Parking Garage – 25 Vine St.
b. Plaza Garage (2) – Plaza Dr.
c. 900 Elm St. Garage – 900 Elm St.
d. Center of NH Garage – Granite St.
e. Foundry Parking Deck – 80 Commercial St.

f. Anthem Garage – Kosciusko St.
g. CMC Garage – McGregor St.
h. FKA 'Citizens Bank Garage' – 875 Elm St.
i. Elliot at Rivers Edge – Queen City Ave
j. Approved SNHU Garage – S. Commercial St.
k. Elliot Hospital – 1 Elliot Way
l. Airport Parking Garage – 1 Airport Rd.

2. **Public Water System**
   a. City of Manchester Water Works -281 Lincoln St**.**
3. **Solid Waste Treatment Plant**
   a. Drop Off Facility – 500 Dunbarton Rd.
4. **Transfer Station**
   a. Manchester Transfer Station – 500 Dunbarton Rd.
5. **Telephone Facilities**
6. **Post Office**
   a. U.S. Postal Service – 1000 Elm St.
   b. U.S. Postal Service – 955 Goffs Falls Rd.

Category 3 - Facilities/Populations to Protect:

The third category contains people and facilities that need to be protected in event of a disaster.

1. **Annual Events** – visit www.manchesternh.gov for a full list
2. **School/Daycare** – visit www.mansd.org for a full list
3. **Gathering Places**
4. **Historic Buildings/Sites**
5. **Religious Facilities**
6. **Major Employers**
   a. Elliot Hospital – 1 Elliot Way
   b. Catholic Medical Center – 100 McGregor Street
   c. Southern NH University – 1250 Elm St and 33 S. Commercial
   d. Eversource Energy – 780 N. Commercial St.
   e. Fairpoint Communications – 770 Elm St.
   f. Comcast – Industrial Ave
   g. TD Bank – Multiple Locations
   h. Citizens Bank – Multiple Locations
   i. St. Anselm College – 100 Saint Anselm Drive
   j. Anthem Blue Cross & Blue Shield – 1155 Elm Street
   k. AutoFair – Multiple locations
   l. Oracle-Dyn – 150 Dow Street
   m. PillPack – 250 Commercial St
7. **Natural Assets**
8. **Hazardous Sites**

9. **Recreational Facilities**
   a. Adam Curtis Skate Park – 275 Maple st.

b. Derryfield Country Club – 625 Mammoth rd.
c. Gill Stadium – 396 Valley st.
d. JFK Memorial Coliseum – 303 Beech st.
e. Manchester dog park – 344 Second St.
f. Mcintyre Ski Area – 50 Chalet Way
g. Regis Lemaire Youth Center – 275 Maple St.
h. The Hollows Disc Golf Course – 178 W. Mitchell St.
i. West Side Ice Arena – 1 Electric st.

10. Dams

a. Amoskeag Dam
b. Massabesic Lake Dam
c. Piscataquog River Dam

Category 4 - Potential Resources:

Category 4 contains facilities that provide potential resources for services or supplies.

1. **Medical Supplies**
2 **Gas/Fuel**
3. **Emergency Power Source**
4. **Building Materials**

Commercial Economic Impact Areas

The following is a summary table of the commercial-economic impact areas located in each of the four identified hazard zones within the City. For the purposes of this *Plan*, a commercial economic impact area includes organizations and businesses with more than 25 employees. These are facilities that are vital to the community's economic well-being.

This summary was queried from a database of all essential facilities created for this *Plan*. The Commercial land uses included were taken from a GIS data layer of City parcels maintained by Manchester Information Systems.

The five identified hazard zones are:

- **City Wide Hazards-** includes wind damage from hurricanes, tornados, nor'easters, downbursts, lightning, heavy snow, ice storms, hailstorms, earthquakes, geomagnetism, utility pipe failure, drought, or extreme heat/cold.
- **Special flood hazard areas**- includes riverine flooding, hurricanes, debris impacted infrastructure, ice jams, rapid snowpack melt, or dam breach.
- **Steep Slopes-** includes erosion, mudslides or landslides.
- **Urban Fire Prone Locations-** includes urban fire hazards.
- **Wild Land and Urban-Wild Land Interface**- includes wild land fires and fires at the urban-wild land interface.

Commercial Economic Impact Areas		
Hazard Zone	**Number of Facilities**	**Building Value**
CityWide	916	$740,376,000
Special Flood Hazard Zones	47	$27,393,100
Steep Slope Areas	24	$9,270,600
Urban Fires	503	$246,414,700
Wild Land & Urban-Wild Land Interface Fires	29	$20,536,900

Hazardous Materials Facilities

The following is a summary table of the hazardous materials facilities located in each of the four identified hazard zones within the City. For the purposes of this *Plan*, hazardous materials facilities include active hazardous waste generators, underground storage tanks, and above-ground storage tanks. As defined by the N.H. Department of Environmental Services, active hazardous waste generators may include businesses that produce household hazardous waste, or treat, store or dispose of hazardous waste, or be a waste handler or used oil marketer.

This summary was queried from a database of all essential facilities created for this *Plan*. The listing of Hazardous Materials Facilities was created from the NH Department of Environmental Services GIS data layers for hazardous waste generators, above ground and underground storage tanks.

The five identified hazard zones are:

- **City Wide Hazards-** includes wind damage from hurricanes, tornados, nor'easters, downbursts, lightning, heavy snow, ice storms, hailstorms, earthquakes, geomagnetism, utility pipe failure, drought, or extreme heat/cold.
- **Special flood hazard areas**- includes riverine flooding, hurricanes, debris impacted infrastructure, ice jams, rapid snowpack melt, or dam breach.
- **Steep Slopes-** includes erosion, mudslides or landslides.
- **Urban Fire Prone Locations-** includes urban fire hazards.
- **Wild Land and Urban-Wild Land Interface**- includes wild land fires and fires at the urban-wild land interface.

Number of Hazardous Material Facilities within the Hazard Zones			
Hazard Zone	**Hazardous Waste Generators**	**Above Ground Storage Tank Sites**	**Underground Storage Tank Sites**
City Wide	535	53	340
Special Flood Hazard Zones	44	4	18
Steep Slope Areas	11	7	9
Urban Fires	207	14	137
Wild Land & Urban-Wild Land Interface Fires	62	5	20

SECTION VI
EXISTING MITIGATION STRATEGIES AND PROPOSED IMPROVEMENTS

Examples of Programs for Hazard Categories

Flooding

- Best Management Practices (BMP's)
- Communication Division: Dispatch Center Radio System
- Emergency Back-up Power Service
- Emergency Operations Plan
- Floodplain Conservation District
- Groundwater Protection District (Zoning Ordinance)
- Manchester School District Emergency Evacuation and Notification Plan
- National Flood Insurance Program
- New Hampshire Shoreland Protection Act
- River Stewardship
- Southeast NH Hazard Materials Mutual Aid
- State Dam Program
- Storm Drain Maintenance
- Stormwater Management Program
- City-Adopted Building Code
- Weekly Culvert Inspection (informal) especially during heavy beaver activity periods
- Wellhead/Aquifer Monitoring Program
- Wetland Conservation District (Zoning Ordinance)

Severe Wind (includes Tornadoes & Hurricanes)

- Best Management Practices (BMP's)
- Manchester School District Emergency Evacuation and Notification Plan
- Communication Division: Dispatch Center Radio System
- Emergency Back-up Power Service
- Emergency Operations Plan
- Fire Codes, Fire Prevention
- Southeast NH Hazard Materials Mutual Aid
- State Dam Program

Debris Impacted Infrastructure

- Communication Division: Dispatch Center Radio System
- Emergency Operations Plan
- River Stewardship
- Southeast NH Hazard Materials Mutual Aid

- State Dam Program
- Storm Drain Maintenance

Ice & Snow Events
- Best Management Practices (BMP's)
- Manchester School District Emergency Evacuation and Notification Plan
- Communication Division: Dispatch Center Radio System
- Emergency Back-up Power Service
- Emergency Operations Plan
- Emergency Snow Removal
- Southeast NH Hazard Materials Mutual Aid
- State Dam Program
- Road Design Standards (Regulations)
- Storm Drain Maintenance
- City-Adopted Building Code
- Winter Parking and Placing Snow or Ice In Highway Ordinances

Dam Breach or Failure
- Communication Division: Dispatch Center Radio System
- Emergency Operations Plan
- State Dam Program

Wildfire
- Best Management Practices (BMP's)
- Communication Division: Dispatch Center Radio System
- Emergency Back-up Power Service
- Emergency Operations Plan
- Fire Codes, Fire Prevention
- Southeast NH Hazard Materials Mutual Aid
- Storm Drain Maintenance
- City-Adopted Building Code
- Force Fire Towers

Landslide/Erosion
- Best Management Practices
- Communication Division: Dispatch Center Radio System
- Road Design Standards (Regulations)
- River Stewardship Program
- Wetland Conservation District (Zoning Ordinance)

Earthquake
- Manchester School District Emergency Evacuation and Notification Plan

- Communication Division: Dispatch Center Radio System
- Emergency Back-up Power Service
- Emergency Operations Plan
- Fire Codes, Fire Prevention
- Mobile/Manufactured Homes Regulations
- Southeast NH Hazard Materials Mutual Aid
- State Dam Program
- City-Adopted Building Code

Lightning, Drought, Extreme Temperatures, Hail
- Communication Division: Dispatch Center Radio System
- Emergency Back-up Power Service
- Fire Codes, Fire Prevention
- Installation of Lightning Rods and Grounding Devices

Man-Made Hazards
- Manchester School District Emergency Evacuation and Notification Plan
- Manchester Fire Dept Regulations for Sprinkler Systems
- Communication Division: Dispatch Center Radio System
- Emergency Operations Plan
- Fair Share Contribution
- Fire Codes, Fire Prevention
- Groundwater Protection District
- Law Enforcement
- Road Design Standards (Regulations)
- Sanitary Protection Requirements (Zoning Ordinance)
- State Wellhead/Aquifer Monitoring Program
- Southeast NH Hazard Materials Mutual Aid
- Wellhead/Aquifer Monitoring Program

Description of Existing Programs

The City of Manchester has adopted several programs and ordinances for hazard mitigation. Below are brief descriptions of these programs and how they aid in hazard mitigation.

Emergency Operations Plan
Manchester maintains an Emergency Operations Plan. The latest update of this plan was conducted during 2015. The plan coordinates the City Departments' actions and responses before, during and after emergency operations. Events planned for range from flooding and snowstorms to downed aircrafts and nuclear attack. The plan was prepared to conform to guidelines by the Federal

Emergency Management Agency, U.S. Nuclear Regulatory Commission, Federal Energy Regulatory Commission, the New Hampshire Emergency Management Agency and the NH Emergency Management Plan. The plan establishes the Emergency Operations Center (at the Central Fire Station). The EOC provides room for staff meetings, communication between departments and agencies, and media relations. The Emergency Operations Plan procedures addresses evacuation procedures, emergency notification, and evacuation routes to be taken. Additionally, it includes a Terrorism Assessment, a HazMat annex, and decontamination annex.

Floodplain District (Zoning Ordinance & Subdivision and Site Plan Regulations)
Floodplain District regulations apply to all lands designated as special flood hazard areas by FEMA in its *Flood Insurance Study for the City of Manchester, N.H.* and Digital Flood Insurance Rate Maps dated September 25, 2009. Encroachments, including fill, new construction, substantial improvements to existing structures, and other development are prohibited unless certification by a registered professional engineer is provided by the applicant demonstrating that such encroachment will not result in any increase in flood levels during the occurrence of the 100 year base flood. The Building Commissioner shall review all building permit applications for new construction or substantial improvements to determine whether proposed building sites will be reasonably safe from flooding.

Elevation Certificates
An Elevation Certificate is required when (1) a structure is built or substantially improved within a known flood zone, or (2) if the flood map shows a part of the lot within the flood zone and the certified foundation plan shows the house is located within the flood zone. The land surveyor must supply the footing elevation.

Wetlands Regulations (Zoning Ordinance)
A twenty-five (25) foot setback shall be maintained from proposed buildings, structures and parking lots, or enlargements thereof, to any wetland within the State Statutory jurisdiction of the NH Department of Environmental Services. Such setback shall not apply to wetlands, or portions thereof, which have been approved for filling by the NH Department of Environmental Services. In addition, no on-site subsurface disposal system or any part thereof shall be constructed or enlarged within one hundred twenty-five (125) feet of a wetland.

Airport Overlay Districts (Zoning Ordinance)
Three overlay districts are established in the Zoning Ordinance to mitigate potential disasters related to the operation of the airport. The first is the Navigational Hazard Overlay that regulates against the creation of any potential

obstructions to aerial approach, radio system functioning, and visibility. The zone is defined as all areas within a 100,000-foot radius of the Manchester airport control tower. The Approach Overlay limits the height of buildings structures, trees or other potential obstructions to 30 feet in the designated airspace for take-off and landing. The Noise Overlay District identifies and precludes development of uses incompatible with airport noise and requires soundproofing for any compatible new development.

Manufactured Housing (Zoning Ordinance)
Regulations are established to provide suitable and affordable living environments in manufactured home parks and subdivisions. Minimum standards are set regulating required utilities, construction and installation methods, and foundations in order to protect the occupants and reduce the homes' vulnerability to natural disasters.

Excavation Regulations (Zoning Ordinance & Subdivision & Site Plan Regulations)
Excavation Regulations minimize safety hazards created by open excavations; safeguard the public health and welfare; preserve the natural assets of soil, water, forests, and wildlife; maintain aesthetic features of the environment; prevent land and water pollution; and promote soil stabilization.

Steep Slopes (Zoning Ordinance, Subdivision and Site Plan Regulations)
The Zoning Ordinance excludes land with slopes over 25% in determining buildable land area and useable open space. The design criteria of the Subdivision and Site Plan Regulations indicate that proposed lots with steep slopes in excess of 25% may limit the suitability of the land for building development.

Road Design Standards (Subdivision and Site Plan Regulations)
Manchester maintains road design regulations as part of the City's Subdivision Regulations. These regulations assure "safe and convenient access" to all associated lots and set engineering standards to maintain adequate visibility and safety.

City of Manchester Standard Specifications for Road, Drain & Sewer Construction
Standard Specifications, maintained by the Highway Department, set forth regulations for sanitary, health and safety provisions that ensure public convenience and safety. General provisions and technical specifications regulate environmental protection, erosion control, storm water runoff and drainage, protection of existing and continuation of utility systems, material control, waste disposal, engineering and design standards, and traffic flow.

Snow Emergency Ordinance (Chapter 71, City Code of Ordinances)
The Snow Emergency Ordinance allows the Public Works Director to declare snow emergencies triggering parking bans on all listed snow emergency routes to expedite the flow of traffic and snow removal. Additionally, the ordinance sets winter parking restrictions limiting parking to one side of the street for all City streets to maintain necessary road widths, traffic flow and ease of snow removal and maintenance.

Manchester Building Codes (Chapter 151, City Code of Ordinances)
The Building Regulations Division of the Planning and Community Development Department enforces at a minimum the provisions of the New Hampshire State Building Code, as amended, consisting of the 2009 editions of the International Building Code, the International Plumbing Code, the International Mechanical Code, the International Energy Conservation Code, the International Residential Code and the 2017 edition of the National Electrical Code. Where conflicting with locally adopted codes, the stricter standards apply. Building codes set minimum standards to safeguard the public health, safety and general welfare of occupants utilizing structural, fire and life safety provisions, wind loads and design, seismic design, flood proofing and egress design.

Manchester Housing Code (Chapter 150, City Code of Ordinances)
"The Housing Code Ordinance was established to ensure that all residential rental properties in the City of Manchester meet or exceed minimum standards… One item of particular importance is the need for hard-wired smoke detectors. As of January, 2000 all smoke detectors in residential rental property must be powered by the house current, wired in accordance with the electrical code (Manchester Building Department)." Additionally, the housing code delineates standards ensuring proper ventilation, fire prevention, fuel tank storage, safety and sanitation, and the provision of utilities including water, sewer, heat and electricity.

Fire Codes, Fire Prevention (Chapter 92.05, City Code of Ordinances)
This chapter of the Code of Ordinances adopts the International Fire Code, 2006 edition, INCLUDING Appendix Chapters B, C, D, F, and G, and its provisions to protect residents from fire hazards in residential and non-residential facilities. Additionally, emergency fire lanes are designated, fire alarm system is established along with its maintenance, and hazardous materials regulations. Provisions are created for EMS, Ambulance, Air Medical Response, and general rescue services.

Manchester Fire Dept Regulations for Fixed Fire Protection Systems
These rules compliment the Housing and Building codes by establishing further minimum fire protection standards and specifications for sprinkler systems, clean agent systems, and commercial cooking suppression systems.

Safety Compliance Standards
The Safety Compliance Standards are a set of minimum criteria to reduce the potential of urban and wild land fires through the regulation of outdoor cooking, live Christmas trees, open fires within City limits, egress doors, fire alarm resetting and pyrotechnic sales.

Hazmat/Terrorism Response
The City of Manchester's Fire Department is responsible for Hazmat training and response and does so from the Central Fire Station at 100 Merrimack St. The program has purchased "specialized response equipment" and implemented "an advanced hazardous material technician training program (Manchester Fire Department "Bio-Terrorism Hazmat Training)." The program covers chemical, biological, and nuclear agents and their properties, effects and identification methodology. Within the Police Department is a Special Reaction Team which is also organized to respond to acts of terrorism.

Communication Division: Fire Dispatch Center and Radio System
The Communication Center, located at the Central Fire Department and Emergency Operation Center, operates the Fire Dispatch Center, a municipal fire alarm system composed of at least 700 fireboxes and 300 miles of wire, public address systems, sirens, emergency notification devises, traffic control emitters, test equipment, intercoms, video surveillance equipment, two-way radios, and radios for all departments. The Fire Dispatch Center has nine full time dispatchers, with a minimum of two on duty at all times. The dispatch center sends the closest fire truck and ambulances to the site of a call. The City utilizes an eleven channel 800 MHz trunked radio system shared by fire, police, EMS and Public Works.

Police (Chapter 31, City of Manchester Code of Ordinances)
The Chief of Police is charged with preserving public peace, preventing riots and disorder. During fires the police are to prevent theft and further unwarranted destruction of property. The police department operates a dispatch center separate from the fire and EMS center.

Water Ordinances (Chapter 51, City of Manchester Code of Ordinances)
Regulations are established for water usage and the responsibility for maintenance of water related infrastructure designated to the property owner.

These regulations aim to prevent damage to or tampering with public pipes, reservoirs or other Water Works property.

Manchester Water Works Emergency Operations Manual
This manual establishes an action plan for the department and its employees in the event of a natural or man-made disaster. Specific response plans are outlined for each hazard type as it pertains to the individual Water Works divisions. The manual also includes emergency contact lists, a list of Manchester Water Work's buildings and structures, emergency action and notification forms, and additional information on the hazards.

Water Distribution Programs
Manchester Water Works has several programs in effect, including a backflow prevention program to prevent water contamination from faulty plumbing connections, a water corrosion control program that ensures compliance with federal lead and copper standards, and a meter exchange program to accurately measure water consumption. The Manchester Water Works has in place an ongoing program to replace or rehabilitate approximately 3 miles of aging distribution per year.

Lake Massabesic Watershed Protection Rules
These rules (ENV-WS 386.47) were established and adopted by the New Hampshire Department of Environmental Services under RSA 485:24 to protect the purity of the water supply and watershed land. Limits are placed on acceptable recreation activities, development, and use of land in the designated watershed area. These regulations are enforced by the Manchester Water Works and a staff of watershed patrol officers who focus on public education and outreach. In 2006 the *Lake Massabesic Protection Overlay District (LMPOD)* was included in the City Zoning Ordinance. The purpose of this overlay district is to protect the Lake Massabesic drinking water supply to the City of Manchester.

Sewer Ordinances (Chapter 52, City of Manchester Code of Ordinances)
This chapter's purpose is to ensure proper removal and disposal of sewage and waste water as well as the operation and maintenance of the necessary systems to do so, including sewers, drains, and treatment plant. The appropriate uses of the sanitary sewer and storm drains are established. Additional regulations are outlined for industrial pretreatment, septage disposal, and sewer construction and connection standards.

On-Site Sewage Disposal Systems (Chapter 53, City Code of Ordinances)
The on-site sewage disposal system regulations are in place to protect the public heath and well being of residents and ensure that systems are designed and

constructed so they are not a public nuisance or environmentally harmful. A review of proposed plans by the Health Authority is mandated for all new subdivisions. This chapter calls for permits to be issued and sets design requirements and remediation in the event of failure.

Supplemental Environmental Projects Program (SEPP)
SEPP was implemented in 1999 as part of an innovative phased process to reduce combined sewer overflows in the Merrimack and Piscataquog Rivers. The program creates $5.6 million for environmental and health projects over the next five years. Six major components of the program are environmental education, improvement children's health, urban pond restoration, streambank stabilization and erosion control, control of polluted runoff and stormwater, habitat protection and preservation of rare wetlands.

Stormwater Management Program
Manchester's Storm Water Management Program (SWMP) was completed in conformance with the Environmental Protection Agency's mandate. Program controls include public education and outreach, public participation, illicit discharge detection and elimination, construction of site runoff controls, post-construction stormwater management in new developments, and pollution prevention for municipal operations.

Wastewater Treatment
The wastewater treatment plant is designed to treat an average of 34 million gallons per day (mgd), with a peak of 56 mgd. Utilizing a combined sewer overflow bypass order, approved by the Federal Environmental Protection Agency, the plant can process up to 80 mgd. Fifteen pumping stations work in combination to pump all wastewater to the plant. The plant then utilizes a process of preliminary treatment, grit removal, primary clarifiers, secondary treatment, secondary clarifiers, and disinfection.

Health and Sanitation (Chapter 91, City of Manchester Code of Ordinances)
The Health and Sanitation Ordinance's primary purpose it to protect the health of Manchester's residents. Several activities are regulated, including childcare facilities, paint removal, swimming and bathing facilities, mosquito control, and solid waste and littering.

State Dam Program
The City of Manchester Water Works maintains twenty-two Class NM, L, S and H dams in coordination with the State Dam Program, regulated by the Department of Environmental Services, Water Division. City staff inspects all dams on a weekly basis and a more extensive review is conducted monthly. Inspections look for "unusual seepage, erosion of embankments and around

structures, animal burrows in earthen dams, spalling and cracking of concrete surfaces, vegetation growth and security issues (City of Manchester, "Dam Monitoring")." Preventive maintenance is conducted as needed. All class B and C plans have Emergency Action Plans that included emergency notification procedures, staff assignments, warning procedures, inundation area evacuation procedures, and a formal list of plan holders.

Emergency Action Plan: Massabesic Lake Dam

The Lake Massabesic Dam is located at the confluence of Cohas Brook and Canal and Lake Massabesic West Pond. The Emergency Action Plan indicates the following areas would be at risk due to dam breach or flooding: Cohas Avenue from Bricket Road to the pumping station, Bodwell Road south of Mammoth Road, Sears Drive, Roycraft Road from Sears Drive to the end, Lebel Avenue, Edna Avenue, Come Street, and portions of Interstate 93. The Lake Massabesic Emergency Action Plan was last updated during The summer of 2018. The dam is owned and operated by the Manchester Water Works.

Amoskeag Development Emergency Action Plan

The Amoskeag Dam is located on the Merrimack River near the Amoskeag Bridge in Manchester. The Amoskeag Hydro Project Inundation Map indicates approximately 2.7 miles of shoreline on the west bank and 4.3 miles of shoreline on the east bank of the Merrimack, as well as 1.75 miles along the Piscataquog River in Manchester that could be affected if the dam fails. The Amoskeag Development Emergency Action Plan is tested and updated annually. The dam is owned and operated by Public Service of New Hampshire.

New Hampshire Shoreland Protection Act

The Shoreland Protection Act, adopted during 1991 and last updated in 2011, establishes minimum standards for the future subdivision, use, and development of all shore lands within 250 feet of the ordinary high water mark. When repairs, improvements or expansions are proposed to existing development, the law requires these alterations to be consistent with the intent of the Act. The N.H. Department of Environmental Services is responsible for enforcing the standards within the protected shoreland, unless a community adopts an ordinance or shoreland provisions that are equal to or more stringent than the Act.

Best Management Practices

The State has established Best Management Practices (BMPs) for erosion and sediment control. These BMPs are methods, measures or practices to prevent or reduce water pollution, including, but not limited to, structural and nonstructural controls, operation and maintenance procedures, and other requirements and scheduling and distribution of activities. Usually, BMPs are applied as a system of practices rather than a single practice. BMPs are selected because of site-specific conditions that reflect natural background conditions.

Existing Protection Matrix

The Manchester Hazard Mitigation Committee has developed a summary matrix of existing strategies that support hazard mitigation efforts, which is presented on the following pages. This matrix, a summary of the preceding information, includes the existing protection program (Column 1), a description of the existing protection (Column 2), the area of town affected (Column 3), the enforcing department or agency (Column 4), and the identified improvements or changes needed (Column 5).

Local agencies within the City of Manchester have historically integrated and implemented mitigation strategies identified in the Hazard Mitigation Plan in the planning mechanisms listed below. They will continue to incorporate information from this Plan and future ones as they get updated.

Existing Protection Policies, Programs and Proposed Improvements for the City of Manchester

Existing Protection Program	Description	Effective Area	Implementing Department or Agency	Improvements or Changes Needed (Funding Sources)	2018 Update
Emergency Operations Plan	Describes City department & personnel duties & equipment available during an emergency; evacuation and notification; and Terrorism Assessment. Last updated 2015	Citywide	• Emergency Management Director	Update as required (Operating Budget and HSEM)	Updated in 2015 and currently being implemented
Floodplain Development District (Zoning Ordinance)	Guides development in the floodplain to prevent increased risk to existing buildings in the SFHAs	Special flood hazard areas as mapped on FIRMs	• Planning Board • Building Department	No changes needed at this time.	Continuously monitoring for compliance
Elevation Certificates	Records building 1st floor elevations for new construction /substantial improvements in SFHA	Special flood hazard areas as mapped on FIRMs	• Building Department	Update Flood Insurance Rate Maps and Flood Insurance Study (FEMA & Grants)	September 25, 2009 DFIRM and FIS adopted
Wetland Regulations (Zoning Ordinance)	Protects wetlands and includes 25-foot buffer between the wetland and buildings, structures or parking lots	All wetlands under the jurisdiction of the NH Department of Environmental Services	• Building Department • Planning Board • Department of Public Works	General updates and revisions to defining terms required (Operating Budget)	Complete and continuously monitoring for compliance

Existing Protection Program	Description	Effective Area	Implementing Department or Agency	Improvements or Changes Needed (Funding Sources)	2018 Update
Airport Overlay Districts (Zoning Ordinance)	3 overlay districts that minimize navigational disturbances, set height limitations (30') to prevent airspace obstructions, and mitigate adverse impacts of noise on surrounding development	For radio/electrical disturbances- area within 100,000 feet of the control tower. For noise- N1 and N2 zones	• Building Department • Airport Authority • FAA	No changes needed at this time.	Continuously monitoring for compliance
Manufactured Housing (Zoning Ordinance)	Sets minimum standards for utilities, construction, installation and foundations	All parks or subdivisions in the R-1A, R-1B, R-2 and R-3 zoning districts	• Building Department • Planning Board	No changes needed at this time.	Continuously monitoring for compliance
Steep Slopes (Zoning Ordinance, Subdivision and Site Plan Regulations)	Zoning Ordinance excludes slopes of 25% or greater from the calculation of usable open space; Subdivision and Site Plan Regs state slopes or areas containing slopes of 25% or more are unsuitable for development	Slopes of 25% or greater (Subdivision & Site Plan) Slopes of 25% or greater (Zoning Ordinance	• Planning Board • Building Department • Department of Public Works	Revise the ordinances to be consistent in chosen slope gradient (Operating Budget)	The zoning ordinance and site plan regulations now consistently refer to 25% steep slopes.

Existing Protection Program	Description	Effective Area	Implementing Department or Agency	Improvements or Changes Needed (Funding Sources)	2018 Update
Road Design Standards (Subdivision and Site Plan Regulations)	Standards for design and engineering to ensure visibility and safety	All new subdivisions	• Planning Board • Highway Department	No changes needed at this time.	Continuously monitoring for compliance
Standard Specifications for Road Drain and Sewer Construction	Provisions and technical specifications for environmental protection, erosion control, drainage, engineering and design	All new road, drain and sewer construction	• Highway Department • Planning Board	No changes needed at this time.	Continuously monitoring for compliance
Snow Emergency Ordinance (Ch. 71, City Code of Ordinances)	Provisions regulating parking during winter months to preserve traffic flow and ease of snow removal	Citywide	• Public Works	No changes needed at this time.	Continuously monitoring for compliance
Manchester Building Codes	Regulates construction of buildings and fire protection; sets a minimum standard of protection to building occupants	Citywide	• Building Department	No changes needed at this time.	Continuously monitoring for compliance

Existing Protection Program	Description	Effective Area	Implementing Department or Agency	Improvements or Changes Needed (Funding Sources)	2018 Update
Manchester Housing Code	Standards for rental properties to have proper ventilation, fire prevention, utilities & safety	Citywide	• Building Department	No changes needed at this time.	Continuously monitoring for compliance
Fire Codes, Fire Prevention (Ch. 92 City Code of Ordinances)	Adopts the International Fire Code; protection for building occupants from fire hazards including, design suppressant and alarm systems. Also establishes EMS, Ambulance and other rescue related services	Citywide	• Fire Department	No changes needed at this time.	Continuously monitoring for compliance
Fire Department Regulations for Fixed Fire Protection Systems	Complement the Building Code in setting minimum fire protection standards	Citywide	• Fire Department	No changes needed at this time.	Continuously monitoring for compliance
Safety Compliance Standards	Minimum standards to reduce the potential of urban and wildfires	Citywide	• Fire Department	No changes needed at this time.	Continuously monitoring for compliance

Existing Protection Program	Description	Effective Area	Implementing Department or Agency	Improvements or Changes Needed (Funding Sources)	2018 Update
Hazmat/Terrorism Response	Specialized program and equipment for responding to Hazmat events, including bio-terrorism	Citywide	• Fire Department	Revise and update as required (Operating Budget)	Revise and update as required (Operating Budget)
Communication Division: Dispatch and Radio System	911 call dispatch center for fire and EMS at the central fire station as well as citywide 800 MHz trunked radio system	Citywide	• Fire Department • Police Department • EMS • Public Works	No changes needed at this time.	Continuously monitoring for compliance
Police (Ch. 31, City Code of Ordinances)	Requires the police to preserve public peace, prevent riots and disorder. During fires prevent destruction of property	Citywide	• Police Department	No changes needed at this time.	Continuously monitoring for compliance
Water Ordinances (Ch. 51, City Code of Ordinances)	Regulates water usage, and maintenance of water related infrastructure	Citywide	• Manchester Water Works	Create overlay zone for the zoning ordinance to protect the watershed (Operating Budget)	Lake Massabesic Protection Overlay District (LMPOD) complete

Existing Protection Program	Description	Effective Area	Implementing Department or Agency	Improvements or Changes Needed (Funding Sources)	2018 Update
Manchester Water Works Emergency Operations Manual	Manual of emergency response plans for each MWW division based on hazard types	Citywide	• Manchester Water Works	No changes needed at this time.	Continuously monitoring for compliance
Water Distribution Programs	Programs to reduce water contamination and upgrade the water treatment facility	Citywide	• Manchester Water Works	No changes needed at this time.	Continuously monitoring for compliance
Lake Massabesic Watershed Protection Rules	Regulations limiting activity within the watershed to protect the water supply quality	Lake Massabesic watershed	• Manchester Water Works • NH DES	No changes needed at this time.	Continuously monitoring for compliance
Sewer Ordinances (Ch. 52, City Code of Ordinances)	Regulates removal and disposal of sewage and wastewater; regulations for industrial pretreatment, septage disposal and sewer construction standards	Citywide	• Environmental Protection Division • Department of Public Works	Continue separation of the Combined Sewer Overflows (Operating Budget, US Environmental Protection Agency, NH Dept. of Environmental Services)	Continuously monitoring for compliance

Existing Protection Program	Description	Effective Area	Implementing Department or Agency	Improvements or Changes Needed (Funding Sources)	2018 Update
On-Site Sewage Disposal Systems (Ch. 53, City Code of Ordinances)	Regulations to ensure against public and environmental health risks; require review of all proposed systems	Citywide (all new subdivisions)	• Health Department	Extend City sewer service to areas with onsite sewage disposal systems (Operating Budget, Grants)	Currently being implemented as necessary
Supplemental Environmental Projects Program	Environmental and health projects related to erosion control, wetlands, pollution control and stormwater	Citywide	• Environmental Protection Division • Department of Public Works • Health Department • Parks and Recreation	No changes needed at this time.	Continuously monitoring for compliance
Stormwater Management Program	Detects & eliminates illicit discharge, establishes runoff controls, and post construction stormwater management	Citywide	• Environmental Protection Division • Department of Public Works	No changes needed at this time.	Continuously monitoring for compliance
Wastewater Treatment	Treatment plant servicing the City and surrounding towns, disinfects all wastewater prior to release into the Merrimack	Citywide	• Environmental Protection Division	No changes needed at this time.	Continuously monitoring for compliance

Existing Protection Program	Description	Effective Area	Implementing Department or Agency	Improvements or Changes Needed (Funding Sources)	2018 Update
Health and Sanitation (Ch. 91, City Code of Ordinances)	Responsible for assessing and improving the public health of the City; regulates mosquito control, solid waste and littering	Citywide	• Health Department • Building Department • Department of Public Works	No changes needed at this time.	Continuously monitoring for compliance
NH State Dam Program and Emergency Action Plans	Maintenance of dams in coordination with the State Dam Program. Establishes Emergency Action Plans for all class B and C dams.	All City owned dams and adjacent land area	• NH DES • Manchester Water Works • Parks and Recreation	No changes needed at this time.	Continuously monitoring for compliance
Emergency Action Plan: Massabesic Lake Dam	Schedule of monitoring, evaluation, maintenance, and preventive actions for the dams; evacuation and recovery plans; identifies inundation areas	All land adjacent to the Lake Massabesic Dam	• Manchester Water Works	No changes needed at this time.	Continuously monitoring for compliance
Amoskeag Development Emergency Action Plan		Merrimack and Piscataquog Rivers and adjacent land area	• Eversource Energy	No changes needed at this time.	Continuously monitoring for compliance

Existing Protection Program	Description	Effective Area	Implementing Department or Agency	Improvements or Changes Needed (Funding Sources)	2018 Update
NH Shoreland Protection Act	Standards for all protected shorelands within 250 feet of the ordinary high water mark of state public waters	Merrimack and Piscataquog Rivers, Lake Massabesic	• Planning Board • Building Department • NH DES • Manchester Water Works	No changes needed at this time.	Updates to the Act in 2008, continuously monitoring for compliance
Best Management Practices (BMPs)	State guidelines for sediment and erosion control; protection of natural environment and prevention of potential damage due to poor construction methods	Citywide	• State of NH • Dept. of Public Works • Planning Board • Building Department • Manchester Water Works	No changes needed at this time.	Continuously monitoring for compliance

SECTION VII
NEWLY IDENTIFIED MITIGATION STRATEGIES AND CRITICAL EVALUATION

Summary of Existing and New Strategies

Initial selection of mitigation projects was based on filling in perceived gaps in hazard protection within the City. The Manchester Hazard Mitigation Committee then brainstormed additional actions of benefit to the City and its residents with the potential to reduce future damages. Projects were reviewed, and keyed below, for their ability to reduce hazard impacts to both existing (E) and future (F) buildings and infrastructure; as well as the City's ability to respond (R) to disasters. The Manchester Hazard Mitigation Committee confirmed in 2018 whether items outlined in 2011 plan were **Completed (C), Ongoing (O), or Not Started (N)**, and provided an explanation of next steps as needed. Below are tables of the 20 existing mitigation strategies identified in the 2011 Plan, and three newly identified mitigation strategies[11]**.** Items completed from 2011 Plan were identified for removal from 2018 plan update (highlighted in red).

Priorities & Programs Outlined in 2011 Plan		Status	Next Steps
1	Continue the separation of Combined Sewer Overflows as part of the Supplemental Environmental Projects Program in Manchester. (E,F)	**O**	Waiting on direction from EPA/DES
2	Continue to upgrade and increase communications infrastructure, including redundant rings of fiber for emergency backup purposes (E,F,R)	**O**	Added programs
3	Revise/update Hazmat/Terrorism response as needed (E,F,R)	**O**	
4	Incorporate all GIS and database materials developed during the hazard mitigation planning process by SNHPC into the City of Manchester's GIS system in order to effectively plan and implement future mitigation projects (E,F,R)	**C**	Completed/integrated. No further action required
5	Hazardous tree removal program to identify & remove diseased or damaged trees. (E,F,R)	**O**	DPW has prioritized and will continue to expand
6	Public education through public service announcements and dissemination of information at different venues and training programs on emergency management, response and sheltering in place. (E,F,R)	**O**	
7	Maintenance program for underground utility lines(E,F)	**O**	Emergency Planning working w/ DPW to surveil underground
8	Community Warning System- planning and project development (E,F,R)	**O**	Using Nixel since '09; will continue to expand upon system capabilities

[11] More specific details on each new hazard mitigation strategy can be found in Section VIII "Prioritized Implementation Schedule and Funding Sources."

9	Replace aging highway equipment (E,F,R)	**O**	
10	Merrimack River secondary water treatment plant and water supply (E,F,R)	**O**	
11	Explore Hazard Mitigation funding for structural renovations to bridges to mitigate debris-impacted infrastructure (E,F)	**N**	
12	Implement the Community Warning System- Sirens, etc. (E,F,R)	**N**	No desire for sirens; emphasizing #8 items
13	Extend sewer service to areas with onsite sewage disposal systems (install remainder of the trunkline interceptors only at this time) (E,F)	**O**	12+ years left, most interceptor work complete. Some service mains have been involved
14	Upgrade culverts at Ray Brook crossing River Road and Elm Street as they are inadequate (E,F)	**N**	Lack of Funding
15	Work with PSNH (now Eversource) / Utilities to get lines underground (E,F,R)	**O**	Now Eversource; upgrading above-ground network instead. Lt. Field will write a blurb
16	Revise the Steep Slopes sections of the Zoning Ordinance (25%) and Subdivision and Site Plan Regulations (25%) to be consistent in chosen slope gradient. (E,F)	**C**	They're integrated. Complete!
17	Construct a new Public Safety Training Facility for interdep-artmental emergency planning and training efforts. (E,F,R)	**O**	
18	Flood proofing for selected historic Amoskeag mill buildings prone to repetitive flooding. (E,F)	**O**	
19	Acquisition of flood prone properties, in particular Bass Island. (E,F)	**N**	BOMA decides acquisition. This is mitigated through zoning requirements. Bass Island is in process to be removed from floodway.
20	Upgrade Queen City Bridge, Notre Dame Bridge and Amoskeag Bridge to meet seismic design standards as funds become available (E,F,R)	**N**	Lack of Funding

New Mitigation Strategies in 2018 Plan		**Next Steps**
NEW	Central High School Flood mitigation – install flood logs around school between Amherst and Beech Streets. (E,F,R)	Flooding is problematic adjacent to Central High School
NEW	Integrate smart city controls into the street and traffic light network (E,F,R)	This network could include devices that monitor seismic activity, air quality, waste water flow, potable drinking water distribution, noise, parking and traffic.
NEW	Identify sites for video announcement signage and install (E,F,R)	City has video signage that can be used for emergency announcements that have not been set up yet.

- Develop and implement an industry standard municipal mesh network, designed to support a wide variety of monitoring and control devices. This network could include devices that monitor seismic activity, air quality, waste water flow, potable drinking water distribution, noise, parking

and traffic. Based on the input of these sensors devices can be controlled in an effort to improve communication, public safety, first responder and utility response times.

Mitigation Strategy Evaluation Process

Using a similar methodology as the previous plan, the HMP Committee identified new actions based on the updated risk assessment and capability assessment. The new actions were prioritized in combination with the actions carried forward from the previous plan. The STAPLEE method analyzes the Social, Technical, Administrative, Political, Legal, Economic and Environmental aspects of a project and is commonly used by public administration officials and planners for making planning decisions.

The following questions were asked about the proposed mitigation strategies identified in the table below:

- **Social**: Is the proposed strategy socially acceptable to the community? Are there equity issues involved that would mean that one segment of the community is treated unfairly?

- **Technical**: Will the proposed strategy work? Will it create more problems than it solves?

- **Administrative**: Can the community implement the strategy? Is there someone to coordinate and lead the effort?

- **Political**: Is the strategy politically acceptable? Is there public support both to implement and to maintain the project?

- **Legal**: Is the community authorized to implement the proposed strategy? Is there a clear legal basis or precedent for this activity?

- **Economic**: What are the costs and benefits of this strategy? Does the cost seem reasonable for the size of the problem and the likely benefits?

- **Environmental**: How will the strategy impact the environment? Will the strategy need environmental regulatory approvals?

Each mitigation strategy was evaluated and assigned a score (Good = 3, Average = 2, Poor = 1) based on the above criteria by the Committee. An evaluation chart with total scores for each strategy can be found in the table below. Each strategy was evaluated and prioritized according to the final score. The highest scoring strategies were determined to be of most importance, economically, socially, environmentally, and politically.

STAPLEE CHART **Mitigation Strategy**	Is it **Socially** acceptable?	Is it **Technically** feasible &potentially successful?	Is it **Administratively** workable?	Is it **Politically** acceptable?	Is there **Legal** authority to implement?	Is it **Economically** beneficial?	Is it **Environ-mentally** beneficial?	Total Score
Continue the separation of Combined Sewer Overflows as part of the Supplemental Environmental Projects Program in Manchester.	3	3	3	3	3	3	3	3
Continue to upgrade and increase communications infrastructure, including redundant rings of fiber for emergency backup purposes	3	3	3	3	3	3	2	2.857
Revise and update Hazmat/Terrorism response as required	3	3	3	3	3	3	3	3
Hazardous tree removal program to identify & remove diseased or damaged trees.	2	3	3	2	2	3	2	2.429
Public education through public service announcements and dissemination of information at different venues and training programs on emergency management, response and sheltering in place.	3	3	3	2	3	3	3	2.857
Maintenance program for underground utility lines	3	3	2	3	1	3	1	2.286
Community Warning System- planning and project development	3	3	2	3	3	3	3	2.857
Replace aging highway equipment	2	3	3	2	3	3	3	2.714
Merrimack River secondary water treatment plant and water supply	2	3	3	2	3	3	3	2.714
Explore Hazard Mitigation funding for structural renovations to bridges to mitigate debris-impacted infrastructure	3	2	2	3	3	3	3	2.714
Extend sewer service to areas with onsite sewage disposal systems (install remainder of the trunkline interceptors only at this time)	3	3	3	3	3	3	3	3
Upgrade culverts at Ray Brook crossing River Road and Elm Street as they are inadequate	3	3	3	2	3	3	3	2.857
Work with Eversource / Utilities to get lines underground	3	3	3	3	3	3	3	3
Construct a new Public Safety Training Facility for interdepartmental emergency planning and training efforts.	3	2	2	2	3	2	3	2.429
Flood proofing for selected historic Amoskeag mill buildings prone to repetitive flooding.	2	1	1	1	1	3	3	1.714
Upgrade Queen City Bridge, Notre Dame Bridge and Amoskeag Bridge to meet seismic design standards as funds become available	3	3	2	3	3	3	3	2.857
Add flood logs/improve drainage at Central High School	3	2	3	3	3	3	3	2.857
Integrate smart city controls into streetlight network	3	3	3	2	3	3	3	2.857
Identify sites for video announcement signage and install	3	3	3	2	2	3	3	2.714

SECTION VIII
PRIORITIZED IMPLEMENTATION SCHEDULE AND FUNDING SOURCES

Implementation Strategy for Priority Mitigation Actions

The Manchester Hazard Mitigation Committee reviewed all ongoing, deferred, and new strategies. Each mitigation action was ranked by considering its STAPLEE scores, costs, political will, relative necessity, whether previous work had been completed, and past voting of city residents for capital projects.

Time frame	
Short Term	1 year or less
Mid Term	2 to 3 years
Long Term	4-5 years
Ongoing	This action will be completed on an ongoing basis throughout the life of the plan

Additional funding sources will be researched by the City of Manchester as required to successfully implement the above mitigation actions. Grants will be particularly researched on a project-by-project basis to search out the best grant match.

Summary of Agency Acronyms

CDC= Centers for Disease Control and Prevention
DPW= Manchester Department of Public Works
MWW= Manchester Water Works
NH BEM= New Hampshire Bureau of Emergency Management
NH DES= New Hampshire Department of Environmental Services
NH DOT= New Hampshire Department of Transportation
US EPA= United States Environmental Protection Agency

Summary of Grant Acronyms

CERT= Community Emergency Response Teams
COPS= Office of Community Oriented Police Services, Interoperable Communications Technology Program
DPIG= Disaster Preparedness Improvement Grant
EMPG= Emergency Management Preparedness Grant
FMAP= Flood Mitigation Assistance Program
HMGP= Hazard Mitigation Grant Program
MM= Map Modernization
PDM= Pre-Disaster Mitigation Program
CMOMs= Capacity, Management and operations and management (EPA)

Additional grant related information is in Appendix D.

2018 Rank	2011 Rank	STAPLEE Score *	Mitigation Action	Hazard Addressed	Responsible Party	Anticipated Cost	Potential Funding Source	Time-frame
1	1	3.00	Continue the separation of Combined Sewer Overflows as part of the Supplemental Environmental Projects Program in Manchester.	Flooding	USEPA, NH DPW	$150M	COB, USEPA, NHDES	Long term
2	3	3.00	Revise and update Hazmat/Terrorism response as required	Terrorism	MFD	$10k-$25k	COB, EMPG	Ongoing
3	13	3.00	Extend sewer service to areas with onsite sewage disposal systems (install remainder of the trunk line interceptors only at this time)	Flooding	EPA, DPW	$6M	City Sewer Fees	Long term
4	15	3.00	Work with Eversource to improve infrastructure	All	Utility Providers	>$100k	Eversource	Ongoing
5	2	2.86	Continue to upgrade and increase communications infrastructure, including redundant rings of fiber for emergency backup purposes	All	Infosystems	>$100k	COB	Long term
6	6	2.86	Public education through public service announcements & dissemination of information at different venues on mitigation techniques, including training programs on emergency management, response and sheltering in place.	All	MPD, MFD	$25k-$50k	COB, CERT	Ongoing
7	8	2.86	Community Warning System- planning and project development	Extreme Heat/Cold	Planning, MPD, MFD, DPW	$10k-$25k	COB	Mid Term
8	14	2.86	Upgrade culverts at Ray Brook crossing River Road and Elm Street as they are inadequate	Flooding	Highway Dept.	>$100k	COB, EMPG	Mid Term
9	20	2.86	Upgrade Queen City Bridge, the Notre Dame Bridge and the Amoskeag Bridge to meet seismic design standards as funds become available	Flooding, Winter Weather	Highway Dept.	$1M+	City, NHDOT, Grants	Long Term
10	-	2.86	Add flood logs/improve drainage at Central High School	Flooding	DPW	<$100k	COB, Grants	Short Term
11	-	2.86	Integrate smart city controls into street and traffic network	All	DPW	$25,000	COB, NHDOT Grants	Short Term
12	9	2.71	Replace aging highway equipment	Winter Weather, Flooding, Hurricane	Highway Dept, DPW	$5M	City of Manchester	Ongoing

13	10	2.71	Merrimack River secondary water treatment plant and water supply	Drought, Extreme Heat, Hurricane	MWW	$30M	MWW, Grants	Long Term
14	11	2.71	Explore Hazard Mitigation funding for structural renovations to bridges to mitigate debris-impacted infrastructure	Flooding, Dam failure, Earthquake, Winter weather	Highway Dept.	>$100,000	COB, EMPG	Long Term
15	-	2.71	Identify sites for video announcement signage and install	All	Planning and Building Depts., DPW, Highway Dept	<$250,000	COB, Grants	Short Term
16	5	2.43	Hazardous tree removal program to identify & remove diseased or damaged trees.	Earthquake, Hurricane, Landslide, Lightning, Tornado/ Downburst, Wildfire	DPW, Parks & Rec	$50,000/y	COB	Mid Term
17	17	2.43	Construct a new Public Safety Training Facility for interdepartmental emergency planning and training efforts.	All	MPD, MFD	$2 mill	City of Manchester	Mid Term
18	7	2.29	Maintenance program for underground utility lines	All	Highway Dept.	>$100,000	CMOMs	Continuously
19	18	1.71	Flood proofing for selected historic Amoskeag mill buildings prone to repetitive flooding.	Flooding, Hurricane, Landslide, Dam Failure	Planning and Building Depts.	>$100,000	FMAP or PDM with required City match contribution	Long Term

SECTION IX
ADMINISTRATIVE PROCEDURES REGARDING ADOPTION, EVALUATION AND MONITORING OF THE PLAN

"Incorporating hazard mitigation considerations into the thought processes and decision making that comprise local planning reinforces community sustainability and strengthens community planning programs. It ensures that the community survives natural disasters so that it can grow and develop as it was envisioned."

– Michael J. Armstrong, Associate Director for Mitigation, FEMA

Adoption

Upon notification that FEMA has conditionally approved this *Plan*, a public hearing will be held and the Manchester Board of Mayor and Aldermen will formally adopt the ***Manchester Hazard Mitigation Plan*** as an official statement of City policy. In the future, this *Plan* may constitute a new section of the Manchester Master Plan, in accordance with RSA 674:2. The public hearing shall be properly posted and advertised by the City in accordance with New Hampshire State law. Documentation that the Manchester Board of Mayor and Aldermen have formally adopted the *Plan* will be included in the Appendix J.

Adoption of the ***Manchester Hazard Mitigation Plan*** demonstrates the City's commitment to hazard mitigation. It also qualifies the municipality for federal, state and local funding and prepares the public for what the community can be expected to do both before and after a natural hazard disaster occurs.

Following adoption, the Hazard Mitigation Committee and the Board of Mayor and Aldermen shall seek to incorporate the mitigation actions identified in the Priority Implementation Schedule of Section V of the *Plan* into other planning mechanisms, including the City's Master Plan and Capital Improvement Program (CIP).

The Hazard Mitigation Plan, its goals, objectives and mitigation actions will be reviewed during future plan updates for the Master Plan and Emergency Operations Plan and incorporated as appropriate for the City. The Hazard Mitigation Plan mitigation actions shall also be reviewed by the Capital Improvement Program (CIP) Subcommittee and the Finance Committee during budget and CIP updates for inclusion of the mitigation actions as appropriate.

Monitoring, Evaluating and Updates

The ***Manchester Hazard Mitigation Plan*** shall be monitored and evaluated annually to track progress in implementing the mitigation strategies and actions as well as updating the goals and objectives of the *Plan*. The Manchester Fire Chief/Emergency Management Director shall be responsible for initiating this review and scheduling an annual meeting of the Hazard Mitigation Committee. In addition to reviewing Hazard Mitigation Committee members' progress on projects, the strategy for the following year will be reviewed and new projects will be selected for implementation at the annual meeting.

The Manchester Fire Chief/Emergency Management Director will conduct updates in coordination with the Hazard Mitigation Committee and Manchester Board of Mayor and Aldermen. Updates should be made to the *Plan* every three to five years[12] to accommodate for actions that have failed or are not considered feasible after a review for their consistency with STAPLEE, the timeframe, the community's priorities, and funding resources. Priorities that were not ranked high, but identified as potential mitigation strategies, should be reviewed as well during the monitoring and update of this *Plan* to determine feasibility of future implementation. Also, at that time any other items identified during the annual meetings will be updated in the *Plan*, including, but not limited to goals, objectives, identification of past hazard events, and updating the inventory of City assets vulnerable to hazards.

Keeping with the process of adopting the ***Manchester Hazard Mitigation Plan***, a public hearing to receive comment on the *Plan* maintenance and updating shall be held during the review period, and the Board of Mayor and Aldermen will adopt the final product.

Continued Public Involvement

The public will continue to be invited and encouraged to be involved during this process at monitoring, evaluation and update meetings. All meetings involving implementation or updates of the *Plan* shall be open to the public as is required by RSA 91-A, and notice of the meeting will be posted at least 24 hours in advance in a minimum of two locations such as the City Hall and Library. The meetings may also be publicized on the local access television station or local newspaper. To gain additional public involvement, draft copies of the amended *Hazard Mitigation Plan* will be made available at two public locations for review and comment. The document should be left for a minimum of two weeks and then all comments will be considered in drafting final revisions.

[12] FEMA Disaster Mitigation Act of 2000 44 CFR Part 201.6(d)(3) mandates "Plans must be reviewed, revised if appropriate, and resubmitted for approval within five years to continue to be eligible for HMGP project grant funding." (Federal Register Vol. 36, No. 38, Feb 26, 2002, Rules and Regulations, p8852)

APPENDIX A

DEFINITIONS

Areas at Risk: Emergency equipment or areas not needed to respond at the time of a natural disaster, but which could still be threatened if a natural disaster were to occur. These include critical facilities not utilized for emergency response, people and facilities to be protected in the event of a disaster, and/or potential resources for services or supplies in the event of a disaster. Examples include schools, parks, commercial resources, day care facilities, and senior housing.

Critical Facilities: Any building, structure or location that is vital to the hazard response effort, maintains an existing level of protection from hazards for the City, and would create a secondary disaster if a hazard were to impact it. Examples include police station, fire station, emergency medical services, law enforcement, electric generators, and emergency shelters.

Commercial Economic Impact Areas: These areas include organizations and businesses with more than 25 employees. These are facilities that are vital to the community's economic well-being.

Emergency Management Plan: A jurisdiction's emergency management plan is typically designed to establish the procedures that will take place during an emergency and designate who will be responsible to perform those procedures.

Essential Facilities: All critical facilities, areas at risk, commercial economic impact areas and hazardous material locations.

GIS: Geographic Information Systems includes a form of mapping that enables users to easily locate physical attributes of a community such as dams, bridges, wetlands, steep slopes, etc. Much of the data for these maps is maintained by Complex Systems Research Center in Durham, N.H.

Hazard Mitigation: The practice of reducing risks to people and property from natural hazards. FEMA defines hazard mitigation as "any action taken to reduce or eliminate the long-term risk to human life and property from hazards."

Hazardous Materials Facilities: These facilities include active hazardous waste generators, underground storage tanks, and above-ground storage tanks.

Hazardous Waste Generators: Defined by the N.H. Department of Environmental Services, these are businesses that produce household hazardous waste, or treat and store or dispose of hazardous waste, or be a waste handler or used oil marketer.

APPENDIX B

NEW HAMPSHIRE DAM CLASSIFICATION SCHEDULE

Non Menace (NM) structure means a 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, provided the dam is:

- Less than six feet in height if it has a storage capacity greater than 50 acre-feet; or
- Less than 25 feet in height if it has a storage capacity of 15 to 50 acre-feet.

Low Hazard (L) structure means a 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 any of the following:

- No possible loss of life.
- Low economic loss to structures or property.
- Structural damage to a town or city road or private road accessing property other than the dam owner's that could render the road impassable or otherwise interrupt public safety services.
- The release of liquid industrial, agricultural, or commercial wastes, septage, Or contaminated sediment if the storage capacity is less than two-acre-feet and is located more than 250 feet from a water body or water course.
- Reversible environmental losses to environmentally-sensitive sites.

Significant Hazard (S) structure means a 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 any of the following:

- No probable loss of lives.
- Major economic loss to structures or property.
- Structural damage to a Class I or Class II road that could render the road impassable or otherwise interrupt public safety services.
- Major environmental or public health losses, including one or more of the following:
- Damage to a public water system, as defined by RSA 485:1-a, XV, which will take longer than 48 hours to repair.
- The release of liquid industrial, agricultural, or commercial wastes, septage, sewage, or contaminated sediments if the storage capacity is 2 acre-feet or more.
- Damage to an environmentally-sensitive site that does not meet the definition of reversible environmental losses.

High Hazard (H) means a 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 as a result of:

- Water levels and velocities causing the structural failure of a foundation of a habitable residential structure or commercial or industrial structure, which is occupied under normal conditions.
- Water levels rising above the first floor elevation of a habitable residential structure or a commercial or industrial structure, which is occupied under normal conditions when the rise due to dam failure is greater than one foot.
- Structural damage to an interstate highway, which could render the roadway impassable or otherwise interrupt public safety services.
- The release of a quantity and concentration of material, which qualify as "hazardous waste" as defined by RSA 471-A:2 VI.
- Any other circumstance that would more likely than not cause one or more deaths.

APPENDIX C
BIBLIOGRAPHY, AGENCIES, WEBSITES

I. BIBLIOGRAPHY

City of Charlestown. Hazard Mitigation Plan. Charlestown RI: January 1997.

City of Manchester, New Hampshire. Code of Ordinances. Cincinnati, OH: American Legal Publishing Corporation, September 2002.

City of Manchester, New Hampshire Building Department. "Codes and Ordinances." 18 Feb 2004. < http://www.manchesternh.gov/CityGov/BLD/codes.html>

City of Manchester, New Hampshire Emergency Management Office. Emergency Management Plan. Manchester, NH: Manchester Emergency Management Office, December 2002.

City of Manchester, New Hampshire Environmental Protection Division. "Manchester's Wastewater Treatment Plant." 17 Feb 2004.
<http://www.manchesternh.gov/CityGov/DPW/EPD/Wastewater/Home.html>

City of Manchester, New Hampshire Environmental Protection Division. "Stormwater Management Program." 17 Feb 2004.
<http://www.manchesternh.gov/CityGov/dpw/EPD/stormwater/Home.html>

City of Manchester, New Hampshire Environmental Protection Division. "Supplemental Environmental Protection Program." 17 Feb 2004.
<http://www.manchesternh.gov/CityGov/DPW/EPD/SEPP/Home.html>

City of Manchester, New Hampshire Fire Department. "Bio-Terrorism Hazmat Training." 18 Feb 2004. <http://www.manchesternh.gov/CityGov/MFD/BioTerr.html>

City of Manchester, New Hampshire Fire Department. "Communication Division." 18 Feb 2004. <http://www.manchesternh.gov/CityGov/MFD/Communications.html>

City of Manchester, New Hampshire Fire Department. "Fire Data." 23 Jan 2004.
<http://www.manchesternh.gov/CityGov/MFD/firedata.html>

City of Manchester, New Hampshire Fire Department. Rules and Regulations for Fixed Fire Protection Systems. Manchester: Fire Department, December 2003. 18 Feb 2004.
<http://www.manchesternh.gov/CityGov/MFD/files/49E8FB5B685741EB937FB5F1A31C98C3.pdf>

City of Manchester, New Hampshire Fire Department. "Safety Compliance Standards." 18 Feb 2004. <http://www.manchesternh.gov/CityGov/MFD/FPCompStds.html>

City of Manchester, New Hampshire Department of Public Works. "Highway Division." 17 Feb 2004. <http://www.manchesternh.gov/CityGov/DPW/HWY/Home.html>

City of Manchester, New Hampshire Highway Commission. Standard Specifications for Road, Drain and Sewer Construction. Manchester, NH: City Public Works Department, January 2004. 17 Feb 2004. <http://www.manchesternh.gov/CityGov/dpw/HWY/files/93BAE5B68943418C9C4287770185F97C.pdf>

City of Manchester, New Hampshire Planning Board. Master Plan: Manchester, New Hampshire. Manchester: City Planning Department, November 1993.

City of Manchester, New Hampshire Planning Board. Subdivision and Site Plan Regulations. Manchester: City Planning Department, January 2000. 18 Feb 2004. <http://www.manchesternh.gov/CityGov/PLN/files/E085C2387BFC4D83A62021DF229523C4.pdf>

City of Manchester, New Hampshire Water Works. "Dam Monitoring Program." 12 Feb 2004. <http://www.manchesternh.gov/CityGov/WTR/Wtrshed/Dams.html>

City of Manchester, New Hampshire Water Works. Emergency Action Plan: Massabesic Lake Dam. Manchester: Manchester Water Works, March 21, 1991.

City of Manchester, New Hampshire Water Works. Emergency Operations Manual. Manchester: Manchester Water Works, November 2003.

City of Manchester, New Hampshire Water Works. "Water Distribution: Distribution Programs." 13 Feb 2004. <http://www.manchesternh.gov/CityGov/WTR/Programs/Home.html>

City of Manchester, New Hampshire Zoning Board of Adjustment. Zoning Ordinance. Manchester: Building Department, February 2001.

City of Montpelier Department of Planning and Development. Montpelier Flood Hazard Mitigation Plan. Montpelier, Vermont: May 1998.

Commonwealth of Massachusetts. Flood Hazard Mitigation Planning: A Community Guide. The Commonwealth of Massachusetts, Department of Environmental Management, Flood Hazard Management Program: June 1997.

Federal Emergency Management Agency. Community-Based Hazard Mitigation Planning: Lowering the Risks and Costs of Disasters. New England Training Workshop, 27 August 1998.

Federal Emergency Management Agency. "Federally Declared Disasters by Calendar Year." 26 Jan 2004. <http://www.fema.gov/library/drcys.shtm>

Federal Emergency Management Agency. Federal Response Plan. FEMA, January 2003.

Federal Emergency Management Agency. Flood Insurance Study (FIS): City of Manchester, New Hampshire, Hillsborough County. FEMA, August 1980.

Federal Emergency Management Agency. Hazard Mitigation Planning Handbook. Washington, DC: FEMA, 1997.

Federal Emergency Management Agency. Multi-Hazard Mitigation Planning Guidance Under the Disaster Mitigation Act of 2000. Washington, DC: FEMA, March 2004.

Federal Emergency Management Agency. National Mitigation Strategy: Partnerships for Building Safer Communities. Washington, DC: FEMA, December 6, 1995.

Federal Emergency Management Agency. Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments. Washington, DC: FEMA, September 1990.

Federal Emergency Management Agency. Protecting Business Operations: Second Report on Costs and Benefits of Natural Hazard Mitigation. Washington, DC: FEMA, August 1998.

Federal Emergency Management Agency. Reducing Losses in High Risk Flood Hazard Areas: A Guidebook for Local Officials. Washington, DC: FEMA, February 1987.

Federal Emergency Management Agency. Understanding Your Risks: Identifying Hazards and Estimating Losses, FEMA 386-2. Washington, DC: FEMA, August 2001.

Florida Depart. of Community Affairs. The Local Mitigation Strategy: A Guidebook for Florida Cities and Counties. Florida: April 1998.

Kafka, Alan L. Ph.D. "Why Does the Earth Quake in New England?: The Science of Unexpected Earthquakes, Revised: January 3, 2004." Weston Observatory, Dept. of Geology and Geophysics, Boston College. 26 Jan 2004. <http://www2.bc.edu/~kafka/Why_Quakes/why_quakes.html>

Makar Ph. D., Jon. "Failure Analysis for Grey Cast Iron Water Pipes." Ottowa: Institute for Research Construciton, National Research Council Canada, September 1999. 17 Feb 2004. <http://irc.nrc-cnrc.gc.ca/fulltext/nrcc43363.pdf>

National Oceanic and Atomospheric Administration. "Tornados- Fujita Tornado Damage Scale." 23 Jan 2004. <http://www.noaa.gov/tornadoes.html>

National Weather Service Forecast Office. "Climate Data- Past Weather and Normals." 26 Jan 2004. <http://www.erh.noaa.gov/er/gyx/climate.shtml#disclaimer>

National Weather Service Forecast Office. "Winter Weather Summaries issued during the past 120 days." 26 Jan 2004. <http://www.erh.noaa.gov/er/gyx/pns.html>

National Weather Service – National Hurricane Center. "The Saffir-Simpson Hurricane Scale." 23 Jan 2004. <http://www.nhc.noaa.gov/aboutsshs.shtml>

New Hampshire Department of Environmental Services Dam Bureau. "Dams" GIS Data Layer. NH DES GIS Department, June 2002.

New Hampshire Department of Environmental Services Dam Bureau. Environmental Fact Sheet DB-4 "Typical Failure Modes of Embankment Dams," 1997. 23 Jan 2004. <http://www.des.state.nh.us/factsheets/dam/db-4.htm>

New Hampshire Department of Environmental Services Dam Bureau. Environmental Fact Sheet DB-5 "Typical Failure Modes for Stone Faced Earth Dams," 1997. 23 Jan 2004. <http://www.des.state.nh.us/factsheets/dam/db-5.htm>

New Hampshire Department of Environmental Services Dam Bureau. Environmental Fact Sheet DB-6 "Typical Failure Modes for Dam Spillways," 1997. 23 Jan 2004. <http://www.des.state.nh.us/factsheets/dam/db-6.htm>

New Hampshire Department of Environmental Services Dam Bureau. Environmental Fact Sheet DB-7 "Typical Failure Modes for Gated Dam Outlets," 1997. 23 Jan 2004. <http://www.des.state.nh.us/factsheets/dam/db-7.htm>

New Hampshire Department of Environmental Services Dam Bureau. Environmental Fact Sheet DB-11 "Emergency Action Plans: Prudent Planning Required for Dam Owners," 1997. 23 Jan 2004. <http://www.des.state.nh.us/factsheets/dam/db-11.htm>

New Hampshire Department of Environmental Services Shoreland Protection. Environmental Fact Sheet SP-1 "Erosion Control for Construction in the Protected Shoreland Buffer Zone," 1998. 23 Jan 2004. <http://www.des.state.nh.us/factsheets/sp/sp-1.htm>

New Hampshire Department of Environmental Services Watershed Management Bureau Volunteer Lake Assessment Program. "Glossary of Lake Terms." 23 Jan 2004. <http://www.des.state.nh.us/wmb/vlap/glossary.htm>

New Hampshire Bureau of Emergency Management (NH BEM). State of New Hampshire Natural Hazards Mitigation Plan. Concord, NH: NH Bureau of Emergency Management, October 1999.

North Carolina Division of Emergency Management Hazard Mitigation Section. "Nor'easters." 23 Jan 2004. <http://www.dem.dcc.state.nc.us/mitigation/noreaster.htm>

Northeast Regional Climate Center. "Comparative Climatic Data for the United States." 26 Jan 2004. <http://www.nrcc.cornell.edu/ccd.html>

Office of Management and Budget. Federal Programs Offering Non-Structural Flood Recovery and Floodplain Management Alternatives. The Office of Management and Budget, June 1998.

Pulli, Jay J. "Seismicity, Earthquakes Mechanisms, and Seismic Wave Attenuation in the Northeastern United States," PhD Dissertation Abstract. MIT, June 10, 1983. 26 Jan 2004. <http://www-eaps.mit.edu/erl/research/theses/abstracts/Pulli.html>

Schwab, J. with K. Topping, et al. Planning for Post-Disaster Recovery and Reocnstruction, Planning Advisory Services, Report Number 483/484. Chicago: American Planning Association, December 1998.

Southern New Hampshire Planning Commission. Real Estate Tracking Project- 2003. Manchester, NH: SNHPC, December 2003. < http://www.nharpc.org/reports/southern/2003%20SNHPC%20Real%20Estate%20Report.pdf>

Suffolk County Water Authority (SFWA). "It's Tough Work, But Somebody's Got to do it." Oakdale, NY: Jan 2003. 17 Feb 2004. <http://www.scwa.com/commercial/currentbill.cfm>

Texas Natural Resource Conservation Commission. Texas Community Officials Primer on Floodplain Planning Strategies and Tools. Texas, June 1994.

Tornado Project Online. "New Hampshire Tornados 1950-1995: Hillsborough." 23 Jan 2004. <http://www.tornadoproject.com/>

Town of Holden Beach, North Carolina. Community-Based Hazard Mitigation Plan. Holden Beach, NC: State of North Carolina, 2003. As published at: <http://www.ncem.org/mitigation/example_plans.htm#approvedplans>

United States Geological Survey (USGS). "The Severity of an Earthquake." 26 Jan 2004. <http://pubs.usgs.gov/gip/earthq4/severitygip.html>

United States Geological Survey (USGS) Earthquake Hazards Program. "ANSS Maps of Recent Earthquake Activity in the USA." 26 Jan 2004. <http://earthquake.usgs.gov/recenteqsUS/Maps/US2/42.44.-73.-71_eqs.html>

University of California Berkely, National Information Services for Earthquake Engineering. "Damage du to Structural Vibration." 13 Feb 2004. <http://nisee.berkely.edu/bertero/html/damage_due_to_structural_vibration.html#j35>

Wisconsin Department of Natural Resources. Community Flood Mitigation Planning Guidebook.

World Bank. "Reservoir Safety Design." 13 Feb 2004. <http://www.worldbank.org/html/fpd/em/hydro/rsd.stm>

II. AGENCIES

New Hampshire Bureau of Emergency Management		271-2231
Federal Emergency Management Agency		617-223-4175
NH Regional Planning Commissions:		
	Central NH Regional Planning Commission	796-2129
	Lakes Region Planning Commission	279-8171
	Nashua Regional Planning Commission	883-0366
	North Country Council	444-6303
	Rockingham Planning Commission	778-0885
	Southern New Hampshire Planning Commission	669-4664
	Southwest Region Planning Commission	357-0557
	Strafford Regional Planning Commission	742-2523
	Upper Valley Lake Sunapee Regional Planning Commission	448-1680
NH Executive Department:		
	Governor's Office of Energy and Community Services	271-2611
	New Hampshire Office of State Planning	271-2155
NH Department of Cultural Affairs		271-2540
	Division of Historical Resources	271-3483
NH Department of Environmental Services		271-3503
	Air Resources	271-1370
	Waste Management	271-2900
	Water Resources	271-3406
	Water Supply and Pollution Control	271-3504
	Rivers Management and Protection Program	271-1152
	Bureau of Dams	271-3503
NH Fish and Game Department		271-3421
NH Department of Resources and Economic Development		271-2411
	Natural Heritage Inventory	271-3623
	Division of Forests and Lands	271-2214
	Division of Parks and Recreation	271-3255
NH Department of Transportation		271-3734
US Department of Commerce		
	National Oceanic and Atmospheric Administration	
	National Weather Service; Gray, Maine	207-688-3216
US Department of the Interior		
	US Fish and Wildlife Service	225-1411
	US Geological Survey	225-4681
US Department of Agriculture		
	Natural Resource Conservation Service	868-7581

III. WEBSITES

Sponsor	*Internet Address*	*Summary of Contents*
Natural Hazards Research Center, U. of Colorado	http://www.colorado.edu/litbase/hazards/	Searchable database of references and links to many disaster-related web sites.
Atlantic Hurricane Tracking Data by Year	http://wxp.eas.purdue.edu/hurricane	Hurricane track maps for each year, 1886 – 1996
National Emergency Management Association	http://nemaweb.org	Association of state emergency management directors; list of mitigation projects.
NASA – Goddard Space Flight Center "Disaster Finder:	http://www.gsfc.nasa.gov/ndrd/disaster/	Searchable database of sites that encompass a wide range of natural disasters.
NASA Natural Disaster Reference Database	http://ltpwww.gsfc.nasa.gov/ndrd/main/html	Searchable database of worldwide natural disasters.
U.S. State & Local Gateway	http://www.statelocal.gov/	General information through the federal-state partnership.
National Weather Service	http://nws.noaa.gov/	Central page for National Weather Warnings, updated every 60 seconds.
USGS Real Time Hydrologic Data	http://h20.usgs.gov/public/realtime.html	Provisional hydrological data
Dartmouth Flood Observatory	http://www.dartmouth.edu/artsci/geog/floods/	Observations of flooding situations.
FEMA, National Flood Insurance Program, Community Status Book	http://www.fema.gov/fema/csb.htm	Searchable site for access of Community Status Books
Florida State University Atlantic Hurricane Site	http://www.met.fsu.edu/explores/tropical.html	Tracking and NWS warnings for Atlantic Hurricanes and other links
National Lightning Safety Institute	http://lightningsafety.com/	Information and listing of appropriate publications regarding lightning safety.
NASA Optical Transient Detector	http://www.ghcc.msfc.nasa.gov/otd.html	Space-based sensor of lightning strikes
LLNL Geologic & Atmospheric Hazards	http://www-ep.es.llnl.gov/www-ep/ghp.html	General hazard information developed for the Dept. of Energy.
The Tornado Project Online	http://www.tornadoroject.com/	Information on tornados, including details of recent impacts.
National Severe Storms Laboratory	http://www.nssl..uoknor.edu	Information about and tracking of severe storms.
Earth Satellite Corporation	http://www.earthsat.com/	Flood risk maps searchable by state.
USDA Forest Service Web	http://www.fs.fed.us/lan	Information on forest fires and land management.

APPENDIX D
TECHNICAL AND FINANCIAL ASSISTANCE FOR HAZARD MITIGATION

This matrix provides information about key all-hazards grant programs from the Departments of Homeland Security, Justice, Transportation, Health and Human Services, and Education under which state, local, and tribal governments, first responders, and the public are eligible to receive preparedness, response, recovery, mitigation, and prevention assistance.

Agency	Office/ Directorate	Program	Purpose	Funding Beneficiaries
Programs to prepare the Nation to address the consequences of natural and man-made disasters and emergencies.				
Department of Homeland Security	*Border and Transportation Security Directorate*	State Homeland Security Grant Program www.ojp.usdoj.gov	This core assistance program provides funds to build capabilities at the state and local levels and to implement the goals and objectives included in state homeland security strategies and initiatives in the State Preparedness Report.	State governments
	Emergency Preparedness and Response Directorate	Emergency Management Performance Grants www.fema.gov http://www.fema.gov/government/grant/index.shtm	To assist State and local governments in enhancing and sustaining all-hazards emergency management capabilities.	States with pass through to local emergency management organizations
	Emergency Preparedness and Response Directorate	Assistance to Firefighters Grant Program www.usfa.fema.gov/grants http://www.firegrantsupport.com/afg/	The primary goal of the Assistance to Firefighters Grants (AFG) is to meet the firefighting and emergency response needs of fire departments and nonaffiliated emergency medical services organizations.	Local, State, and Regional Fire Departments and agencies.
	Emergency Preparedness and Response Directorate	State and Local Emergency Operation Centers (EOCs) www.fema.gov http://www.fema.gov/government/grant/index.shtm	To improve emergency management and preparedness capabilities by supporting flexible, sustainable, secure, and interoperable Emergency Operations Centers (EOCs) with a focus on addressing identified deficiencies and needs.	States; local governments may be sub-grantees of the State
	Emergency Preparedness and Response Directorate	Citizen Corps www.citizencorps.gov	To bring community and government leaders together to coordinate community involvement in emergency preparedness, planning, mitigation, response and recovery.	States with a pass through to local governments

Agency	Office/ Directorate	Program	Purpose	Funding Beneficiaries
Department of Homeland Security	*Emergency Preparedness and Response Directorate*	National Fire Academy Training Grants www.fema.gov	To provide financial assistance to State Fire Training Systems for the delivery of a variety of National Fire Academy courses/programs.	State fire training organizations
	Emergency Preparedness and Response Directorate	Emergency Management Institute Training Assistance www.fema.gov	To defray travel and per diem expenses of State, local and tribal emergency management personnel who attend training courses conducted by the Emergency Management Institute, at the Emmitsburg, Maryland facility; Bluemont, Virginia facility; and selected off-site locations. Its purpose is to improve emergency management practices among State, local and tribal government managers, in response to emergencies and disasters. Programs embody the Comprehensive Emergency Management System by unifying the elements of management common to all emergencies: planning, preparedness, mitigation, response, and recovery.	State, local, and tribal emergency managers
	Emergency Preparedness and Response Directorate	Hazardous Materials Assistance Program (CERCLA Implementation)	Provide technical and financial assistance through the States to support State, local and tribal governments in oil and hazardous materials emergency planning and exercising. To support the Comprehensive Hazardous Materials (HAZMAT) Emergency Response – Capability Assessment Program (CHER-CAP) activities.	State, local, and tribal governments, state emergency response committees, local emergency planning commissions
	Emergency Preparedness and Response Directorate	Interoperable Communications Equipment Grant http://www.fema.gov/government/grant/index.shtm	To provide governance, planning, training and exercise, and equipment funding to States, Territories, and local and tribal governments to carry out initiatives to improve interoperable emergency communications, including communications in collective response to natural disasters, acts of terrorism, and other man-made disasters.	N/A

Agency	Office/ Directorate	Program	Purpose	Funding Beneficiaries
Department of Homeland Security	*Emergency Preparedness and Response Directorate*	Chemical Stockpile Emergency Preparedness Program www.fema.gov	A cooperative agreement to enhance emergency preparedness capabilities of the States and local communities at each of the eight chemical agent stockpile storage facilities. The purpose of the program is to assist States and local communities in efforts to improve their capacity to plan for and respond to accidents associated with the storage of chemical warfare materials.	State and local governments and the general public in the vicinity of the eight chemical agent stockpile storage facilities.
	National Preparedness Directorate	**Metropolitan Medical Response System** http://www.fema.gov/mmrs	To provide contractual funding to the 124 largest metropolitan jurisdictions to sustain and enhance the integrated medical response plans to a WMD terrorist attack.	Local governments
Department of Justice	*Office of Domestic Preparedness*	State Domestic Preparedness Equipment Support Program http://www.ojp.usdoj.gov/odp/equipment.htm	Funding will be provided to enhance first responder capabilities, and to provide for equipment purchases and exercise planning activities for response to Weapons of Mass Destruction (WMD) domestic terrorist incidents.	State and local governments
	Office of Community Oriented Police Services (COPS)	COPS Interoperable Communications Technology Program www.cops.usdoj.gov	To facilitate communications interoperability public safety responders at the state and local level.	Tribal, State, and local law enforcement agencies
Department of Health and Human Services		Public Health and Social Services Emergency Fund www.hhs.gov	To continue to prepare our nation's public health system and hospitals for possible mass casualty events, and to accelerate research into new treatments and diagnostic tools to cope with possible bioterrorism incidents.	Individuals, families, Federal, State, and local government agencies and emergency health care providers
	Health Resources and Services Administration	State Rural Hospital Flexibility Program www.ruralhealth.hrsa.gov	To help States work with rural communities and hospitals to develop and implement a rural health plan, designate critical access hospitals (CAHs), develop integrated networks of care, improve emergency medical services and improve quality, service and organizational performance.	States with at least one hospital in a non-metropolitan region

Agency	Office/ Directorate	Program	Purpose	Funding Beneficiaries
Department of Health and Human Services	*Health Resources and Services Administration*	EMS for Children www.hrsa.gov	To support demonstration projects for the expansion and improvement of emergency medical services for children who need treatment for trauma or critical care. It is expected that maximum distribution of projects among the States will be made and that priority will be given to projects targeted toward populations with special needs, including Native Americans, minorities, and the disabled.	State governments and schools of medicine
	National Institute of Health	Superfund Hazardous Substances Basic Research and Education www.nih.gov	To establish and support an innovative program of basic research and training consisting of multi-project, interdisciplinary efforts that may include each of the following: (1) Methods and technologies to detect hazardous substances in the environment; (2) advance techniques for the detection, assessment, and evaluation of the effects of hazardous substances on humans; (3) methods to assess the risks to human health presented by hazardous substances; and (4) and basic biological, chemical, and physical methods to reduce the amount and toxicity of hazardous substances.	Any public or private entity involved in the detection, assessment, evaluation, and treatment of hazardous substances; and State and local governments
	Centers for Disease Control	Immunization Research, Demonstration, Public Information and Education www.cdc.gov	To assist States, political subdivisions of States, and other public and private nonprofit entities to conduct research, demonstrations, projects, and provide public information on vaccine-preventable diseases and conditions.	States and nonprofits organizations
	Centers for Disease Control	Surveillance of Hazardous Substance Emergency Events www.atsdr.cdc.gov	To assist State health departments in developing a State-based surveillance system for monitoring hazardous substance emergency events. This surveillance system will allow the State health department to better understand the public health impact of hazardous substance emergencies by developing, implementing, and evaluating a State-based surveillance system.	State, local, territorial, and tribal public health departments

Agency	Office/ Directorate	Program	Purpose	Funding Beneficiaries
Department of Health and Human Services	*Centers for Disease Control*	Human Health Studies, Applied Research and Development www.atsdr.cdc.gov	To solicit scientific proposals designed to answer public health questions arising from situations commonly encountered at hazardous waste sites. The objective of this research program is to fill gaps in knowledge regarding human health effects of hazardous substances identified during the conduct of ATSDR's health assessments, consultations, toxicological profiles, and health studies, including but not limited to those health conditions prioritized by ATSDR.	State health departments
Department of Education	Office of Safe and Drug free Schools (OSDFS)	Readiness and Emergency Management for Schools http://www.ed.gov/programs/dvpemergencyresponse/index.html/	This grant program supports efforts by LEAs to improve and strengthen their school emergency management plans, including training school personnel and students in emergency management procedures; communicating with parents about emergency plans and procedures; and coordinating with local law enforcement, public safety, public health, and mental health agencies.	School Districts
Department of Transportation	*Pipeline and Hazardous Materials Safety Administration (PHMSA)*	Hazardous Materials Emergency Preparedness Training and Planning Grants http://phmsa.dot.gov/hazmat/grants	Increase state, local, territorial, and Native American tribal effectiveness to safely and efficiently handle HazMat accidents and incidents; enhance implementation of the Emergency Planning and Community Right-to-Know Act of 1986; and encourage a comprehensive approach to emergency planning and training by incorporating response to transportation standards.	States, local, territorial, tribal governments.
Programs to coordinate Federal response efforts and to assists states, localities, and tribes in responding to disasters and emergencies.				
Department of Homeland Security	*Emergency Preparedness and Response Directorate*	Urban Search and Rescue www.fema.gov	To expand the capabilities of existing Urban Search and Rescue Task Forces.	28 existing US&R Task Forces

Agency	Office/ Directorate	Program	Purpose	Funding Beneficiaries
Programs to provide assistance to States, localities, tribes, and the public to alleviate suffering and hardship resulting from Presidentially declared disasters and emergencies caused by all types of hazards.				
Department of Homeland Security	*Emergency Preparedness and Response Directorate*	Individuals and Households Program http://www.fema.gov/assistance/process/guide.shtm	**To provide assistance to individuals and families who have been affected by natural or man-made Presidentially declared disasters. Funding provided from the Disaster Relief Fund.**	Individuals and Families
	Emergency Preparedness and Response Directorate	Public Assistance http://www.fema.gov/government/grant/pa/index.shtm	**To provide assistance to states, localities, tribes, and certain non-profit organizations affected by natural or man-made Presidentially declared disasters. Funding provided from the Disaster Relief Fund**	State, local and tribal governments; private non-profit organizations
	Emergency Preparedness and Response Directorate	Fire Management Assistance Grant Program http://www.fema.gov/government/grant/fmagp/index.shtm	**Provide funds to States, local, and tribal governments for the mitigation, management, and control of wildland fires posing serious threats to improved property.**	State, local and tribal governments
Small Business Administration	*Office of Disaster Assistance*	Disaster Loan Program http://www.sba.gov/services/disasterassistance/	**To offer financial assistance to those who are trying to rebuild their homes and businesses in the aftermath of a disaster.**	Individuals, families, private sector
Department of Justice	*Office for Victims of Crime*	Antiterrorism and Emergency Assistance Program http://www.ojp.usdoj.gov/ovc/publications/infores/terrorism/	**To provide assistance programs for victims of mass violence and terrorism occurring within and outside the United States and a compensation program for victims of international terrorism.**	Public and private nonprofit victim assistance agencies
Programs to reduce or eliminate future risk to lives and property from disasters.				
Department of Homeland Security	*Emergency Preparedness and Response Directorate*	Hazard Mitigation Grant Program http://www.fema.gov/government/grant/hmgp/index.shtm	**To provide assistance to states, localities, and tribes to fund projects that will reduce the loss of lives and property in future disasters. Funding is provides from the Disaster Relief Fund and administered by the states according to their own priorities.**	State, local, and tribal governments

Agency	Office/ Directorate	Program	Purpose	Funding Beneficiaries
	Emergency Preparedness and Response Directorate	Pre-Disaster Mitigation Program http://www.fema.gov/government/grant/pdm/index.shtm	**This program provides funding for mitigation activities before disaster strikes. In recent years it has provided assistance for mitigation planning. In FY03, Congress passes a competitive pre-disaster mitigation grant program that will include project funding.**	State, local, and tribal governments
Department of Homeland Security	*Emergency Preparedness and Response Directorate*	Flood Mitigation Assistance Program (FMA) http://www.fema.gov/government/grant/fma/index.shtm	**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.**	State, local and tribal governments
	Emergency Preparedness and Response Directorate	Repetitive Flood Claims Program (RFC) http://www.fema.gov/government/grant/rfc/index.shtm	**The Repetitive Flood Claims (RFC) grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (P.L. 108–264), which amended the National Flood Insurance Act (NFIA) of 1968 (42 U.S.C. 4001, et al). Up to $10 million is available annually for FEMA to provide RFC funds to assist States and communities reduce flood damages to insured properties that have had one or more claims to the National Flood Insurance Program (NFIP).**	State, local and tribal governments
	Emergency Preparedness and Response Directorate	Severe Repetitive Loss Program (SRL) http://www.fema.gov/government/grant/srl/index.shtm	**The Severe Repetitive Loss (SRL) grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004, which amended the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss (SRL) structures insured under the National Flood Insurance Program (NFIP).**	State, local and tribal governments

Agency	Office/ Directorate	Program	Purpose	Funding Beneficiaries
	Emergency Preparedness and Response Directorate	Map Modernization http://www.fema.gov/plan/prevent/fhm/mm_main.shtm	**This funding provides assistance to develop digital flood maps, support flood-mapping activities and expand the Cooperating Technical Partners Program to communities and regional entities.**	State, local and tribal governments
Programs to interdict potentially hazardous events from occurring				
Department of Health and Human Services	*Centers for Disease Control*	Immunization Grants www.cdc.gov	To assist States and communities in establishing and maintaining preventive health service programs to immunize individuals against vaccine-preventable diseases.	States
Other				
Department of Housing and Urban Development	*NH Office of Energy and Planning*	Community Development Block Grant (CDBG) Program http://www.hud.gov/offices/cpd/communitydevelopment/programs/	HUD provides flexible grants to help cities, counties, and States recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations.	State, local and tribal governments

Mitigation Programs of Other NH State Agencies

The following agencies of the state of New Hampshire are directly or indirectly involved in activities that include Hazard Mitigation Planning and/or program implementation:

- *NH Department of Transportation Bureau of Repair and Maintenance*
- *NH OSP/NFIP Program*
- *NH OSP Coastal Program*
- *NH DRED Division of Forests and Lands*
- *NH DES Water Resources Division – Dam Safety Program*
- *NH DES Wetlands Program*
- *NH DES Shoreline Protection*

APPENDIX E

STAPLEE AND PROJECT EVALUATION

STAPLEE is an acronym for a general set of criteria common to public administration officials and planners. It stands for the Social, Technical, Administrative, Political, Legal, Economic, and Environmental criteria for making planning decisions. Questions to ask about suggested actions include:

- ***Social*****:** Is the proposed action socially acceptable to the community? Are there equity issues involved that would mean that one segment of the community is treated unfairly?

- ***Technical:*** *Is the p*roposed action technically feasible and will it work? Is it a long term solution?

- ***Administrative:*** Can the community implement the action? Is there someone to coordinate and lead the effort? Are there funding sources already allocated or available for this project?

- ***Political:*** Is the action politically acceptable? Does the project help to achieve other community objectives?

- ***Legal:*** Is the community authorized to implement the proposed action? Is there a clear legal basis of precedent for this project or is there chance of legal challenge?

- ***Economic:*** What are the costs and benefits of this action? Does the cost seem reasonable for the size of the problem and the likely benefits? Does the project reduce potential future damages from disasters?

- ***Environmental:*** How will the action impact the environment, i.e. land, water, animals, plants? Will the action need and meet environmental regulatory approvals?

STAPLEE CHART **Mitigation Strategy**	Is it **Socially** acceptable?	Is it **Technically** feasible &potentially successful?	Is it **Administratively** workable?	Is it **Politically** acceptable?	Is there **Legal** authority to implement?	Is it **Economically** beneficial?	Is it **Environ-mentally** beneficial?	Total Score
Continue the separation of Combined Sewer Overflows as part of the Supplemental Environmental Projects Program in Manchester.	3	3	3	3	3	3	3	3
Continue to upgrade and increase communications infrastructure, including redundant rings of fiber for emergency backup purposes	3	3	3	3	3	3	2	2.857
Revise and update Hazmat/Terrorism response as required	3	3	3	3	3	3	3	3
Hazardous tree removal program to identify & remove diseased or damaged trees.	2	3	3	2	2	3	2	2.429
Public education through public service announcements and dissemination of information at different venues and training programs on emergency management, response and sheltering in place.	3	3	3	2	3	3	3	2.857
Maintenance program for underground utility lines	3	3	2	3	1	3	1	2.286
Community Warning System- planning and project development	3	3	2	3	3	3	3	2.857
Replace aging highway equipment	2	3	3	2	3	3	3	2.714
Merrimack River secondary water treatment plant and water supply	2	3	3	2	3	3	3	2.714
Explore Hazard Mitigation funding for structural renovations to bridges to mitigate debris-impacted infrastructure	3	2	2	3	3	3	3	2.714
Extend sewer service to areas with onsite sewage disposal systems (install remainder of the trunkline interceptors only at this time)	3	3	3	3	3	3	3	3
Upgrade culverts at Ray Brook crossing River Road and Elm Street as they are inadequate	3	3	3	2	3	3	3	2.857
Work with Eversource / Utilities to get lines underground	3	3	3	3	3	3	3	3
Construct a new Public Safety Training Facility for interdepartmental emergency planning and training efforts.	3	2	2	2	3	2	3	2.429
Flood proofing for selected historic Amoskeag mill buildings prone to repetitive flooding.	2	1	1	1	1	3	3	1.714
Upgrade Queen City Bridge, Notre Dame Bridge and Amoskeag Bridge to meet seismic design standards as funds become available	3	3	2	3	3	3	3	2.857
Add flood logs/improve drainage at Central High School	3	2	3	3	3	3	3	2.857
Integrate smart city controls into streetlight network	3	3	3	2	3	3	3	2.857
Identify sites for video announcement signage and install	3	3	3	2	2	3	3	2.714

APPENDIX F

MHMC MEETING AGENDAS, MINUTES AND ATTENDANCE SHEETS

Manchester Hazard Mitigation Plan Update
Coordination Meeting Agenda
5/15/17 10am
Manchester Fire Department Headquarters

1. Review the planning process
    a. Review Local Mitigation Plan Review Guide
    b. Review Local Mitigation Planning Handbook
    c. Review Mitigation Ideas Guide
    d. Review Region I Good Practice Guides

2. Determine who to invite to participate on the planning team not currently present
    a. Neighboring communities
    b. Local and regional agencies involved in hazard mitigation
    c. Agencies with authority to regulate development
    d. Others?

3. Determine how to involve members of the public
    a. Invitations/press releases about meetings
    b. Legal notices
    c. Fliers
    d. Surveys
    e. Other methods?

4. Determine what existing plans, documents, and reports to review and incorporate into the update

5. Determine Manchester's existing authorities, policies, programs, and resources related to hazard mitigation and its ability to expand and improve on these.

6. Discuss homework and set next meeting date.

Manchester Hazard Mitigation Plan Update
Planning Meeting 1 Agenda

6/21/17 10am
Manchester Public Health Department
1528 Elm Street, Manchester, NH 03101

1. Review Natural Hazards in Manchester

2. Review Previous Occurrences of Hazards

3. Review Probability of Future Hazard Events

4. Review Critical Facilities and their Vulnerabilities

5. Review Vulnerability by Hazard

6. Discuss homework and set next meeting date

Hazard Mitigation Planning Committee Minutes

Meeting Date: 21 June 2017 10:00am-12:00pm

Manchester Health Dept. 1528 Elm St. Manchester NH 03101

Attendees: Kerrie Poplin-Planning and Community Development, Jennie Angell-Information Systems, Sarah Morris-Manchester Health Department, Michael Carr- Manchester Health Department, Phil Alexakos- Manchester Health Department, Paul Blais- Emergency Manager Catholic Medical Center, Heather Dunkerley-NH Homeland Security and Emergency Management Field Representative, Josh Gagne- Department of Public Works-Facilities, Jeff Belanger-Planning and Community Development, Mike Landry-Planning, Eric Levesque-Information Systems, Hannah Koehler-Manchester Fire Department Intern, TJ Rapson Manchester Fire Department Intern, Kevin M. Healy-Capt. Emergency Management Coordinator-Manchester Fire Department, Guy Chabot-Manchester Water Works, Peter Lenon-Manchester Fire Department, Melanie Sanuth-MEDD, Bryan Disko-City Clerk Office, Will Craig-Eversource

Agenda:

Meeting Scheduled Start: 10:00 am

Actual meeting start: 10:00 am

Items on the **Agenda** and Notes from Meeting

1. **Review Natural Hazards in Manchester**
    a. Remove lightning from wind hazard and move to other hazards
    b. Remove non-natural hazards of Debris impacting infrastructure, Dam breach or failure, urban fires, utility pipe failure, isolated homes, other water retention facility failure. A statement will be included in the updated plan to explain the reasoning behind their removal.
    c. Change on maps for new construction/change in natural hazards affecting these areas, specifically Hackett Hill Rd. and the areas around Crystal Lake.
    d. Develop a list of brush and wildland fires that were naturally occurring
    e. Possibility of adding a hazard on "naturally occurring threats" (i.e. Mosquito borne illness, radon, pandemic, natural water contamination, ticks, air quality etc…) At a minimum include links to other existing planning documents that assess the vulnerability of these hazards and the prevention/mitigation actions
    f. Possibly adding black ice/ice buildup on roads to list of identified hazards.
    g. Change "geomagnetism" to "solar weather"
2. **Review Previous Occurrences of Hazards**
    a. Each hazard was reviewed with possible locations for data on number of occurrences
    b. How much damage was caused by each
    c. Develop a list of pump out calls to determine areas for localized flooding
    d. List from DPW on culvert locations that cause problems
    e. Follow up on economic costs of shutting down schools
3. **Review Probability of Future Hazard Events**
    a. How is the probability calculated? What scales are used to determine low, med, high probability? Follow up with SNHPC for their raw data
    b. FEMA Region 1 has documents providing guidance on extent of damage scales

c. Evaluate probability/severity for all hazards to ensure accuracy
d. Hail reporting scales have changed, could change the vulnerability in the plan.
e. Revise criteria for extreme heat to reflect updated standards

4. **Review Critical Facilities and their Vulnerabilities**
    a. Authoritative Sources have been identified in the attached spreadsheet
    b. Update the location of the facilities noted in the attached spreadsheet
    c. Request data from SNHPC for sources
5. **Review Vulnerability by Hazard**
    a. Review hazard extent spreadsheet for specific vulnerable areas for accuracy
6. **Discuss homework and set next meeting date**
    a. Justin will work with IT to set up the public website with meeting agendas, maps, and previous hazard mitigation plan
    b. Next meeting will be scheduled with assistance of City Clerk and IT using Doodle poll
    c. Committee members will provide information on historical hazard events from 2011-2017 based on sources identified
    d. Phil Alexakos will assist in obtaining natural hazard historical data from NOAA & NWS
    e. Manchester Fire & IT will reach out to SNHPC for GIS data and historical data used to determine probability ratings in 2011 plan
    f. All Committee members will review Infrastructure Data Sources & Updates Spreadsheet to identify GIS data they have been tasked to obtain (yellow column)
    g. All Committee members will review 2011 Hazard Extents to identify changes in extent for 2017 (blue column)
    h. Justin and Kevin will work with IT to develop new draft maps for next meeting
    i. Justin and Kevin will work with interns to update the hazard probability ratings using compiled data

Meeting Scheduled End: 12:00pm
Meeting Actual End: 12:06 pm
Attachments
Hazard Probability Spreadsheet
Infrastructure Data Sources & Updates Spreadsheet
Hazard Extent Spreadsheet
FEMA Region 1 Hazard Extent Scales

Hazard Mitigation Planning Committee Minutes

Meeting Date: 31 July 2017

Manchester Fire Department 100 Merrimack St. Manchester NH 03101
Attendees: Jacqueline Cardoza Nashua OEM, Justin Kates Nashua OEM, Mark Kirouac NHDOT, Mike Carr MHD, Phil Alexakos, RH Field MFD, Eric Levesque MIS, Josh Gagene DPW, Jennie Angell MIS, TJ Rapson MFD, Brian Disko City Clerk, Jeff Belanger, Kevin Healy Elliot Hospital, Chris Proulx DPW, Melanie Sanuth Economic Development
Agenda:

Meeting Scheduled Start: 10:00 am

Actual meeting start: 10:00 am

Items on the **Agenda** and Notes from Meeting

1. **Determine changes in development and land use planning since last plan that impact hazard mitigation**
    a. EPD to check new regulations
    b. MFD to check on new fire codes for buildings and wildfire
    c. New fire station added since last plan update

2. **Complete status of previous actions**
    a. Check on status of any previous actions
    b. New utility piping on Elm St. and Queen City Ave. / Paving
    c. Expanding environmental protection zone
    d. New safety compliance standards
3. **Document changes in hazard mitigation priorities since last plan**
    a. Prioritization of projects
4. **Set goals to reduce vulnerability to each hazard**
    a. ???
5. **Select at least 2 NFIP actions**
    a. ???
6. **Complete mitigation actions**
    a. ???
7. **Homework and next meeting date**
    a. Follow up with EPD on wastewater treatment

Meeting Scheduled End – 12:00 PM

Meeting Actual End - ?

Manchester Hazard Mitigation Committee Meeting

AGENDA: Meeting # 3
November 20, 2017
Manchester Fire Department, 100 Merrimack Street
Manchester, NH 03101

1. **Call to Order**
2. **Approve the Minutes of July 31, 2017 Meeting**
3. **Introductions – SNHPC Staff and Committee Members**
4. **Review Hazard Mitigation Tasks (9)**
5. **Review of Content On Hand**
    a. Introduction (50% there)
    b. Community Profile
    c. Hazard Identification
    d. Assessing Probability, Severity, and Risk
6. **Hazard Vulnerability Assessment**
7. **Critical Facilities at Risk**
    a. Confirm Critical Facilities List (2015) is up to date
    b. Identify Commercial economic impact areas
8. **Task List for Next Meeting**
    a. Develop a Mitigation Strategy:
        i. Existing Mitigation Strategies and Proposed Improvements
        ii. Newly Identified Mitigation Strategies and Critical Evaluation
    b. Email Hazard Photos
9. **Next Meeting Schedule_____ and Adjournment**

Manchester Hazard Mitigation Committee Meeting

Minutes of Meeting #3

20 November 2017

Manchester Fire Department 100 Merrimack St. Manchester, New Hampshire 03101

Attendees: Eric Levesque MIS, Brett French MFD, Peter Lennon MFD, Jeff Belanger MPCD, Mike Landry MPCD, Josh Gagne Facilities, Guy Chabot MWW, Phil Alexakos MHD, Bryan Disko City Clerk, Derek Shooster SNHPC, Maddie Diionno SNHPC, Kevin Healey Elliot Hospital, Robert Field MFD

Meeting called to order at 14:02

- Minutes of the July 31, 2017 meeting were read and approved
- Committee members were introduced that were present
- SNHPC reviewed their status of the project and items they had received
- The Eversource critical infrastructure list was discussed and discussion was had that this list includes municipal functional areas, as well as healthcare facilities and education institutes. This list has been provided for comment by department heads and comments have already been made.
- The Hazard Vulnerability Assessment (HVA) was tabled to the end of the meeting
- The critical facilities at risk were ranked into 4 categories and several areas of concern was discussed and contact information for each were listed for follow up or further information
    - Category 1-Emergency Response Services
        - Will Craig from Eversource can provide a list of substations in the city
        - A list needs to be generated identifying critical bridges, evacuation routes, and culverts that could impede evacuation. Interstate 93 was used as an example
    - Category 2-Non Emergency Response Facilities
        - Manchester Fire Alarm to provide a contact number for telephone infrastructure
    - Category 3-Facilties/Populations to Protect
        - A list of events that generates a permit will be the criteria for annual events to be added to the report
        - Phil to provide a list of daycares in the city
        - John Clayton for historic buildings/sites

        - Religious facilities will be identified as ones that have a free standing structure to practice their religion
        - Economic development assist in providing a list for major employers
        - Natural assets John Clayton and Don Pinard to assist in gathering information
        - TIER II reports to identify hazardous sites. Lt. Field to provide that
        - State of NH has a list identifying dams in the city
    - Category 4-Potential Resources
        - Gas/Fuel resources. TIER II reports and assessing can be used to identify these
    - Commercial Economic Impact Areas-Economic development and assessing
    - Hazardous Material Facilities
        - TIER II inspection and documentation information can help identify these areas. Lt. Field will provide this information
- Hazard Vulnerability Assessment
    - The group assigned rankings according to the criteria. Derek will do the calculations at a later date to determine severity and relative threat
- Derek will email the committee a list of mitigation strategies and proposed improvements for the next meeting
- The Next meeting will be held January 8, 2018 at 1400. Derek requested photos of incidents that have resulted from natural disasters to put in the report. Lt. Field said he could provide photos.

Manchester Hazard Mitigation Committee Meeting

AGENDA: Meeting # 4
January 8, 2018
Manchester Fire Department, 100 Merrimack Street
Manchester, NH 03101

1. **Call to Order**
2. **Approve the Minutes of November 20, 2017 Meeting**
3. ~~**Review of Hazard Vulnerability Assessment**~~
4. **Existing Mitigation Strategies and Proposed Improvements**
    a. Examples of programs for Hazard Categories
    b. Description of Existing Programs (assign)
    c. Existing protection mitigation strategy effectiveness
    d. Review of effectiveness
5. **Newly-Identified Mitigation Strategies and Critical Evaluation**
    a. Summary of Existing & New Strategies
    b. STAPLEE Chart
6. **Task List for Next Meeting**
    a. Prioritize Mitigation Actions
7. **Next Meeting Schedule_____ and Adjournment**

Manchester Hazard Mitigation Committee Meeting

Minutes of Meeting #4

8 January 2018

Manchester Fire Department 100 Merrimack St. Manchester, New Hampshire 03101

Attendees: Eric Levesque MIS, Brett French MFD,, Jeff Belanger MPCD, Mike Landry MPCD, Josh Gagne Facilities, Phil Alexakos MHD, Bryan Disko City Clerk, Derek Shooster SNHPC, Cam Prolman SNHPC, Kevin Healey Elliot Hospital, Robert Field MFD, Chris Proulx DPW

Meeting called to order at 14:06

- Minutes of the December 21, 2017 meeting were read and approved
- Committee members were introduced that were present
- SNHPC reviewed their status of the project and items they had received
- Hazard Vulnerability Assessment was removed from the agenda due to the successful completion in the previous meeting
- The committee reviewed the 2011 mitigation strategies and identified if they were completed, ongoing or not started
    - The committee added Central High School flooding concerns to the chart for 2018
- The STAPLEE Chart was completed as a group.
    - Item #4, the incorporation of GIS was removed from the list
    - Item #12, the community siren system was removed from the list
    - Item #15, the Eversource underground utilities section was reworded to read continuing above ground and infrastructure upgrades for the city.
    - Item #16, the steep slope section was removed from the list
    - Item #19, the acquisition of Bass Island was removed from the list as this is mitigated through zoning requirements
    - Central High School flooding added to the list
    - Integrated city control of Eversource street lighting added to the list
- Derek will email a list of Mitigation Strategies that will need to be ranked by the committee
- The 2011 Hazard Mitigation report will also be emailed to the committee for reference.
- Derek is still waiting pictures and descriptions of incidents in the city for use within the report. Kevin Healey will try and obtain some.
- Meeting adjourned at 15:30
- Next meeting is not schedule at this time.

Manchester Hazard Mitigation Committee Meeting

AGENDA: Meeting # 5
May 14, 2018
Manchester Fire Department, 100 Merrimack Street
Manchester, NH 03101

1. **Call to Order**
2. **Approve the Minutes of January 8, 2018 Meeting**
3. **Review DRAFT Hazard Mitigation Plan, Including List of Prioritized Mitigation Strategies**
4. **Task List**
    a. Integrate final edits to plan, confirm compliance with NH HSEM
    b. Schedule meeting with Manchester Board of Mayor & Aldermen to review and approve Final Plan
5. **BOMA Meeting Schedule_____ and Adjournment**

City of Manchester, New Hampshire

Hazard Mitigation Committee Meeting #4
January 8, 2018
2:00 PM

Manchester Fire Deptartment
100 Merrimack Street
Manchester, NH 03101

ATTENDANCE SHEET

Name	Position Title/ Department Affiliation	E-mail & Phone
Derek Shooster	SNHPC	DSHOOSTER@SNHPC.ORG
Cam Pedman	SNHPC	CPEDMAN@SNHPC.ORG
Kevin McHenley	Elliot Hospital	KHealey@Elliothosp.org
Brett French	Fire Dept	bfrench@manchester-nh.gov
Michael Landry	Planning + Comm. Dev.	mlandry@manchesternh.gov
Jeff Belanger	Planning and Com. D.	jbelanger@manchesternh.gov
Bryan Disko	City Clerk/ Licensing + Facilities	coordinator bdisko@manchesternh.gov
Eric Levesque	Info Sys	elevesque@manchesternh.gov
Phil Alexakis	Manchester Health	palexakis@manchesternh.gov
Josh Caterer	DPW - Facilities	jcaterer@manchesternh.com
Rit Field	MFD	No change
Chris Prowla	DPW	Cprowla@manchesternh.gov

City of Manchester
Emergency Management
Sign-In Sheet

Date: NOV. 20.2017
Time: 2PM
Location: 100 MERRIMACK ST
Page: 1

Name	Organization	Phone Number	Email address
Eric Levesque	Info Sys.	624-6577	elevesque@manchesternh.gov
BRETT FRENCH	Fire Dept	669-2256	bfrench@manchesternh.gov
Peter Lennon	Fire Dept	669-2256	plennon@manchesternh.gov
Jeff Belanger	PCD (Planning)	624-6450	jbelanger@manchesternh.gov
Mike Landry	PCD	792-6752	mlandry@manchesternh.gov
Jason GAGNE	DPW-Facilities	557-7051	jgagne@manchesternh.gov
Guy Chabot	MWW	792-2801	gchabot@manchesternh.gov
Phil Alexakos	MHO	628-6003x304	palexaki@manchesternh.gov
Bryan DISKO	City Clerk	792-6637	bdisko@manchesternh.gov
DEREK SHOOSTER	SNHPC	669.4664	DSHOOSTER@SNHPC.ORG
MADDIE DIIONNO	SNHPC	669 4664	mdiionno@snhpc.org
Melanie Sanuth	MEDO	624 6505	msanuth@manchesternh.gov
Kevin M. Healey	Elliot Hospital	663-3729	Khealey@manchesternh.gov- Khealey@Elliot-hs.org
Robert H. Field	Manchester Fire	669-2256	rfield@manchesternh.gov

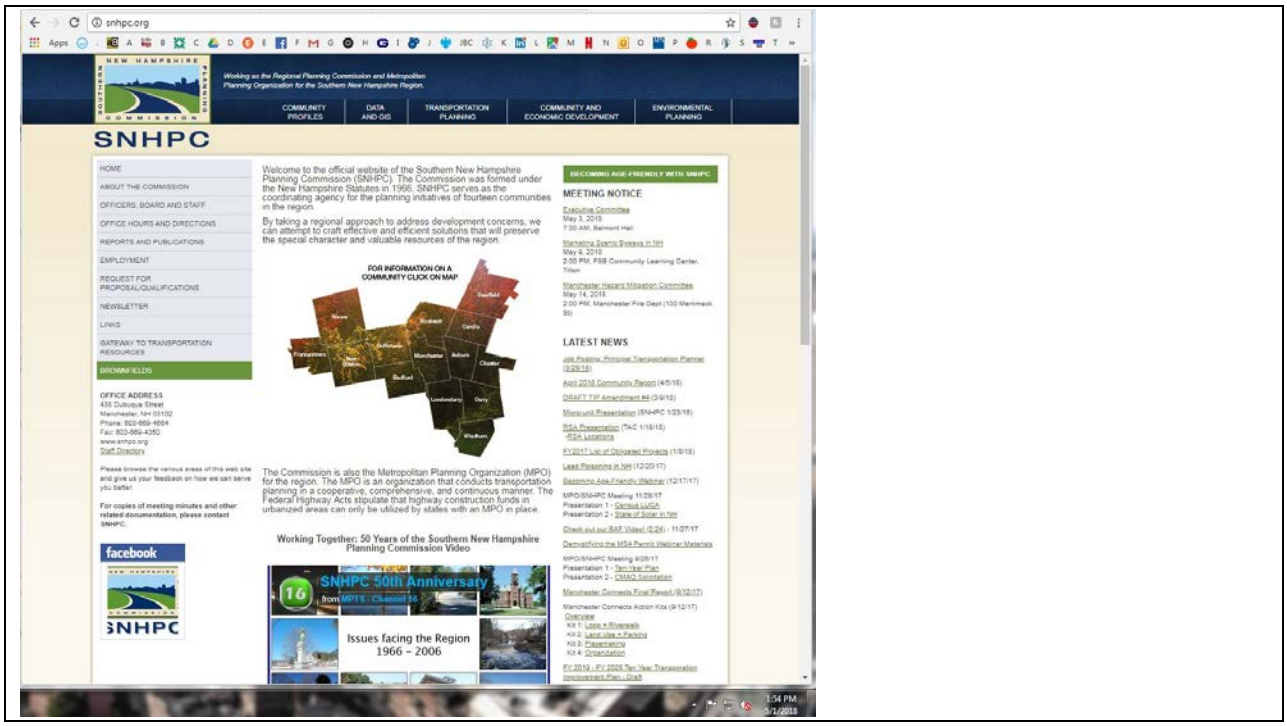
UNIVERSAL
PERFECTLY PRACTICAL

May 15th, 2017 Hazard-Mitigation (Initial) Planning Mtg

Name	Agency	Email / Phone #
Eric Levesque	Manchester Info Sys	elevesque@manchesternh.gov 624-6527
Bob Fiala	MFD	rfiala@ " "
Justin Kates	Nashua OEM	katesj@nashuanh.gov 603-722-0281
Jacqueline Cardoza	Nashua OEM	CardozaJ@nashuanh.gov
Kevin M. Healey	MFD	Khealey@manchesternh.gov
Jason Gagne	DPW-Facilities	jgagne@manchesternh.gov
PETER CHIESA	SOLICITOR	PCHIESA@MANCHESTERNH.gov
Guy Chabot	MWW	gchabot@manchesternh.gov
Bryan Disko	City Clerk	bdisko@manchesternh.gov
Pam Croasdale	WATER	pcroasdale@manchesternh.gov
Jennie Angell	Info Systems	Jangell@Manchesternh.gov
Melanie Sanuth	Econ. Development	MSanuth@manchesternh.gov
Peter Lennon	Manchester FD	plennon@manchesternh.gov
DAVID GMILLER	MWW	dmiller@manchesternh.gov
Jeff Belanger	Planning	jbelanger@manchesternh.gov
Kerrie Poplin	Planning	kpoplin@manchesternh.gov
Mike Landry	Planning	mlandry@manchesternh.gov
Chris Pratt	DPW	cproulx@manchesternh.gov
Phil Alexakos	MFD	palexakos@manchesternh.gov
Sarah Morris	NHD	Smorris@manchesternh.gov

APPENDIX G

PUBLIC AND OTHER AGENCY PARTICIPATION


snhpc.org
Working as the Regional Planning Commission and Metropolitan Planning Organization for the Southern New Hampshire Region.
COMMUNITY PROFILES
DATA AND GIS
TRANSPORTATION PLANNING
COMMUNITY AND ECONOMIC DEVELOPMENT
ENVIRONMENTAL PLANNING
SNHPC
HOME
ABOUT THE COMMISSION
OFFICERS, BOARD AND STAFF
OFFICE HOURS AND DIRECTIONS
REPORTS AND PUBLICATIONS
EMPLOYMENT
REQUEST FOR PROPOSAL/QUALIFICATIONS
NEWSLETTER
LINKS
GATEWAY TO TRANSPORTATION RESOURCES
BROWNFIELDS
OFFICE ADDRESS
438 Dubuque Street
Manchester, NH 03102
Phone: 603-669-4664
Fax: 603-669-4350
www.snhpc.org
Staff Directory
Please browse the various areas of this web site and give us your feedback on how we can serve you better.
For copies of meeting minutes and other related documentation, please contact SNHPC.
facebook
Welcome to the official website of the Southern New Hampshire Planning Commission (SNHPC). The Commission was formed under the New Hampshire Statutes in 1966. SNHPC serves as the coordinating agency for the planning initiatives of fourteen communities in the region.
By taking a regional approach to address development concerns, we can attempt to craft effective and efficient solutions that will preserve the special character and valuable resources of the region.
FOR INFORMATION ON A COMMUNITY CLICK ON MAP
Deerfield
Nottingham
Candia
Manchester
Auburn
Chester
Londonderry
Derry
Windham
The Commission is also the Metropolitan Planning Organization (MPO) for the region. The MPO is an organization that conducts transportation planning in a cooperative, comprehensive, and continuous manner. The Federal Highway Acts stipulate that highway construction funds in urbanized areas can only be utilized by states with an MPO in place.
Working Together: 50 Years of the Southern New Hampshire Planning Commission Video
SNHPC 50th Anniversary
from MPTS - Channel 16
Issues facing the Region
1966 - 2006
BECOMING AGE-FRIENDLY WITH SNHPC
MEETING NOTICE
Executive Committee
May 3, 2018
7:30 AM, Belmont Hall
Marketing Scenic Byways in NH
May 9, 2018
2:00 PM, FSB Community Learning Center, Tilton
Manchester Hazard Mitigation Committee
May 14, 2018
2:00 PM, Manchester Fire Dept (100 Merrimack St)
LATEST NEWS
Job Posting: Principal Transportation Planner (3/26/18)
April 2018 Community Report (4/5/18)
DRAFT TIP Amendment #4 (3/9/18)
Monadnock Presentation (SNHPC 1/23/18)
RSA Presentation (TAC 1/18/18)
-RSA Locations
FY2017 List of Obligated Projects (1/8/18)
Lead Poisoning in NH (12/20/17)
Becoming Age-Friendly Webinar (12/17/17)
MPO/SNHPC Meeting 11/28/17
Presentation 1 - Census LUCA
Presentation 2 - State of Solar in NH
Check out our BAF Video! (2:24) - 11/27/17
Demystifying the M54 Permit Webinar Materials
MPO/SNHPC Meeting 9/26/17
Presentation 1 - Ten Year Plan
Presentation 2 - CMAQ Solicitation
Manchester Connects Final Report (9/12/17)
Manchester Connects Action Kits (9/12/17)
Overview
Kit 1: Logo + Riverwalk
Kit 2: Land Use + Parking
Kit 3: Placemaking
Kit 4: Organization
FY 2019 - FY 2028 Ten Year Transportation Improvement Plan - Draft
1:54 PM

CITY OF MANCHESTER HAZARD MITIGATION PLAN MEETING
(OPEN TO THE PUBLIC)

The Southern New Hampshire Planning Commission (SNHPC) is assisting the City of Manchester in updating the community's existing 2011 Hazard Mitigation Plan and is inviting the public and surrounding municipalities as well as other local, town, state and federal officials and environmental organizations to participate in the planning process.

The fifth Manchester Hazard Mitigation Committee Meeting will take place on May 14, 2018 at 2:00PM in the Manchester Fire Department at 100 Merrimack Street, Manchester, NH.

As the primary contacts for the plan, please contact Kevin Healey (khealey@manchesternh.gov) or Derek Shooster (dshooster@snhpc.org) for any questions, information, or interest in the plan at (603)-669-4664. Thank you!

END

(Attachment featured on www.manchesternh.gov and at Public Library).

APPENDIX H

PRIORITIZED MITIGATION ACTIONS FROM PREVIOUS PLAN

Rank	Action		
Cost	***Leadership***	***Time Frame***	***Funding***
	Statement of Benefits and Costs		
1	Continue the separation of Combined Sewer Overflows as part of the Supplemental Environmental Projects Program in Manchester.		
$150 mill	*Environmental Protection Div. and Dept. of Public Works*	*15 Years*	*City Operating Budget, US EPA, NH DES*
	Separation of the CSOs, a funded and in process project, will reduce pollution in the rivers and will minimize stormwater flooding due to a system functioning over capacity.		
2	Continue to upgrade and increase communications infrastructure, including redundant rings of fiber for emergency backup purposes		
>$100,000	*Infosystems*	*5-10 Years*	*City Operating Budget*
	Necessary to insure adequate communications ability during emergencies/disasters		
3	Revise and update Hazmat/Terrorism response as required		
$10,000 - $25,000	*Fire Department*	*Continuous as needed*	*City Operating Budget, EMPG*
	To maximize the potential of the City's Hazmat and Terrorism response, revisions and updates are essential to ensure the City's safety and security.		
4	Incorporate all GIS and database materials developed during the hazard mitigation planning process by SNHPC into the City of Manchester's GIS system in order to effectively plan and implement future mitigation projects		
<$10,000	*Planning Department, InfoSystems*	*< 1 Year*	*City Operating Budget*
	A low cost way to have essential data available to identify potential future hazards; protect populations, structures and infrastructure at risk; and mitigation planning efforts. Being done as part of the Hazard Mitigation Plan update process.		
5	Hazardous tree removal program to identify & remove diseased or damaged trees.		
$50,000	*DPW, Parks & Rec. Dept.*	*5 Years*	*City Operating Budget*
Annually	Project costs would be less than cost of mitigated damages to homes and infrastructure, particularly reduced power and telephone outages if trees or limbs were to fall during a hazard event.		

Rank	Action		
Cost	***Leadership***	***Time Frame***	***Funding***
	Statement of Benefits and Costs		

6	Public education through public service announcements and dissemination of information at different venues and training programs on emergency management, response and sheltering in place.		
$25,000 - $50,000	*Planning, Police, Fire Depts*	*Continuously as events/programs are scheduled*	*City Operating Budget, CERT*
	Public education is typically a low cost method to increase public awareness of emergency management, hazard mitigation and appropriate response, these benefits are immeasurable.		
7	Maintenance program for underground utility lines		
>$100,000	*Highway Dept*	*Continuously*	*CMOMs*
	Proper maintenance will deter costly repairs in the future		
8	Community Warning System- planning and project development		
$10,000 – $25,000	*Planning, Police, Fire Depts*	*2 Years*	*City Operating Budget*
	This is the first step in a three part project. Costs for planning and project development would be minimal. Benefits would not be seen until after the third step, implementation.		
9	Replace aging highway equipment		
$5 mill	*Highway Dept, DPW*	*Continuously as needed*	*City of Manchester*
	Vehicles are initially expensive. Replacement of older equipment will help the City keep roads clear for emergency vehicles and save lives.		
10	Merrimack River secondary water treatment plant and water supply		
$30 mill	*MWW*	*10 Years*	*MWW, Grants*
	Development of the Merrimack River as a secondary source of supply for the greater Manchester area will not only supply needed water resources, but will provide a level of redundancy in the event of natural or manmade disasters.		
11	Hazard Mitigation for structural renovations to bridges to mitigate debris-impacted infrastructure		
>$100,000	*Highway Department*	*5-10 Years*	*City Operating Budget, EMPG*
	Structural renovations will help deter future failures		
12	Implement the Community Warning System- Sirens, etc.		
$250,000+	*Planning, Police, Fire Depts*	*5-10 Years*	*DPIG, EMPG or PDM with required City match*
	A community warning system, utilizing sirens, is a highly effective way of notifying residents of an emergency with the potential to save lives and assets.		
13	Extend sewer service to areas with onsite sewage disposal systems (install remainder of the trunkline interceptors only at this time)		
$6 million	*Environmental Protection Div. and Dept. of Public Works*	*10 Years*	*City Sewer Fees*
	Extension of the sewer service will prevent future environmental hazards from disaster situations		
Rank	**Action**		
Cost	***Leadership***	***Time Frame***	***Funding***

14	Upgrade culverts at Ray Brook crossing River Road and Elm Street as they are inadequate		
>$100,000	*Highway Department*	*5 Years*	*City Operating Budget, EMPG*
	Upgrading culverts can prevent future flooding issues		
15	Work with Eversource / Utilities to get lines underground		
>$100,000	*Highway Department*	*Continuously as development happens*	*Eversource/Utilities*
	Underground utilities, while costly, can prevent costly damages during emergencies and disasters. This will be a long-term effort, working with the utilities to make this happen as development continues in the future.		
16	Revise the Steep Slopes sections of the Zoning Ordinance (25%) and Subdivision and Site Plan Regulations (30%) to be consistent in chosen slope gradient.		
<$10,000	*Building and Planning Depts*	*1-2 Years*	*City Operating Budget*
	This is a low cost way to mitigate development on or near steep slopes that may pose a risk for erosion, landslides or mudslides.		
17	Construct a new Public Safety Training Facility for interdepartmental emergency planning and training efforts.		
$2 mill	*Police and Fire Depts*	*5 Years*	*City of Manchester*
	A new structure for training would allow Manchester's rescue personal to train on site, thus creating more opportunities for training and resulting in better skilled professionals in the event of an emergency.		
18	Flood proofing for selected historic Amoskeag mill buildings prone to repetitive flooding.		
>$100,000	*Planning and Building Departments*	*5-10 Years*	*FMAP or PDM with required City match contribution*
	Saves many thousands of dollars in flood damage repairs, especially repetitive loss properties. In Manchester's millyard this will help preserve historical buildings and help revitalize the downtown.		
19	Acquisition of flood prone properties, in particular Bass Island.		
>$100,000	*Planning and Building Departments*	*5 Years*	*FMAP or PDM with required City match contribution*
	Bass Island, located in the 100 year floodplain and floodway, is threatened by development. If developed, this area is prone to repetitive flooding. Acquisition of the undeveloped site would eliminate any future increase of flood damage costs		
20	Upgrade Queen City Bridge and Notre Dame Bridge to meet seismic design standards as funds become available		
$1+ mill	*Highway Department*	*15+ Years*	*City, NH DOT, Grants*
	Despite the expensive cost of this project, the benefits, in the event of a major earthquake, would be greater, ensuring access to both east and west Manchester for emergency services and/or evacuation and saved lives.		

APPENDIX I

MAPS

MAP 1: AREAS AT RISK

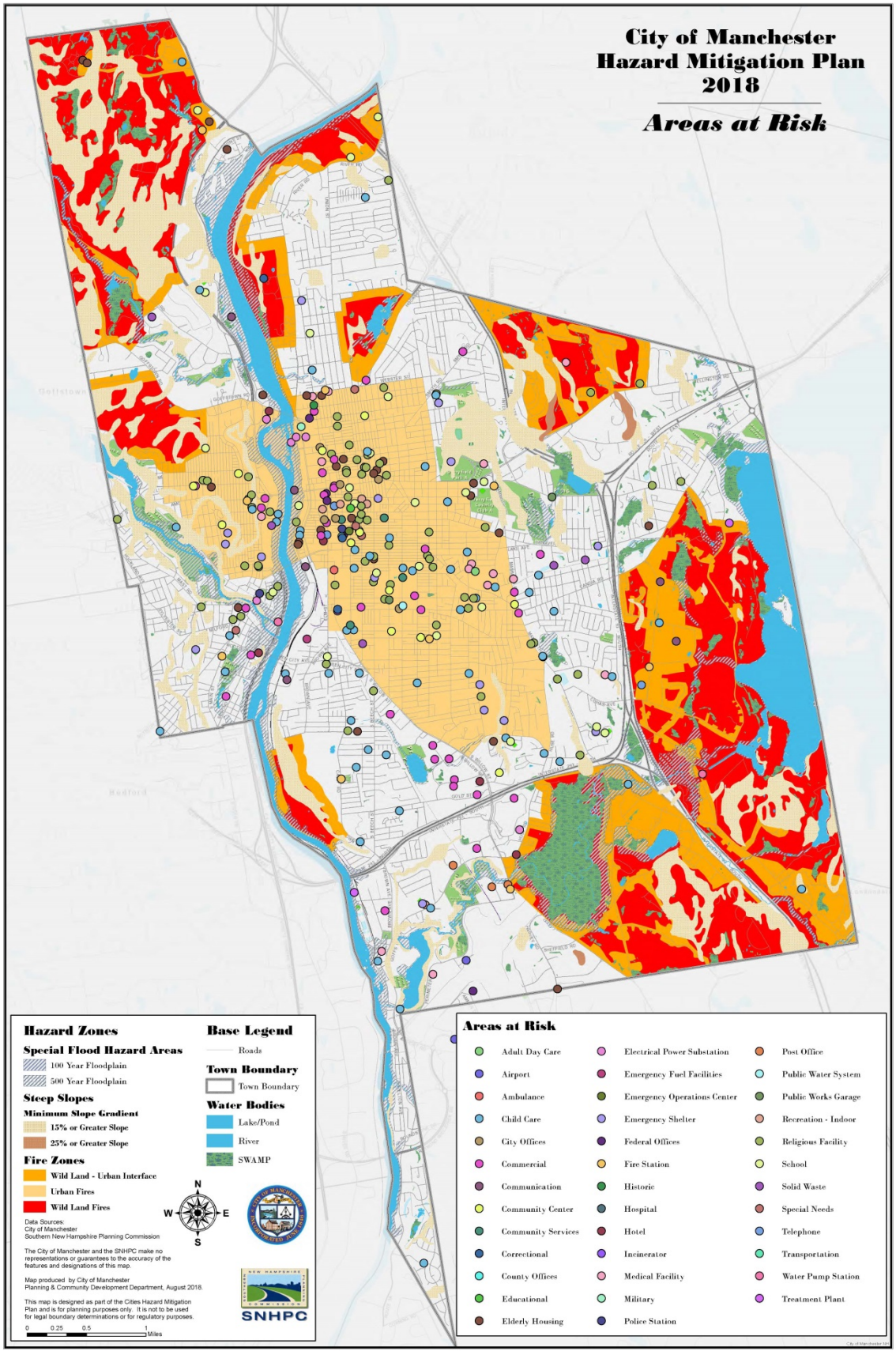
MAP 2: COMMERCIAL AREAS AT RISK

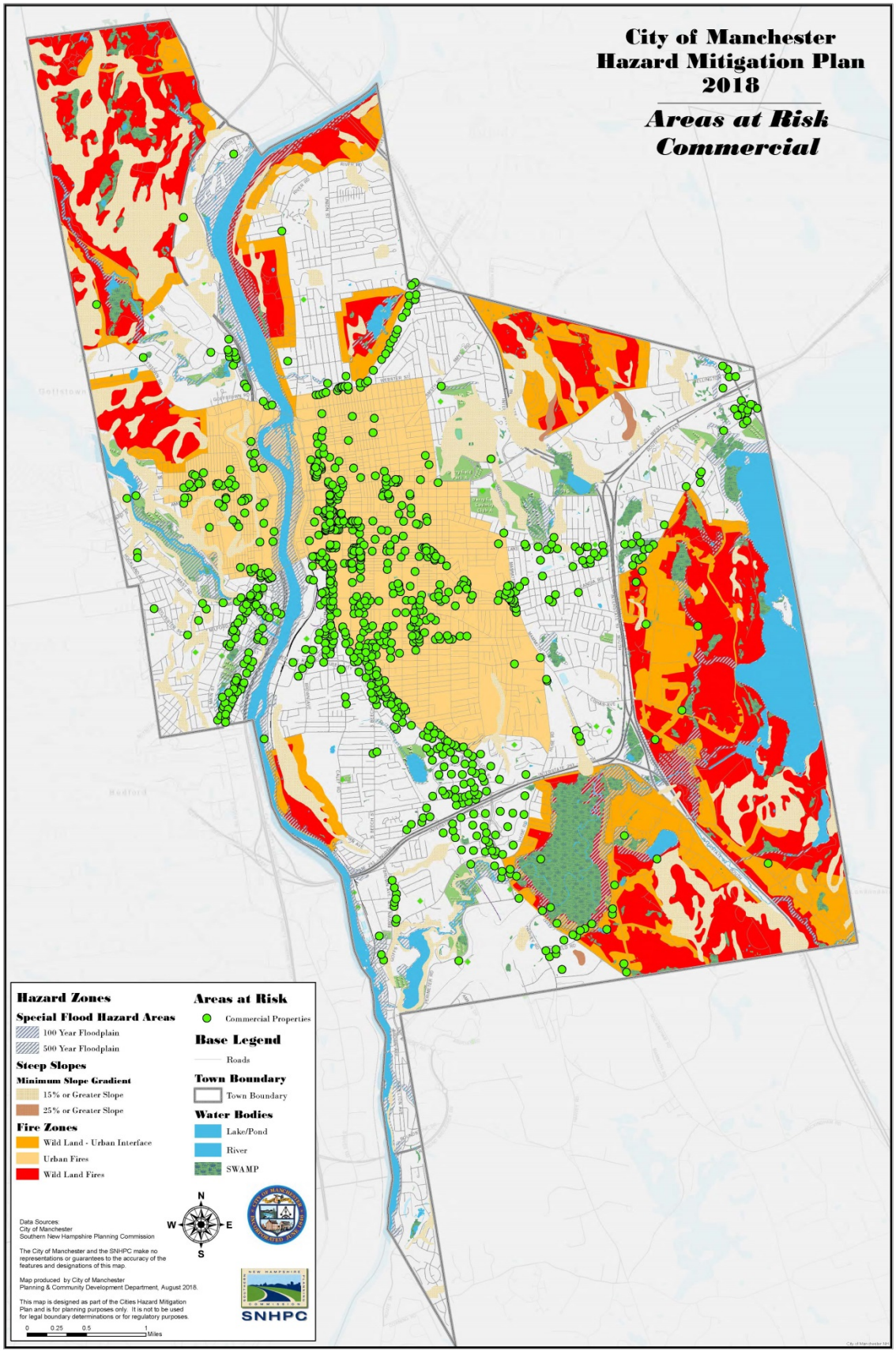
MAP 3: ESSENTIAL FACILITIES

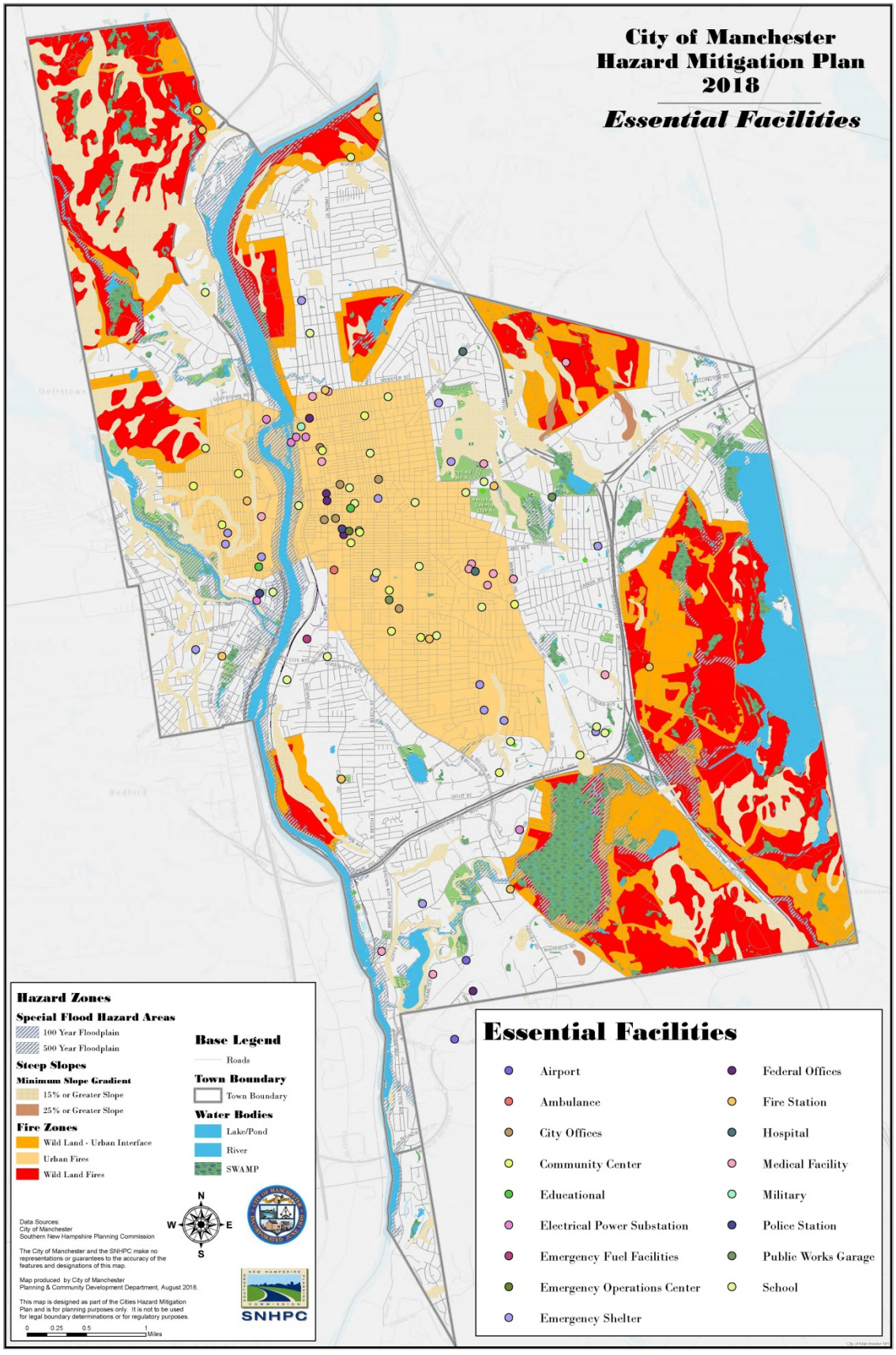
MAP 4: HAZARDOUS MATERIALS SITES

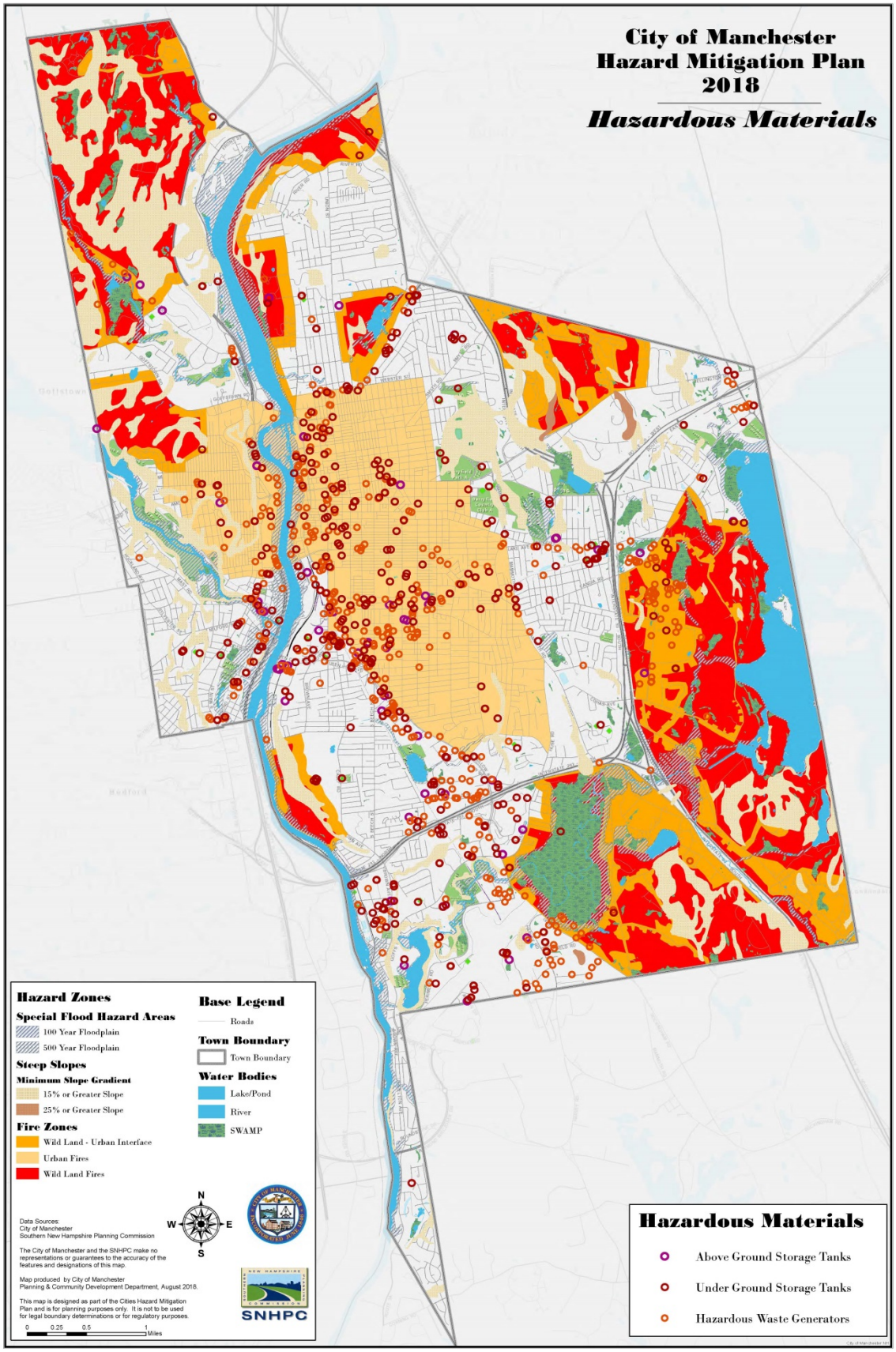
MAP 5: IDENTIFIED HAZARD ZONES

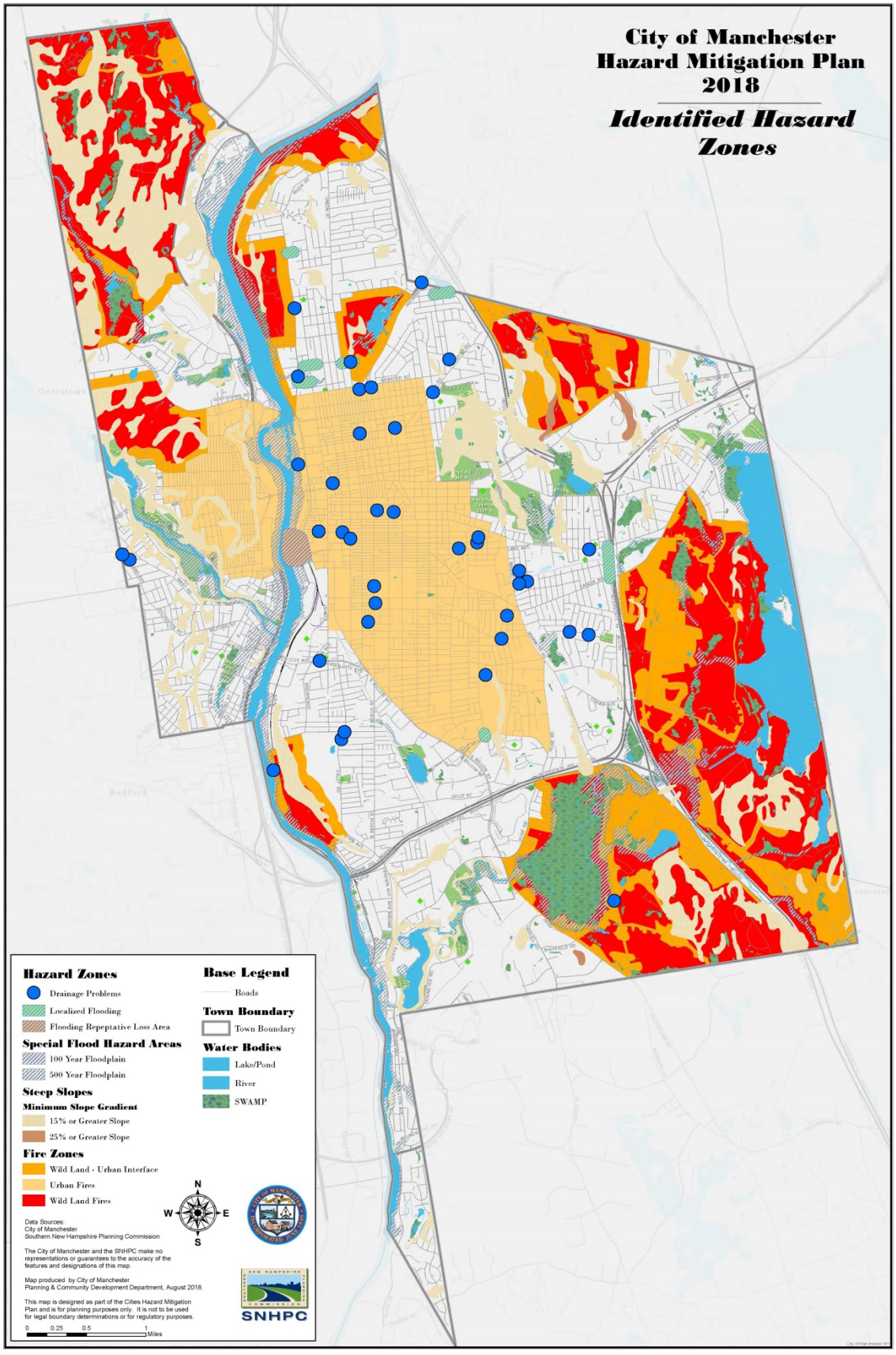
MAP 6: UTILITIES

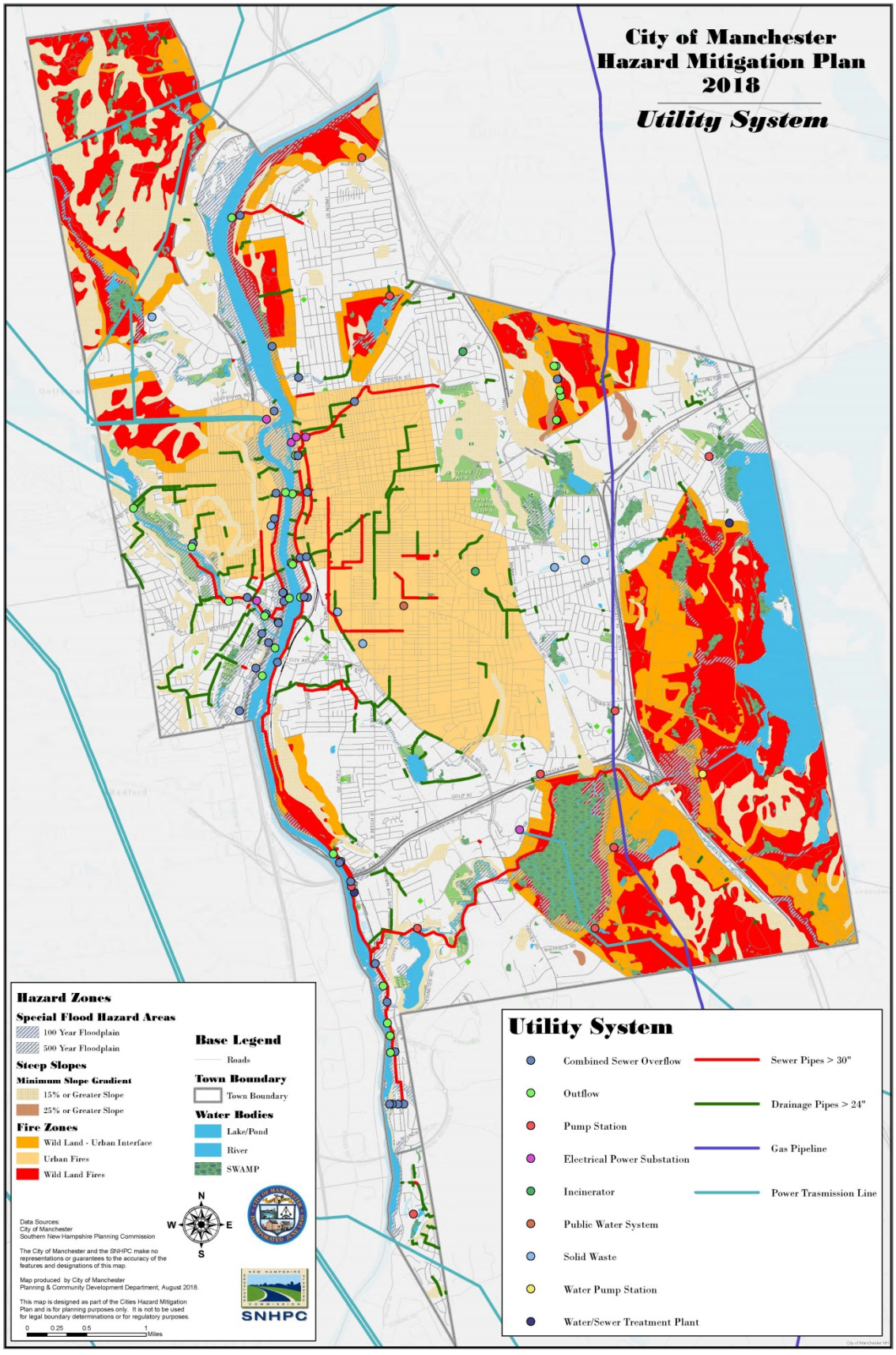

City of Manchester
Hazard Mitigation Plan
2018
Areas at Risk
Hazard Zones
Special Flood Hazard Areas
100 Year Floodplain
500 Year Floodplain
Steep Slopes
Minimum Slope Gradient
15% or Greater Slope
25% or Greater Slope
Fire Zones
Wild Land - Urban Interface
Urban Fires
Wild Land Fires
Data Sources:
City of Manchester
Southern New Hampshire Planning Commission
The City of Manchester and the SNHPC make no representations or guarantees to the accuracy of the features and designations of this map.
Map produced by City of Manchester
Planning & Community Development Department, August 2018.
This map is designed as part of the Cities Hazard Mitigation Plan and is for planning purposes only. It is not to be used for legal boundary determinations or for regulatory purposes.
0 0.25 0.5 1 Miles
Base Legend
Roads
Town Boundary
Town Boundary
Water Bodies
Lake/Pond
River
SWAMP
N
W
E
S
SNHPC
Areas at Risk
Adult Day Care
Airport
Ambulance
Child Care
City Offices
Commercial
Communication
Community Center
Community Services
Correctional
County Offices
Educational
Elderly Housing
Electrical Power Substation
Emergency Fuel Facilities
Emergency Operations Center
Emergency Shelter
Federal Offices
Fire Station
Historic
Hospital
Hotel
Incinerator
Medical Facility
Military
Police Station
Post Office
Public Water System
Public Works Garage
Recreation - Indoor
Religious Facility
School
Solid Waste
Special Needs
Telephone
Transportation
Water Pump Station
Treatment Plant


City of Manchester
Hazard Mitigation Plan
2018
Areas at Risk
Commercial
Hazard Zones
Special Flood Hazard Areas
100 Year Floodplain
500 Year Floodplain
Steep Slopes
Minimum Slope Gradient
15% or Greater Slope
25% or Greater Slope
Fire Zones
Wild Land - Urban Interface
Urban Fires
Wild Land Fires
Areas at Risk
Commercial Properties
Base Legend
Roads
Town Boundary
Town Boundary
Water Bodies
Lake/Pond
River
SWAMP
N
W
E
S
Data Sources:
City of Manchester
Southern New Hampshire Planning Commission
The City of Manchester and the SNHPC make no representations or guarantees to the accuracy of the features and designations of this map.
Map produced by City of Manchester
Planning & Community Development Department, August 2018.
This map is designed as part of the Cities Hazard Mitigation Plan and is for planning purposes only. It is not to be used for legal boundary determinations or for regulatory purposes.
0 0.25 0.5 1 Miles
SNHPC


City of Manchester
Hazard Mitigation Plan
2018
Essential Facilities
Hazard Zones
Special Flood Hazard Areas
100 Year Floodplain
500 Year Floodplain
Steep Slopes
Minimum Slope Gradient
15% or Greater Slope
25% or Greater Slope
Fire Zones
Wild Land - Urban Interface
Urban Fires
Wild Land Fires
Base Legend
Roads
Town Boundary
Town Boundary
Water Bodies
Lake/Pond
River
SWAMP
N
W
E
S
Data Sources:
City of Manchester
Southern New Hampshire Planning Commission
The City of Manchester and the SNHPC make no representations or guarantees to the accuracy of the features and designations of this map.
Map produced by City of Manchester
Planning & Community Development Department, August 2018.
This map is designed as part of the Cities Hazard Mitigation Plan and is for planning purposes only. It is not to be used for legal boundary determinations or for regulatory purposes.
0 0.25 0.5 1 Miles
SNHPC
Essential Facilities
Airport
Ambulance
City Offices
Community Center
Educational
Electrical Power Substation
Emergency Fuel Facilities
Emergency Operations Center
Emergency Shelter
Federal Offices
Fire Station
Hospital
Medical Facility
Military
Police Station
Public Works Garage
School


City of Manchester
Hazard Mitigation Plan
2018
Hazardous Materials
Hazard Zones
Special Flood Hazard Areas
100 Year Floodplain
500 Year Floodplain
Steep Slopes
Minimum Slope Gradient
15% or Greater Slope
25% or Greater Slope
Fire Zones
Wild Land - Urban Interface
Urban Fires
Wild Land Fires
Base Legend
Roads
Town Boundary
Town Boundary
Water Bodies
Lake/Pond
River
SWAMP
N
W
E
S
Data Sources:
City of Manchester
Southern New Hampshire Planning Commission
The City of Manchester and the SNHPC make no representations or guarantees to the accuracy of the features and designations of this map.
Map produced by City of Manchester
Planning & Community Development Department, August 2018.
This map is designed as part of the Cities Hazard Mitigation Plan and is for planning purposes only. It is not to be used for legal boundary determinations or for regulatory purposes.
0 0.25 0.5 1 Miles
SNHPC
Hazardous Materials
Above Ground Storage Tanks
Under Ground Storage Tanks
Hazardous Waste Generators


City of Manchester
Hazard Mitigation Plan
2018
Identified Hazard Zones
Hazard Zones
Drainage Problems
Localized Flooding
Flooding Repeptative Loss Area
Special Flood Hazard Areas
100 Year Floodplain
500 Year Floodplain
Steep Slopes
Minimum Slope Gradient
15% or Greater Slope
25% or Greater Slope
Fire Zones
Wild Land - Urban Interface
Urban Fires
Wild Land Fires
Base Legend
Roads
Town Boundary
Town Boundary
Water Bodies
Lake/Pond
River
SWAMP
N
W
E
S
Data Sources:
City of Manchester
Southern New Hampshire Planning Commission
The City of Manchester and the SNHPC make no representations or guarantees to the accuracy of the features and designations of this map.
Map produced by City of Manchester
Planning & Community Development Department, August 2018.
This map is designed as part of the Cities Hazard Mitigation Plan and is for planning purposes only. It is not to be used for legal boundary determinations or for regulatory purposes.
0 0.25 0.5 1 Miles
SNHPC


City of Manchester
Hazard Mitigation Plan
2018
Utility System
Hazard Zones
Special Flood Hazard Areas
100 Year Floodplain
500 Year Floodplain
Steep Slopes
Minimum Slope Gradient
15% or Greater Slope
25% or Greater Slope
Fire Zones
Wild Land - Urban Interface
Urban Fires
Wild Land Fires
Base Legend
Roads
Town Boundary
Town Boundary
Water Bodies
Lake/Pond
River
SWAMP
Data Sources:
City of Manchester
Southern New Hampshire Planning Commission
The City of Manchester and the SNHPC make no representations or guarantees to the accuracy of the features and designations of this map.
Map produced by City of Manchester
Planning & Community Development Department, August 2018.
This map is designed as part of the Cities Hazard Mitigation Plan and is for planning purposes only. It is not to be used for legal boundary determinations or for regulatory purposes.
0 0.25 0.5 1 Miles
N
W
E
S
SNHPC
Utility System
Combined Sewer Overflow
Outflow
Pump Station
Electrical Power Substation
Incinerator
Public Water System
Solid Waste
Water Pump Station
Water/Sewer Treatment Plant
Sewer Pipes > 30"
Drainage Pipes > 24"
Gas Pipeline
Power Trasmission Line

APPENDIX J

DOCUMENTATION OF PLAN ADOPTION

To the Board of Mayor and Aldermen of the City of Manchester:

The Committee on Public Safety, Health and Traffic respectfully recommends, after due and careful consideration, that the proposed Hazard Mitigation Plan prepared by Southern New Hampshire Planning Commission be approved.

(Unanimous vote with the exception of Alderman Gamache who was absent)

Respectfully submitted,

Clerk of Committee

At a meeting of the Board of Mayor and Aldermen held September 4, 2018, on a motion of Alderman O'Neil, duly seconded by Alderman Shea, the report of the Committee was accepted and its recommendation adopted.

City Clerk

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

FEMA

SEP 26 2018

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 Manchester 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 **September 24, 2018** our Agency was notified that your office completed its review of the City of Manchester, New Hampshire Hazard Mitigation Plan 2018 and determined it meets the requirements of 44 C.F.R. Pt. 201.

With this plan approval, the City of Manchester 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 City of Manchester, New Hampshire Hazard Mitigation Plan 2018 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 September 24, 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.

SEP 26 2018

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

Sincerely,

Mark F. Gallagher for

Douglas F. Wolcott Jr.
Acting Deputy Regional Administrator

DFW: ms

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