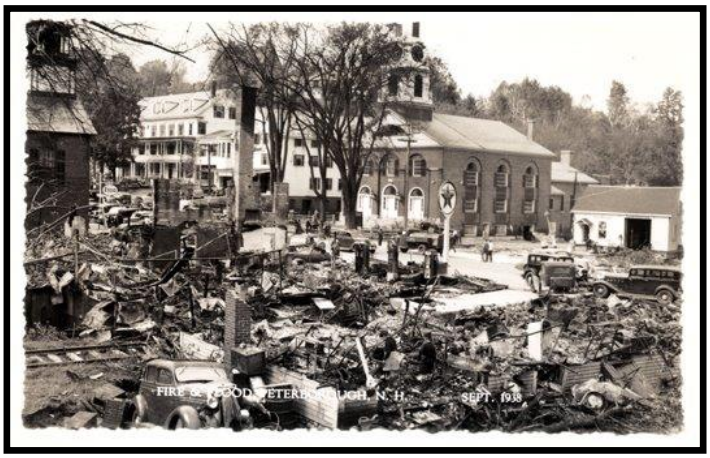
HAZARD MITIGATION PLAN

FOR THE TOWN OF PETERBOROUGH

NEW HAMPSHIRE



2021 UPDATE

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HAZARD MITIGATION PLAN

2021 UPDATE

FOR THE TOWN OF PETERBOROUGH

NEW HAMPSHIRE

Prepared by the:

Town of Peterborough Hazard Mitigation Committee

&

The Peterborough Office of Planning & Building

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

FEMA

December 14, 2021

Brian Eaton, State Hazard Mitigation Officer
New Hampshire Department of Safety, Homeland Security and Emergency Management
33 Hazen Drive
Concord, New Hampshire 03303

Dear Mr. Eaton:

As outlined in the FEMA-State Agreement for FEMA-DR-4457, your office has been delegated the authority to review and approve local mitigation plans under the Program Administration by States Pilot Program. Our Agency has been notified that your office completed its review of the Hazard Mitigation Plan for the Town of Peterborough New Hampshire and approved it effective **December 13, 2021** through **December 12, 2026** in accordance with the planning requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended, the National Flood Insurance Act of 1968, as amended, and Title 44 Code of Federal Regulations (CFR) Part 201.

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

The plan must be updated and resubmitted to the FEMA Region I Mitigation Division for approval every five years to remain eligible for FEMA mitigation grant funding.

Thank you for your continued commitment and dedication to risk reduction demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please contact Jay Neiderbach at (617) 832-4926 or Josiah.Neiderbach@fema.dhs.gov.

Sincerely,

Paul F. Ford
Acting Regional Administrator
DHS, FEMA Region I

PFF:jn

cc: Fallon Reed, Chief of Planning, New Hampshire

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EXECUTIVE SUMMARY

The Peterborough Hazard Mitigation Plan serves as a means to reduce future losses from natural, technological, or human-made hazard events before they occur. This updated Plan was developed by the Peterborough Hazard Mitigation Committee and contains Hazard Mitigation Goals consistent with those of the State of New Hampshire and specific to Peterborough.

Hazards addressed in this Plan are as follows:

- **Natural Hazards**
  - Flooding
  - Nor'easters/Heavy Snow Storms
  - Ice Storms
  - Infectious Disease
  - Drought
  - Ice Jam
  - High Winds (Tornadoes)
  - Tropical Storms
  - Lightning/Thunderstorms/ Downbursts/Hail
  - Urban Fire
  - Solar Storm & Space Weather
  - Extreme Cold
- **Natural Hazards**
  - Earthquake
  - Wildfire
  - Extreme Heat
  - Landslide
  - Subsidence
  - Avalanche
- **Technological Hazards**
  - Long-Term Utility Outages
    - Communication
    - Electricity
    - Water Systems
    - Wastewater Treatment Plant
  - Aging Infrastructure
  - Dam Failure
  - Radiological Release
- **Human-Caused Hazards**
  - Transport Accident
  - Cyber Event
  - Mass Casualty Incident
  - Terrorism/Violence

The Peterborough Hazard Mitigation Committee identified Critical Facilities and categorized them as follows:

Emergency Response Facilities & Services

- Fire Station
- Police Station
- Public Works Department
- Town House
- Community Center
- Utilities
- Dams
- Major Transportation Routes

Facilities/Populations to Protect

- Medical/Healthcare Facilities
- Schools
- Employment Centers
- Residential Populations
- Hazardous Materials Storage

Non-Emergency Response Facilities

- Vose Farm Road Business Center
- NH Ball Bearing
- ConVal Schools
- Monadnock Community Hospital
- Downtown Commercial District
- Village Commercial District
- Route 101 Retail Area

Potential Resources

- Fire Station
- Police Station
- Public Works Department
- Town House
- Community Center
- Public and Private Emergency Generators

Special Consideration

- Historic Structures/Sites
- Churches
- Recreational Sites & Facilities
- Data

Peterborough Hazard Mitigation Goals

HAZARD MITIGATION GOALS

TOWN OF PETERBOROUGH, NH

The overall Goals and Objectives of the Town of Peterborough with respect to Hazard Mitigation are stipulated below. These goals and objectives have been developed by the Hazard Mitigation Committee and are considered representative of Peterborough's circumstances regarding hazard mitigation. These goals are also consistent with those contained in the State of New Hampshire Multi-Hazard Mitigation Plan Update of 2018.

1. To improve upon the protection of the general population, the citizens of the Town of Peterborough and guests, from all natural, technological, and human-made hazards.

2. To reduce the potential impact of disasters on the Town of Peterborough's Emergency Response Services.

3. To reduce the potential impact of disasters on the infrastructure and Critical Facilities in the Town of Peterborough.

4. To improve the Town of Peterborough's Emergency Preparedness and Disaster Response and Recovery Capability.

5. To address the challenges posed by climate change relative to the increasing risks and impacts of the hazards identified in this Plan.

6. To reduce the potential impact of disasters on the Town of Peterborough's economy and on its natural environment.

7. To reduce the potential impact of natural and man-made disasters on the Town of Peterborough's specific historic treasures.

8. To identify, introduce, and implement cost-effective Hazard Mitigation measures so as to accomplish the Town's Goals and Objectives and to raise the awareness and acceptance of Hazard Mitigation opportunities generally.

9. To enhance public awareness of all identified hazards in order to prevent and mitigate hazard impacts.

10. To work in conjunction and cooperation with the State of New Hampshire's Hazard Mitigation Goals.

Recommended Mitigation Strategies:

The Peterborough Hazard Mitigation Committee identified a number of existing hazard mitigation programs and strategies, described in detail in Chapter 6. The Peterborough Hazard Mitigation Committee prioritized them as follows, based on a methodology described in Chapter 8:

2021 Hazard Mitigation Strategies

1. Incorporate the Hazard Mitigation Plan into the Master Plan by reference.
2. Repair the North Dam
3. Upgrade the Community Rating System from Class VIII to Class VII
4. Participate in a USACE project for Asset Management Plans
5. Repair the Fly Pond Dam
6. Amend the Subdivision Street Standards to address dead-end roads
7. Review the Stormwater Management and Erosion Control Regulations
8. Complete the construction of the Main Street Bridge and Granite Street Retaining Wall
9. Continue to explore options for a Town Dispatch Center
10. Continue improvements to the Downtown Drainage System
11. Develop a Town Policy for Managing Town Government Operations During a Pandemic
12. Bring the Cold Spring Well online
13. Create a Town Webpage dedicated to Hazard Mitigation

ACKNOWLEDGEMENTS

The Peterborough Hazard Mitigation Committee was comprised of the following individuals who met and contributed to this Hazard Mitigation Plan 20 Update:

- Fash Farashahi, GIS/IT Director
- Scott Guinard, Chief of Police, Town of Peterborough
- Ed Henault, Peterborough Open Space Committee
- Tim Herlihy, Code Enforcement Officer, Town of Peterborough
- Matt Lundsted, Conservation Commission, Town of Peterborough
- Seth Maclean, Assistant Town Administrator/Public Works Director Town of Peterborough
- Danica Melone, Town Planner, Town of Peterborough
- Jason Tremblay, US Army Corps of Engineers, MacDowell Lake, Peterborough
- Edmund Walker, Fire Chief and Emergency Management Director, Town of Peterborough
- Alan Zeller, Planning Board, Town of Peterborough

Support was provided to the Committee throughout the process by Elizabeth Gilboy and Kayla Henderson of the NH Department of Safety.

Project Leader: Carol Ogilvie, Planning Consultant

CHAPTER 1

INTRODUCTION

BACKGROUND

As a result of the Disaster Mitigation Act of 2000, the Federal Emergency Management Agency (FEMA) has made it a requirement to have an approved hazard mitigation plan in order to be eligible for federal grants. In response to this mandate, the Town of Peterborough prepared its first Hazard Mitigation Plan that was approved and adopted in 2004; the update to that Plan was approved and adopted in 2010; a subsequent Plan was approved and adopted in 2016; this current Plan reflects the mandatory five-year update process. All applicable resources used in the development of this 2021 Update are listed in Appendix D.

WHAT IS HAZARD MITIGATION?

"Hazard Mitigation means any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards" (44 CFR 206.401).

AUTHORITY

This Hazard Mitigation Plan was prepared under the authority of the Planning Mandate of Section 409 of Public Law 93-288 as amended by Public Law 100-707, the Robert T. Stafford Act of 1988, hereinafter referred to as the "Stafford Act." Accordingly, this Hazard Mitigation Plan will be referred to as "the Plan."

FUNDING SOURCE

This Plan was funded by a grant from the Federal Emergency Management Agency.

PURPOSE

The Peterborough Hazard Mitigation Plan is a planning tool to be used by the Town of Peterborough, as well as other local, state and federal governments, in their efforts to reduce the effects from natural, technological, and human-made hazards. This plan does not constitute any section of Peterborough's Town Ordinances, although it is intended to be adopted by reference into the Peterborough Master Plan.

SCOPE AND METHODOLOGY OF THE PLAN

The scope of this Plan includes the identification of hazards that have affected the Town of Peterborough in the past, an assessment of future vulnerability from these and newly-identified hazards, identification of existing mitigation strategies, and the development of recommended improvements and new mitigation strategies targeted at the hazards that have been identified as being those most likely to affect the Town of Peterborough. Details of the process followed to develop this Plan are found in the Appendices. This Plan also relies on the NH State Multi-Hazard Plan, as well as many of the plans and documents referenced in Chapter 6, Table 14 and in the Appendices.

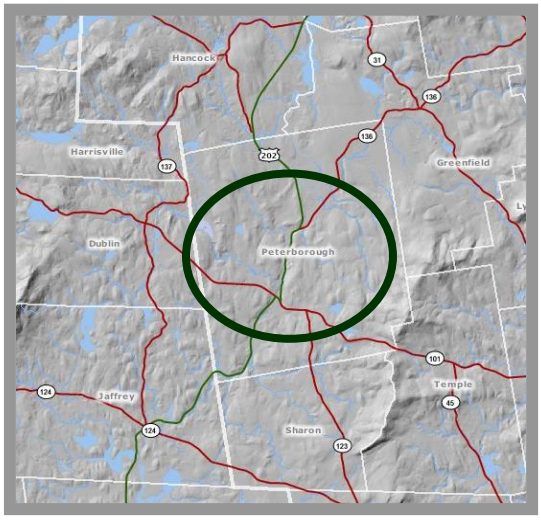
CHAPTER 2

COMMUNITY PROFILE

TOWN OVERVIEW

The Town of Peterborough is located in Hillsborough County in southwest New Hampshire in what is known as the Monadnock Region (see State Map below). Peterborough is bounded on the north side by Hancock, on the east by Greenfield and Temple, on the south by Sharon, all in Hillsborough County, and on the west by Jaffrey, Dublin and Harrisville, all in Cheshire County (see Regional Map below).

State



Regional Map

The Town of Peterborough comprises 38 square miles of land area and 0.4 square miles of inland water area. The natural form of the town of Peterborough consists of a triangular shaped valley, running and widening in a south to north direction and contained to the west and east by rising topography. Towards Dublin and Jaffrey, elevations rise to approximately 1,000 feet above sea level. Towards Sharon, Temple, and Greenfield, elevations rise to the summit of Pack Monadnock Mountain which is at 2,280 feet above sea level. The dominating topography is, therefore, to the southeast.

The Contoocook River, originating south of Peterborough in Rindge, flows in a northerly direction to Concord and a confluence of the Merrimack River system. The Contoocook approximately bisects the valley base that makes up the entire central portion of the town's geography. Nubanusit Brook (which is controlled by the US Army Corp of Engineers at MacDowell Dam), with its sources to the northwest of Peterborough, flows southeasterly to join the Contoocook River at the narrow southern end of the valley. The confluence of these two systems is the location of Downtown Peterborough in the main village area; the availability and amenity of this major water source obviously being of significance in the original selection and development of the site.

A three-member Board of Selectmen governs the Town of Peterborough. The Town supports a full-time Town Administrator, as well as Police and Fire Chiefs, Directors of Public Works,

Finance, Recreation and Library, a Town Planner, and a Code Enforcement Officer, all with associated support positions both full- and part-time.

DISASTER RISK

The greatest identified risks for Peterborough are from flooding, winter storms and communication and electrical disruptions. The high risk is attributed to both the high probability of occurrence and the potential for extensive damage associated with these risks. More information and detail about risk can be found in Chapter 4.

DEVELOPMENT PATTERNS AND LAND USE

Population & Housing Trends

Tables 1-3 following present past and current information on population and the housing supply in Peterborough. Please note that for purposes of consistency, only US Census and/or NH Office of Strategic Initiatives (OSI) data are used.

Table 1 shows population data for the past four decades; please note that the population for 2020 is an estimate, as the final counts for the U.S. Census is not complete as of this writing. These data show a fairly moderate rate of growth for the Town; the decade of the 1990s saw the greatest increase in population since 1980, and that 12.3% increase represents an average annual increase of just over one percent. The total population increase since 1980 averages out at 0.01% annually. The last decade has seen the second largest rate of growth since the 1990's, at 10%.

Table 1: Peterborough Population 1980 - 2019

	1980	1990	2000	2010	2019	% Change 1980 - 2019
Population	4,895	5,239	5,883	6,284	6,688	37%
% Change		7%	12%	7%	6%	

Sources: U.S. Census; NH Office of Strategic Initiatives; Town of Peterborough

In terms of future population (see Table 2 below) the NH Office of Strategic Initiatives estimates that Peterborough will have a population of just over 7,000 by the year 2040. While population projections can vary widely in accuracy of prediction, in 2016 OSI had projected a population of 6,904 for the year 2020, and in this year is still using this number as an estimate. Therefore, the future projections at this point seem to be realistic. And if so, the numbers indicate a much slower population growth than the Town has experienced over the past several decades.

Table 2: Peterborough Population Projections

	2020	2025	2030	2035	2040	% Change 2020 - 2040
Population	6,688	6,795	6,926	7,008	7,037	5.2%
% Change	--	1.6%	1.9%	1.2%	0.4%	

Source: NH Office of Strategic Initiatives; Town of Peterborough

Housing supply for Peterborough is illustrated below in Table 3. The housing stock has increased at a much greater rate than the population over the past 40 years. This is, however, not uncommon in that nationwide we are seeing smaller, and therefore more numerous, households. Some of the increase seen here is also related to numerous building permits that were granted in the past but were not built out and occupied until much later.

Table 3: Peterborough Housing Supply

	1980	1990	2000	2010	2019	% Change 1980 - 2013
Total Housing Units	1,952	2,242	2,509	2,956	3,137	60.1%
% Change	--	14.8%	11.9%	17.8%	6.1%	

Sources: U.S. Census; NH Office of Strategic Initiatives

The make-up of the housing stock is fairly evenly divided between single-family homes and multi-family units (51.5% single-family and 48.5% for multi-family). This is somewhat unusual for towns in rural New Hampshire, but there are a few reasons for this: (1) Peterborough has a municipal water and sewer system; therefore, the Town can accommodate multi-family units that rely on this infrastructure; (2) the data used for this table combines duplex units with multi-family units; and (3) condominium units – which are typically constructed as attached units, are counted as single-family units because they are owner-occupied.

Historic Development Patterns

Peterborough's development pattern can be described as having four components: (1) highway development along Routes 101 and 202; (2) village nodes; (3) neighborhoods; and (4) frontage development along the town roads. An examination of old town maps indicates that Peterborough always had a dispersed development pattern; this is likely because the Town was divided into lots as soon as the land grant was sold. A 1954 map does not look appreciably different in terms of dispersal than today's land use map. The first Master Plan, written in 1974, identified five distinct villages or neighborhood areas; by 1992, those had increased to eight. The observation was also made in the 1992 Plan that the distinction between town and country had become blurred, with some areas connected by highway strip development, a type of development not typical of an old-fashioned New England Village.

General Land Use Pattern

Today, the general land use pattern is not appreciably different from that described in 1992. As noted above, some of the village areas are connected by strip development and are not typical of an old-fashioned New England village. The remainder of the Town is still predominantly rural, although there are pockets of residential development throughout. The 1992 Master Plan provides a detailed description of these individual areas.

Present Development Pattern

Described on the following pages are the various land uses that exist in Peterborough today. The identification of these uses was based on tax assessing information, aerial photographs, and visual surveys, and is illustrated on the Existing Land Use Map on Page 9.

- **RESIDENTIAL.** Residential development in Peterborough is comprised of a mix of single-family homes, condominium developments and multi-family housing. As the Existing Land Use Map illustrates, this development is dispersed throughout the entire Town, much of it as frontage development along town roads. In addition, there are clusters of village or neighborhood development, as well as several apartment/condominium developments. Significant residential populations include: Southfield Village on Route 202 north; the RiverMead Retirement Community that includes cottages and multi-unit villas; and several large apartment complexes, two in West Peterborough and two on Route 202 north.

- **COMMERCIAL.** Commercial activity in Peterborough is, for the most part, located along Route 202 north and south, and in the Downtown/Village areas. There are several areas where commercial activity is clustered (outside of the Downtown). One of these is at the intersection of Routes 101 and 202 South to the Monadnock Plaza; just west of this intersection is a small retail center that contains a grocery store and pharmacy. Along Route 202 South are existing commercial/industrial buildings that are being revitalized and expanded; and 202 North has a small cluster of commercial uses in the area north and south of the Contoocook Valley Regional High School.

- **INDUSTRIAL/LIGHT INDUSTRIAL.** Industrial activity does not comprise a significant portion of developed land uses in Peterborough, accounting for less than ***two percent*** of the developed land area. Most of the land area that is designated as industrial is used for sand and gravel extraction. The number of buildings that are dedicated to this use is actually quite small, but includes NH Ball Bearings, Microspec, and Peterborough Basket; with the exception of Peterborough Basket Company, they are all located on Route 202 north and south of the center of Town.

- **PUBLIC/SEMI-PUBLIC/INSTITUTIONAL.** These uses are principally municipal government functions, such as town government offices and facilities (including the Library); it does not include town-owned recreational facilities, which are identified separately. The category also includes churches, cemeteries, post offices, schools, and nursing homes (but not Assisted Living Facilities). The Town has a state-of-the-art Wastewater Treatment Plant with a solar array located at the same site that powers the Wastewater Treatment Plan and puts excess electricity back into the grid; and the Library is currently undergoing major new construction. On the private sector side, the Scott-Farrar Home has completed a project with a mix of independent and assisted living units and a memory care unit in a new facility on Elm Street.

- **RECREATIONAL.** The Town of Peterborough owns six public parks: Depot Park, Putnam Park, and Bocelli in the downtown; the Wilder (Rotary) Park on Hunt Road; Teixeria Park in West Peterborough; and Adams Playground on Union Street. Adams Playground is a 50-acre park that provides tennis courts, a swimming pool, basketball courts, baseball and softball fields, a volleyball court, an outdoor ice-skating rink, a skateboarding park, a children's playground center, and office space for the Recreation Department. In addition, there is a town beach at Cunningham Pond. And, although outdoor passive recreation takes place on many other lands all around Town, they are not specifically identified as "recreational," since they fall under protected lands or public lands category.

Other non-Town recreational areas consist of MacDowell Lake and Recreation Area and several State Parks.

Table 4 following presents the categories of land uses in Peterborough by acres and the percentage of land each use accounts for. Map 1 on Page 9 illustrates the location and spatial distribution of these land uses.

Based on the calculations presented in Table 4 below, residential use continues to account for the greatest amount of developed land area in town, although it has increased only slightly since the 2010 Plan was developed. In regard to Map 1 following, it appears that residential use (coded yellow on the map) accounts for most of the land area in town. For the purposes of this analysis, only two acres are assigned to every single-family home, regardless of the size of the lot; on the map, however, the entire parcel is colored. For all other land uses, the entire parcel acreage is utilized, since in most cases the entire parcel is occupied for the non-residential use. Overall, the amount of developed land increased by roughly one percent, with a corresponding decrease in the amount of vacant land; this change was largely accounted for by the modest increase in residential use and commercial use.

Table 4:
Existing Land Use, 2020 by Acre and Percent of Land Area

Land Use	Acres	% of Developed Land Area	% of Total Land Area
Residential	2,200	36%	9%
Commercial	836	14%	4%
Industrial	120	2%	1%
Public/Semi-Public	1,162	19%	5%
Recreation	1,148	19%	5%
Roads	710	11%	3%
Total Developed	6,177		26%
Total Land Area	23,732		
Vacant	17,555		74%

Source: Town of Peterborough Geographic Information System

POTENTIAL FOR DEVELOPMENT

The potential for future development in Peterborough is based on a number of factors, which include more than the amount of vacant land. Although Peterborough has approximately 18,000 acres (or 75% of its total land area) vacant, in actuality future development of all of this land might not be feasible, due to zoning restrictions and/or environmental constraints. In addition to land that has natural or regulatory constraints, there is also land that cannot be developed due to public or private conservation easements or some other form of protection.

Table 5 illustrates these three categories of constraints to development:

(1) Wetlands and shorelands that are regulated by the zoning ordinance; these sensitive areas cannot be used for development.

(2) Steep slopes and floodplains, which are not prohibited from development by town regulations, constitute lands that are generally considered to be problematic for development.

(3) Conservation Easements, which permanently restrict any kind of development. Leaving aside the steep slopes and floodplain which, as noted, may be developed in part at least, there are approximately 10,000 acres of land that are restricted or unavailable for development. Naturally there will be some overlap of these three features, but the fact remains that of the 18,000 vacant acres, a good portion of those acres are restricted in some fashion from development.

Table 5: Constraints to Development	
Constraints:	**Acres**
Wetlands	1,544
Shoreland	1,577
Total Zoning Constraints*	**3,121**
Slopes >25%	1,880
Floodplain	2,027
Total Natural Constraints	**3, 907**
Conservation Easements	**5,152**
Total Constrained Acres	**12,180**
Source: Town of Peterborough Geographic Information System	

*Note that the acres of wetland and shoreland in the table include the buffer, since this is land that is also unavailable for development.

A technique that staff in the Office of Planning and Building has used to estimate what level of growth could occur in the future is known as a Build-Out Analysis. "Build-out" is a theoretical condition, and it exists when all available land has been developed. The analysis estimates the maximum number of housing units that would exist with full build-out, the population of the Town at that time, and the year when build-out would be complete.

There are a number of variables that make up a thorough analysis, most of which are beyond the scope of this document. However, a simple calculation can be done for illustrative purposes ONLY, and this was done as part of the 2003 Master Plan update; there has been only a moderate amount of development since that time (@1%), so the estimates below are considered to be still reasonable. In the Rural District a lot must have at least 200 feet of frontage and a minimum of three acres in order to be considered a legal building lot. If only those lots in the Rural District that have twice the required frontage and lot size (and are not protected by conservation easements) are included in the calculation, it results in the following:

- There were 250 lots in the Rural District that meet the frontage and lot size criteria.
- Of the 250 lots, 180 already had a house on them, leaving 70 lots that were vacant.
- The 250 lots comprise @ 9,400 acres; the 70 lots comprise 2,550 acres.

Thus, as of 2003, there were about 70 lots in the Rural District that could be subdivided under the current zoning rules into at least two lots, without factoring in the possibilities of constructing roads or which housing types might be developed. Since this assessment was first completed, there have been approximately 10 new lots created in the Rural District that would meet the frontage and lot size criteria to be further subdivided. In the other districts in town, there have been no new subdivisions that would allow for further subdivisions; in fact, most of the Family and General Residence Districts are already built out.

In terms of potential for build out of these lots, there are a number of constraints to fulfilling such a hypothetical condition, including employment opportunities, willingness to subdivide

and develop, market influences, services available, and other factors relating to regional demographics. It is important to bear in mind that any analysis of this type is highly speculative, and external factors primarily related to the national and regional economies and populations will have a significant influence on development.

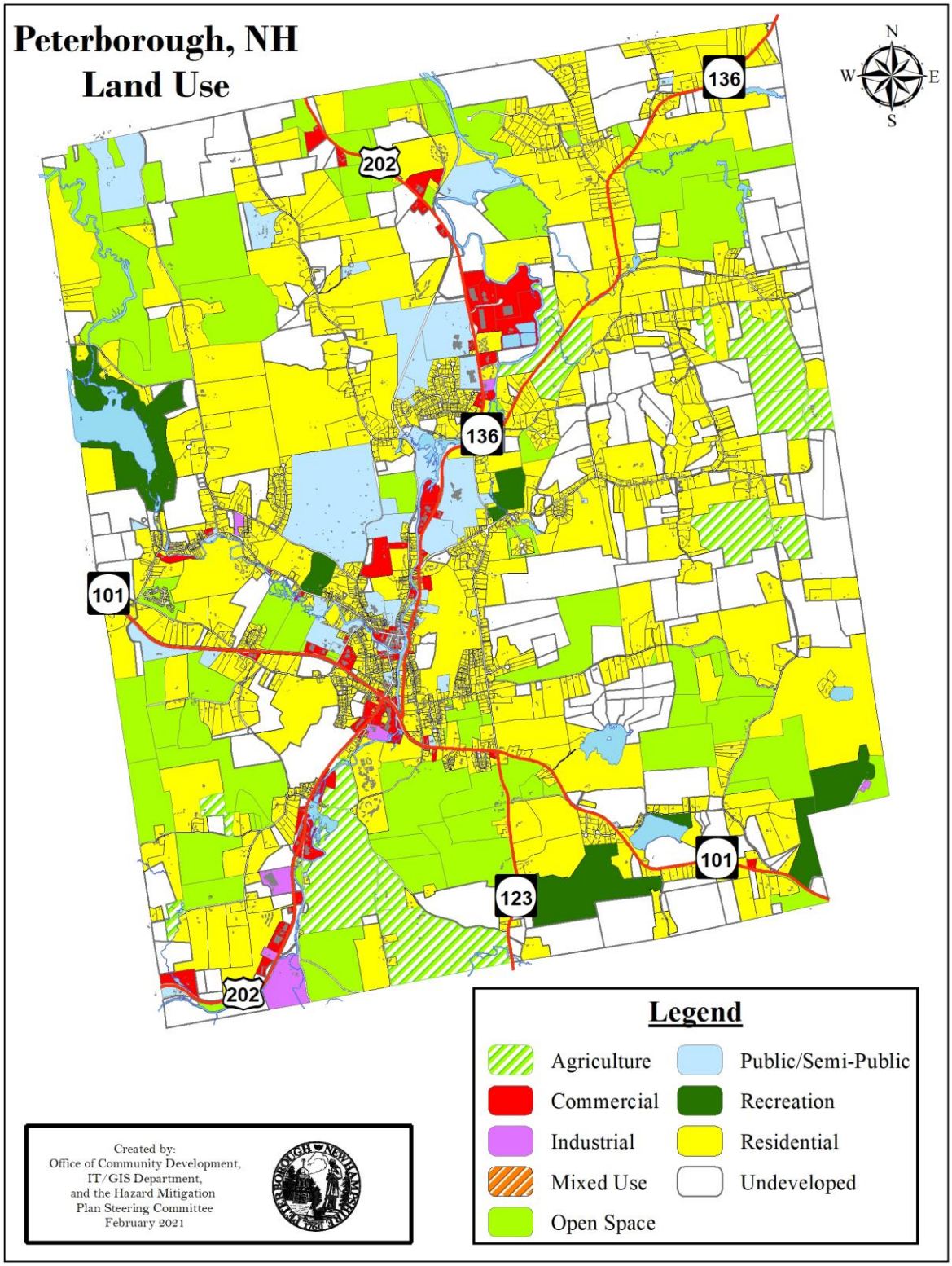
Development in Hazard Areas

Many of the hazards identified in this Plan are regional risks and as such, much of any new development would be vulnerable, at some level, to hazard risk. The exception to this is flooding, which, as has been noted, is not only a statewide issue but a local one, in that Peterborough has a history of flooding in specific areas; further, it is expected that flooding will continue to pose the greatest threat to the town.

Most of the development in the floodplain is residential, although there is a portion of commercial land along Route 202 south that lies within the flood hazard area. All new and substantial improvements must be constructed in accordance with FEMA/NFIP regulations, which is described in more detail in Chapter 6. Within the special flood hazard areas there is only moderate potential for new development; most of the land has already been built upon; in addition, there are approximately 800 acres within the flood hazard areas that are under some type of permanent easement, either Town-, State- or Federally-owned and managed.

Since the 2016 Plan Update, overall vulnerability within the identified hazard areas has changed very little, meaning that the hazards that were considered high risk at that time are still considered high risk. Other hazards, however, are considered to be less vulnerable. This is due in part because the overall risks and risk assessments have not changed; in part because there has been very little new development in these areas since 2016; and in part due to increase mitigation measures undertaken by the Town over the past several years.

MAP 1: EXISTING LAND USE



CHAPTER 3

HAZARD IDENTIFICATION

The State of New Hampshire's Multi-Hazard Mitigation Plan recommends that municipalities examine the hazards listed below; these include consideration of technological and human-made disasters as well as natural hazards. This Plan incorporates the majority of the natural hazards listed within the State Plan that are considered to be risks for Peterborough. Complete definitions of these hazards from the NH Multi-Hazard Mitigation Plan can be found in Appendix B. Snow Avalanche and Coastal Flooding are not addressed in this Plan because the risk of an avalanche is considered not applicable as there is no past history, Peterborough does not have the type of geology that lends itself to snow avalanche, nor does the State Plan identify Peterborough as being at risk. Coastal Flooding is not applicable because Peterborough has no coastal areas. The hazards are listed below in the order in which they are assessed in Chapter 5 by their risk potential.

NATURAL HAZARDS

- Inland Flooding
- Nor'easters/Heavy Snow Storms
- Ice Storm
- Infectious Diseases
- Drought
- Ice Jam
- High Winds (Tornadoes)
- Tropical Storms
- Lightning/Thunderstorms/Downbursts/ Hail
- Urban Fire
- Solar Storm & Space Weather
- Extreme Cold
- Earthquakes
- Wildfire
- Extreme Heat
- Landslide
- Subsidence
- Avalanche

TECHNOLOGICAL HAZARDS

- Long-Term Utility Outage
- Aging Infrastructure
  - Communication
  - Electricity
  - Water System
- Aging Infrastructure
- Dam Failure
- Radiological Release

HUMAN-CAUSED

- Transport Accident
- Cyber Event
- Mass Casualty Incident
- Terrorism/Violence

PAST HAZARD EVENTS THAT HAVE IMPACTED PETERBOROUGH

Over the years of Peterborough's history, the town has been impacted by numerous moderate and severe natural disasters that were localized, regional or statewide in coverage. Some of the more significant past events that have had the most widespread and damaging impacts on Peterborough are presented in Table 6 and in the narrative following.

Table 6:
Historic Hazard Events

Type of Event	Date/Disaster Number	County/Area/River Effected	Recurrence interval (in years)	Damage Amount	Impacts
Flooding	March 24-30, 1785	Pemigewasset, Merrimack, **Contoocook**, Blackwater and Ashuelot	Unknown	Unknown	
Flooding	October 24, 1785	Cocheco, Baker, Pemigewasset, **Contoocook** and Merrimack	Unknown	Unknown	Greatest discharge at Merrimack and at Lowell, Mass. Through 1902.
Flooding	April 21-24, 1852	Pemigewasset, Winnespaukee, **Contoocook**, Blackwater, and Ashuelot	Unknown	Unknown	Merrimack River at Concord; highest stream stage for 70 years. Merrimack River at Nashua; 2 feet lower than 1785.
Flooding	April 19-22, 1862	**Contoocook**, Merrimack, Piscataquog, and Connecticut	Unknown	Unknown	Highest stream stages to date on the Connecticut River; due solely to snowmelt.
Flooding/ Tropical Storm	October 3-5, 1869	Androscoggin, Pemigewasset, Baker, **Contoocook,** Merrimack, Piscataquog, Soughegan, Ammonoosuc, Mascoma, and Connecticut	Unknown	Unknown	Tropical storm lasting 36 hours. Rainfall, 6-12 inches.
Flooding	March 11-21, 1936	Statewide	25 to > 50>	Unknown	Double flood; first due to rains and snowmelt; second, due to large rainfall.
Flooding/ Hurricane	September 21, 1938	Statewide	Unknown	Unknown	Stream stages similar to those of March 1936 and exceeded 1936 stages in the Upper Contoocook River.
Flooding	November 1950	**Contoocook River and Nubanusit Brook**	Unknown	Unknown	Localized storm resulted in flooding of this area.
Severe Storms/ Flooding	August 27, 1986	Cheshire, **Hillsborough.**	Unknown	$1,005,000	Severe summer storms with heavy rains, tornadoes; flash flood and severe winds.
Flooding	March 31 to April 2, 1987	Androscoggin, Diamond, Saco, Ossipee, Piscataquog, Pemigewasset, Merrimack, and **Contoocook** Rivers.	25 to > 50		Caused by snowmelt and intense rain. Precursor to a significant, following event.
Severe Storms/ Flooding	April 16, 1987	Cheshire, Carroll, Grafton, **Hillsborough,** Merrimack, Rockingham, Sullivan	Unknown	$4,888,889	

Type of Event	Date/Disaster Number	County/Area/River Effected	Recurrence interval (in years)	Damage Amount	Impacts
Severe Storms/ Winds	August 29, 1990/ 876-DR	Belknap, Carroll, Cheshire, Coos, Grafton, **Hillsborough,** Merrimack, Sullivan.	Unknown	$2,297,777	A series of storm events with moderate to heavy rains produced widespread flooding in New Hampshire.
Hurricane	August 19, 1991/ DR-917-NH	Statewide, but extensive damage in Rockingham and Strafford Counties.	Unknown	Unknown	
Heavy Snow	March 16, 1993/ 3101-EM	Statewide	Unknown	$832,396	
Severe Storms/ Flooding	October 29, 1996/ 1144-DR	Grafton, **Hillsborough,** Merrimack, Rockingham, Strafford, Sullivan	Unknown	$2,341,273	
Ice Storm	January 15, 1998/ 1199-DR	Statewide	Unknown	$12,446,202	
Snow Emergency	March 8,2001/ 3166-EM	Cheshire, Coos, Grafton, **Hillsborough**, Merrimack, Rockingham, Strafford	Unknown	$4,500,000	
Snow Emergency	February 17-18, 2003/ 3177-EM	Cheshire, **Hillsborough**, Merrimack, Rockingham, Strafford	Unknown	$3,000,000	
Snow Emergency	March 11, 2003/ 3177-EM	Cheshire, **Hillsborough**, Merrimack, Rockingham, Strafford	Unknown	$3,000,000	
Snow Emergency	January 15, 2004/ 3193-EM	Belknap, Carroll, Cheshire, Coos, Grafton, **Hillsborough**, Merrimack, Sullivan	Unknown	$3,200,000	
Snow Emergency	March 30, 2005/ 3207-EM	Belknap, Carroll, Cheshire, Grafton, **Hillsborough**, Merrimack, Rockingham, Strafford, Sullivan	Unknown	$4,654,738	
Snow Emergency	April 28, 2005/ 3211-EM	Carroll, Cheshire, **Hillsborough**, Rockingham, Sullivan	Unknown	$2,677,536	
Severe Storm & Flooding	October 26, 2005/ 1610-DR	Grafton, **Hillsborough,** Merrimack, Rockingham, Strafford, Sullivan	Unknown	$2,341,273	
Severe Storm & Flooding	May 31, 2006/ 1643-DR	Belknap, Carroll, Grafton, **Hillsborough**, Merrimack, Rockingham, Strafford	Unknown	$17,691,586	
Severe Storm & Flooding	April 15 – 23, 2007/ 1695-DR	Statewide	Unknown	$27,900,000	

Type of Event	Date/Disaster Number	County/Area/River Effected	Recurrence interval (in years)	Damage Amount	Impacts
Flooding	October 3, 2008/ 1799-DR	**Hillsborough** and Merrimack	Unknown	$1,050,147	
Severe Winter Storm	December 11, 2008/ 3297-EM & 1812-DR	Statewide	Unknown	$15,000,000	Most of the damage was from heavy ice that brought down trees and power lines. Peterborough was without power in some parts for three weeks.
Severe Winter Storm	January 2, 2009/ 1812-DR	Statewide	Unknown	$19,789,657	
Severe Winter Storm/Rain/ Flooding	February 23-March 3, 2010/ 1787-DR	Grafton, **Hillsborough**, Merimack, Rockingham, Strafford, and Sullivan	Unknown	$2,000,000	Flood and wind damage to most of southern New Hampshire
Severe Winter Storm	May 12, 2010/ 1913-DR	**Hillsborough** and Rockingham	Unknown	$3,057,473	
Severe Winter Storm	October 29-30, 2011/ 3344-EM	Statewide	Unknown	Unknown	
October Nor'Easter	December 7, 2011/ 4049-DR	**Hillsborough** and Rockingham	Unknown	$4,411,457	
Hurricane	October 30, 2012/ 4095-EM	Statewide	Unknown	Unknown	
Severe Snow and Blizzard	February 8 – 10, 2013/ 4105-DR	Belknap, Carroll, Cheshire, **Hillsborough**, Merrimack, Strafford, Rockingham	Unknown	Unknown	
Severe Winter Storm	November 26-29, 2014	Statewide	Unknown	Unknown	217,000 Power Outages. The 5th largest power outage event in NH history.
Severe Winter Storm	January 26-28, 2015	**Hillsborough**, Rockingham, and Strafford			
Severe Winter Storm and Snowstorm	March 25, 2015 4209-DR	**Hillsborough**, Rockingham, and Strafford	Unknown	$4,939,214	
Flood Event	**October 30, 2017**	**Peterborough**	**Unknown**	**$30,000**	**Erosion of Town Roads**
Ice Jam/ Flooding	**January 12, 2018**	**Peterborough**	**Unknown**	**Unknown**	**Road flooding/Damage to numerous homes**
COVID-19 Pandemic	**1-20-20 ongoing DR-4516-NH**	**Peterborough/Statewide**	**Unknown**	**Unknown**	**Death/Economic Disruption**

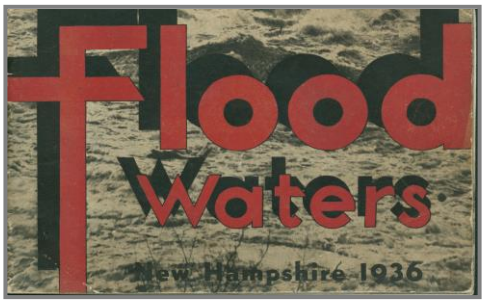
Sources:
NH Homeland Security and Emergency Management; FEMA; Peterborough Hazard Mitigation Committees

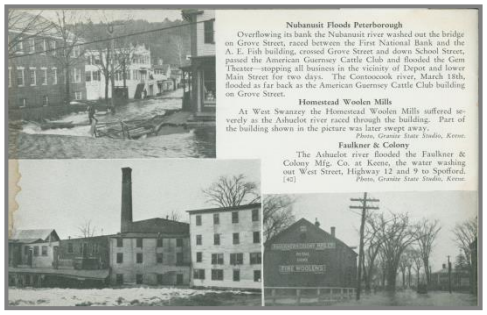
SELECTED SPECIFIC HAZARD EVENTS IN PETERBOROUGH

In Table #6 above, the last three events identified are new since the 2016 Update of this Plan; these three events were also Peterborough specific, although the pandemic is not specific to Peterborough. In the description of specific events below, the flooding of 2017 and ice jam of 2018 are also events that occurred since the 2016 Plan.

Since the last Plan update of 2016, Peterborough has not experienced any impacts from the following hazards: Dam Failure, Earthquake, Extreme Temperatures, High Winds/Tornadoes, Landslide, Lightning, Solar Storm and Space Weather, Tropical and Post-Tropical Cyclones, or Wildfire. This being New Hampshire, the Town has experienced severe winter weather, although these events have not led to any unusual problems or designated disasters.

(1) A flood in March of 1936 that was, at the time, considered to be the greatest disaster New Hampshire had ever experienced. This continues to be the flood of record for the Merrimack River Basin.





(2) The Hurricane of September 1938, which not only leveled much of the woodlands, but also caused serious flooding; much of the downtown burned because firefighters could not get through the floodwaters to fight the fires.

Downtown Peterborough September 21, 1938 – before the fires broke out.

(3) April 1951 Flood. This was the first flood event to be handled by MacDowell Dam, coming just nine months after construction was completed in 1950. During this event the Dam stored 52% of its capacity (4.2 billion gallons of water).

Flood, Fire and Hurricane Visit Peterborough

Peterborough received more than its share when "All Three" arrived together. The Contoocook River rose to a higher level than in 1936, flooding entire business district—then came fire and hurricane.

Plants of Transcript Printing Company, Farmers' Grain Company and other buildings were totally destroyed, and only by heroic efforts of firemen was entire village saved from being wiped out.

Town's loss was estimated in excess of $500,000.

[10]

B. & M. Railroad and main h
Joseph Noone's Sons Co. w
damaged.

(4) June 1984 Flood. During this event the MacDowell Dam reached a water elevation of 943.2 feet, which was above its normal elevation of 912 mean sea level. The dam stored 84% of its total capacity. This was the highest and biggest flood water storage event in Peterborough until the 1987 flood event.

(5) March-April 1987 Floods. This event represents the biggest flood water storage event in Peterborough and continues to be the flood of record since the 1936 and 1938 floods. This is the only time in the history of the MacDowell Dam where the spillway was used to divert excessive flood water away from downtown Peterborough. The pool got up to 949.8 Mean Sea Level, which is 126% of reservoir capacity. Had the MacDowell Dam not been in place, Peterborough would have seen damages like those from the floods of 1936 and 1938.

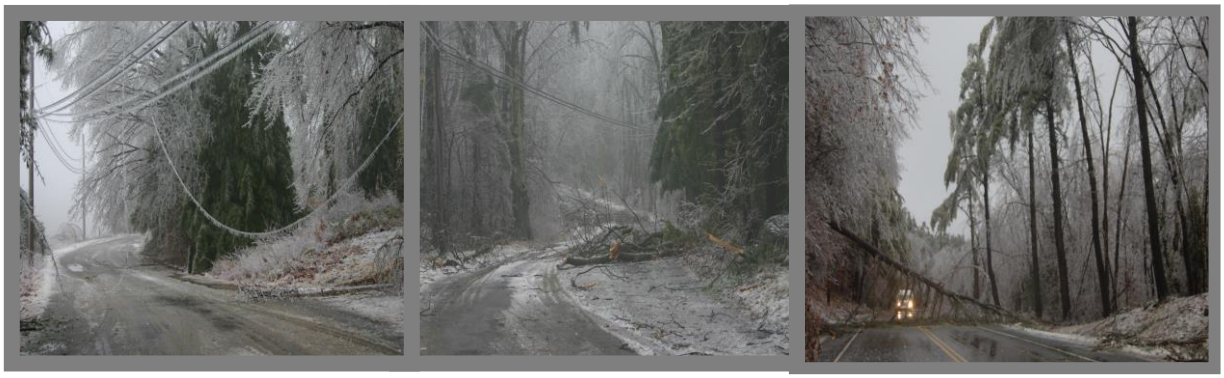
(6) Ice Storm of January 1998 that hit the entire northeast caused major damage to trees, public and private utilities, transportation networks, and the operations of commerce, not to mention serious private property losses. At the time, this storm was the costliest declared disaster in New Hampshire's history.

(7) Nor'Easter of April 2007: This storm was a statewide event in which all ten counties received disaster declarations from FEMA. The localized impacts – primarily flooding - of the storm are illustrated on Map 3 following, which was generated during meetings called by the Emergency Management Director for the specific purpose of reviewing the damages relative to the Town's Hazard Mitigation Plan to determine the reliability of the information in that Plan. This exercise confirmed the at-risk areas that were identified in the previous hazard assessment. As a result of this analysis, the Public Works Department has addressed, in some fashion, each of the locations on the map that show a recurring flood or road washout.

Two flooded locations and a bridge out on Old Greenfield Road.

(8) Ice Storm of December 2008. On December 11 – 12, 2008 all but the northern region of the state was hit by a devastating ice storm that left over half of the state without power. The Monadnock Region was one of the hardest hit and power was not restored (to most but not all) until the 13th day of the event; by December 30th Public Service of New Hampshire (now Eversource) had restored power to all households in town. At the height of the event, most of the roads in town were impassable. Town crews had to clear trees and debris just to get the roads clear enough so that the utility workers could get to the poles and wires. During this time the crews also had to contend with three snowstorms. Communications were disrupted, and police, fire and public works personnel were unable to communicate with one another for a number of days.

The Emergency Management Director established an EOC in the Fire Station and the Select Board set up a Shelter at the Middle School, which they helped run for ten days, with the help of numerous volunteers. The event cost the Town over $300,000 in labor and materials, 75% of which was reimbursed by FEMA. Private property owners also suffered varying degrees of damage, some quite extensive and much of it not reimbursable through insurance. Clean up continued months after the event for both public and private properties.



(9) April 2010. A rain and snowmelt event brought the capacity of the MacDowell reservoir to 75%.

(10) March 9, 2011. An ice jam on the Contoocook River resulted in a section of Concord Street being inundated.

(11) October 30, 2017 Flood Event. This flood caused about $30,000 in damage, with significant flooding and erosion of public infrastructure on East Mountain, Sharon, Powersbridge, Old Greenfield, and Middle Hancock Roads.

(12) January 13, 2018 Ice Jam and Flooding. An ice jam on the Contoocook River caused significant flooding on sections of Concord Street, Summer Street, and Sharon Road.

There have been two man-made events that have had serious impacts on the town and the environment:

- In 1982 the South Well was contaminated by a manufacturing facility; this event has significantly affected the available water supply to the Town. The Town spent years working with the facility to explore options and techniques that would allow the well to come back online; however, it is clear by now that this is not an option.

- In January of 2003 a gasoline spill at a self-service gas station in the Downtown went into the storm drains and the underground canals; from there, directly into the Contoocook River. Fortunately, the spill was caught right away, and responders were on the scene quickly. Nevertheless, the entire Downtown was evacuated and it was months before some of the affected businesses were functioning at their normal levels.

The map at the end of this chapter illustrates the more recent hazard events that have been tracked since the Town prepared its first Hazard Mitigation Plan in 2004. Map 2 shows the location of specific events that have occurred in Peterborough or along the Contoocook River or Nubanusit Brook, recently and in the distant past. The map illustrates that Peterborough is most at risk from flooding.

OTHER HAZARD EVENTS

Information collected by the National Climate Data Center shows that since October of 1996 there have been nine storm events in Peterborough that totaled at least $2 million in property damage: five thunderstorm & wind; two floods; one flash flood; and one hail event. Since 1950 Hillsborough County has been affected by dozens of these types of events, plus blizzards, heavy snow, high winds, ice storms, tornadoes and winter storms. Of all of these storm events, heavy snow caused the most property damage at $6.201 million; high winds were responsible for the second greatest dollar damages at $4.724 million; and flooding – even though it is this area's greatest risk, caused less property damage at $3.742 million.

COVID-19 Pandemic

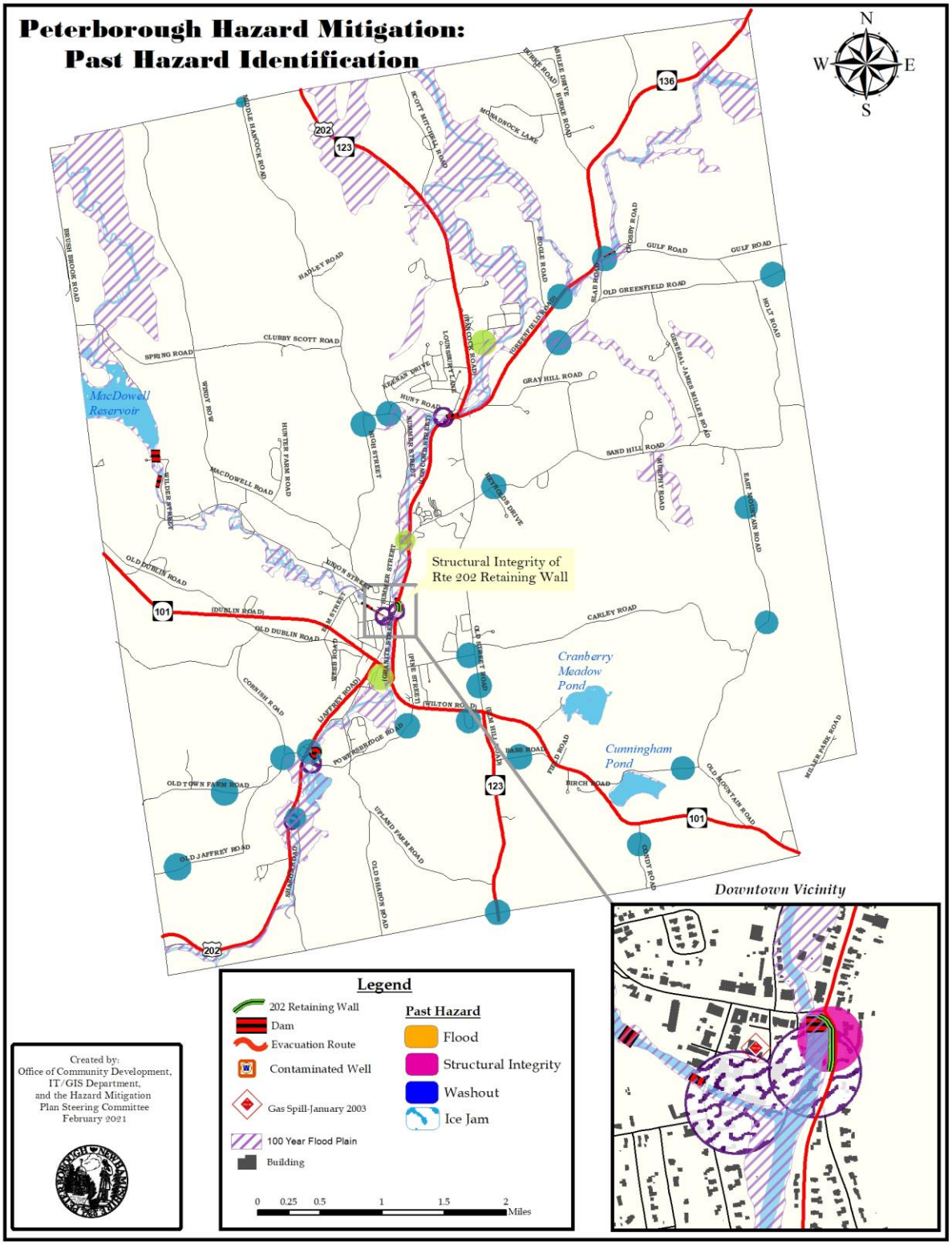
Since January of 2020 Peterborough, like the rest of the state, has been dealing with the effects of the COVID-19 pandemic. Throughout this time, various Executive Orders from the Governor's Office have resulted in Stay-at-Home orders, closures of most public offices, schools, retail and personal and professional services. During the COVID-19 pandemic, the Peterborough community was impacted in the following ways:

- **Change to Business Functions.** Many Peterborough businesses adjusted their day-today to meet state and federal COVID-19 protocols, such as reduced hours; installing protective barriers for staff and patrons; enforcing masks and other protective

equipment be utilized; installing air purifiers; developing outdoor seating to allow for business to continue; increased trend in curb-side pick-up for all types of businesses; up-tick in signage requests from the Town to advertise business changes such as hours or new curb-side options; and increased spending to purchase protective gear and equipment such as masks and gloves. Many businesses, including the Peterborough Town Offices, made a shift to holding meetings virtually so that business could resume as usual.

- **Change to School Functions.** Schools also needed to adjust their functions in order to meet state and federal COVID-19 protocol, and to ensure the health and safety of students and faculty. Many schools took steps to allow for online learning from home where classes were taught remotely. In such instances, the Contoocook Valley School District had to deploy hotspot interconnectivity devices for students with no internet. The School District made a concerted effort to start the 2020-2021 school year by providing a space for students to attend classes on campus under tents outside during the warmer weather, or they could learn remotely. The School District also had to take significant steps to redesign the school pick-up and drop-off process: this included changing bus routes, encouraging drop-offs by guardians, providing adequate spacing between car drop-off lines, and enforcing safety protocol such as spacing and masks on school buses.
- **Cases and Loss of Life.** As of this writing, Peterborough has had a total of 343 active cases of COVID-19. The total number of COVID-related losses in Peterborough is not clear, but data on Hillsborough County show there have been at least 655 deaths regionally. Data also indicates that Hillsborough County experienced at least 35,973 COVID-19 cases since the pandemic began.

MAP 2: PAST HAZARDS



CHAPTER 4

CRITICAL FACILITY IDENTIFICATION

A Critical Facility is defined as a building, structure, or location that:

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

The Critical Facilities for the Town of Peterborough that have been identified by the Hazard Mitigation Committee are listed in the accompanying tables and shown on Map 4. For the purpose of the Plan, the facilities are broken into the following categories: (1) Emergency Response Facilities & Services; (2) Non-Emergency Response Facilities; (3) Facilities/Populations to Protect; and (4) Potential Resources. In addition to these four categories, the Hazard Mitigation Committee has also identified a category of "Special Consideration." Note that there is some overlap in the categorization of these assets, as some facilities serve more than one function.

1. Emergency Response Facilities & Services

These Facilities are those that have the highest priority for protection because they are first responders to a disaster or they provide essential services in the event of a disaster. Included in this category are utilities and the major roads that are essential for traffic movement. Note that the locations for the communication towers, pumps and wells are not identified.

Table 7:
Emergency Response Facilities & Services

Facility Type	Location
▪ Fire Station	Summer Street
▪ Police Station	Grove Street
▪ Public Works Department	Grove Street & Elm Street
▪ Town Government Administration	Town House, Grove Street
▪ Community Center	Elm Street
▪ Utilities:	
▫ 6 Communication Towers (Public & Private)	
▫ Consolidated Communications Switching Station	Concord Street
▫ Comcast Switching Station	Route 101/Temple Mountain
▫ Solar Array (Private)	Water Street
▫ Eversource Substations	Old Dublin Road MacDowell Road
▫ Hydroelectric Facilities	Noone Falls River Street Wilder Street Union Street
▪ Wells • 3 existing Town Wells • Cold Spring Well Site (under development with the Town of Jaffrey)	

Facility Type	Location
▪ Wastewater Treatment Plant	Water Street
• Pump Station	
• Pump Station	
▪ Dams	Various locations throughout the Town (see Appendix F)
▪ USGS Gauging Stations	Contoocook River @Noone's Falls MacDowell Lake
▪ Major Transportation Routes:	
• Route 202	
• Route 101	
▪ Other:	
• Helicopter Landing Pad	Monadnock Community Hospital

Source: Peterborough Hazard Mitigation Committee

2. Non-Emergency Response Facilities

The businesses listed below are those that are deemed by the Hazard Mitigation Committee to be essential for the everyday operation of Peterborough, in that they are prominent for the number of people employed and therefore the impact on the economy in the event of disruption of daily business in the event of a disaster. In the case of an event, the employees may need to be evacuated; in other cases, they may need to remain in place. In addition, if the facility is large enough, it may serve as a shelter to others from the outside.

Table 8:
Non-emergency Response Facilities

Facility Type	Location
▪ NH Ball Bearing	Jaffrey Road (Route 202 S)
▪ South Meadow Middle and ConVal Regional High School	Concord Street (Route 202 N)
▪ Peterborough Elementary School	High Street
▪ Monadnock Community Hospital	Old Street Road
▪ Downtown Commercial District	Main/Grove/School Streets
▪ Village Commercial District	Routes 101 & 202
▪ Shaws/CVS Retail Area	Route 101 West
▪ Vose Farm Road Business Center	Route 202 North/Vose Farm Road

Source: Peterborough Hazard Mitigation Committee

3. Facilities/Populations to Protect

Vulnerable populations may be comprised of the following:

- ❒ Areas or facilities that are densely populated, including businesses with significant employee populations.
- ❒ Buildings that house people who may not be self-sufficient.
- ❒ Areas with homes that are not very resistant to disasters.
- ❒ All elderly housing or day care facilities, nursing homes, hospitals, and schools.
- ❒ Locations where hazardous materials are stored and/or used.
- ❒ Residential dwellings located on dead-end, non-connected Town roads.

Table 9-a: Facilities/Populations to Protect	
Facility Type	**Location**
Medical/Health Care Facilities:	
▪ Monadnock Community Hospital	Old Street Road
▪ Pheasant Wood Center	Pheasant Road
▪ Summerhill Assisted Living	Old Dublin Road
▪ The Scott-Farrar Home	Elm Street
▪ RiverMead Retirement Community (Assisted Living and Nursing Care)	Old Sharon & Powersbridge Roads
▪ Robin Hill Farm	Summer Street & Wilton Road
Schools:	
▪ Peterborough Elementary School	High Street
▪ South Meadow Middle School	Concord Street
▪ ConVal Regional High School	Concord Street
▪ Monadnock Community Early Learning Center	Community Lane
▪ The Well School	Middle Hancock Road
▪ Trinity Christian Academy	Dublin Road (Route 101)
▪ Happy Valley School	Gulf Road
Employment Populations:	
▪ Vose Farm Road Business Center	Vose Farm Road
▪ ConVal Middle and High Schools	Concord Street
▪ Peterborough Elementary School	High Street
▪ Downtown Commercial District	Main/Grove/School Streets
▪ Village Commercial District (with two shopping plazas)	Routes 101 & 202
▪ NH Ball Bearing	Jaffrey Road (Route 202 S)
Residential Populations:	
▪ Five apartment complexes with a total of ***222*** units	Downtown, West Peterborough, and Route 202 North
▪ Homes on dead-end roads	Town-wide
▪ RiverMead Retirement Community with @ 180 units of independent living, assisted living and nursing care.	Old Sharon & Powersbridge Roads

Source: Peterborough Hazard Mitigation Committee

Table 9-b below lists the places in Peterborough that store or use hazardous materials. These are included in the critical asset listing due to the potential for leaking or combustion, either because of an accident or a disaster.

Table 9-b: Hazardous Materials Locations		
Facility Type	**Material(s)**	**Location**
1. Big Apple Convenience Store	▪ In-ground gas and biodiesel tanks	Wilton Road
2. Alltown Convenience Store	▪ In-ground gas and biodiesel tanks	Jaffrey Road
3. Monadnock Community Hospital	▪ Oxygen storage tanks ▪ In-ground diesel ▪ Propane tanks	Old Street Road
4. Hilltop Golf Course	▪ In-ground gas tank	High Street
5. NH Ball Bearing	▪ Lubricants & Coolants ▪ Degreasing solvents ▪ Propane ▪ Fuel Oil ▪ Methanol ▪ Compressed gases ▪ Small quantity caustics	Jaffrey Road

6. Waste Water Treatment Plant	▪ Chlorine	Pheasant Road
7. A. W. Peter's Oil	▪ Above-ground petroleum tanks	Summer Street
8. DPW Garage	▪ Above-ground diesel tanks ▪ Oil & Lubricants ▪ Gasoline	Elm Street
9. Carroll Concrete	▪ Additives ▪ Above-ground gas tank	Jaffrey Road
10. Bus Company	▪ Propane tanks	Hancock Road
11. Agway	▪ Yard and garden chemicals ▪ Pool chemicals	Jaffrey Road
12. Belletete's Building Supply	▪ Lumber yard ▪ Solvents ▪ Propane Tanks ▪ Yard and garden chemicals	Concord Street
13. Peterborough Plaza	▪ Propane Tank behind building ▪ Pool chemicals sold at Ocean State Job Lots ▪ Propane Tanks	Routes 101 & 202
14. Monadnock Plaza	▪ Propane Tanks	Route 202
15. Peterborough Basket Company	▪ Flammable solvents and finishes ▪ Sawdust	Grove Street Extension
16. Whiton Building	▪ Propane tanks	Jaffrey Road
17. Peterborough Recycling Center	▪ Used Oil	Scott-Mitchell Road

Source: Peterborough Hazard Mitigation Committee

4. Potential Resources

Table 10 below lists facilities in Town that may provide the potential to be resources for services or supplies. This list includes agencies/locations that have emergency generators that can be used on-site or moved to a different location in an emergency.

Table 10:
Potential Resources

Facility Type	Location
▪ Fire Station	Summer Street
▪ Police Station	Grove Street
▪ Public Works Department	Grove Street & Elm Street
▪ Town Government Administration	Town House, Grove Street
▪ Community Center	Elm Street
▪ Utilities:	
▫ Communications Towers (Public and Private)	
▫ Telephone Landline Switching Station	Concord Street
▫ Solar Array (Public & Private)	Water Street
▫ Water Supply System – Water Tanks	
▪ Wells	
▪ Wastewater Treatment Plant	Water Street
▪ Major Transportation Routes:	
• Route 202	
• Route 101	
▪ Other:	
• Helicopter Landing Pad	Monadnock Community Hospital
• Emergency Generators	The Town House; Fire Station; Police Station; Wastewater Treatment Plant; MacDowell Dam; Hospital;

Source: Peterborough Hazard Mitigation Committee

5. Special Consideration

Combined into the category of Special Consideration are Historic Sites & Buildings, Churches, and Recreational Gathering Places. The preservation of historic sites and buildings in the event of a disaster are of utmost importance to the residents of Peterborough. Further, these may be more vulnerable to certain hazards since they may not meet current building codes, have the most up-to-date safety features, and/or have limited access. Churches serve as gathering places and can temporarily provide shelter; many of the churches are also considered historic based on their age and architecture. Recreational sites are common places where large numbers of people are gathered at one time. The protection and preservation of these sites and structures are consistent with Goal #7 of this Plan, even though there are no specific mitigation strategies that speak directly to the issue.

A "special" category of Special Consideration is one that does not fit easily within these categories and does not show up in Table 11, and that is "Data." With today's reliance on computers and electronic data storage, any event that could damage or destroy electronic files would be catastrophic – for Town Government, for the business community, and healthcare providers, to name only a few.

Table 11: Special Consideration

Facility Type	Location
Historic Structures/Sites:	
• G.A.R. Hall	Grove Street
• Monadnock Center for History and Culture	Grove Street
• Peterborough Town House	Corner of Main and Grove Streets
• Mariposa Museum	Main Street
• Gurnsey Building	Main Street
• Union Mill	Union Street, West Peterborough
• MacDowell Dam and Lake	Wilder Street, West Peterborough
• Dams:	
▫ Transcript Dam	Downtown @Main & Granite Streets
▫ North Dam	Routes 202 & 136
▫ Noone Falls	South Peterborough @ Route 202 & Noone Falls
Churches:	
• All Saints Parish	Concord Street
• Church of Jesus Christ of Latter-Day Saints	Old Bennington Road
• First Church of Christ Scientist	Concord Street
• Good Shepherd Lutheran	Dublin Road (Route 101)
• Grace Evangelical Methodist	Hancock Road (Route 202)
• Monadnock Congregational	Wilton Road (Route 101)
• Peterborough Unitarian	Main Street
• Divine Mercy	Wilton Road (Route 101)
• Next Level Church	Dublin Road (Route 101)
• Union Congregational	Concord Street
• United Methodist	Concord Street

Recreational Sites:	
• Adams Playground	Union Street
• Cunningham Pond	Cunningham Pond Road
• Edward MacDowell Lake	Wilder Street
• Shieling Forest	Old Street Road
• Casalis State Forest	Casalis Road
• Miller State Park	Route 101/Temple Mountain
• Temple Mountain Reservation	Route 101/Temple Mountain

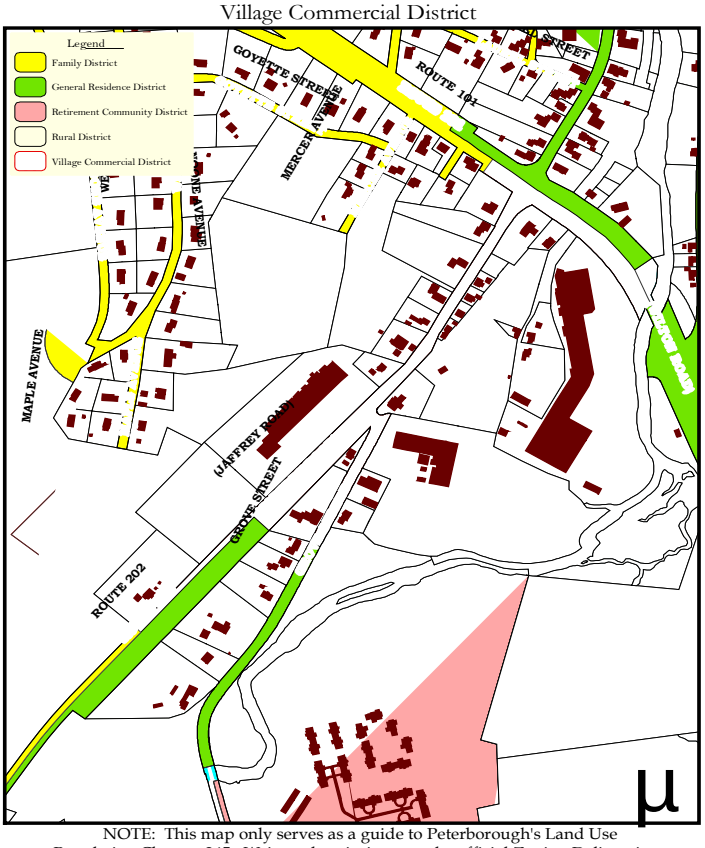
Source: Peterborough Hazard Mitigation Committee

Potential Future Vulnerability

The potential vulnerability in the future for any of these various critical assets is mixed. Since the first Hazard Mitigation Plan was adopted in 2004, the Town has seen little new development overall, and only minimal development in identified hazard areas. There is some potential, however, for future vulnerability, as described below. Note that two of the three vulnerable areas also contain populations that are considered vulnerable and needing protection.

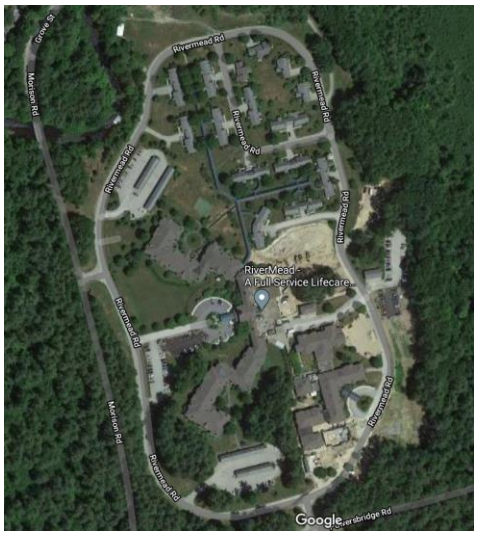
(1) The Village Commercial Zoning District has vacant land area that is currently undeveloped; should the land become developed, this would add to the potential for new buildings, infrastructure and/or assets being at risk. The District is also at risk from particular hazards, as identified in Chapter 3, notably flooding, given the proximity of the Contoocook river that abuts the entire eastern boundary of the District.

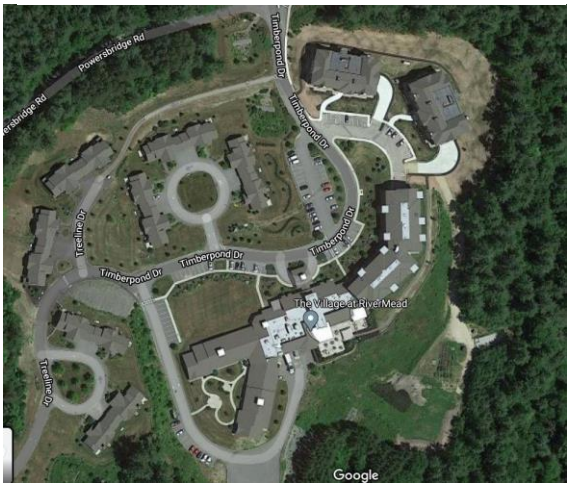
Village Commercial District



NOTE: This map only serves as a guide to Peterborough's Land Use Regulation Chapter 245. Written descriptions are the official Zoning Delineations.

(2) The RiverMead Retirement Community has expanded with the development of a separate neighborhood. The original RiverMead (below left) consists of 87 apartments and 26 cottages; the new development (below right) consists of 30 apartments, 14 cottages, and 24 villa-style homes. The Community also offers assisted living for memory support and nursing care on site.



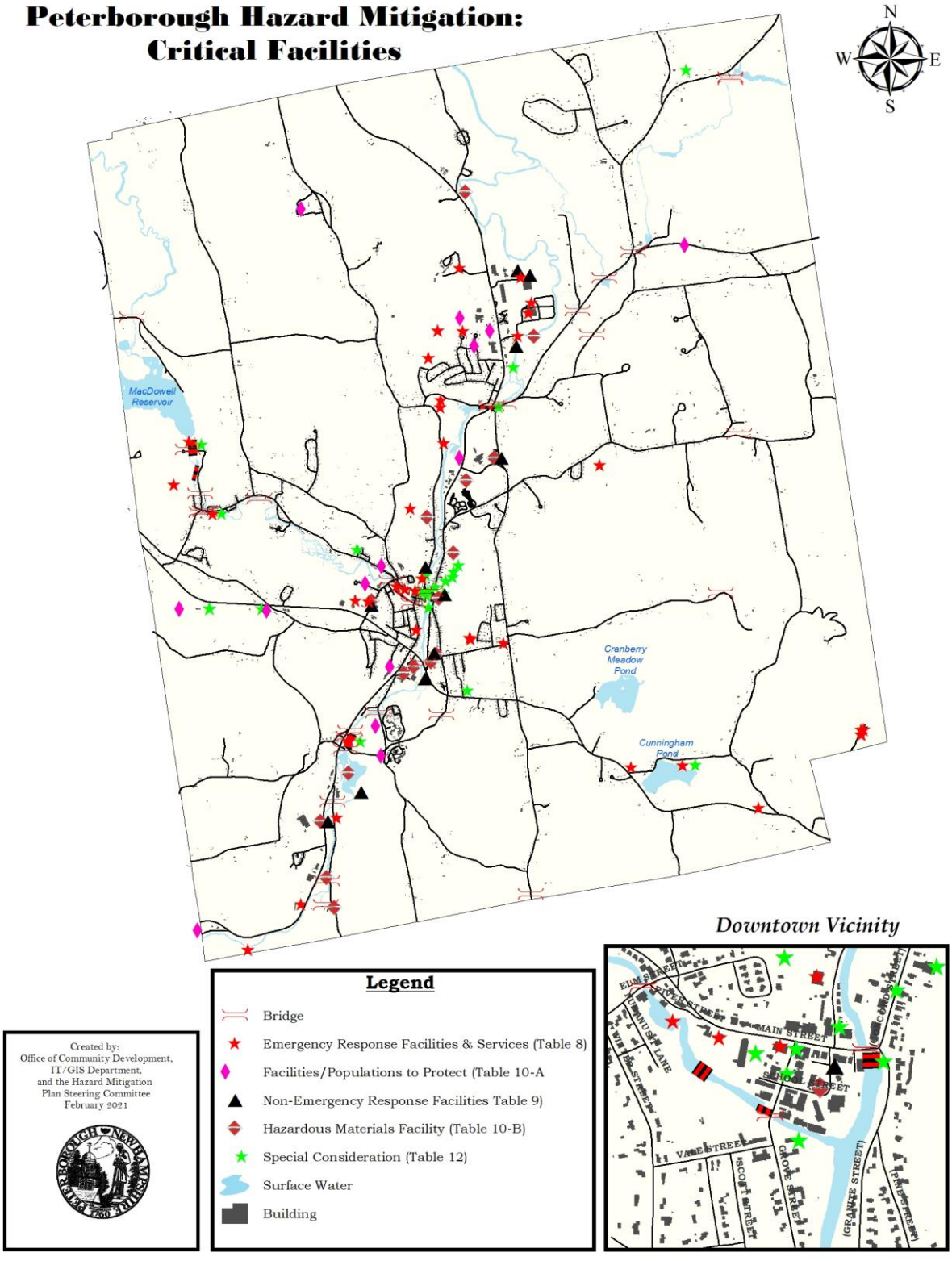


(3) The Hospital has a master plan that considers future development on its campus, although no plans have yet been brought before the Town.

As for those potential future assets that are not located in an identified specific hazard area, they are of course vulnerable to power outages and other system-wide disruptions. Regarding the Town-owned facilities, the Wastewater Treatment Plant has improved technology that should minimize its vulnerability in the event of a disaster. At the same location, a solar array is online that generates enough electricity to power the Wastewater Treatment Plant. Concepts have been considered to consolidate Police and Fire into one new facility, but as of this writing there are no concrete plans to move forward with any changes to these, or any other Town facilities.

Monadnock Community Hospital Campus

MAP 3:
CRITICAL FACILITIES



CHAPTER 5

RISK ASSESSMENT

Peterborough is prone to a variety of natural and man-made hazards, the most commonly occurring being natural and technological hazards. Of the natural hazards, flooding, snow and ice storms pose the greatest risks for Peterborough. Aside from these, long-term utility outages are a high risk, and actually rank the highest in terms of the severity and probability. Geological events have not played much of a role in Peterborough's history; the topography does not lend itself to much vulnerability from such occurrences. The same is true for tropical storms/hurricanes, with the exception of the 1938 hurricane, which was a devastating event for most of New England. Winter weather is an intermittent hazard throughout the Town. While Peterborough can experience heavy snowfalls and icing situations, in recent history damages have been minimal, with the exception of the ice storms in January of 1998 and December of 2008.

Worth noting here is the issue of climate change. While there continues to be debate about the scope and impacts, the planet is in fact experiencing changes in weather patterns that affect infrastructure; these include changes in precipitation, and extreme temperature fluctuations that have wide-ranging impacts on the natural environment as well as the built environment, including communication, transportation, and water and sewer infrastructure. Recognizing this, in 2017 FEMA released a report titled *Incorporating Climate Change into State Hazard Mitigation Planning, Region I Phase I* that states in part: "The scientific evidence is clear: The Earth's climate is warming. It is also very clear that the effects of climate change pose real and significant threats to community safety, resilience, and quality of life…"

All of New Hampshire is susceptible to these effects. For example, we are seeing more frequent and more severe storms, both in winter and in summer. The flooding and/or increased stormwater runoff that results from some of these storms is beyond the capacity of the existing drainage systems to handle. But simply replacing culverts with larger culverts is not as simple as it might seem, since every culvert is part of a larger drainage system and every change to one culvert with have impacts above and below that culvert. This is just one example of preparedness that will need further attention in the future. [For additional information on this issue and possible impacts on Peterborough and the state, refer to the U.S. Global Change Research Program's Regional Climate Change Impacts reports. GlobalChange.gov; New Hampshire - State Summaries 2019 (ncics.org)]

Following is a compilation of hazards that have impacted Peterborough in the past, as well as those that are determined to pose a threat in the future, as described in Chapter 3. Table 12 below presents these hazards in a ranking order based on methodology provided by FEMA, which is detailed in Appendix C. The process involves assigning values as follows:

Impacts (Human, Property, Business):	**Probability of Occurrence (Chance w/in 25 Years**
1 = Inconvenience	1 = 0-33%
3 = Moderate to major damage	2 = 34-66%
6 = Devastation	3 = 67-100%

The overall risk is calculated by combining the impacts and the probability of occurrence. The table ranks these by highest to lowest risk for each of the three types of hazards identified. While going through the process of ranking the risks, the Committee did, to the best of its ability at this time, take into account any anticipated increased risks due to climate change.

Note that some of these identified risks have been grouped together because they are likely to occur together posing the same level of risk for Peterborough (e.g., Nor'easterrs and Heavy Snow Storms).

As the table illustrates, most of the identified hazards pose a low risk to Peterborough. Of the 25 hazards identified for Peterborough, only four are considered to be High Risk, and five are medium risk.

Table 12: Risk Assessment

Overall Risk: Yellow: 1-6 = Low Risk Orange: 7-12 = Medium Risk Red: 13-18 = High Risk	**Human Impact** **Probability of Death or Injury**	**Property Impact** **Physical Losses and Damages**	**Business Impact** **Interruption of Services**	**Probability** **Likelihood of Occurrence in 25 Years**	**Severity** **Average Impact**	**Risk** **Risk Severity x Probability**
Natural Hazards:						
Inland Flooding	3	6	6	3	5.00	15
Nor'easters/Heavy Snow Storm	3	6	6	3	5.00	15
Ice Storm	3	6	6	3	5.00	15
Infectious Diseases	6	1	6	3	3.00	9
Drought	3	3	3	3	3.00	9
Ice jam	3	3	2	3	2.67	8
Tropical Storms	3	3	6	2	4.00	8
High Winds (Tornadoes)	3	6	6	1	5.00	5
Lightning/Thunderstorms/ Downbursts/Hail	1	3	1	3	1.67	5
Urban Fire	2	3	3	2	2.67	5
Solar Storm & Space Weather	3	1	3	2	2.33	5
Extreme Cold	1	1	3	2	1.67	3
Earthquake	1	1	3	2	1.67	3
Wildfire	2	1	1	2	1.33	3
Extreme Heat	1	1	1	2	1.00	2
Landslide	1	1	1	1	1.00	1
Subsidence	1	1	1	1	1.00	1
Avalanche	Not Applicable					

Overall Risk: Yellow: 1-6 = Low Risk Orange: 7-12 = Medium Risk Red: 13-18 = High Risk	**Human Impact** **Probability of Death or Injury**	**Property Impact** **Physical Losses and Damages**	**Business Impact** **Interruption of Services**	**Probability** **Likelihood of Occurrence in 25 Years**	**Severity** **Average Impact**	**Risk** **Risk Severity x Probability**
Technological Hazards:						
Long-Term Utility Outage:						
▫ Communication	6	6	6	3	6.00	18
▫ Electricity	6	6	6	3	6.00	18
▫ Water Systems	6	6	6	3	6.00	18
▫ Wastewater Treatment Plant	6	6	6	3	6.00	18
Aging Infrastructure	3	6	6	1	5.00	5
Dam Failure	3	3	3	1	3.00	3
Radiological Release	3	3	3	1	3.00	3
Human-Caused Hazards						
Transport Accident	3	3	6	2	4.00	8
Cyber Event	1	2	3	3	2.00	6
Mass Casualty Incident	3	1	1	1	1.67	2
Terrorism/Violence	3	2	2	1	2.33	2

Loss Estimates for Hazard Events

Part of the process of identifying potential hazards is to assess potential financial losses from those hazards. Following is a description of the potential risk to Peterborough of each of these identified hazards, and an assessment of the financial cost to the town in the event of any of these hazardous events. The method used for calculating the financial losses are those developed for FEMA and described in the FEMA manual, *Understanding Your Risks: Identifying Hazards and Estimating Losses* (August 2001), which provides the basic framework for the loss estimates described below. Detailed descriptions of these identified hazards are contained in Appendix B, including hyperlinks to the various agencies that provide specific information.

Note that human losses are not calculated for this exercise, but could be expected to occur depending on the nature and severity of each hazard. Instead, the focus of the analyses is on the potential losses of economic assets, excluding changes in land values. When numerical estimates are given for potential losses, the figures include losses to structures, contents, and functional downtime (for commercial properties) unless noted otherwise. Based on the most recent available property valuation data, the value of all structures in Peterborough, including exempt structures such as schools and churches, as of November of 2020 was $707,489,400.

❒ NATURAL HAZARDS

1. Inland Flooding - High Risk

Like most New Hampshire towns, flooding represents the greatest natural risk to Peterborough, as it is the most common event, and can create much damage. Major floods commonly occur in the spring, fall and winter. Spring flooding is typically the result of snowmelt and heavy rains, in conjunction with ice jams. The Contoocook River experiences some level of flooding on a regular basis. The construction of MacDowell Dam on Nubanusit Brook has certainly helped to regulate how much water gets into the Contoocook from that source; but the Contoocook has such a large catchment area that it continues to flood regardless of the regulation of the Nubanusit.

Running from south to north, the Contoocook River passes through the center of town and several important, densely populated residential and commercial areas. Nubanusit Brook runs from MacDowell Dam in the northwest corner of Town and feeds into the Contoocook River in the Downtown, and also passes through several residential districts. Both waterways are prone to flooding caused by heavy rains and rapid snowmelt.

Another risk that is not typically addressed is flooding caused by beaver dams. This is actually a not uncommon event in New Hampshire, and has and can lead to fairly significant road wash outs and closures, with very costly repairs. Unfortunately, there is no way to prevent these events with certainty, but many communities do undertake a beaver relocation effort when the problem is severe enough. In these cases, the animals are humanely trapped and moved to a remote location.

Contoocook River - High Risk:

Approximately 83 structures are situated in the floodplain along the Contoocook River with an estimated combined replacement value of $33,617,600 excluding their content*s*. Of these 83 structures, most are residential in nature; of the non-residential structures, 12 of them are for fuel and water storage; and the governmental buildings consist of structures at the Town's Recycling Center and the Fire Station. Six bridges span the river, connecting the western and eastern sections of town. Several sections of Route 202 and several important town roads also border the Contoocook River. Significant damage to these structures and roads could dramatically hinder emergency response efforts in the wake of a disaster. Table 13-a describes the assets located in the Contoocook floodplain and the potential losses that could be expected during a flood. This analysis provides a basic estimate of the number of people that typically occupy this area, but it does not confer actual fatalities. Moreover, the analysis includes dollar amounts for economic losses, which are dependent on the level of flood waters. This relationship is incorporated into the analysis by calculating potential losses for three different flood levels at two, four, and eight feet.

Table 13-a: Estimated Flood Loss – Contoocook River						
Assets in Hazard Area				Total Estimated Loss		
Type	Building Value	# Buildings	# People	2' Flood	4' Flood	8' Flood
Residential:	$11,270,500	56	119	$3,944,675	$5,522,545	$9,664,454
Commercial:	$20,363,600	25	500	$11,340,204	$15,876,286	$26,683,017
Governmental:	$2,144,600	2	0	$422,920	$592,088	$1,036,154
Total:	$33,748,600	83	619	$15,707,799	$21,990,919	$37,383,624
Source: Town of Peterborough Assessing Database, November 2020						

Nubanusit Brook - Medium Risk:

Following the completion of the Edward MacDowell Dam in 1950, flooding on Nubanusit Brook has diminished markedly. Only eight structures are located in the river's floodplain with an estimated combined replacement value of $15,564,100 excluding their contents. Two of these buildings are apartment complexes that house approximately 80 persons. Furthermore, the MacDowell Dam facility lies within this risk area. Even though the number of buildings in the floodplain are few, the Brook converges with the Contoocook River in the center of town. Consequently, any flooding on Nubanusit Brook is likely to compound flood conditions on the Contoocook River, particularly in the downtown area. Five bridges also span the Brook, all of which would be at risk during a severe flood. The loss estimate figures outlined in the table below were computed in the same manner as those for the Contoocook River, and include estimates for economic losses for the commercial facilities located in the floodplain.

Table 13-b: Estimated Flood Loss – Nubanusit Brook						
Assets in Hazard Area				Total Estimated Loss		
Type	Value	# Buildings	# People	2' Flood	4' Flood	8' 'Flood
Residential:	$4,023,600	5	91	$1,408,260	$1,971,564	$3,450,237
Governmental:	$10,400,700	3	0	$2,080,140	$2,912,196	$5,096,343
Total:	$14,424,300	10	151	$3,488,400	$4,883,760	$8,546,580
Source: Town of Peterborough Assessing Database, November 2020						

2. Nor'easters/Heavy Snow Storms - High Risk

Heavy snow storms, which are defined as snow storms that deposit 4 or more inches of snow in a 12-hour period, are the most common winter weather hazard in Peterborough. Occasionally, these heavy snowstorms are accompanied by high winds and low temperatures, and thus may be classified as Nor'easters or blizzards. A well-known problem caused by heavy snowstorms is the deterioration of road conditions. Despite having a well-equipped snow removal crew, roads in Peterborough often become dangerous during such storms. Occasionally, a section of Route 101 that passes over Temple Mountain in the southeast corner of town must be closed due to high snow accumulations.

These storms can also damage aboveground utility system such as power and telephone lines. Poor road conditions combined with utility disruptions can severely limit emergency and medical services throughout Peterborough. Large deposits of heavy snow can also lead to a variety of structural problems, particularly roof and structural collapse. Past examples of structural damage caused by heavy snow loads include the collapse of a large barn on a local

farm and the cracking of support beams in the town library in February 2003. Overall, the expense of snow removal, cost of repairs, and loss of business associated with heavy snow storms can have a large economic impact on the entire town.

Although heavy snowstorms are a frequent phenomenon in Peterborough, it is difficult to predict their future impact. There are innumerable variables that ultimately determine the severity of these storms and the ultimate damage they cause. Consequently, a quantitative analysis is impractical. The entire Town is considered susceptible to this hazard.

A hyperlink in Appendix B goes to the National Weather Service webpage that provides information on snowfall by region. From the website: NOAA's National Centers for Environmental Information is now producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two thirds of the U.S. The RSI ranks snowstorm impacts on a scale from 1 to 5, similar to the Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes.

3. Ice Storm – High Risk

Ice is a common feature of the winter months ranging from light freezing rain and sleet to heavy ice storms. Peterborough has suffered two devastating ice storms in recent history: one in January of 1998; and one in December of 2008. Ice storms are considered high risk because they are no longer uncommon occurrences and if they do occur, they can result in severe consequences. The entire Town is considered susceptible to this hazard.

4. Infectious Disease – Medium Risk

The State of NH Multi-Hazard Plan classifies infectious disease as being low risk for all counties in the state, with a medium potential for future probability. These risks can change based on the time of year. Past outbreaks in New Hampshire include the H1N1 pandemic from late April of 2009 and February of 2010 and an outbreak of Hepatitis C in an acute care hospital. More recently, and as of this writing, Peterborough (as well as the entire country) is dealing with the COVID-19 pandemic that was first recorded in this country in January of 2020; for this reason, and the Committee's sense that this type of hazard is likely to increase, the risk has been elevated from low to medium.

5. Drought - Medium Risk

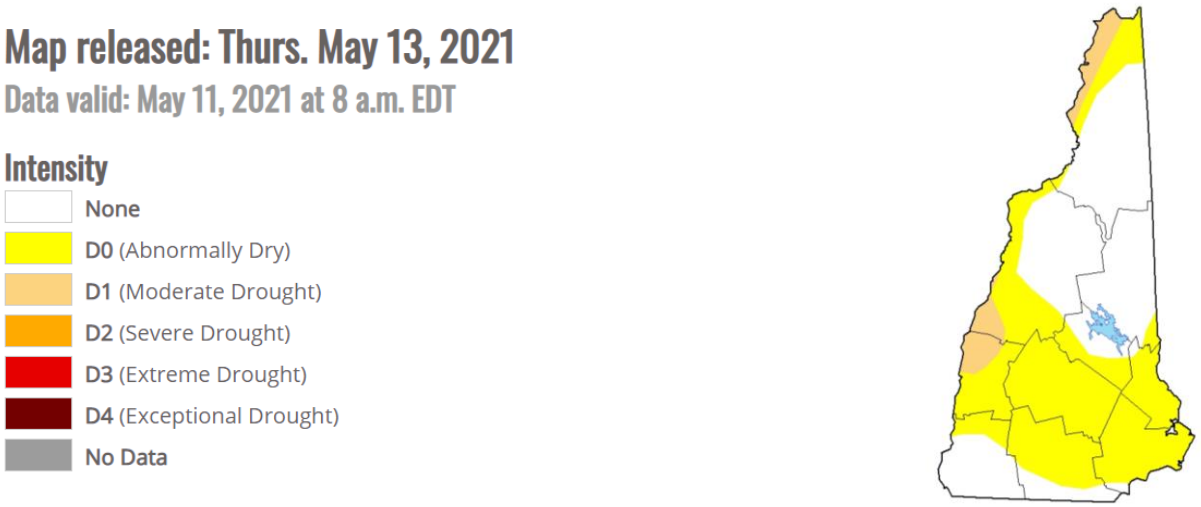
Overall, drought is considered to be a low-risk hazard for Peterborough. Based on the most recent Palmer Drought Severity Index, all of the New Hampshire experienced moderate drought in 2015 and a more severe drought in 2020. There have been several documented cases of drought in Peterborough in the past, but the general abundance of water in the town has diminished their effects. The typical effects of these dry spells included higher wildfire risk, decreased water supplies, diminished hydroelectric output, as well as environmental impacts such as the loss of aquatic wildlife. Associated with the loss of aquatic wildlife is a direct economic impact, given the role that fishing plays in the economy, locally as well as state-wide.

These problems are likely to become more pronounced as population growth continues in Peterborough, further increasing demand for limited water resources. For this reason, the risk of drought is likely to grow in the future. Areas impacted by a drought would primarily be

those that are in forested or agricultural use, however, limited water supply would affect virtually the entire Town – those on the municipal system, as well as those on private wells. There is a possibility that when the new Cold Spring well site goes online, that this could provide some amelioration during drought, but it is too soon to predict that.

According to the NH State Hazard Mitigation Plan, Hillsborough County was impacted by the drought event of the 1960s as was the rest of the State. The county hosts significant forestry, agricultural and livestock assets which are negatively impacted by such events. Since drought poses no direct threat to structures, contents, or human life, a quantitative analysis of the hazard is impractical. It is sufficient to say that a prolonged drought would strain the town's water supplies, which could impact human life. The entire Town is considered susceptible to this hazard, since most of the Town is forested.

The map below illustrates drought conditions for the state as of May 11, 2021. Peterborough and most of Hillsborough County are abnormally dry, according to these data. A hyperlink in Appendix B directs to the website with more detailed information.



6. <u>Ice Jams – Medium Risk</u>

The locations most prone to ice jams are the several dams along the Contoocook River and the confluence of the Contoocook River and Nubanusit Brook in the downtown area. In the past, ice jams have often resulted in localized flooding. Occasionally, severe ice jams have caused substantial flooding upstream of the jam site. Consequently, the risk of property damage and loss is similar to that described above in inland flooding, but to a lesser extent. Based on historical evidence, the downtown area is most prone to ice jams and consequent flooding. Ice jams may also elevate the risk of a dam breach because several of the dams along the

Contoocook River and Nubanusit Brook are old and in disrepair. The consequences of such a dam breach, however, would be modest because the dams are classified as minimal risk dams. (See Appendix F for a map of known ice jam locations in Town.)

7. <u>Tropical Storms – Medium Risk</u>

Although tropical storms (previously referred as hurricanes) occur infrequently in Peterborough, the severity associated with such storms makes them an important hazard for the town. The most destructive event in the town's history was the hurricane of 1938. The downtown area was flooded after days of rain and high winds ripped trees from the saturated ground. Secondary fires also burned down half the town's commercial district in the wake of the storm. Although no deaths occurred, the total damages amounted to over $500,000 (roughly $9,000,000 today). After this catastrophe, a number of improvements were made in order to minimize damage from such an event. Most notably, the federal government constructed Edward MacDowell Dam on Nubanusit Brook. More recent hurricanes have been weaker, producing only nominal damage to property in Peterborough.

The potential loss estimate for a tropical storm is dependent on two main factors: rain totals and wind strength. Based on historical data, Peterborough is typically prone to a category 3 hurricane or lower on the Saffir-Simpson scale. The tables below provide the potential losses for hurricanes that fall within this range (category 1 - 3). It should be noted that the category systems do not provide a direct indication of potential rainfall. Consequently, the flood levels used below are the same as those used for typical flooding. The estimated losses for flooding and wind associated with tropical storms presented below in Tables 13-c and 13-d are the sum of losses estimated for the known flood-prone areas surrounding both the Contoocook and the Nubanusit.

Table 13-c: Estimated Loss from Flooding – Combined Contoocook & Nubanusit Floodplain

Assets in Hazard Area				Total Estimated Losses		
Type	Value	# Buildings	# People	2' Flood	4' Flood	8' Flood
Residential:	$15,294,100	61	130	$7,953,865	$11,135,411	$19,486,969
Commercial:	$20,363,600	28	560	$12,737,459	$17,832,443	$31,140,846
Governmental:	$12,545,300	2	0	$4,941,340	$6,917,876	$12,106,283
Total:	$48,203,000	91	690	$25,632,664	$35,885,730	$62,734,098

Source: Town of Peterborough Assessing Database, November 2020

Estimated losses for wind damage from hurricanes are presented below. This table assumes, based on the risk assessment presented in Table 12 that, while hurricanes have a low probability for Peterborough, if one did strike, approximately three-quarters of the Town would be affected; thus, the total values represented below are 75% of the total assessed valuation of all residential and non-residential buildings in Town, as well as all Town-owned buildings, structures and infrastructure.

A more universal impact of these storms is blocked culverts and is something that has the potential of impacting the entire Town.

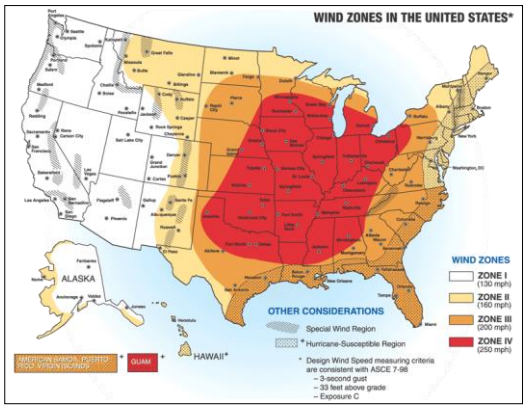
Table 13-d: Estimated Loss from Tropical Storm/High Winds – Combined Contoocook & Nubanusit Floodplain				
Type	Total Value (Buildings)	74-95 MPH (0.025% damage)	96-110 MPH (1% damage)	111-130 MPH (3% damage)
Residential	$15,294,100	$382,353	$1,529,410	$4,588,230
Commercial/Industrial	$20,363,600	$509,090	$2,036,360	$6,109,080
Governmental	$12,545,300	$313,633	$1,254,530	$3,763,590
Total	$48,203,000	$1,205,075	$4,820,300	$14,460,900
Source: Town of Peterborough Assessing Database, November 2020				

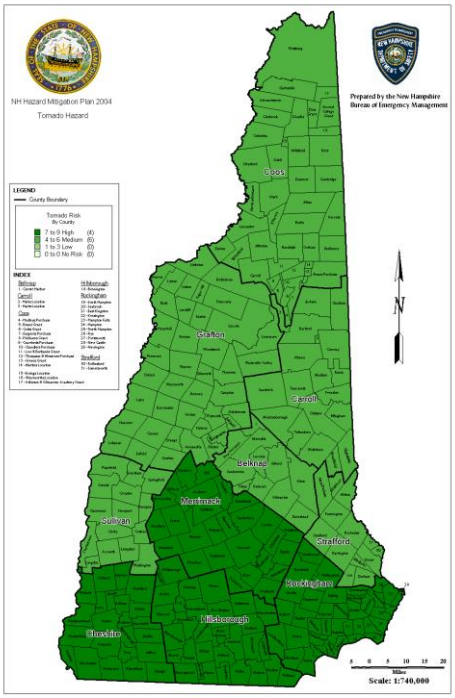
8. High Winds (Tornadoes) – Low Risk

Great Brook Middle School

High wind events and/or tornadoes are relatively uncommon events in New Hampshire; on average about six tornadoes touch-down each year around the state. Since 1951 approximately 79 tornadoes have been recorded in the state. Of these, Hillsborough County has seen 18 and neighboring Cheshire County 10. In 1998 the neighboring town of Antrim experienced an F2 tornado that took down a section of the Great Brook Middle School.

According to the NH State Hazard Mitigation Plan, risk from tornadoes in statewide and in this county is considered to be high (see accompanying map). Hillsborough County has experienced seven known F2 events and one F3 event. The Wind Zone map shown here illustrates that New Hampshire lies in Zone II, with wind speeds of 160 mph, which is considered a significant tornado.





High winds do occur on occasion, generally associated with other storm events, such as severe thunderstorms or snowstorms/blizzards. The Hazard Mitigation Committee considers high winds and/or tornadoes to have an overall low risk, because the effect of a tornado in Peterborough would probably not be town-wide because; due to the topography here, it would be likely to strike in localized, smaller areas. Damage largely depends on where the tornado strikes and whether that area is densely populated or not. Dollar amounts would depend on whether the winds hit an area with a high density of buildings.

9. Lightning Strikes – Low Risk

According to the State of New Hampshire Multi-Hazard Mitigation Plan Update 2018, statewide lightning is considered to be a low risk, although the probability for occurrence is high. In Peterborough, there have been no deaths in recent history due to lightning; however, national statistics indicate that it remains a significant environmental danger. Occasionally, lightning strikes cause property damage in Peterborough, but the scope of the damage is generally quite minimal. Several of the town's communication antennas, however, are quite vulnerable to lightning strikes due to their location on exposed mountain ridges. In the past, lightning strikes have disabled these antennas, causing disruptions in the town's emergency and non-emergency radio communications. In addition, lighting strikes at MacDowell Dam have disabled the computers there. The USACE has upgraded to fiber optics, which provides increased surge protection and enhanced grounding. The entire Town is considered susceptible to this hazard.

Associated with the category of Lightning Strikes are also thunderstorms, hailstorms, and downbursts. Thunderstorms are fairly common in Peterborough, especially during the summer months. These storms often generate heavy rainfall and high winds, which can result in flash flooding, in conjunction with severe thunder and lightning. Occasionally, thunderstorms produce other weather hazards including downbursts and hailstorms. The entire Town is considered susceptible to this hazard.

Despite the frequent occurrence of thunderstorms in Peterborough, major hailstorms are rare. When hail does occur, it is typically small and non-destructive. The absence of major agriculture production in Peterborough further diminishes the potential economic loss generally associated with hailstorms. There is also no record of property damage that is attributed to hailstorms. For these reasons, hailstorms are considered a low-risk hazard for Peterborough. The entire Town is considered susceptible to this hazard.

Peterborough has experienced downbursts in the last few years. Trees were uprooted, shingles blown off structures, and chimneys lost bricks. There have been some fatalities due to downbursts in the surrounding region, but none have yet occurred in Peterborough. All areas of the town are vulnerable to this weather phenomenon.

No potential loss estimate is available because there is no definitive information to use in modeling this hazard. As mentioned earlier, downbursts have the potential to cause deaths and destroy property, but the actual effects depend upon the location and severity of such an event. The entire Town is considered susceptible to this hazard.

10. Fire- Low Risk

Fire risk in Peterborough is of two types – urban and wildfire, described below; both are considered low risk.

- **Urban Fire**

The Greater Downtown area contains a number of wood-construction buildings that could create a risk from spreading fires in a densely-developed area. During the 1938 hurricane most of the downtown did, in fact, burn. Since then, however, much of the reconstruction and new

construction of the downtown was brick and mortar. In addition, building codes are in place that address fire issues. For these reasons, the threat of urban fire is considered to be small.

- **Wildfire**

While massive wildfires have historically been a Western phenomenon, each year hundreds of acres of forests are consumed by fires in New Hampshire. The greatest risk exists in the spring and late summer/early fall. In Peterborough, the reduction of timber harvesting and several destructive storms (e.g., ice storm 1998) have increased the risk for forest fires across the town by increasing the fuel loading on the ground of the forested land. This growing risk is further compounded by limited road access to remote forested areas, particularly in the northwest and southeast quadrants of the town. Of continuing concern is the significant debris in the woods and forests remaining from the December 2008 ice storm. Although the Peterborough Fire Department regulates outdoor fires through permitting, lightning strikes and human activity remain potential causes of wildfires.

Estimating the potential losses that can be attributed to wildfire is difficult because there are a myriad of variables that determine the location and severity of such a hazard. Based on historical information and basic intuition, however, it is estimated that 10 square miles of the town are prone to large wildfires. This represents 26% of the town's total land area of 38 square miles. Population densities in these high-risk areas tend to be low, which implies that the potential for loss of life, structures, and possessions is minimal. If wildfires were to expand outside these areas, however, potential losses would increase significantly.

As mentioned above, a specific area of concern is the immediate area surrounding North Pack Monadnock and Pack Monadnock Mountains along the town's southeastern border. Ten homes are located in this area, which adjoins a state park and a network of conservation land. This region is considered a high-risk area for wildfires because it is a large tract of forested hills and mountains with limited road access. The table below provides some basic estimates of potential losses resulting from wildfires.

Table 13-e: Wildfire in North Pack Monadnock/Pack Monadnock

Assets in Hazard Area			Total Estimated Loss	
Type	# of Buildings	# of People	10% Damage	100% Damage
Residential	10	30	$633,219	$6,332,190
Total	10	30		

Source: Town of Peterborough Assessing Database, November 2020

The first column under "Total Estimated Loss" (10% Damage) denotes the potential losses from a large wildfire that is efficiently and effectively contained. More specifically, a significant amount of forested land would be consumed, but firefighters would be able to protect structures in the area and prevent the fire from spreading into adjacent areas. For this reason, contents are not included in the damage estimate. The second column indicates the potential damage in a worse-case scenario. According to this scenario, all buildings and their contents in the area would be consumed by fire.

11. Solar Storm & Space Weather – Low Risk

According to the State's Multi-Hazard Plan, the entire state is at risk for solar storms and space weather, although the risk is considered to be low. The risks, however, can be significant with disruptions to communication systems and damage to electronic components. In Peterborough, where so many of the critical public safety functions and water & sewer systems rely on communication systems, any disruption in the system would create town-wide problems.

The State Plan has not identified any significant, damaging solar storms or space weather for the State in recent years, it does note that HF radio communications routinely experience minor impacts or disruptions, citing an event in March of 1989 in Quebec, Canada, which experienced a 9-hour blackout when solar winds caused a fluctuation in the Earth's magnetic field and caused Hydro-Quebec's transmission to go down.

12. Extreme Cold – Low Risk

During the winter months, temperatures in Peterborough are quite variable. The average for the season is 19° F. It is not uncommon for temperatures to exceed 40° F and drop below 0° F. When temperatures remain low, however, there is an increased risk to life and property. Moreover, extreme cold can adversely affect utilities in town, especially the town's water system. Extreme cold can also increase the chances of the ice jams developing on the two major waterways in town (see pages 32-33).

The entire area of Peterborough is susceptible to extreme winter weather including heavy snow storms, ice storms, and extreme cold. In the past, extreme winter weather has caused structural damage to a number of buildings, ranging from minor water damage to total structural failure. These weather phenomena have resulted in a number of deaths in Peterborough and the surrounding region. Winter storms also frequently damage above-ground utility systems, particularly electrical and telephone lines. Roadways also become hazardous for vehicle traffic, especially on steeper sections. These widespread effects can sometimes place an immense strain on the town's emergency response personnel and resources. The entire Town is considered susceptible to this hazard.

A hyperlink in Appendix B goes to the National Weather Service Wind Chill Chart that illustrates actual temperatures based on wind speeds and the time it takes to contract frostbite. From the website: The NWS Wind Chill Temperature (WCT) index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from winter winds and freezing temperatures. The index does the following:

- Calculates wind speed at an average height of 5 feet, the typical height of an adult human face, based on readings from the national standard height of 33 feet, which is the typical height of an anemometer
- Is based on a human face model
- Incorporates heat transfer theory based on heat loss from the body to its surroundings, during cold and breezy/windy days

- Lowers the calm wind threshold to 3 mph
- Uses a consistent standard for skin tissue resistance
- Assumes no impact from the sun, i.e., clear night sky.

13. Extreme Heat - Low Risk

Extreme heat occurs rather infrequently in Peterborough (although, as noted earlier, based on global climate changes, this could become a factor in Peterborough). When extreme heat conditions do exist, however, the potential for loss of life is quite real. The town and its residents are less prepared to deal with extreme heat than their Western and Southern counterparts because it is an infrequent phenomenon. The most vulnerable segments of the population include the young and the elderly. According to recent demographic data, 28% of the town's residents fall into either of these two categories.

Prolonged extreme heat can damage roads and bridges. Furthermore, extreme heat increases the risk of other hazards occurring, especially drought and wildfire. Better resources and improved awareness in Peterborough have diminished some of the risk associated with extreme heat, but it remains a hazard nonetheless. There is no potential loss estimate for extreme heat because there is no realistic way to model this hazard in Peterborough, due largely to the lack of historical data and the variable nature of this hazard. The entire Town is A hyperlink in Appendix B goes to the National Weather Service webpage for heat forecast tools, showing the likelihood of heat disorders with prolonged exposure or strenuous activity.

14. **Earthquake – Low Risk**

Seismic activity in Peterborough and the surrounding region is limited. Small tremors occur frequently in the area, but they are generally unnoticeable. Major earthquakes are a rare phenomenon because there are no major fault lines in vicinity of Peterborough. There is no historical record of major damage due to seismic activity in the region. According to the United States Geological Service, the town is likely to experience a magnitude 4.6 quake every 10 years and a magnitude 7 quake every 1,000 years (on the Richter scale). The accompanying map illustrates the nation-wide risk of earthquakes; all of New Hampshire is at a low risk (4-8%) for ground acceleration.

Although seismic activity in Peterborough is considered minimal, a minor earthquake could cause extensive damage to the town and possible loss of life. Many buildings in town are quite old, lacking the necessary design features to withstand significant seismic activity. Smaller structures, including most residential buildings, consist primarily of wood-frame construction. Larger buildings in town are typically made of brick and stone with varying degrees of reinforcement.

When the 2016 Hazard Mitigation Plan was developed, approximately 76% of the residential structures and 50% of the commercial/industrial structures in Peterborough were constructed before the formal adoption of building codes in 1977. Since that time, the percentage of pre-code structures is less than that, since of the over 3,000 structures in town, less than 50% of them were constructed prior to the adoption of the building code. Nevertheless, many structures remain vulnerable to seismic damage. A sizeable earthquake would also damage

roads and town utilities, particularly the water and sewer systems. Extensive damage to these facilities would seriously hinder emergency response efforts following such a disaster.

Table 13-f below presents estimates for dollar losses in the event of an earthquake in Peterborough. As with the estimates for tornadoes, reference is made to the risk assessments in Table 13, where earthquakes are projected to impact about half of the Town. Therefore, the values presented in this table represent 50% of the total assessed valuations for buildings. The table presents damage estimates for three scenarios - a 10%, 5% or 2% probability of exceeding predictions over a 50-year period (PE). For each scenario, the Peak Ground Acceleration (PGA), which measures the strength of the earthquake, increases; thus, the damage assessments increase, even though the probability is decreasing.

Table 13-f: Estimated Loss - Earthquake

Type	Total Value (Buildings)	10% PE in 50 years PGA=5.17%	5% PE in 50 years PGA=8.93%	2% PE in 50 years PGA=17%
Residential	$243,739,750	$243,740	$1,706,178	$8,043,412
Commercial/Industrial	$44,164,350	$44,164	$309,150	$1,457,424
Governmental	$45,483,650	$45,484	$318,386	$1,500,960
Total	$333,387,750	$333,388	$2,333,714	$11,001,796

Source: Town of Peterborough Assessing Database, November 2020

15. Extreme Heat - Low Risk

Extreme heat occurs rather infrequently in Peterborough (although, as noted earlier, based on global climate changes, this could become a factor in Peterborough). When extreme heat conditions do exist, however, the potential for loss of life is quite real. The town and its residents are less prepared to deal with extreme heat than their Western and Southern counterparts because it is an infrequent phenomenon. The most vulnerable segments of the population include the young and the elderly. According to recent demographic data, 55% of the town's residents fall into either of these two categories. Prolonged extreme heat can damage roads and bridges. Furthermore, extreme heat increases the risk of other hazards occurring, especially drought and wildfire. Better resources and improved awareness in Peterborough have diminished some of the risk associated with extreme heat, but it remains a hazard nonetheless. There is no potential loss estimate for extreme heat because there is no realistic way to model this hazard in Peterborough, due largely to the lack of historical data and the variable nature of this hazard. The entire Town is considered susceptible to this hazard.

16. Landslide - Low Risk

From a geological perspective, Peterborough's terrain is quite stable. Although the terrain is hilly in many areas of town, the presence of matured soil compositions and vegetation cover have reduced the effects of erosion. Consequently, the risk for landslides is generally limited to steep slopes with minimal vegetation cover, especially along rivers. One potential problem that was identified, however, is the presence of old retaining walls throughout town. If one of

these walls were to fail, they could damage structures in the immediate vicinity. In addition to structural damage, a land slide along the river can cause blockages, which can result in flooding.

Pine Street Section of Retaining Wall

An area of specific concern was the steep slope along the Contoocook River adjacent to Route 202/Pine Street. An old stone retaining wall dating back to the 1890s supports the base of the slope along the river. Structural assessments have confirmed that the wall became increasingly unstable. If the wall were to collapse, it would render Route 202, which is a federal highway, unpassable, and seriously endanger the 11 houses that sit just above the roadway.

While there is a potential risk for the failure of old retaining walls, the extent of this hazard is not well known. A number of factors influence the severity of landslides, such as slope gradient, soil composition, and water content of the ground. To provide a basic estimate of potential losses, the retaining wall adjacent to Route 202/Pine Street can be used as a model – even though the risk of landslide is dramatically reduced due to the reconstruction project. There are 11 residential structures within 150 feet of the retaining wall, six of which are three-unit apartment buildings. The estimates below are based on the assumption that the structures would be completely destroyed (worse-case scenario). This assumption is made because of limited data and modeling techniques for this hazard. In actuality, structural damage is likely to be less if such a hazard did occur.

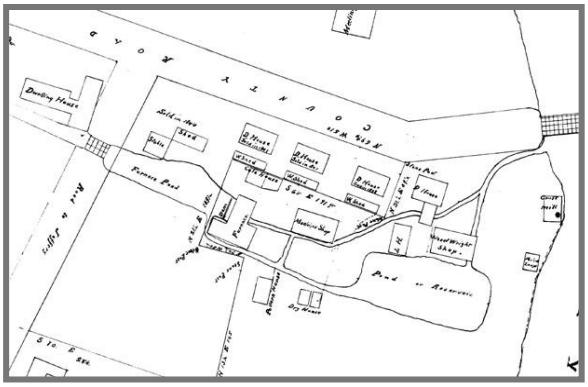
Table 13-g: Estimated Loss – Landslide at Route 202 & Pine Street			
Assets in Hazard Area		Total Estimated Loss	
Type	# of Buildings	# of People	100% Damage
Residential	11	33	$4,368,900
Total	11	33	$4,368,900

A planned reconstruction of the wall has been in the planning stages for a number of years, and was finally initiated as part of a major project to replace the bridge over the Contoocook at the intersection of Main and Pine (Route 202) Streets. As of this writing, construction is underway and is expected to be complete by the end of 2022.

17. <u>Subsidence - Low Risk</u>

The risk for natural subsidence is considered low in Peterborough based on soil composition and water features. There is a small potential risk for subsidence, however, over the two aquifers that have supplied the town with water since 1953: the North and South Aquifers. At present, a number of residential buildings are located over the aquifers, but there have been no documented cases of structural damage due to subsidence.

A more likely danger is the presence of old, man-made subterranean structures beneath populated areas of town, particularly in the downtown. And old canal system running below the center of town has been a primary concern due to its critical location and considerable deterioration (Sketch #1 shows an early map of the location). The town conducted an investigation of the canal system in 2002 and made several key improvements to reinforce the canal, including filling in some sections of it to mitigate the potential for a collapse. The condition of the underground structure continues to be monitored.



A potential loss estimate for natural subsidence is not practical because there is no record of cost for this hazard. A basic analysis, however, is possible for the underground canal in the center of town because its general location and condition is known. Although it is highly unlikely the entire remaining canal would collapse, the assessment below in Table 13-h makes this assumption. Overall, there are approximately$2.5 million worth of assets located over the canal. The estimate shown here in Table 13-i represents the maximum potential damage that would be caused by a total collapse (as unlikely as that appears).

Table 13-h: Estimated Loss – Collapse of Downtown Canal

Assets in Hazard Area		Total Estimated Loss	
Type	# of Buildings	# of People	100% Damage
Commercial	5	100	$2,498,500
Total	5	100	$2,498,500

One other potential risk for subsidence is an abandoned excavation operation on Route 202 just south of the Monadnock Plaza. The operation resulted in the creation of a very steep embankment, at the top of which sit two single-family homes, and one additional home is only potentially at risk if there were to be a collapse of the embankment. Table 13-i shows the potential loss if all three dwellings were completely destroyed.

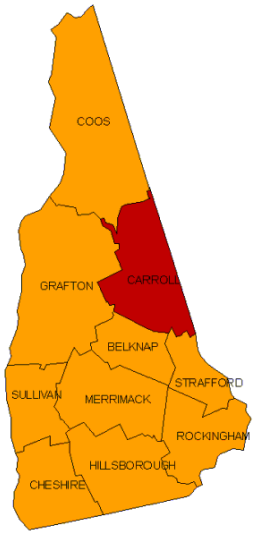
Table 13-i: Estimated Loss - Collapse of Hazardous Embankment			
Assets in Hazard Area		Total Estimated Loss	
Type	# of Buildings	# of People	100% Damage
Single-Family Residential	3	9	$443,200
Source: Town of Peterborough Assessing Database, November 2020			

Other:

The State Multi-Hazard Plan no longer includes Radon in its list of hazards, nor does it address arsenic. Since both of these elements are present in Peterborough, the Committee felt it was important to at least make note of them and their potential impacts.

- **Radon**

According to the Environmental Protection Agency (EPA), Peterborough is located in a region that has moderate potential for radon gas, as does most of the state. Radon is found in water and in the air; it is basically decaying uranium that is trapped within granite, thereby explaining why the levels are so high in New Hampshire.



The map to the right, prepared by the EPA, shows that only one county in the state has a high potential for radon (Carroll County, in red). The moderate rating of the rest of the state implies that 1.2 to 2.3% of the general population is likely to develop lung cancer due to radon exposure.

Although there have been no recorded deaths directly attributed to radon exposure in Peterborough, it is still a potential long-term health risk for the town's population. No quantitative analysis is given for radon because it is a hazard to human health, not physical property. The long-term, invisible nature of this hazard also makes it difficult to predict its effects on human life in Peterborough. It can be surmised that a small percentage of Peterborough's residents will be affected by this contaminate during their lifetimes. Given the source of radon, the entire Town is considered to be at risk from this hazard.

When purchasing a home, most home inspectors test for Radon in the water and the air. Since Peterborough town water is tested regularly, there is no cause to worry about radon in the water unless residents have their own water well. In that case they should test. For Radon in the air, mostly basements, the inspector places a test kit for 24 hours in a location within the house, typically the basement. Certified labs then analyze the test kit for radon. The mitigation is through vent systems. For Radon in the water, there are several ways to mitigate but the most environmentally friendly and costly is a bubbler system that collects the radon and then it dissipates in the air through a stack.

Arsenic
Arsenic in water is tested regularly for well owners. NH DES actually changed their limits to a more stringent level a couple decades ago. New Hampshire has higher standards for water quality compared to MA, especially when talking about radon and arsenic. Mitigation for arsenic usually calls for filtration systems and reverse osmosis installed by a certified company.

❒ TECHNOLOGICAL HAZARDS

18. Long-Term Utility Outage – High Risk

- **Communications**

The importance of the fire, police and public works personnel being able to communicate during a disaster cannot be underestimated. It is difficult to place a dollar amount on the damage that might be caused by this failure to communicate. The Town has made progress since the 2016 Plan in improving communications between Police, Fire and Public Works, although there is still room for improvement. There are now two cell towers in town, as opposed to one in the past; the Police, Fire and Public Works departments each has their own public safety dispatch system in place; and there are radio repeaters for the Police and Fire Departments at the Hospital. The Police and Fire Chiefs continue to work toward the realization of a goal for the Town to have its own public safety dispatch system in place; with this, all emergency calls would come directly into the Town, and Peterborough would no longer need to rely on regional dispatch centers. The entire Town is considered susceptible to significant impacts from long-term disruption to the communication system.

- **Electricity**

It is common in this part of the country to lose electricity during severe weather events – both high winds and rains in the spring and fall, or ice and wind in the winter. The Town has three portable generators and permanent generators installed at critical Town facilities; the hospital, nursing homes the schools, and some of the larger business have emergency back-up generators. There would, however, be a loss of function for the smaller businesses in the event of widespread power failure; the costs of any downtime would vary widely by the type of business. Most of these businesses are located in the downtown and along Route 202. The entire Town is considered susceptible to this hazard.

- **Water and Sewer Systems**

Approximately 60% of all structures in Town are served by the municipal water and sewer system (illustrated on both Map 3 and Map 4), affecting about 4,700 people. The sewer system is at risk from disruption of the system or the treatment, which could be caused by loss of electricity, earthquake, or fire. The water system, on the other hand, is made up of three components, each with its own set of hazard risks, described in Table 13-j below.

Table 13-j: Water System Components & Risks		
Supply	Storage	Distribution
Contamination of the Aquifer	Earthquake	Accidental Rupture
Drought	Structural Failure	Earthquake
Earthquake	Lightning	Flooding
Loss of Electricity	Vandalism	Age/Corrosion
Disruption of Treatment	Wildfire	Cyber Attack
Vandalism	Extreme Heat or Cold	
Cyber Attack	Cyber Attack	

The two systems combined are valued at approximately $15 million. It is highly unlikely that all components of either system would be destroyed. Losses would primarily be incurred from functional downtime for any businesses that were affected, and the actual cost to the town to repair and/or replace the damaged components. Assuming a 1-5% range of damage, the costs to repair these systems would be approximately $150,000 - $750,000.

19. Aging Infrastructure – Medium Risk

Peterborough, like so many other communities in the northeast, is faced with the prospect – and costs, of repairing and replacing old infrastructure, including bridges, culverts, water distribution systems, etc. For example, all of the Town's bridges were destroyed or heavily damaged in the 1938 hurricane. Of those that were replaced after that event, some have only just recently been replaced, and others are either in the process or are on schedule to be replaced. While the State Multi-Hazard Plan considers all of New Hampshire to be at high risk from aging infrastructure, for Peterborough the ranking is actually low, and that is because of the work that is being done on an ongoing basis, including monitoring, reduced the probability of occurrence.

20. Dam Failure – Medium Risk

Peterborough has a total of 52 dams on seven named rivers, brooks or streams, as well as a number of unnamed brooks and streams. Table 13-k lists the dams by type of construction and ownership; a complete list of the dams can be found in Appendix F. Most of dams are owned by private individuals.

Table 13-k: Dams in Peterborough		
Dam Type	#	Ownership
Concrete	14	9 Private/5 Public
Earth	24	21 Private/3 Public
Stone w/Concrete	1	Private
Timber/Stone	5	3 Private/2 Public
Concrete/Earth	1	Private
Earth/Stone	1	Private
Stone/Earth	1	Private
Unknown	5	3 Private/2 unknown
Source: NH Department of Environmental Services		

The Edward MacDowell Dam, located on Nubanusit Brook, is a Class C dam that is maintained and operated by the US Army Corps of Engineers. It has been classified by the NH Department of Environmental Services as a high hazard dam. Depending on the water level of Edward MacDowell Reservoir, the failure of this dam could cause serious damage to property along Nubanusit Brook and the Contoocook River from the center of Peterborough to Henniker. A significant surge of water could also cause minor dams located downstream to fail, further elevating the level of danger. This risk is

considered relatively low due to annual inspections that would allow early detection and prevention. The Army Corps installed early warning systems after the flooding of 1987 that allow for this detection.

Two other dams also warrant attention, although they have not been classified by the NH Department of Environmental Services; they are the Transcript Dam in the Downtown, and the North Dam at Route 202 and Route 136. The Transcript Dam had structural problems that were, in part, related to issues with the retaining wall, although the problems have been repaired (discussed later). And the North Dam has structural problems as well that require on-going attention; the dam, however, is not scheduled for repair.

Failure of the MacDowell Dam would result primarily in the properties identified in Tables 13-a and 13-b being affected (the floodplain for both the Nubanusit and Contoocook). Failure of the Transcript Dam would not be expected to result in significant damage, since the water level is already so low at this location. Impacts from a failure of the North Dam would be largely those associated with the storage of water for the Town's water supply as opposed to significant property damage downstream.

21. <u>Radiological Release – Low Risk</u>

Peterborough's geographic location and its economy make it increasingly vulnerable to a hazardous radiological materials release. Locally, small quantities of radiological material are stored and used in Monadnock Community Hospital for medical purposes. Potentially, these hazardous materials could be released in the vicinity of the hospital or other areas of town, jeopardizing the health of town residents.

No potential loss estimate is provided due to the lack of data for this hazard. Based on past episodes in the United States and other countries, however, it can be assumed that the cost of recovery after a radiological release would be very high. The power plant has been decommissioned, nevertheless, the risks will remain for a long time.

❒ HUMAN-MADE HAZARDS

22. Transport Accident - Medium Risk

Transport accidents are those that involve aviation, rail, shipping, tractor trailer, or vehicle accidents. Peterborough has no airport and no longer has rail; it is, however, located at the intersection of two major highways, Route 101 and 202, making it vulnerable to accidents.

The most recent average daily traffic recorded by the NH DOT show 15,000 vehicles per day at the intersection of Routes 101 and 202; Route 202 south of this intersection sees about 13,000 a day; and Route 101 at the Dublin Town Line about 6,300 a day, whereas closer to the 101/202 intersection the count increases to 9,200. According to a recent study[1], from 2007 to 2016, both highways saw a total of 373 accidents, most of them however with no injuries.

[1] Peterborough NH 101/US 202 Corridor Improvement Study 2018-2019; prepared by the Southwest Region Planning Commission.

While these statistics do not reveal the exact numbers of tractor trailers traveling through Peterborough, it can be surmised that more than a small percentage of daily traffic falls into this category. This hazard is further compounded by the prevalence of water bodies along these two major highways. Consequently, the release of motor oil, gas, or any hazardous materials on these roads could potentially affect a much larger area through surface and underground waterways.

In addition to the risks associated with high-traffic state highways, Peterborough has numerous local roads that have no through-connectivity to other road networks. Some of these roads were built as dead-end or cul-de-sacs, but others are old roads, portions of which have become discontinued over time due to lack of use and/or older housing stock decaying and not being replaced. The potential for harm is great when any of these roads are blocked because of a hazard event; residents cannot get out and emergency services cannot get in. The Subdivision Regulations do contain standards for road construction, although there is not currently a requirement that new roads be connected to an existing network. Map 6 following illustrates the location of these roads, and gives some indication of the numbers of dwellings and therefore the population that would be affected in the event of a road closure and/or failure.

23. **Fixed Facility - Medium Risk**

There are many facilities in town that store hazardous materials, but some pose higher risk to the community than others. The facilities that pose the highest risk include two gas stations and a home heating oil storage site located in the central area of town. Large quantities of refined petroleum are stored on these locations, all of which are situated on or near the Contoocook River. The release of these hazardous liquids poses two major problems: fire and contamination. The discharge of gasoline into the river is a critical concern because it feeds the North Aquifer. This aquifer supplies the town with most of its drinking water.

In January 2003, such a hazardous release did occur at one of the gas stations when over 200 gallons of gasoline were accidentally released from a fuel truck. The gasoline leaked onto a nearby roadway, into the municipal drainage system, and down into an old underground canal. A small amount of gasoline eventually reached the Contoocook River, but a quick response prevented any major contamination. As a precaution, several of the town's wells located on the North Aquifer were temporarily shut down. The spill caused no known long-term effects, but it highlights the risk of a fixed facility release in the downtown area. This gas station has ceased operating and the underground fuel tanks have been removed.

Determining the potential loss associated with fixed facility releases of hazardous material is difficult because there is no well-developed model for this hazard. If such a spill were to contaminate a major ground water source like the North Aquifer, however, it would have a major impact on the town. For example, the South Aquifer was discovered to be contaminated in 1982 with volatile organic compounds (VOCs) leaked from a nearby factory. A town well was immediately shut down and a groundwater treatment facility had to be constructed on the site. For the next twenty years, a multi-million-dollar clean-up process was implemented to restore the groundwater, although recent studies have concluded that it is highly unlikely that this well will ever come back online.

No numerical analysis is available because there are no known figures available on the type and frequency of hazardous transports passing through Peterborough. As emphasized above, however, cleaning hazardous waste is expensive. According to the Federal Motor Carrier Safety Administration, the average cost for a hazardous materials release accident was estimated to be about $536,000 in 2001, the most recent available study data[2], although that cost is no doubt higher today. The costs are more than doubled if the accident generates a fire. These statistics provide a basic sense of the potential costs associated with a hazardous material release on a transportation route in Peterborough.

24. Cyber Event – Low Risk

Cyber events are those that are conducted through a computer network that jeopardizes the integrity of a physical or virtual system. Because of overall, widespread reliance on computers and the internet for utilities, public safety and commerce, the entire state is considered to be vulnerable to a Cyber Event. Potential targets include critical infrastructure and the public and private sector. To date, Peterborough has not been victim of cyber fraud or phishing, nevertheless, it is vitally important to maintain secure systems to avoid the potential for this risk.

25. Mass Casualty Event – Low Risk

Mass Casualty events are those that involve large numbers of people, typically the result of incidents such as transportation accidents, armed attacks, or natural hazard disasters. The State's Multi-Hazard Plan considers the state to be at low risk for this type of event, and all counties to be equally vulnerable.

There have been several events in the state, although Peterborough has had only one documented case: in February of 2014 there was an explosion at NH Ball Bearings, Inc. that left two people critically injured and four people with serious injuries.

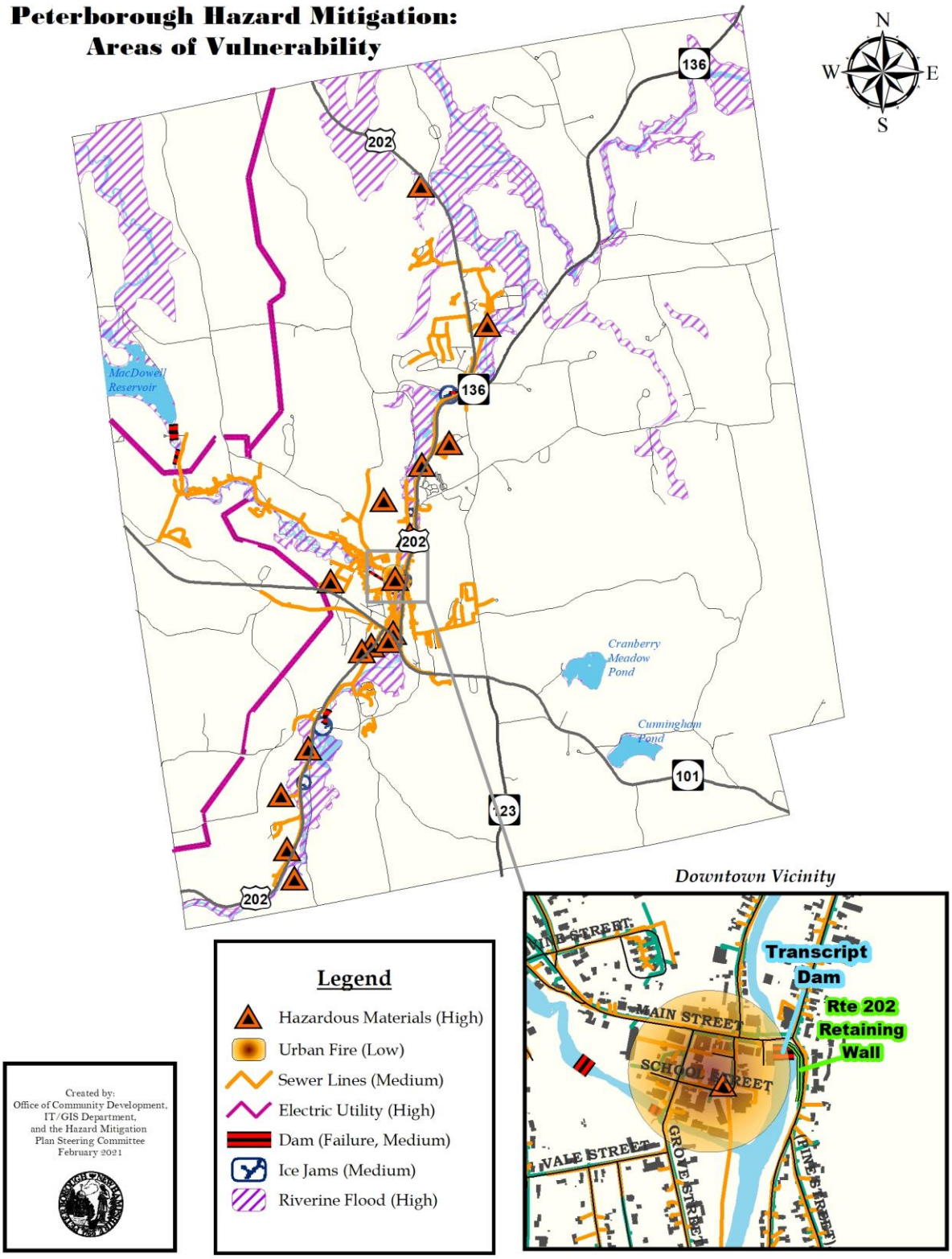
Concord High School had an active shooter event in 1985, and although thankfully Peterborough has not experienced such an event, all of the schools in Town and the School District have Emergency and Response Plans in place that include procedures for this type of event.

26. Terrorism/Violence – Low Risk

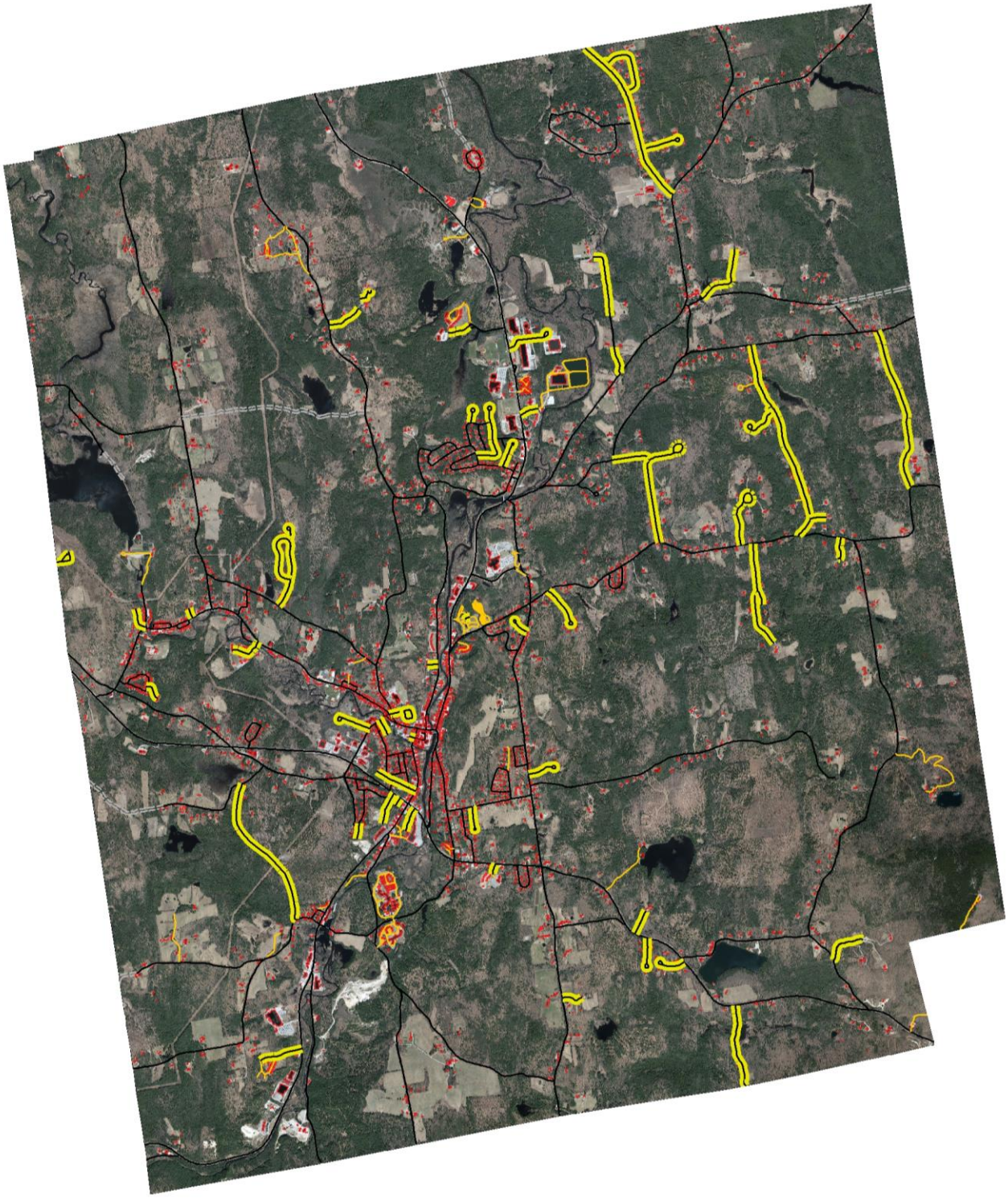
According to the State's Multi-Hazard Plan, the entire state is vulnerable to both terrorist attacks and violent crime, and although the risk is high, the probability is considered low. New Hampshire has not experienced a major terrorist attack, there have been two documented pipe bomb attacks – one in 1972 at the Manchester Airport, and one in 1998 at the Concord City Library. There has been one additional pipe bomb found after the Library incident, and several bomb threats. Thankfully, there have been no documented events in Peterborough.

[2] *Comparative Risks of Hazardous Materials and Non-Hazardous Materials Truck Shipment Accidents/Incidents*; March 2001

MAP 4: AREAS OF VULNERABILITY



MAP 5: DEAD-END ROADS IN PETERBOROUGH



CHAPTER 6

EXISTING MITIGATION STRATEGIES

The Hazard Mitigation Committee identified mitigation Strategies that are already in place (see Table 14 below) and include activities at the federal, state, and local levels. The identified activities/programs are those that were determined by the Committee to play a role in the reduction of damages and losses in the event of a natural hazard or secondary disaster; note that these strategies are not listed in any order of priority, only segregated by type, which are: (1) Emergency Operations; (2) Infrastructure; (3) Planning; and (4) Regulatory.

The Committee made determinations as to the effectiveness of each one, and recommended changes or improvements where necessary to improve the effectiveness. Effectiveness is defined as follows, and it is important to note that "effectiveness" in this circumstance refers to the ability to meet the stated goal – not necessarily the ability to prevent a hazard.

Excellent…… The strategy exceeds its expectations.

Good……The strategy works as intended and meets its goals.

Average……The strategy does not entirely meet its goals.

Poor……The strategy does not work as intended and falls short of its goals.

Most of the strategies identified in Table 14 are deemed to be "Good"; none have been identified as being "Poor", nor have any been identified as exceeding expectations (Excellent). Where "On-going" is used in the Improvements column, this means that the program or activity is serving its purpose and is intended to be continued.

TABLE 14:

EXISTING MITIGATION STRATEGIES

Existing Program or Activity	Description	Area of Town Covered	Responsible Agent(s)	Effective-ness	Improvements or Changes Needed
EMERGENCY OPERATIONS:					
1. Communication between Town Departments	Fire, Police and Public Works cooperate to ensure effective response in emergencies. Two cell towers have been constructed in town. Radio repeaters for the Police and Fire Departments are located at the Hospital. All department directors, superintendents and fire and police personnel have cell phones.	Town-wide	Fire Chief/Police Chief/Public Works Director	Good	24/7 power backup is still needed. There is space at the top of the cell tower at the Country Club for Town service, but it has not yet been utilized.
2. Emergency Back-up Power	The Town has 14 permanent and one portable generators. MacDowell Dam has two portable generators that are available to use.	As needed	Fire Chief/ Police Chief/ Public Works Director/ USACE	Good	On-going

Existing Program or Activity	Description	Area of Town Covered	Responsible Agent(s)	Effective-ness	Improvements or Changes Needed
3. Fire Department Training	There is monthly training for all members.	Town-wide	Fire Chief	Good	On-going
4. Flood Warning Systems	Gauges in the Contoocook River @ Noone Falls, Steele Road, and the Jack Daniels Inn; with Internet access to the NWS information. Direct telephone line at MacDowell Dam	Contoocook River Corridor Nubanusit Brook	Fire Chief/ Police Chief/ Public Works Director/ USACE	Good	On-going
5. NH Public Works Mutual Aid Program	Connects towns to resources needed in the event of an emergency.	Town-wide	Public Works Director	Good	On-going
6. Police Department Training	Police Academy training for non-certified officers On-going training in various areas	Town-wide	Police Chief	Good	Ongoing
7. Police Mutual Aid Agreements	Peterborough Police Department has mutual aid agreements with neighboring towns and the Hillsborough County Sheriff's Department for coverage.	Town-wide	Police Chief	Good	On-going
8. Southwestern NH Fire Mutual Aid	Dispatch center in Keene for fire and ambulance. Covers southwestern NH and southeastern VT.	Town-wide	Fire Chief	Good	System at times is overloaded; alarms to Peterborough can be delayed. An improvement would be expected if Peterborough had its own Dispatch Center.
9. State Police On-line Telecommuni-cation System (SPOTS)	Police Department has computer access to the state police database for various issues and events. Four cruisers have mobile data terminals to access SPOTS from the road.	Town-wide	Police Chief	Good	On-going
10. Warning Systems	Fire Horn @ the Fire Station/Radio & TV Stations/Websites Town Nixel Web-based warning system/Use of other Social Media/School District Notification System	Town-wide	Emergency Management Director/ Town IT Department/C onVal School District	Good	On-going

Existing Program or Activity	Description	Area of Town Covered	Responsible Agent(s)	Effective-ness	Improvements or Changes Needed
11. Wastewater Treatment Facility Emergency Response Guide	A set of procedures that defines staff responsibilities and SOP's to be followed in response to emergency situations.	Waste-water Treatment Facility and pump stations	• Public Works Director • Utilities Superinten-dent	Good	On-going. Last updated in 2017. Next scheduled update for 2022.
12. Public Access to online maps & data	All GIS maps and data of critical infrastructure are web-based and accessible online to DPW, Fire & Rescue and the public.	Town-wide	Town IT Department	Good	On-going
13. Hazardous Tree Program	The Town maintains on on-going program to trim and cut trees that pose hazards. The Town appropriates money annually for this work.	Town-wide	Public Works Director	Good	On-going
INFRASTRUCTURE:					
14. Culvert and Storm Drain Maintenance	Maintains systems and identifies areas that need improvement. In 2018 the Town embarked on a comprehensive road improvement program that covers, in part, drainage related to roads being reconstructed.	Town-wide	Public Works Director	Good	On-going
15. Fire Hydrants	All hydrants are GPS'ed for exact locations. The Town budgets $5,000 annually for repair, maintenance and replacement.	Town-wide	Public Works Director	Good	On-going
16. Utility Poles	All poles are GPS'ed for exact locations	Town-wide	Public Works Director	Good	On-going
17. Leak Detection System for Water System	Water audits are taken to monitor water usage. All repairs are up-to-date. In 2017 the Town performed a comprehensive leak detection audit.	Town Water System Coverage	Public Works Director	Good	On-going
18. NH DOT Bridge Inspection Program	The DOT inspects all bridges on a regular basis and issues a report identifying problems.	Town-wide	Public Works Director	Good	On-going
19. Snow Removal Policy	Sets forth the order in which town roads will be cleared of snow.	Town-wide	• Public Works Director • Highway Super-intendent	Good	On-going

Existing Program or Activity	Description	Area of Town Covered	Responsible Agent(s)	Effective-ness	Improvements or Changes Needed
20. Road and Bridge Construction Standards	Specifies standards and materials for all Town roads and bridges and includes storm water management. In 2018 the Town enacted an enhanced roadway management program and budgets @ $400,000 annually to bring degraded roads up to standard.	Town-wide	Public Works Director/ Highway Super-intendent/ Planning Board	Good	On-going. Standards are updated as needed. Town should evaluate the effectiveness of connecting dead-end roads.
21. Road and Sidewalk Reconstruction	The Public Works Director maintains a 10-Year Plan for the continued repair and reconstruction of town roads and sidewalks.	Town-wide	Public Works Director/ Highway Super-intendent	Good	On-going.
22. Water Supply Vulnerability Assessment	Identifies which components of the water supply system could be vulnerable to vandalism and/or terrorism	Areas served by the Town water system	Public Works Director/IT Director	Good	On-going. Update pending for March 2021.
PLANNING:					
23. Capital Reserve Funds for Large Equipment	Plans for future large expenditures by setting aside money each year. Ensures that necessary equipment will be functional.	Town-wide	Public Works Director	Good	
24. Community Rating System	FEMA/NFIP program that offers reductions in flood insurance rates for town participation in flood mitigation activities	Town-wide	Office of Planning & Building	Good	Town is seeking to upgrade the rating from a Class VIII to a Class VII.
25. Contingency Emergency Plan for DPW Elm Street Fuel Tanks	Describes the basic procedure to be followed in the event of fuel spills at the DPW Highway Garage	DPW Highway Garage on Elm Street	Director of Public Works/ Emergency Management Director	Good	On-going
26. Local Emergency Operations Plan	Describes the preparation and emergency response required by the Town to react to any type of an emergency situation.	Town-wide	Fire, Police and Public Works Departments	Good	On-going. Current Plan approved in 2017. Update scheduled for 2022.
27. Fleet Maintenance	The Town supports full-time mechanics to maintain all Town vehicles, although some major repairs may go to authorized repair facilities.	Town-wide	Public Works Director/ Highway Department Supervisor	Good	On-going
28. Fleet Replacement Program	Town-owned vehicles are replaced on a regular schedule to ensure that they are all in good working order.	Town-wide	Public Works Director/Fire Chief/Police Chief	Good	On-going

Existing Program or Activity	Description	Area of Town Covered	Responsible Agent(s)	Effective-ness	Improvements or Changes Needed
29. Geographic Information System (GIS)	The Town utilizes a geographic database that maps all critical facilities, flood plains, municipal water and sewer systems, etc. Over time, this system has become essential in providing Public Works and Public Safety with critical data.	Town-wide	Town IT Department	Excellent	On-going
30. Master Plan	Contains an inventory of Town-owned lands and buildings, describes existing land use development, and projects future development. A Master Plan Steering Committee oversees the maintenance and continual updating of the Master Plan.	Town-wide	Planning Board/Master Plan Steering Committee/ Town Planner	Good	On-going. The Vision and Land Use Sections are currently undergoing an update scheduled for 2021.
31. Monadnock Community Hospital Evacuation Plan	In the event of an emergency, evacuation of patients would be coordinated with NH DHHS and Peterborough Fire & Rescue.	Hospital Campus	Monadnock Community Hospital/ Emergency Management Director	Good	Updated annually.
32. School Emergency Plan	Sets forth procedures to be followed in the event of an incident; includes procedures for lock-downs and evacuations.	High School/ Middle School/ Elementary School	Super-intendent of Schools/ Police & Fire Chiefs	Good	On-going, with annual training.
33. All Hazards Medical Plan	Sets forth the procedures to be followed in the event of a major medical disaster.	Region-wide	Fire Chief/ Health Officer/ Greater Monadnock Public Health Region	Good	On-going
34. US ACE Flood Emergency Plan	Describes the procedure to be followed in the event of an overflow of the MacDowell Dam.	Nubansit Brook and the Contoocook River	Fire Chief/ Police Chief/US ACE	Good	On-going. Current Plan updated in 2019.
REGULATORY:					
35. Ground-water Protection District	Protects identified groundwater, wellhead areas, and drinking water sources.	Ground-water and Wellhead Protection District	Planning Board/Water Resources Committee/ Code Enforcement Officer/Town Planner	Good	On-going

Existing Program or Activity	Description	Area of Town Covered	Responsible Agent(s)	Effective-ness	Improvements or Changes Needed
36. Best Management Practices	Various state agencies recommend practices for a variety of land use activities, aimed primarily at mitigating erosion and sedimentation.	Town-wide	Planning Board/Public Works Director/ Code Enforcement Officer/ Town Planner	Good	It is important to stay aware of the BMP's as they are updated, or new ones put forward.
37. Drinking Water Standards	In accordance with NH DES standards, all new wells must be tested for potable water	Town-wide	Code Enforcement Officer	Good	On-going. The Code Enforcement Officer oversees the testing for all new construction.
38. Floodplain Protection Ordinance	Manages and regulates development in the floodplain in accordance with NFIP standards and FEMA requirements.	FEMA-designated flood-plain areas	Planning Board/Code Enforcement Officer/ Town Planner	Good	On-going
39. Height Restrictions	Zoning Ordinance limits the height of structures based on Fire Department's capacity to fight fires.	Town-wide	Planning Board/Code Enforcement Officer/Fire Chief/ Town Planner	Good	On-going
40. International Building & Residential Codes	Sets construction standards for residential and non-residential buildings.	Town-wide	Code Enforcement Officer	Good	On-going
41. Septic System Standards	Requires the location and construction of on-site septic systems to comply with state and local standards to minimize potential damage from flooding or other hazardous events.	Town-wide	Planning Board/Public Works Director/ Code Enforcement Officer	Good	On-going
42. Shoreland Conservation Zone	Restricts development within 100 feet of the shoreland.	Corridors for the Contoocook River, Nubanusit Brook, and all water bodies shown on USGS maps	Planning Board/ Conservation Commission/ Code Enforcement Officer/ Town Planner	Good	On-going
43. State Fire Code	Sets construction standards related to life safety, fire prevention, fuel and gas.	Town-wide	Fire Chief/ Code Enforcement Officer	Good	On-going

Existing Program or Activity	Description	Area of Town Covered	Responsible Agent(s)	Effective-ness	Improvements or Changes Needed
44. Stormwater Management Regulations	Sets standards for the mitigation of stormwater runoff.	Town-wide	Planning Board/Public Works Director/ Town Planner	Good	On-going. They should be reviewed to ensure that they are adequate to meet the challenges of climate chiange.
45. Wetland Overlay Protection District	Designates a buffer area around wetland, within which no development can occur.	Town-wide	Planning Board/Code Enforcement Officer/ Town Planner	Good	On-going. The ordinance could be strengthened to provide additional wetland setbacks & protection.

Worth noting in this discussion of mitigation strategies is the importance of the existence of the Edward MacDowell Dam in West Peterborough. The dam was built in 1950 by the US Army Corps of Engineers, who continues to operate and maintain it. The dam was constructed following the severe hurricane of 1938 as part of a series of dams in the Merrimack River Basin for the purpose of flood protection. The lake formed by the dam and the adjacent areas also serve as an important recreation site for residents and visitors. In terms of the dam's efficacy, the Army Corps estimates that to date over $21 million dollars in flood damages have been avoided by the existence of the dam. (See Appendix **F** for more specific details on the dam.)

NATIONAL FLOOD INSURANCE PROGRAM

One of the mitigation strategies noted in the table above is participation in the National Flood Insurance Program. For towns such as Peterborough, where flooding is the most common risk, this is a program that offers financial benefit to those who purchase flood insurance while providing the town with additional protection against damages from flooding. The sidebar contains more detail on the program.

Peterborough has been a participating member of the National Flood Insurance Program since May 1, 1980. Participation is made possible by the Town adopting and enforcing floodplain management regulations and the Floodplain District became a part of the Town of Peterborough Zoning Ordinance in March of 1980. Flood Insurance Rate Maps and the Flood Boundary and Floodway Map are used for flood insurance purposes and are on file at the Office of Community Development.

Sections of the Contoocook River and Nubanusit Brook have been restudied and new maps for the entire town were approved by FEMA. Both the updated maps (DFIRMS) and the Flood Insurance Study became effective on September 25, 2009.

The Town attends to the requirements of FEMA regarding floodplain legislation and amends, as necessary, its zoning ordinance and the language in the Subdivision and Site Plan Review Regulations that is also a requirement for participation. As of this date, all three documents are current and in compliance with FEMA requirements.

As of this writing, the Town has records of 219 buildings located within FEMA-designated Special Flood Hazard Areas. As of this writing, there are 52 NFIP policies in effect in Peterborough. Since January 1, 1978, there have been 48 claims for property losses, totaling $604,193. Peterborough has no NFIP-insured structures that have a history of repetitive loss.

In addition to the NFIP, Peterborough also participates in the Community Rating System (CRS), and came into the program at a Class VIII, which affords a 10% reduction in flood insurance policies.

The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary federal program that allows any homeowner located in a special flood hazard area, and any other homeowners in town, to purchase flood insurance. In order to be able to take advantage of this opportunity, however, the town is required to adopt a Floodplain Management Ordinance.

This ordinance requires towns to track all development in the flood zones and specifically to ensure that any new or substantial improvements to existing structures comply with the floodplain management standards. The purpose of this ordinance is to minimize the potential for flood damage, to avoid damage-prone uses in the floodplains, and to reduce development pressures in floodplains.

The advantage to the residents is that they are then able to receive federally-subsidized flood insurance for their buildings, whether or not they are in the floodplain. Furthermore, if a property owner needs flood insurance as a requirement for financing, the federally-subsidized insurance would not be available to him or her if the town was not a participant in the NFIP.

In the development of the prioritized list, the Committee considered that all actions would be consistent and not in conflict with the Town's continued participation in the National Flood Insurance Program. The Town intends to continue its participation in the CRS and even hopes to be able to achieve additional points for a higher classification level. A recertification is conducted every year, by which the Town documents that it continues to engage in the activities that earned the initial points for acceptance into the Program.

CHAPTER 7

PROPOSED MITIGATION STRATEGIES

DEVELOPING NEWLY-IDENTIFIED MITIGATION STRATEGIES

In this step of the process, the Committee identified new mitigation strategies that would complement the existing strategies described in the previous section, and further the goals of this Plan, as spelled out in Chapter 1. In order to identify needed mitigation strategies, the Committee first looked back at the Risk Assessment presented in Chapter 5. Out of the 25 hazards to which Peterborough is considered vulnerable, this exercise identified four high-risk hazards to which the Town appears to be most vulnerable; they are:

1. Inland Flooding
2. Nor'easters/Heavy Snow Storms
3. Ice Storms
4. Long-Term Utility Outage

Using this information as guidance, the Committee then developed a list of possible strategies, which are presented in Table 16 following. The types of activities proposed by the Committee are organized into five categories described in the sidebar. The non-prioritized items also identify which type of activity the proposed strategy would fall under, what part of town would be affected, and which hazard would be mitigated. Prior to developing the strategies presented in Table 16, however, the Committee reviewed the Recommended Mitigation Strategies from the 2016 Plan, in order to identify any completed, deleted, or deferred actions. The results of this exercise are presented in Table 15 below:

- **Prevention:** Administrative or regulatory actions and processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.
- **Property Protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard, or removal of the structures from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.
- **Emergency Services:** Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.
- **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, drainage, seawalls, retaining walls, and safe rooms.
- **Equipment:** Purchase of equipment that aids in the reduction of damages from natural and man-made hazards.

Table 15:
2016 Recommended Mitigation Strategies

Recommended Mitigation Strategy	Status	Explanation of Status
1. Maintain the Hazardous Tree Removal Program	Completed/Deferred	This is an on-going program that is funded annually in the DPW budget.
2. Upgrades to Town-wide Communications	Completed/Deferred	This is an on-going effort that will continue as long as deemed necessary.
3. Upgrade the North Dam	Deferred	This strategy remains in the Plan, but the scope of the project is not certain.
4. Explore options for a Town Dispatch Center	Deferred	The Town continues to work on a solution to provide Peterborough with its own Dispatch Center.
5. Reconstruct the Main Street Bridge and the Granite Street Retaining Wall	Deferred	This project is under construction and should be complete within a few months.
6. Evaluate the Transcript Dam for repair or breaching	Completed	The dam has been evaluated and repaired with the intention of keeping it in place.
7. Upgrade Downtown Canal	Completed	This project was completed by repairing and in some cases filling in sections of the canal.
8. Improvements to the Downtown Drainage System	Deferred	Funds are appropriated every year to continue improvements to the system.
9. Continue to enhance the functionality of the Town's Geographic Information System (GIS)	Completed/Deferred	Funds are appropriated every year to maintain and upgrade this system.
10. Provide interconnectivity between the Police and Fire Stations to the Town House	Completed	Fiber connectivity has been provided that connects the Town House, Police, and Fire Stations.
11. Upgrade the Community Rating System from Class VIII to Class VII	Deferred	The Town is in the process of meeting the requirements necessary for the upgrade.
12. Plan for the future connectivity of new roads to existing roads; and, where possible, re-establish connections on roads that have become discontinued	Deferred	There are no immediate plans for such work given the political and financial challenges involved.
13. Revisit the previously-proposed amendments to the Wetlands Protection Overlay District	Deleted	No work has been done on this project since 2016 and there is currently no plan to go forward.

Of the 13 Mitigation Strategies identified in 2016, three of them have been accomplished and one will be removed as inexpedient to continue. Table 16 below presents the 2021 Recommended Mitigation Strategies. Some of these are carried forward from the 2016 Plan; others are new, based on changing circumstances since the 2016 Plan Update was developed. Table 17 contains strategies that are expected to be ongoing because they are important for mitigation and therefore do not have a deadline for completion.

Table 16:
2021 Recommended Mitigation Strategies

MITIGATION ACTIONS			
Hazard Type	**Recommended Mitigation Strategy**	**Affected Location**	**Type of Activity**
All Hazards	1. Incorporate the Hazard Mitigation Plan into the Master Plan by reference	Town-wide	· Emergency Services · Prevention · Structural Project
Flooding	2. Repair the North Dam	Contoocook River Corridor	· Prevention · Structural Project
Flooding	3. Upgrade the Community Rating System from Class VIII to Class VII	Special Flood Hazard Areas	· Prevention · Property Protection
Flooding	4. Participate in a US Army Corps of Engineers project to develop local guidance for asset management plans	Town-wide	· Prevention · Property Protection
Flooding	5. Repair the Fly Pond Dam	Summer Street & Hunt Road	· Prevention · Property Protection
· Flooding · Extreme Weather (Ice Storms, Nor'easters)	6. Amend the Subdivision Street Standards to discourage or disapprove dead-end roads	Town-wide	· Emergency Services · Property Protection · Prevention
· Flooding · Extreme Weather (Ice Storms, Nor'easters	7. Review the Stormwater Management and Erosion Control Regulations to ensure that they address impacts of climate change	Town-wide	· Emergency Services · Prevention · Structural Project
· Flooding · Landslide	8. Complete the reconstruction of the Main Street Bridge and the Pine Street Retaining Wall	Downtown & Contoocook River downstream	· Structural Project
· Transport Accident · All Other Hazards	9. Continue to explore options for a Town Dispatch Center	Town-wide	· Emergency Services

Hazard Type	Recommended Mitigation Strategy	Affected Location	Type of Activity
· Flooding · Tropical Storms	10. Pursue further improvements to the Downtown Drainage System	Downtown & Contoocook River downstream	· Structural Project · Prevention
Infectious Disease	11. Develop a Town Policy for Managing Town Government operations during a pandemic.	Town-wide	· Prevention
Drought	12. Bring the Cold Spring well online to provide an additional source of water	Town-wide	· Prevention
All Hazards	13. Create a page on the Town's Website designated to Hazard Mitigation	Town-wide	· Public Outreach & Education

DESCRIPTION OF THE MITIGATION STRATEGIES

During the development of the projects identified in Table 16, the Committee recognized that emphasis should be placed on mitigation. It is, however, understood that there is some potential for hazards the town simply cannot plan away – for example, accidents on either of the major highways that might involve the transportation of hazardous materials. For that reason, several of the strategies are of an "emergency response" type, rather than of a purely preventative nature, although overall, most of the strategies involve some level of prevention. In addition, they are also intended to reduce the effects of hazards on both existing and new buildings and infrastructure.

Another change from the 2016 Plan is that the recommended strategies are distinguished between those that reflect an action that has a specific time frame attached to it – that is, expected to be complete in [X] number of years; and then another group of strategies that are intended to stay in place either for an extended period of time, or perpetually because of the critical role they play in hazard mitigation.

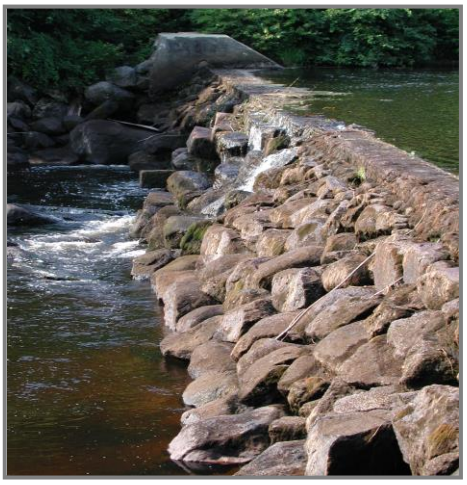
RECOMMENDED MITIGATION STRATEGIES

1. Incorporate the Hazard Mitigation Plan into the Master Plan

The Town of Peterborough Planning Board maintains and update its local master plan on a regular basis. There are state statutes that specify what sections must be included in a master plan, as well as a description of optional sections. One of the optional sections is a natural hazards section, described as: "A natural hazards section which documents the physical characteristics, severity, frequency, and extent of any potential natural hazards to the community. It should identify those elements of the built environment at risk from natural hazards as well as extent of current and future vulnerability that may result from current zoning and development policies." The Planning Board, at its next available opportunity in the master plan process, should incorporate this Plan into the Master Plan by reference so that these strategies are more visible to the public

2. Repair the North Dam

The North Dam has been inspected by the NH Department of Environmental Services and found to be much deteriorated. In fact, the report notes that more water flows under and through the dam than over it, as can be seen in the picture to the right. Should this dam fail, the repercussions would be especially serious for the important wetland behind the dam. Furthermore, two of the Town's wells are located near the reservoir behind the dam and may rely on this source for some portion of their capacity.



North Dam

A Feasibility Study was conducted in 2016 and determined that the dam was not a hazard. The study identified three potential actions, from taking the dam out altogether to repairing it; the repair seems to be the most likely option at this point. More work may need to be done on the dam in the next 5-10 years.

3. Upgrade the Community Rating System from Class VIII to Class VII

Peterborough applied for participation into the CRS Program in 2004 and was accepted as a Class VIII, a status that allows flood insurance policy holders a 10% discount on their insurance rates. The Town is currently going through the process, as part of its re-certification, to see whether it is feasible to get upgraded to a Class VII, which would add another 5% reduction in flood insurance rates – from a 10% to a 15% reduction. The application was submitted last year and was not successful, however it will be resubmitted this year (2021). As part of the application process, the Town must demonstrate that it is meeting certain benchmarks, including providing education and outreach to all property owners, lenders and insurance companies, among other things. These activities are detailed in the annual report submitted to the NFIP.

4. Participate in the US Army Corps of Engineers Project to Develop Local Guidance for Asset Management Plans

The US Army Corps of Engineers has reached out to the Town of Peterborough with a request for the Town to participate in a project to develop guidance for strengthening local asset management plans (AMP) specific to infrastructure assets. The lack of AMPs means that New Hampshire communities struggle to document their assets or track maintenance and repairs. Considering the problems and flooding risks posed by blocked and/or inadequately sized culverts, have a robust AMP is critical in managing infrastructure and mitigating damage.

Peterborough was chosen as one of three towns in New Hampshire that the USACE has reached out to with a request to participate in this program. The three towns were selected because they are towns that are already working to build out their asset inventories, or who have had recent experience with multiple flood-induced culvert failures. The guidance that will be developed will be based on input from these three pilot towns and will be made available to all towns in the state via online workshops and in-person trainings and will include a guidance manual.

5. Repair the Fly Pond Dam

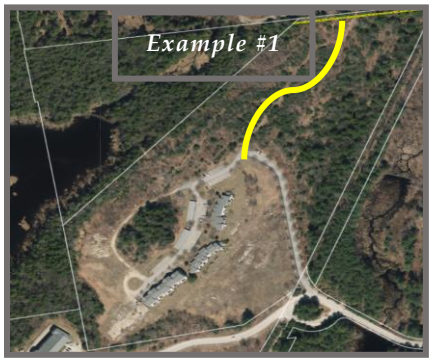
The Fly Pond Dam is located on Summer Street near Hunt Road. The dam is not able to hold back water during heavy rains or peak melting. When overtopped, the roadway becomes impassible, causing major traffic interruption to Summer Street, which is a very busy local roadway. The Town has applied for a grant to assist with the funding; the application has been submitted, and if successful, the project should begin in 2021.

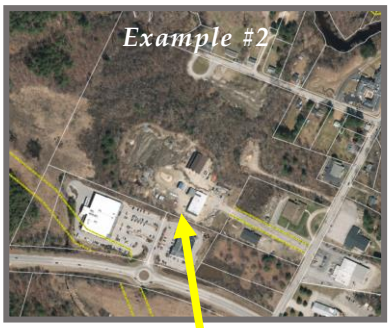
6. Amend the Subdivision Street Standards to Plan for Future Road Connectivity

Peterborough has many local roads that are dead-ends, either because they were built new as cul-de-sacs, or they are old roads of which some portion has become discontinued (see Map 5**).** Should these roads become blocked by flooding or debris, not only are the residents at risk of being trapped, but emergency personnel cannot get in to provide aid. The Subdivision Regulations do contain standards for road construction, although there is not currently a requirement that new roads be connected to an existing network.

The Planning Board should address this by amending the Street Standards in the Subdivision Regulations to require road connections in all new subdivisions – where feasible; and if not, at a minimum require a dedicated easement for an emergency access in the event of just such an emergency situation.

Examples of previous Planning Board action on this issue can be found in two different land use development projects – one for a residential subdivision, and the other for a commercial development; in each case the Planning Board required that the applicant reserve a dedicated strip of land to serve as emergency access and/or future connectivity in the event the abutting landowner is willing to provide a connection. Example #1 is at Southfield Village off of Route 202 North; the emergency lane would provide access to the parcel just to the north.





Location of Potential Future Connector

Example #2 is at the Shaw's/CVS retail site on Route 101; the intention here was to provide a connector in the even the Town-owned parcel to the north (known as Evans Flats, site of the Highway Garage) should become developed, including new road networks.

Example #3 illustrates a potential solution for providing an emergency access along an existing boundary line for an established subdivision. In this example, these two dead-end roads serve 19 homes; if either one of these roads were blocked, anywhere from 7 to 12 homes would be cut off from escape or assistance.

7. <u>Review Peterborough's Stormwater Management and Erosion Control Regulations</u>

The Town's Subdivision Regulations contain standards for managing stormwater runoff and erosion control. These standards have been in place for many years and may no longer be adequate to address the impacts of climate change, which include more frequent and more severe storms. It is important that these standards reflect the current science of mitigation, and are designed to provide the same protection into the foreseeable future.

With the frequency of inland flooding events increasing as a result of climate change in the northeast, and where older aging and undersized stormwater infrastructure is present, careful consideration should be made to future design of relevant and related stormwater infrastructure. This includes municipally-owned and managed infrastructure and projects and, where appropriate, also when private infrastructure and projects intersect with public, especially where there is opportunity for adverse public impact.

8. <u>Complete the Reconstruction of the Main Street Bridge and the Pine Street Retaining Wall</u>

This project, which has been in the Town's Hazard Mitigation Plan for a number of years, is currently under construction and expected to be complete by the end of 2022.

The photo to the right shows the bridge construction in progress. The bottom photo is a view of the reconstruction of the retaining wall.

9. <u>Continue to Explore Options for a Town Dispatch Center</u>

This recommended strategy calls for outfitting the existing police to handle 24/7 police, fire and ambulance dispatch services. Currently the local dispatch is only operational during the weekdays. The Fire Department receives coverage from the Mutual Aid services based in Keene, and the Police from the Hillsborough County Sheriff's Department.

Neither of these backup systems is adequate when there are numerous calls coming in at once, or they are overly busy with other towns. The Police Station has a room that could serve this purpose. In addition, the Police Station has the SPOTS terminal, a base radio, other computer equipment, and shower facilities. The building would need some minor structural modifications, along with shelf and storage space for dispatch records.

As of this writing, the Town is pursuing plans for a combined Public Safety Complex that would include a Dispatch Center.

10. Pursue Further Improvements to Downtown Drainage

Issues with drainage in the Downtown are twofold – one has to do with street and yard flooding that occurs during downpours, in part because the catch basins cannot accommodate the runoff; and the other has to do with the runoff and overflow going directly into the Contoocook River (the River is a listed impaired waterbody), carrying pollutants with it.

The Town has completed two projects to date that were aimed at improving the drainage situation in the Downtown; the projects included the installation of deep sump leaching catchbasins, parking lot infiltration divider and biobasins with vegetative plantings, an oil/water separator downgradient of the gas station, installation of roof leader/ rain garden/drywell combinations for runoff from the Town House, and the use of catch basins and rain gardens at the intersection of Grove and School Street and rain gardens at Putnam Park.

Further improvements to drainage in the Downtown was accomplished last year when the Town constructed a new public parking lot off of Grove Street adjacent to the Contoocook and the Nubanusit. The parking lot is connected to Depot Square by a pedestrian/bicycle walkway. There is a closed drainage system constructed underneath the parking lot that serves to further improve water quality into the two waterbodies.

11. Develop a Policy for Managing Town Government Operations During a Pandemic

In response to the COVID-19 pandemic of 2020 into 2021, the Town of Peterborough Administration developed best practices guidance for its employees regarding working remotely, quarantine if necessary, and travel. Given the likelihood that this pandemic is not an isolated incident, the Town sees the need to have a comprehensive policy in place that it can rely on in case of such an event. Such a policy has been discussed and is expected to be in place by the end of this year (2021).

12. Bring the Cold Stone Springs Well Online

The Cold Stone Springs Well, located in Sharon, is a joint-municipal well site to be owned, operated, and maintained by the Towns of Peterborough and Jaffrey. The project will bring back online the existing approved groundwater wells (LGWP-2007-0004A) and will include added treatment and connection to existing distribution systems in Jaffrey and Peterborough. The wells will address supply deficiencies in both communities, and provide a much-needed system of redundancy in Peterborough where limitations currently exist with respect to the southern portion of the town. The project has been fully funded, and is expected to be completed and fully online in 2023.

13. Create a Hazard Mitigation Webpage

As noted above, there are certain hazards over which the Town has no control and cannot stop from happening. Therefore, an important measure to take is in providing information to the public on what risks Peterborough is vulnerable to, and what residents and property owners can do on their own to protect themselves and their property. The Town should have a dedicated page on its website with links to all pertinent information – local, state, and federal. Below is a list of a number of websites that provide this sort of information:

- NH Department of Homeland Security/Emergency Management: Welcome - Homeland Security & Emergency Management, NH DOS
- Federal Emergency Management Agency: Home | FEMA.gov
- The National Flood Insurance Program: Homepage | The National Flood Insurance Program | FloodSmart | NFIPServices
- NFIP - The Community Rating System: National Flood Insurance Program Community Rating System | FEMA.gov
- The National Weather Service: National Weather Service
- Earthquake Drills: Great ShakeOut Earthquake Drills - Select Your ShakeOut Region

OTHER MITIGATION STRATEGIES

Table 17 below includes various mitigation strategies that have been identified in the previous Hazard Mitigation Plans; these are strategies that the Committee considers important to mitigation but do not have a completion date as they are expected to be ongoing in some fashion for the foreseeable future.

Table 17:
Preparedness & Response Action Items

Mitigation Strategy	Affected Location	Type of Activity
1. Support funding for upgrades and improvements to the Geographic Information System	Town-wide	· Prevention · Property Protection · Emergency Services
2. Support funding for the Hazardous Tree Removal Program	Town-wide	· Prevention · Property Protection
3. Retain mutual aid pacts with surrounding towns to share resources and provide assistance in emergency situations	Town-wide	· Prevention · Emergency Services
4. Continue upgrades to Town-wide Communications to ensure that they are fully operational and able to function during emergencies	Town-wide	· Emergency Services
5. Designate a cooling and warming center for residents	Town-wide	· Extreme Temperatures
6. Review and monitor building codes to ensure that they include standards to mitigate these hazards	Town-wide	· Prevention
7. Support funding for training for firefighters and for necessary equipment	North Pack/Pack Monadnock	· Prevention

1. Continue to Enhance the Functionality of the Geographic Information System (GIS)

The Town supports a Geographic Information System that is overseen by the GIS Manager/IT Director. The system is used to collect and manage a wide array of data that serve not only planning-related needs, but numerous public safety and public works functions as well. The floodplain boundaries, along with various other data layers, are available for public access at two computer terminals in the Town House.

Peterborough Fire Rescue continues to enhance its online "common operational picture" GIS application that is used for routine tasks and in Emergency Response Operations. The Department of Public Works relies on the GIS for a number of critical tasks, including:

- mapping of all catch basins, water and sewer lines, and other components of the public utilities systems
- improving storm water mapping and inventory by implementing a robust GIS-based conditional assessment and inspection program
- expanding the use of an online GIS task management system to monitor the hazardous tree cutting program.

This is labor-intensive work, and some of it must be provided by consultants (for example the orthophotography). In order for this system to provide the intended value as a hazard mitigation tool, the data need to be kept up-to-date, and more data need to be added. A capital reserve fund was established for this purpose at Town Meeting 2007, and regular updates to the system continue to be made.

2. Hazardous Tree Program

Every year during spring and winter storms dead and damaged trees pose a risk from breaking and falling. Damage can occur to property and persons, in addition power lines are often affected, which disrupts utilities and communications. Each year the Town appropriates $10,000 to the Public Works Department for this clean-up. It is important that this activity be continued as regular maintenance. Note that Eversource (formerly PSNH) has its own program for pruning trees around power lines.

3. Retain Mutual Aid Pacts

The Town does – and has for many years, participated in mutual aid agreements with neighboring towns to share resources – equipment and personnel as appropriate, when there is an unusual event for which a particular town does not have the equipment needed to deal with it. Although Peterborough does have robust public works, police, and fire operations, the Town still relies on assistance from its neighbors during hazard events. Given that hazards do not recognize political boundaries, it is important and necessary that Peterborough and its neighbors assist one another when the need arises.

4. Continue Upgrades to Town Communication Systems

Due to Peterborough's geography, maintaining a seamless communication network for emergency services is very difficult. Transport Accidents are considered to be a medium risk in

Peterborough due to the existence of two state highways that transect the Town. The Town has limited control over whether accidents happen; it can, however, ensure that emergency services can be quickly dispatched. Progress was made by the locating of a telecommunication tower in Town in 2005. The tower owner has granted the Town space at the top of the tower for an antenna that can be used by public works, police, and fire personnel, but it has not yet been instituted. There are still dead spots in Town that need to be addressed. A second cell tower is located on Route 202 north.

The Hospital in town allows the Police and Fire Departments to have a repeater on one of their antennas. With this addition, the emergency responders believe the communication issue will be largely resolved. The Town also uses a NIXEL alert system for emergencies, such as road closures, water service disruptions, etc., as well as NH Alert, operated by NH Homeland Security Emergency Management.

5. Designate a Cooling and Warming Center for Residents

Understanding that there are some hazard events over which the Town has no control, for example severe storms that can result in long-term utility outages, it is important that the Town has a plan for protecting residents in such an emergency. This was the case during the ice storm in 2008, when the Town was without power for three weeks. The Middle School was used as a shelter until it was safe for people to return to their homes. There should be a location agreed-upon and designated for this purpose in the future.

6. Keep Building and Fire Codes Current

Having up-to-date building codes is one strategy the Town can utilize to ensure that all new construction meets the latest codes for fire and life safety as well as earthquake resiliency.

7. Support Funding for Firefighters and Equipment to Fight Wildfires

Although wildfires are considered low risk for Peterborough, given the likely location of such an event, the Fire Department needs to have the equipment necessary to fight such a fire, and the firefighters also need the specialized training for this type of fire.

CHAPTER 8

EVALUATION AND IMPLEMENTATION OF PROPOSED STRATEGIES

After the Committee developed the list of possible mitigation strategies, the members followed a two-step approach to set priorities for the implementation of these strategies:

First, these strategies were ranked using the STAPLEE scoring methodology recommended by FEMA. The evaluation form and the scoring results are presented in Table 18 on the following page. Questions are asked of each potential mitigation strategy (see the sidebar), and a score is applied, based on how well the strategy answers the questions. A score of "1" for Poor, "2" for Average and "3" for Good is applied to each strategy.

STAPLEE EVALUATION

Is the Action:

- Socially acceptable?
- Technically feasible?
- Administratively possible?
- Politically acceptable?
- Legally authorized?
- Economically beneficial?
- In need of environmental approvals?

The Committee considered the following when going through the ranking exercise. To the question regarding compliance with existing regulations, the answer was in all cases a "3", since the Committee did not propose any strategy that would not meet regulations. The same logic was applied to the Legally Authorized question, even if other authorizations would be required. As for the Economically Beneficial question, a "3" was applied if there was a perceived large benefit for a relatively small effort. And finally, if environmental approvals were required, the strategy scored a "1" or a "2", depending on the perceived effort to receive the appropriate approvals.

After going through the scoring process for each mitigation strategy, the totals were compared, and ranked from highest to lowest. A score of 21 would be the highest. The 12 mitigation strategies proposed by the Committee ranged in scoring from the highest of 21 to the lowest of 8. Of the 13 recommended strategies, there are only five ranked places, since several of the strategies received the same score. In general, the strategies that score the highest do so, not only because they are deemed to be effective, but they are also workable from a political and practical perspective. Conversely, those that score lower do so because of political and/or practical challenges to implementation.

Compared to the ranking of the 2016 Mitigation Strategies, the 2021 ranking for those strategies remain the same as they were in 2016, with the exception of the Main Street Bridge/Retaining Wall/Transcript Dam project; this was moved up to a 21 because it is under construction and expected to be completed soon.

Table 18:
STAPLEE Evaluation Form

RECOMMENDED MITIGATION ACTION	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 **Environmentally** beneficial?	TOTAL SCORE
1. Incorporate the Hazard Mitigation Plan into the Master Plan by reference.	3	3	3	3	3	3	3	21
2. Repair the North Dam	3	3	2	3	3	3	1	18
3. Upgrade the Community Rating System from Class VIII to Class VII	3	3	3	3	3	3	3	21
4. Participate in a USACE project to develop local guidance for asset management plans.	3	3	2	2	3	3	3	19
5. Repair the Fly Pond Dam	2	3	3	2	3	3	3	19
6. Amend the Subdivision Street Standards to address the problem of dead-end roads.	1	1	1	1	1	1	2	8
7. Review the Stormwater Management and Erosion Control Regulations to ensure that they address impacts of climate change.	3	3	3	2	3	2	3	19
8. Continue to explore options for a Town Dispatch Center	3	3	3	3	3	3	3	21
9. Pursue ongoing improvements to the Downtown Drainage System	3	3	3	3	3	3	3	21
10. Develop a Town Policy for Managing Town Government operations during a pandemic.	3	3	3	3	3	3	3	21
11. Complete the reconstruction of the Main Street Bridge and Granite Street Retaining Wall	3	3	3	3	3	3	3	21
12. Bring the Cold Spring well online to provide an additional source of water	3	3	2	1	3	2	2	16
13. Create a page on the Town's website designated for Hazard Mitigation	3	3	3	2	3	2	2	18

Table 1 below takes the 13 recommended strategies proposed by the Hazard Mitigation Committee and presents them in the order in which they were ranked by the above-described procedure and estimates a cost for the project and timeframe for completion.

Table 19:

PRIORITIZED IMPLEMENTATION SCHEDULE

Rank	STAPLEE Score	Problem Statement	Mitigation Action	Hazard Addressed	Responsible Party	Anticipated Cost	Potential Funding Source	Time Frame
High	21	The Master Plan is the foundation of all land-use regulations and development in Town; including hazard mitigation as a section brings more attention to the Hazard Mitigation Plan.	Incorporate the Hazard Mitigation Plan into the Master Plan by reference	All Hazards	• Planning Board • Town Planner	NA	NA	Short Term
High	21	Need to improve the Town's ability to manage development in the floodplain. By creating the opportunity for reductions in flood insurance, encourage more people to participate in the NFIP.	Upgrade the Community Rating System from Class VIII to Class VII	Flooding	• Office of Planning and Building • IT Department	NA	NA	Short Term
High	21	Without its own Dispatch Center, Peterborough must rely on the County and/or Mutual Aid for dispatch services.	Continue to explore options for a Town Dispatch Center	Emergency Services applicable to all hazard events	• Town Administrator • Police/Fire Chiefs	NA	NA	Medium Term
High	21	Addresses storm water runoff to the River and continues work done to improve water quality and minimize flooding	Pursue ongoing improvements to the Downtown Drainage System	Flooding	• Public Works Director	$30,000	Town	Short Term
High	21	The issues raised by the COVID-19 pandemic illustrated the challenges of keeping the Town operating while at the same time keeping staff and the public safe.	Develop a Town Policy for Managing Government operations during a pandemic	All Hazards	• Town Administrator • Emergency Management Director	NA	NA	Medium Term
High	21	The Bridge is clearly a critical piece of the highway infrastructure, along with the retaining wall that supports that section of U.S. Route 202.	Complete the reconstruction of the Main Street Bridge and Pine Street Retaining Wall	Emergency Services applicable to all hazard events	• Public Works Director	$3 million	Town NH DOT	Short Term

Rank	STAPLEE Score	Problem Statement	Mitigation Action	Hazard Addressed	Responsible Party	Anticipated Cost	Potential Funding Source	Time Frame
Medium	19	Strengthening local Asset Management Plans is key to ensuring that infrastructure is capable of managing hazard events.	Participate in the USACE project for Asset Management Plans.	• Flooding • Subsidence Landslide	• Public Works Director • USACE	NA	NA	Short Term
Medium	19	These regulations need to be reviewed and updated, if necessary, to ensure that they are adequate to address impacts of climate change	Review the Stormwater Management Regulations	• Flooding • Subsidence Landslide	• Office of Planning and Building • Planning Board	NA	NA	Short Term
Medium	19	The Fly Pond Dam regularly overtops and floods Summer Street	Repair the Fly Pond Dam	• Flooding	• Public Works Director	$267,000	Town Grant Private	Short Term
Medium	18	The existence of the North Dam is critical to the Town's drinking water supply.	Repair the North Dam	Flooding	• Public Works Director	$500,000	Town	Medium Term
Medium	18	Public education regarding hazards is a central component to mitigation, by providing the public with necessary information to keep them safe.	Create a Hazard Mitigation page on the Town's website	All Hazards	• Town Administrator • Town Planner	NA	NA	Short Term
Medium	16	This well will provide an additional source of water to address the lack of redundancy in the water system, particularly in south Peterborough.	Bring the Cold Stone Springs Well online	Drought	• Public Works Director	$8.5 Million	• Town • Town of Jaffrey	Medium Term
Low	8	Improve the ability to respond to emergencies and ensure that populations are not trapped.	Amend the Street Standards to address dead-end roads	Emergency Services applicable to all hazard events	• Office of Planning and Building • Planning Board • Public Works Director	NA	Town	Medium Term

[LEGEND: NA means that other than staff time, there is no cost for the project. Timeframe means: Short Term = 1 year or less, or ongoing/Medium Term = 2-3 years/ Long Term = 4-5 years]

As explained above, the Hazard Mitigation Committee followed a procedure for scoring and thereby ranking these various activities but, as is well known, circumstances can change that might affect decisions about timing for any of these items. The Committee has made every attempt to develop a Plan that is comprehensive, by considering not just the mitigation strategy, but also who would be responsible for its implementation and how much it would cost. This Plan, combined with the additional information included in the Appendix, should provide guidance for Peterborough's future hazard mitigation efforts over the five-year life of this Plan.

CHAPTER 9

IMPLEMENTING, MONITORING, UPDATING & ADOPTING THE PLAN

IMPLEMENTATION OF THE PLAN THROUGH EXISTING PROGRAMS

In addition to work by the Hazard Mitigation Committee and town departments, several other mechanisms exist that will ensure the Peterborough Hazard Mitigation Plan 2021 Update receives the attention it requires for maintenance and implementation. These are described below.

The Town of Peterborough will continually explore funding opportunities to help offset the high costs of several of the identified projects, such as repair/reconstruction of dams and retaining walls. (Appendix E contains a list of all federal grant opportunities related to hazard mitigation.) Several of the projects identified require no funding, rather an effort by the Town to complete the project, which is a cost in terms of staff time, but no actual purchase would be required – for example, the upgrading of the CRS rating.

Master Plan

Implementation of the Master Plan has been ongoing since its comprehensive update and adoption in 2003. It is recommended that the Peterborough Hazard Mitigation Plan is included by reference. Previously the Hazard Mitigation Plan was not incorporated into the Master Plan, primarily because no relevant master plan work was ongoing at the time of that Plan preparation. However, in this instance, the Peterborough Hazard Mitigation Committee has specifically included this action as one of the recommended mitigation strategies. Furthermore, while this Plan is not incorporated into any other local plan, many of the identified strategies are funded at least in part through the Town's Capital Improvements Program and/or the General Fund.

Zoning Ordinance and Regulations

Most of the recommended strategies in this Plan do not necessitate amendments to Peterborough's land use regulations, with the exception of Strategies #6 & #7; both would require amendments to Subdivision Regulations, which can be accomplished by the Planning Board after public hearing.

Capital Improvements Program

The Town of Peterborough adopts and maintains a Capital Improvements Program (CIP) on an annual basis. This process is overseen by a CIP Committee that begins its process in August and meets weekly from approximately September into December, after which it presents its budget to the Budget Committee, the Select Board, and the Planning Board. Any hazard mitigation strategies identified in this Plan that fall within the scope of the CIP will be included in the Program.

Continued Public Involvement

On behalf of the Hazard Mitigation Committee, the Town Planner, under direction of the Select Board, will be responsible for ensuring that town departments and the public have adequate

opportunity to participate in the planning process. Administrative staff may be utilized to assist with the public involvement process. For the update process, techniques that will be utilized for public involvement include:

- Providing copies of the Hazard Mitigation Plan to Budget Committee members and to all Department Heads.
- Providing copies of working drafts and the final Plan to neighboring communities with a request that they offer comments.
- Posting notices of any meetings of the Hazard Mitigation Committee at the Town House, Library, and local businesses.
- Posting flyers of the project at the Town House, Library, and local businesses.
- Submit newspaper articles for publication in the Town Newsletter and the local Monadnock Ledger-Transcript.
- Creating a page on the Town's website dedicated to information on hazards and hazard mitigation.

Additionally, the public will be invited to participate in the regular process of updating the Peterborough Hazard Mitigation Plan, using pamphlets and other available media outlets. These outreach activities will be undertaken during any reviews of the Plan and during any Hazard Mitigation Committee meetings the Select Board may call to order.

MONITORING & UPDATES

Recognizing that many mitigation projects are ongoing, and that while in the implementation stage communities my suffer budget cuts, experience staff turnover, or projects may fail altogether, a good plan needs to provide for periodic monitoring and evaluation of its successes and failures within the five-year update period of this Plan.

In accordance with FEMA requirements, this 2021 Plan Update will be revisited and updated in five years. Furthermore, in order to track progress and update the Mitigation Strategies identified in the Action Plan (Chapter 8), the Town will revisit the Peterborough Hazard Mitigation Plan 2021 Update annually, and in any case after a hazard event. The Town Planner is responsible for initiating this review and will consult with members of the Emergency Management Committee identified in the Peterborough Local Emergency Operations Plan as well as the Hazard Mitigation Committee members. Changes should be made to the Plan to accommodate for projects 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 did not make the implementation list, but were identified as potential mitigation strategies, should be reviewed as well during the monitoring and update of this Plan to determine feasibility of future implementation.

ADOPTION

Upon notification to the Town that the Plan has received APA status (approvable pending adoption) by FEMA, the Select Board will hold a public hearing to formally adopt the Peterborough Hazard Mitigation Plan 2021 Update. Documentation of this adoption will be in the form of a Certificate of Adoption as shown on the following page.

CERTIFICATE OF ADOPTION
TOWN OF PETERBOROUGH, NEW HAMPSHIRE
A RESOLUTION ADOPTING THE
PETERBOROUGH HAZARD MITIGATION PLAN 2021 UPDATE

WHEREAS, the Town of Peterborough established a committee to prepare the Peterborough Hazard Mitigation Plan 2021 Update; and

WHEREAS, several public planning meetings were held between October of 2020 and March of 2021 regarding the five-year update of the Peterborough Hazard Mitigation Plan 2021 Update; and

WHEREAS, the Peterborough Hazard Mitigation Plan 2021 Update contains several potential future projects to mitigate hazard damage in the Town of Peterborough; and

WHEREAS, a duly-noticed public hearing was held by the Peterborough Board of Selectmen on Nov. 16, 2021 to formally approve and adopt the Peterborough Hazard Mitigation Plan 2021 Update following the approval of the Federal Emergency Management Agency.

NOW, THEREFORE BE IT RESOLVED that the Peterborough Hazard Mitigation Plan 2021 Update is hereby adopted as an official plan of the Town of Peterborough.

The respective officials identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them.

Future revisions and Plan maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as a part of this resolution for a period of five (5) years from the date of this resolution. An annual report on the progress of the implementation elements of the plan shall be presented to the Select board by the Town Planner.

IN WITNESS WHEREOF, the undersigned has affixed their signatures and the corporate seal of the Town of Peterborough this 16th day of November, 2021.

Peterborough Select Board:

Tyler Ward, Chair

Bill Taylor

Bill Kennedy

ATTEST:
Linda M. Guyette

Linda Guyette, Town Clerk

APPENDICES

The Appendix contains supplemental information to this Hazard Mitigation Plan. The intent of this Plan is to provide information about potential disasters, assets at risk, and a means of implementing the actions to help minimize loss to life and property. In addition, the process by which grant and relief money can be obtained and what programs are available to assist the Town and its residents are equally important. When the Hazard Mitigation Plan process is repeated in subsequent years, materials used for publicity and meetings are exhibited to lay out the process for future Hazard Mitigation Committees.

APPENDIX A:

1. PLAN PROCESS AND METHODOLOGY

The Peterborough Hazard Mitigation Committee followed a specific process to develop the content of this Plan. These steps were followed either as part of committee meetings and/or independently. These steps are described below along with the section of the Plan that addresses each of the steps.

Step 1: Establish a Hazard Mitigation Planning Committee. A Press Release and other local notices were used to reach out to town officials, stakeholders, and residents who might wish to volunteer their time to serve on this committee, some of whom were involved in the past two planning efforts.

Step 2: Identification of Past and Potential Hazards (Chapter 3)

Step 3: Identification of Critical Facilities (Chapter 4)

Step 4: Analyze Land Use and Development Trends (Chapter 2)

Step 5: Complete a Risk Assessment of all identified hazards (Chapter 5)

Step 6: Identification and Evaluation of Existing Mitigation Actions (Chapter 6)

Step 7: Identification of Gaps in Protection/Brainstorm New Mitigation Actions (Chapter 7)

Step 8: Evaluate and Prioritize Proposed Mitigation Actions (Chapter 8)

Step 9: Review and Approve Updated Hazard Mitigation Goals and Objectives (Chapter 1)

Step 10: Approve Adoption and Implementation Methodology (Chapter 9)

Narrative Description of the Process

The process for updating the 2021 Peterborough Hazard Mitigation Plan began in October of 2020. As a first step, a press release was sent to the local newspaper informing the general public of the planning process and inviting all interested persons to participate. A letter was also sent to the nine towns that either abut Peterborough or are in the same watershed and to the following, who are considered to be stakeholders in the process, either by virtue of a role they could serve in the event of a disaster, and/or because they deal with at-risk populations:

- Monadnock Community Hospital
- Pheasant Wood Nursing Home
- Summerhill Assisted Living
- The Scott-Farrar Assisted Living
- RiverMead Retirement Community
- ConVal Regional School District
- NH Ball Bearing

Representatives from ConVal and NH Ball Bearing responded by email to note minor corrections that needed to be made regarding their facilities.

At the same time, certain individuals were contacted to request their participation in the process; some of these individuals were involved in the previous planning efforts, but all were considered to be important for the process for the particular knowledge they would bring to the exercise; for example:

- A member of the Planning Board, the Code Enforcement Officer, and the Town Planner represent the entities in town that are involved in the regulation of land development.
- The IT Director brought GIS/technical expertise to the project, specifically in the creation of the data used by public works and emergency services in town.
- The Police and Fire Chiefs, as well as the Public Works Director, also participate as important representatives in the Town's emergency response services and overseer of public infrastructure.
- A staff person of the US Army Corp of Engineers stationed at MacDowell Lake brought particular expertise to the process regarding the function of MacDowell Dam and its role in flood mitigation planning.
- One member represented the Conservation Commission, and one member represented the Open Space Committee, both of which have particular knowledge of the Town's natural resources.

An initial organizational meeting was set for the individuals who agreed to participate. A notice of this, and all subsequent meetings was posted on the Town's website, in the Town House lobbies, and at the Town Library. Due to the COVID-19 pandemic, all of the meetings were held over the Zoom platform. It should be noted that despite the notifications, no members of the public were involved in the process. Input was received, however, from ConVal School District and NH Ball Bearings.

Prior to the first working committee meeting, all participants were provided a copy of the 2016 Hazard Mitigation Plan as well as the 2018 State of New Hampshire Multi-Hazard Plan.

The steps followed by the Committee in its work are described below by the agendas for each of the Committee meetings. The first (organizational) meeting was held on October 2, 2020. The Committee met nearly every week from that point on until March 12, 2021.

The draft Plan was submitted to NH Homeland Security for approval pending adoption on September 13, 2021 and following notification that the Plan was preliminarily approved, it was presented at a public meeting of the Select Board on _____, 2021. The Board voted to approve the submission of 2021 Plan Update according to the specified process.

The draft Plan was mailed to all of the Select Boards of the towns surrounding Peterborough, with a cover letter informing them of the update process and inviting them to comment on the Plan, if they had local issues that they felt might be impacted by the Peterborough Plan. No response from the abutting towns was received.

2. DOCUMENTATION OF THE PLANNING PROCESS

STEP #1: Call for participation and public notification

Town House Posting, Website and Newspaper

FOR IMMEDIATE RELEASE

PRESS RELEASE

Town of Peterborough

Hazard Mitigation Plan Update

Peterborough, NH – November 9, 2020 — The Town of Peterborough is undertaking the update of the Town's 2016 Hazard Mitigation Plan. The adoption of a Hazard Mitigation Plan is a requirement for any community to be eligible for federal disaster funds in the event of a declared emergency. The Plans, approved by the Select Board and accepted by FEMA, are required to be updated every five years. This current effort represents the fourth Hazard Mitigation Plan for Peterborough, the first one having been adopted in 2004.

A Committee has been established to oversee the development of the Plan. The Committee will meet on a regular schedule, with notices of the meetings and all drafts and other materials to be posted to the Town's website. Unless otherwise noticed, the meetings will be held weekly on Fridays at 1:00 P.M.

Due to COVID, all meetings will be remote over the Zoom platform; all interested parties are welcome and invited to attend. The notices, including the web and telephone access information will be posted on the Town's website.

For More Information, Contact:

Carol Ogilvie, Planning Consultant
603-357-5048
ogilvie.klein@gmail.com

or

Danica Malone, Town Planner
603-924-8000 ext. 104
dmalone@peterboroughnh.gov

TOWN OF
PETERBOROUGH
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PLANNING & BUILDING

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Web: www.townofpeterborough.com

HAZARD MITIGATION COMMITTEE

NOTICE OF MEETINGS

Please be advised that unless otherwise noticed, the Hazard Mitigation Committee will meet every Friday at 1:00 P.M. until the update of the Hazard Mitigation Plan is complete.

Due to the ongoing COVID-19 Pandemic, as allowed by the Governor's Executive Order 2020-10, all meetings will be held remotely via the Zoom platform; please see the access information below.

Join Zoom Meeting
https://zoom.us/j/94617209683
Meeting ID: 946 1720 9683
Dial by your location
+1 929 205 6099 US (New York)
+1 301 715 8592 US (Washington D.C)
+1 312 626 6799 US (Chicago)
Find your local number: https://zoom.us/u/adiVzDPwMV

If anybody has a problem connecting to the meeting, please call Danica Melone at: (603) 924-8000 ext. 116. Calls will be received outside of normal office hours.

STEP #2: Outreach to Neighboring Towns and Stakeholders

Neighboring Towns:
Antrim, Bennington, Dublin, Greenfield, Hancock, Harrisville, Jaffrey, Sharon, and Temple

Stakeholders:

- Monadnock Community Hospital
- Pheasantwood Nursing Home
- Summerhill Assisted Living
- Scott-Farrar Assisted Living
- RiverMead Retirement Community
- Contoocook Valley School District
- NH Ball Bearing

Dear _____,

The Town of Peterborough is in the process of updating its Hazard Mitigation Plan. As part of our process, we are notifying neighboring communities and potential stakeholders to give them the opportunity to participate in and/or provide input to Peterborough's Plan.

Peterborough's current Hazard Mitigation Plan was approved in 2016; it can be found on the Town's website at this link: https://www.townofpeterborough.com/vertical/sites/%7B792D537E-D69C-464A-80FB-790917F72F17%7D/uploads/Hazard_Mitigation_Plan_Peterborough_2016_Update_Final-approved_April_6th_2016.pdf.

The process to update the 2016 Plan will follow the same procedure and address all of the same issues, with a few additions this year, those being technological and human-caused hazards. The Committee will be meeting on a yet-to-be-determined schedule, although all meetings will be remote due to COVID. Meeting information will be posted on the Town's website, as well as the draft versions of the Plan as we go through this process.

You are welcome to join any of the meetings. Please feel free to contact me and/or submit any comments in writing. My contact information is below.

Sincerely,

Carol Ogilvie

Carol Ogilvie
On Behalf of the Peterborough Hazard Mitigation Committee

Tel. (603) 357-5048
Cell (603) 831-1702
Email: ogilvie.klein@gmail.com

STEP #3: Hold Committee Meetings

1st Meeting: Organizational Meeting

Friday
October 2, 2020
1:00 P.M.

AGENDA

I. Welcome and Introductions

II. Overview of the Project/Process and Anticipated Schedule

III. Discussion

IV. Set Future Meeting Date(s)

2nd Meeting: Review Critical Facilities Identified in 2016 Plan

Friday
November 13, 2020
1:00 P.M.

AGENDA

I. Review of Critical Facilities Identification

The task for this meeting is to review Chapter 4 of the 2016 Hazard Mitigation Plan and determine whether the identified Critical Facilities reflect the current situation.

II. Next Meeting

3rd Meeting: Confirm Critical Facilities/Begin Review of Past Hazards

Friday
November 20, 2020
1:00 P.M.

AGENDA

I. Review of Critical Facilities Identification

Review and confirm that the revisions to Chapter 4 discussed at the last meeting are correct.

II. Review of Chapter 3 – Past Hazard Events in Peterborough

III. Next Meeting

4th Meeting: Review Chapter 5 – Risk Assessment

Friday
December 4, 2020
1:00 P.M.

AGENDA

I. Review of Risk Assessment

The task for this meeting is to review Chapter 5 of the 2016 Hazard Mitigation Plan and determine whether the Risk Assessment reflects the current situation.

II. Next Meeting

5th Meeting: Begin Process of Evaluating Risks and Existing Mitigation Strategies

Friday
December 18, 2020
1:00 P.M.

AGENDA

I. Review of Updated Risk Assessment

II. Review of Existing Mitigation Strategies

III. Next Meeting – Friday, January 8, 2021

6th Meeting: Review of Work to Date

Friday
January 8, 2021
1:00 P.M.

AGENDA

I. Review of Updated Chapters 2 - 6

II. Next Meeting – Friday, January 15, 2021

7th Meeting: Review of Proposed Mitigation Strategies

Friday
January 15, 2021
1:00 P.M.

AGENDA

I. Review of Proposed Mitigation Strategies (Chapter 7)

II. Next Meeting – Friday, January 22, 2021

8th Meeting: Review Proposed Mitigation Strategies/Rank Strategies

Friday
January 22, 2021
1:00 P.M.

AGENDA

I. Review of Updated Mitigation Strategies (Table 16, Chapter 7)

II. Consider any new Mitigation Strategies

III. Rank Mitigation Strategies Based on STAPLEE Methodology (Chapter 8)

IV. Next Meeting

9th Meeting: Overview of Revisions To Date

Friday
February 5, 2021
1:00 P.M.

AGENDA

I. Review of Revised Chapters (2, 3, 4)

II. Other

III. Next Meeting – Friday, February 12, 2021

10th Meeting: Overview of Mitigation Strategies & Rankings

Friday
February 12, 2021
1:00 P.M.

AGENDA

I. Review of Revised Tables 12, 14, 16, 17, and 18

II. Update Cost Estimates and Time Frames for the Implementation Schedule (Table 18)

III. Other

IV. Next Meeting – Friday, February 19, 2021

11th Meeting: Overview of Risk Assessment, Existing Strategies & Proposed Strategies

Friday
February 26, 2021
1:00 P.M.

AGENDA

I. Review of Chapter 5

II. Review of Chapters 6, 7 & 8 as time permits

III. Other

IV. Next Meeting – Friday, March 5, 2021

12th Meeting: Review of Complete Draft Plan/Finalize Proposed Strategies & Rankings

Friday
March 5, 2021
1:00 P.M.

AGENDA

I. Review of Complete Draft Plan

II. Discuss Schedule for Plan Approval

III. Other

IV. Next Meeting – Friday, March 12, 2021

13th Meeting: Review Revised Proposed Strategies & Rankings

Friday
March 12, 2021
1:00 P.M.

AGENDA

I. Discuss Revisions to Proposed Mitigation Strategies

II. Review Schedule for Plan Approval

III. Other

IV. Next Meeting (if necessary)

Meeting Participation:

Following is a list of Committee members' participation in the 13 meetings. Aside from the members' participation during the meeting, members were also asked to respond by email with any comments/corrections they had on the drafts that were submitted for their review.

MEETING	ATTENDANCE	MEETING	ATTENDANCE
1ST Meeting 10-2-21	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Matt Lundsted 8. Jason Tremblay 9. Ed Henault 10. Fash Farahashi	2nd Meeting 11-13-20	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Matt Lundsted 8. Jason Tremblay 9. Ed Henault 10. Fash Farahashi 11. Kayla Henderson 12. Liz Gilboy
3rd Meeting 11-20-20	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Matt Lundsted 8. Jason Tremblay 9. Ed Henault 10. Fash Farahashi 11. Liz Gilboy	4th Meeting 12-4-20	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Matt Lundsted 8. Jason Tremblay 9. Ed Henault 10. Fash Farahashi

5th Meeting 12-18-20	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Matt Lundsted 8. Jason Tremblay 9. Ed Henault 10. Fash Farahashi 11. Kayla Henderson 12. Liz Gilboy	6th Meeting 1-8-21	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Matt Lundsted 8. Jason Tremblay 9. Ed Henault 10. Fash Farahashi
7th Meeting 1-15-21	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Matt Lundsted 8. Jason Tremblay 9. Ed Henault 10. Fash Farahashi	8th Meeting 1-22-21	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Matt Lundsted 8. Jason Tremblay 9. Ed Henault 10. Fash Farahashi
9th Meeting 2-5-21	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Matt Lundsted 8. Jason Tremblay 9. Ed Henault 10. Fash Farahashi	10th Meeting 2-12-21	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Jason Tremblay 8. Ed Henault 9. Fash Farahashi
11th Meeting 2-26-21	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Matt Lundsted 8. Jason Tremblay 9. Ed Henault 10. Fash Farahashi	12th Meeting 3-5-21	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Matt Lundsted 8. Jason Tremblay 9. Ed Henault 10. Fash Farahashi 11. Kayla Henderson 12. Liz Gilboy

13th Meeting 3-12-21	1. Danica Melone 2. Tim Herlihy 3. Carol Ogilvie 4. Edmund Walker 5. Seth MacLean 6. Alan Zeller 7. Matt Lundsted 8. Jason Tremblay 9. Ed Henault 10. Fash Farahashi 11. Kayla Henderson 12. Liz Gilboy		

STEP #4: Presentation to Peterborough Select Board

SELECT BOARD MEETING AGENDA
TOWN OF PETERBOROUGH
Tuesday, May___, 2021 – 5:00pm
1 Grove Street, Peterborough, New Hampshire

APPOINTMENTS
5:00pm –
5:30pm – Carol Ogilvie – Public Information Session on Hazard Mitigation Plan Update
5:45pm –

OLD BUSINESS

CONSENT AGENDA
Correspondence:

APPENDIX B:

HAZARD TYPES

The following list describes hazards that have occurred or have the potential to occur in the Town of Peterborough. The descriptions are based on those used in the State of NH Multi-Hazard Mitigation Plans.

- Flooding

Floods are defined as a temporary overflow of water onto lands that are not normally covered by water. Flooding results from the overflow of major rivers and tributaries, storm surges, and/or inadequate local drainage. Floods can cause loss of life, property damage, crop/livestock damage, and water supply contamination. Floods can also disrupt travel routes on roads and bridges. Inland floods are most likely to occur in the spring due to the increase in rainfall and melting of snow; however, floods can occur at any time of the year. A sudden thaw in the winter or a major downpour in the summer can cause flooding because there is suddenly a lot of water in one place with nowhere to go.

100-year Floodplain Events

- Floodplains are usually located in lowlands near rivers, and flood on a regular basis. The term 100-year flood does not mean that a flood will occur once every 100 years. Rather, it is a statement of probability that scientists and engineers use to describe how one flood compares to others that are likely to occur. It is more accurate to use the phrase "1% annual chance of flood." What this means is that there is a 1% chance of a flood of that size happening in a year.

Rapid Snow Pack Melt

- Warm temperatures and heavy rains cause rapid snowmelt. Quickly melting snow coupled with moderate to heavy rains are prime conditions for flooding.

River Ice Jams

- Rising waters in early spring breaks ice into chunks, which float downstream and often pile up, causing flooding. Small rivers and streams pose special flooding risks because they are easily blocked by jams. Ice collecting in river bends and against structures presents significant flooding threats to bridges, roads, and the surrounding lands.

Severe Storms

- Flooding associated with severe storms can inflict heavy damage to property. Heavy rains during severe storms are a common cause of inland flooding.

Beaver Dams and Lodging

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

- Drought

A drought is defined as a long period of abnormally low precipitation, especially one that adversely affects growing or living conditions. Droughts are rare in New Hampshire. They generally are not as damaging and disruptive as floods and are more difficult to define. The effect of droughts is indicated through measurements of soil moisture, groundwater levels, and stream-flow. However, not all of these

indicators will be minimal during a drought. For example, frequent minor rainstorms can replenish the soil moisture without raising ground-water levels or increasing stream-flow. Low stream-flow correlates with low ground-water levels because ground-water discharge to streams and rivers maintains stream-flow during extended dry periods. Low stream-flow and low ground-water levels commonly cause diminished water supply. The link included here provides detailed drought information for New Hampshire as of May of 2021.
https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?NH

- Earthquake

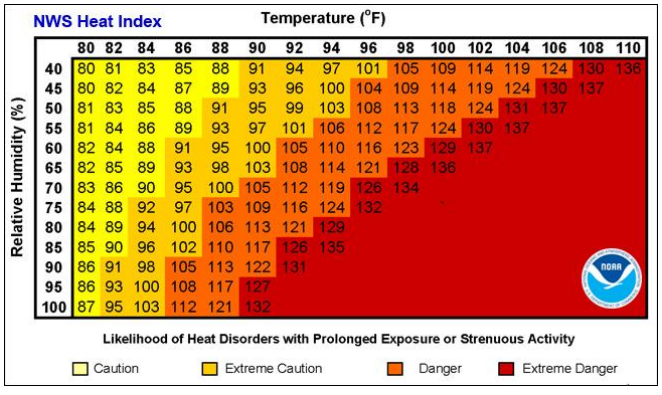
New England is considered a moderate risk earthquake zone. An earthquake is a rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric, water and phone lines, and often cause landslides, flash floods, fires, and avalanches. Larger earthquakes usually begin with slight tremors but rapidly take the form of one or more violent shocks, and end in vibrations of gradually diminishing force called aftershocks. The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. The magnitude and intensity of an earthquake is determined by the use of scales such as the Richter scale and Mercalli scale (illustrated to the right). The following link is to a Fact Sheet from NH Department of Environmental Services that provides specific information on earthquakes in New Hampshire.

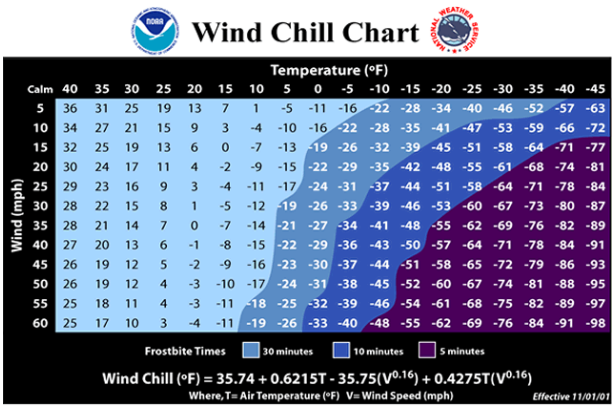
I. Instrumental	Not felt by many people unless in favourable conditions.
II. Weak	Felt only by a few people at best, especially on the upper floors of buildings. Delicately suspended objects may swing.
III. Slight	Felt quite noticeably by people indoors, especially on the upper floors of buildings. Many to do not recognise it as an earthquake. Standing motor cars may rock slightly. Vibration similar to the passing of a truck. Duration estimated.
IV. Moderate	Felt indoors by many people, outdoors by a few people during the day. At night, some awakened.
V. Rather Strong	Felt outside by most, may not be felt by some people in non-favourable conditions. Dishes and windows may break and large bells will ring. Vibrations like train passing close to house.
VI. Strong	Felt by all; many frightened and run outdoors, walk unsteadily. Windows, dishes, glassware broken; books fall off shelves; some heavy furniture moved or overturned; a few instances of fallen plaster. Damage slight.
VII. Very Strong	Difficult to stand; furniture broken; damage negligible in building 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. Noticed by people driving motor cars.
VIII. Destructive	Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture moved.
IX. Violent	General panic; damage considerable in poorly designed structures, well designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X. Intense	Some well build wooden structures destroyed; most masonry and frame structures destroyed with foundation. Rails bent.
XI. Extreme	Few, if any masonry structures remain standing. Bridges destroyed. Rails bent greatly.
XII. Cataclysmic	Total destruction – everything is destroyed. Lines of sight and level distorted. Objects thrown into the air. The ground moves in waves or ripples. Large amounts of rock move position. Landscape altered, or leveled by several meters. In some cases, even the routes of rivers are changed.

https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/geo-3.pdf

- Extreme Temperatures

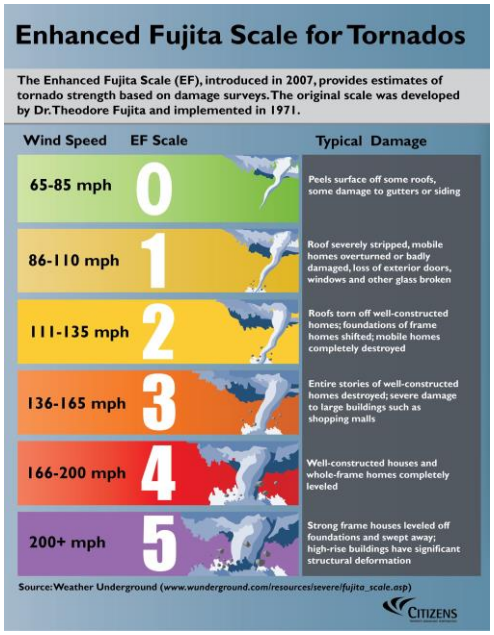
Extreme temperatures are a period of prolonged and/or excessive hot or cold that presents a danger to human health and life. The two links below provide more detail from the National Weather Service on these two extreme temperatures.
https://www.weather.gov/safety/heat-index https://www.weather.gov/safety/cold-wind-chill-chart





- High Wind Event (Tornado)

A tornado is a violent windstorm characterized by a twisting, funnel shaped cloud. They develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. The atmospheric conditions required for the formation of a tornado include great thermal instability, high humidity, and the convergence of warm, moist air at low levels with cooler, drier air aloft. Most tornadoes remain suspended in the atmosphere, but if they touch down, they become a force of destruction. Tornadoes produce the most violent winds on earth, at speeds of 280 mph or more. In addition, tornadoes can travel at a forward speed of up to 70 mph. Damage paths can be in excess of one mile wide and 50 miles long. Violent winds and debris slamming into buildings cause the most structural damage.



The Fujita Scale (shown to the right) is the standard scale for rating the severity of a tornado as measured by the damage it causes. A tornado is usually accompanied by thunder, lightning, heavy rain, and a loud "freight train" noise. In comparison to a hurricane, a tornado covers a much smaller area but can be more violent and destructive.

- Infectious Disease

Infectious diseases are those caused by organisms, such as bacteria, viruses, fungi, or parasites that can live in or on the human body. While normally harmless or even helpful, under certain conditions they can cause disease. According to the NH State Hazard Mitigation Plan, the magnitude and severity of infectious disease is described by its speed of onset (how quickly people become sick or cases are reported) and how widespread the infection is.

Some infectious diseases are inherently more dangerous than others, but the best way to describe the extent of infectious diseases relates to the disease occurrence, as follows:

- Endemic – Constant presence and/or usual prevalence of a disease or infection agent in a population within a geographic area.
- Hyperendemic – The persistent, high levels of disease occurrence.
- Cluster – Aggregation of cases grouped in place and time that are suspected to be greater than the number expected even though the expected number may not be known.
- Epidemic – An increase, usually sudden, in the number of cases of a disease above what is normally expected.
- Outbreak – The same as epidemic, but over a much smaller geographical area.
- Pandemic – Epidemic that has spread over several countries or continents, usually affecting many people.

- Landslide/Subsidence

The process in which soil is carried from one area to another, usually along slopes, by rain, river flow, stormwater runoff, or other means. Without stabilization, erosion can cause severe damage to roads, reduce water quality, and reduce property area at the top of embankments. As the NH State Multi-Hazard Plan notes, there is no universally-accepted standard or scientific scale developed for

measuring the severity of all landslides, there are some ways in which they can be measured, as follows:

- Steepness/grade of the Slope (measured as a percent)
- Geographical Area

  o Measured in square feet, square yards, etc.

  o More accurately measured using LiDAR/GIS systems
- Earthquake, either causing the event or caused by the event (measured using the Moment Magnitude Intensity or Mercalli Scale)

There are also multiple types of landslides:

- Falls: A mass detaches from a steep slope or cliff and descends by free-fall, bounding, or rolling
- Topples: A mass tilts or rotates forward as a unit
- Slides: A mass displaces on one or more recognizable surfaces, which may be curved or planar
- Flows: A mass moves downslope with a fluid motion. A significant amount of water may or may not be part of the mass

Again, from the State Plan: "Like flooding, landslides are unique in how they affect different geographic, topographic, and geologic areas. Therefore, consideration of a multitude of measurements is required to determine the severity of the landslide event."

- 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 about 50,000 degrees Fahrenheit, considerably hotter than the surface of the sun. Fires are a likely result of lightning strikes, and lightning strikes can cause death, injury, and property damage. The grid below presents lighting activity level (AL)as defined by the National Oceanographic Atmospheric Administration and developed with the National Fire Danger Rating System (NFDRS):

AL	Cloud & Storm Development	Lightning Strikes/15 min
1	No thunderstorms.	-
2	Cumulus clouds are common but only a few reach the towering cumulus stage. A single thunderstorm must be confirmed in the observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	1-8
3	Towering cumulus covers less than two-tenths of the sky. Thunderstorms are few, but two to three must occur within the observation area. Light to moderate rain will reach the ground, and lightning is infrequent.	9-15
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered and more than three must occur within the observation area. Moderate rain is common and lightning is frequent.	16-25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy and lightning is frequent and intense.	>25
6	Similar to LAL 3 except thunderstorms are dry.	

- Severe Winter Weather

Ice and snow events typically occur during the winter months and can cause loss of life, property damage and tree damage. The following link to the National Weather Service provides more detail on snow and ice occurrences. https://www.ncdc.noaa.gov/snow-and-ice/rsi/

Heavy Snow Storms

- A winter storm can range from moderate snow to blizzard conditions. Blizzard conditions are considered blinding, wind-driven snow over 35 mph that lasts several days. A severe winter storm deposits four or more inches of snow during a 12-hour period or six inches of snow during a 24-hour period.

Ice Storms

- An ice storm involves rain, which freezes on impact. Ice coating at least one-fourth inch of thickness is heavy enough to damage trees, overhead wires and similar objects. Ice storms often produce widespread power outages. A tool used to predict the size, amount of accumulation and resulting damage is the Sperry-Piltz Ice Accumulation (SPIA) Index, which is to ice storms what the enhances Fujita Scale is to tornadoes and what the Saffir-Simpson Scale is to hurricanes.

Nor'easter

- 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 impact the coast and inland areas from a Northeasterly direction. The sustained winds may meet or exceed hurricane force, with larger bursts, and may exceed hurricane events by many hours (or days) in terms of duration.

- Solar Storms & Space Weather

Solar activity (solar storms) refers to solar flares, coronal mass ejections, high-speed solar wind, and energetic solar particles. Any of these events may occur for a few minutes to several hours, have the ability to affect Earth for days to weeks. All solar activity is driven by the solar magnetic field. A solar flare is an intense burst of radiation resulting from the release of sunspot magnetic energy, which can occur for minutes to hours.

The term space weather describes the dynamic conditions in the Earth's outer space environment, similar to how the terms "climate" and "weather" refer to the conditions in the Earth's lower atmosphere. Space weather includes any and all conditions and events on the sun, in the solar wind, in near-Earth space, and in our upper atmosphere that can affect space-borne and ground-based technological systems. The following link to the National Weather Service provides detail on the ways in which this weather is measured. https://www.swpc.noaa.gov/noaa-scales-explanation

- Tropical Storm (Hurricane)

A hurricane is a tropical cyclone in which winds reach speeds of 74 miles per hour or more and blow in a large spiral around a relatively calm center. The eye of the storm is usually 20-30 miles wide and may extend over 400 miles. High winds and flooding are primary causes of hurricane-inflicted loss of life and property damage. Tropical Storms are typically storms that have been downgraded from a hurricane as it reaches further inland. These storms often have large amounts of rain and severe wind, but wind speeds do not reach the level to be classified as a hurricane.

Saffir-Simpson Hurricane Scale

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

- Severe Wind/ Downburst

Significantly high winds occur especially during tornadoes, hurricanes, winter storms and thunderstorms. Falling objects and downed power lines are dangerous risks associated with high winds. In addition, property damage and downed trees are common during severe wind occurrences. A downburst is a severe, localized wind blasting down from a thunderstorm. These "straight line" winds are distinguishable from tornadic activity by the pattern of destruction and debris. Downbursts fall into two categories:

- Microburst, which covers an area less than 2.5 miles in diameter, and
- Macroburst, which covers an area at least 2.5 miles in diameter.

- Wildfire

Wildfire is defined as an uncontrolled and rapidly spreading fire. A forest fire is an uncontrolled fire in a woody area. They often occur during drought and when woody debris on the forest floor is readily available to fuel the fire. Grass fires are uncontrolled fires in grassy areas. The National Wildfire Coordinating (NWCG) has developed an index for classifying wildfires based on size, as shown in this table.

Class	Area
Class A	1/4th acre or less
Class B	More than ¼ 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

- Technological Hazards

Aging Infrastructure

The continued regression of the Town's physical systems including, but not limited to roads and bridges, culverts, utilities, water, and sewage.

Conflagration

A large and destructive fire that threatens human life, animal life, health, and/or property. It may also be described as a blaze or simply a (large) fire. A conflagration can begin accidentally, be naturally caused (wildfire), or intentionally created (arson).

Dam Failure

Dam Failure is defined as the sudden, rapid, and uncontrolled release of impounded water. Dams can fail due to poor design and/or construction, as well as from poor or inadequate maintenance. The link included here provides detailed information on all state-owned dams in New Hampshire.
http://www.gencourt.state.nh.us/LBA/AuditReports/PerformanceReports/DES_Dams_2015.pdf

Hazardous Materials

A hazardous material is any item or agent (biological, chemical, radiological, and/or physical), which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.

Known and Emerging Contaminants

Contaminants in drinking water include naturally occurring contaminants associated with the geology in a given region and known man-made contaminants associated with nearby land use activities. Some contaminants are considered emerging contaminants. Emerging contaminants are chemicals that historically have not been monitored in drinking water due to the lack of laboratory capabilities to detect the compounds or a lack of knowledge about the use of certain compounds and their potential to cause human health impacts. Emerging contaminants are particularly concerning to the public because the potential health impacts of these are sometimes uncertain.

Long-Term Utility Outage

A long-term utility outage is defined as a prolonged absence of any type of public utility that is caused by infrastructure failure, cyber-attack, supply depletion, distribution disruption, water source contamination, or a natural, human caused or technological disaster. This hazard is new to the 2018 SHMP update and was identified as a rising area of concern at the initial stakeholder meeting held in April of 2017. For the purpose of this plan, the State will consider a long-term utility outage as one lasting a month or more, or a prolonged outage that causes extreme cascading impacts. This hazard has been

ranked High in this Plan because Peterborough is considered to be at great risk for this, and has experienced this in the past.

Radiological
Radiological hazards can range from relatively localized incidents involving small amounts of radioactive materials to large-scale catastrophic events. Smaller sources of radiation hazards may be found in medical facilities, industrial, and laboratory facilities where radioactive materials and/or radiation producing devices are used. Some radiation is produced naturally from decomposition of radioactive isotopes in soils and underlying strata.

- Human-Made Hazards

Cyber Event
The Department of Homeland Security (DHS) defines a cyber incident as an event occurring on or conducted through a computer network that actually or imminently jeopardizes the confidentiality, integrity, or availability of computers, information or communications systems or networks, physical or virtual infrastructure controlled by computers or information systems, or information resident thereon.

Mass Casualty Incident
Any large number of casualties produced in a relatively short period of time, usually as the result of a single incident such as a transportation accident, hurricane, flood, earthquake, or armed attack that exceeds local logistic support capabilities.

Terrorism/Violence
Premeditated, politically motivated violence perpetrated against noncombatant targets by subnational groups or clandestine agents.

Transport Accident
A transport accident is any accident that occurs during transportation. Specifically, for this Plan, it refers to an aviation, rail, shipping, tractor trailer, or vehicle accident.

APPENDIX C:

RISK ASSESSMENT

The following terms are used to analyze the hazards addressed in the Plan. High, Medium, and Low are synonymous with 3, 2 and 1, respectively.

VULNERABILITY- An adjective description (High, Medium, or Low) of the potential impact a hazard could have on the town relating to human, business and property impacts. It is the ratio of population, property, commerce, infrastructure and services at risk relative to the entire town. Vulnerability is an estimate generally based on a hazard's characteristics, and information obtained by the various town departments.

- HIGH: The total population, property, commerce, infrastructure and services of the town are uniformly exposed to the effects of a hazard of potentially great magnitude. In a worst-case scenario, there could be a disaster of major to catastrophic proportions.
- MEDIUM: (1) The total population, property, commerce, infrastructure and services of the town are exposed to the effects of a hazard of moderate influence; or (2) the total population, property, commerce, infrastructure and services of the town are exposed to the effects of a hazard, but not all to the same degree; or (3) an important segment of population, property, commerce, infrastructure or service is exposed to the effects of a hazard. In a worst-case scenario, there could be a disaster of moderate to major, though not catastrophic, proportions.
- LOW: A limited area or segment of population, property, commerce, infrastructure or service is exposed to the effects of a hazard. In a worst-case scenario, there could be a disaster of minor to moderate proportions.

PROBABILITY OF OCCURRENCE - An adjective description (High, Medium, or Low) of the probability of a hazard impacting the town within the next 25 years. Probability is based on a limited objective appraisal of a hazard's frequency using information provided by relevant sources, observations and trends.

- HIGH: There is great likelihood that this event will occur within the next 25 years (1-2 events each year). MEDIUM: There is moderate likelihood that this event will occur within the next 25 years (1-2 events each 5-10 years).
- LOW: There is little likelihood that this event will occur within the next 25 years (1 event in 25 years).

SEVERITY – Calculated by taking the average of the vulnerability for human, business and property impacts of each hazard type.

RISK - An adjective description (High, Medium, or Low) of the overall threat posed by a hazard over the next 25 years. It is calculated by multiplying the probability of occurrence and vulnerability.

- HIGH: (1) There is strong potential for a disaster of major proportions during the next 25 years; or (2) history suggests the occurrence of multiple disasters of moderate proportions during the next 25 years. The threat is significant enough to warrant major program effort to prepare for, respond to, recover from, and mitigate against this hazard. This hazard should be a major focus of the town's emergency management training and exercise program.
- MEDIUM: There is moderate potential for a disaster of less than major proportions during the next 25 years. The threat is great enough to warrant modest effort to prepare for, respond to, recover from, and mitigate against this hazard. This hazard should be included in the town's emergency management training and exercise program.
- LOW: There is little potential for a disaster during the next 25 years. The threat is such as to warrant no special effort to prepare for, respond to, recover from, or mitigate against this hazard. This hazard need not be specifically addressed in the town's emergency management training and exercise program except as generally dealt with during hazard awareness training.

APPENDIX D:
RESOURCES

A. Resources Used in the Preparation of this Plan

1. NH HSEM's State of New Hampshire Multi-Hazard Mitigation Plan (2018)
2. FEMA's Understanding Your Risks: Identifying Hazards and Estimating Losses
3. FEMA's Local Mitigation Planning Handbook, March 2013
4. Town of Peterborough, NH's Master Plan
5. Town of Peterborough NH's Geographic Information System
6. Town of Peterborough, NH's Assessing Database
7. Town of Peterborough Local Emergency Operations Plan (2017)
8. NH Office of Strategic Initiatives State Data Center
9. Edward MacDowell Lake Project Wetland Evaluation Report; Oak Hill Environmental Services; February 25, 2010
10. Edward MacDowell Lake Project Wetlands Evaluation Phase II: Wetlands Management Plan; Oak Hill Environmental Services; September 15, 2010

B. Agencies

New Hampshire Homeland Security and Emergency Management (HSEM)…….271-2231
Field Representative Hillsborough County**:** ……..…….....223-3613
Field Representative Cheshire County: ……..…….223-3613
Mitigation Officer**:** ……...……...…….……...271-2231
Mitigation Planner**:** ……..……..…….……..223-3655
Federal Emergency Management Agency (FEMA) 877-336-2734
Mitigation Plan Review for NH: Jay Neiderback..... 617-832-4926
NH Regional Planning Commissions:
Central NH Regional Planning Commission 226-6020
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 Governor's Office of Energy and Planning 271-2155
NH Department of Cultural Resources: 271-2540
Division of Historical Resources 271-3483
NH Department of Environmental Services: 271-3503
Air Resources 271-1370
Air Toxins Control Program.....271-0901
Asbestos Program.....271-1373
Childhood Lead Poisoning Prevention Program 271-5733

Environmental Health Tracking Program 271-4072
Environmental Toxicology Program 271-3994
Health Risk Assessment Program 271-6909
Indoor Air Quality Program 271-3911
Occupational Health and Safety Program 271-2024
Radon Program 271-4764
Geology Unit 271-3503
Pollution Preventive Program 271-6460
Waste Management 271-2900
Water Supply and Pollution Control 271-3414
Rivers Management and Protection Program 271-8801

NH Municipal Association 224-7447

NH Fish and Game Department 271-3421
Region 1, Lancaster 788-3164
Region 2, New Hampton 744-5470
Region 3, Durham 868-1095
Region 4, Keene 352-9669

NH Department of Resources and Economic Development: 271-2411
Economic Development 271-2629
Travel and Tourism 271-6870
Division of Forests and Lands 271-2214
Division of Parks and Recreation 271-3556
Design, Development, and Maintenance 271-2411

NH Department of Transportation 271-3734

Eversource Energy ..... (800)662-7764
Laurel Brown, Keene, NH ..... 357-7309 ext. 5115

Northeast States Emergency Consortium, Inc. (NESEC) ..... (781) 224-9876

US Department of Commerce: ..... (202) 482-2000
NOAA: National Weather Service; Taunton, Massachusetts ..... (508) 824-5116

US Department of the Interior: 202-208-3100
US Fish and Wildlife Service 225-1411
US Geological Survey 225-4681

US Department of Defense - US Army Corps of Engineers ..... (978) 318-8087

US Department of Agriculture:
Natural Resource Conservation Service 868-7581
Cheshire County, Walpole 756-2988
Sullivan County, Newport 863-4297
Hillsborough County, Milford ..... 673-2409 Ext. #4

C. Mitigation Funding Resources

404 Hazard Mitigation Grant Program (HMGP) . NH Homeland Security and Emergency Management
406 Public Assistance and Hazard Mitigation..... NH Homeland Security and Emergency Management
Community Development Block Grant (CDBG)..... NH HSEM, NH OEP, also refer to RPC
Dam Safety Program ..... NH Department of Environmental Services
Emergency Generators Program by NESEC‡ ..... NH Homeland Security and Emergency Management
Emergency Watershed Protection (EWP) Program ..... USDA, Natural Resources Conservation Service
Flood Mitigation Assistance Program (FMAP) ..... NH HSEM, NH OEP

Flood Plain Management Services (FPMS) ..... US Army Corps of Engineers
Mitigation Assistance Planning (MAP) ..... NH Homeland Security and Emergency Management
Mutual Aid for Public Works ..... NH Municipal Association
National Flood Insurance Program (NFIP) † ..... NH OEP, NH HSEM
Power of Prevention Grant by NESEC‡ ..... NH Homeland Security and Emergency Management
Project Impact ..... NH Homeland Security and Emergency Management
Roadway Repair & Maintenance Program(s) ..... NH Department of Transportation
Section 14 Emergency Stream Bank Erosion & Shoreline Protection……..……US Army Corps of Engineers
Section 103 Beach Erosion…….……..…US Army Corps of Engineers
Section 205 Flood Damage Reduction…….....US Army Corps of Engineers
Section 208 Snagging and Clearing.....US Army Corps of Engineers
Shoreline Protection Program…….....…….NH Department of Environmental Services
Various Forest and Lands Program(s)..... NH Department of Resources and Economic Development
Wetlands Programs.....NH Department of Environmental Services

‡NESEC – Northeast States Emergency Consortium, Inc. is a 501(c)(3), not-for-profit natural disaster, multi-hazard mitigation and emergency management organization located in Wakefield, Massachusetts. Please, contact NH HSEM for more information or visit the Consortium's website at http://www.nesec.org/index.cfm.

† Note regarding **National Flood Insurance Program** (NFIP) and **Community Rating System** (CRS):

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

D. FEMA REGION I MITIGATION PLANNING WEBLIOGRAPHY

Hazard Mitigation is sustained action taken to reduce or eliminate risk to people and their property from natural hazards over the longest possible term.

REGULATORY INFORMATION

Final Rule 44 CFR 201.6

http://www.fema.gov/pdf/help/fr02-4321.pdf

Disaster Mitigation Act of 2000 (DMA 2K)

http://www.fema.gov/library/viewRecord.do?id=1935

DISASTERS AND NATURAL HAZARDS INFORMATION

FEMA-How to deal with specific hazards

http://www.ready.gov/natural-disasters

Natural Hazards Center at the University of Colorado

http://www.colorado.edu/hazards

National Oceanic and Atmospheric Administration (NOAA): Information on various projects and research on climate and weather.

http://www.websites.noaa.gov

National Climatic Data Center active archive of weather data.

http://lwf.ncdc.noaa.gov/oa/ncdc.html

Northeast Snowfall Impact Scale

http://www.erh.noaa.gov/rnk/Newsletter/Fall%202007/NESIS.htm

Weekend Snowstorm Strikes The Northeast Corridor Classified As A Category 3"Major"Storm

http://www.publicaffairs.noaa.gov/releases2006/feb06/noaa06-023.html

FLOOD RELATED HAZARDS

FEMA Coastal Flood Hazard Analysis & Mapping

http://www.fema.gov/national-flood-insurance-program-0/fema-coastal-flood-hazard-analyses-and-mapping-1

Floodsmart http://www.floodsmart.gov/floodsmart/

National Flood Insurance Program (NFIP)

http://www.fema.gov/nfip

Digital quality Level 3 Flood Maps

http://msc.fema.gov/MSC/statemap.htm

Flood Map Modernization

http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/map-modernization

Reducing Damage from Localized Flooding: A Guide for Communities, 2005 FEMA 511

http://www.fema.gov/library/viewRecord.do?id=1448

FIRE RELATED HAZARDS

Firewise http://www.firewise.org

NOAA Fire Event Satellite Photos

http://www.osei.noaa.gov/Events/Fires

U.S. Forest Service, USDA

http://www.fs.fed.us/land/wfas/welcome.htm

Wildfire Hazards - A National Threat

http://pubs.usgs.gov/fs/2006/3015/2006-3015.pdf

GEOLOGIC RELATED HAZARDS

USGS Topographic Maps

http://topomaps.usgs.gov/

Building Seismic Safety Council

http://www.nibs.org/?page=bssc

Earthquake hazard history by state

http://earthquake.usgs.gov/earthquakes/states/

USGS data on earthquakes

http://earthquake.usgs.gov/monitoring/deformation/data/download/

USGS Earthquake homepage

http://quake.wr.usgs.gov

National Cooperative Geologic Mapping Program (NCGMP)

http://ncgmp.usgs.gov/

Landslide Overview Map of the Conterminous United States

http://landslides.usgs.gov/learning/nationalmap

Kafka, Alan L. 2008. Why Does the Earth Quake in New England? Boston College, Weston

Observatory, Department of Geology and Geophysics

http://www2.bc.edu/~kafka/Why_Quakes/why_quakes.html

Map and Geographic Information Center, 2010, "Connecticut GIS Data", University of Connecticut

http://magic.lib.uconn.edu/connecticut_data.html

2012 Maine earthquake

http://www.huffingtonpost.com/2012/10/17/maine-earthquake-2012-new-england_n_1972555.html

WIND-RELATED HAZARDS

ATC Wind Speed Web Site

http://www.atcouncil.org/windspeed/index.php

U.S. Wind Zone Maps

http://www.fema.gov/safe-rooms/wind-zones-united-states

Tornado Project Online

http://www.tornadoproject.com/

National Hurricane Center http://www.nhc.noaa.gov.

Community Hurricane Preparedness Tutorial

http://meted.ucar.edu/hurrican/chp/hp.htm

National Severe Storms Laboratory, 2009, "Tornado Basics",

http://www.nssl.noaa.gov/primer/tornado/tor_basics.html

DETERMINING RISK AND VULNERABILITY

HAZUS http://www.hazus.org

FEMA Hazus Average Annualized Loss Viewer

http://fema.maps.arcgis.com/home/webmap/viewer.html?webmap=cb8228309e9d405ca6b4db6027df36d9&extent=-139.0898,7.6266,-48.2109,62.6754

Vulnerability Assessment Tutorial: On-line tutorial for local risk and vulnerability assessment

http://www.csc.noaa.gov/products/nchaz/htm/mitigate.htm

Case Study: an example of a completed risk and vulnerability assessment

http://www.csc.noaa.gov/products/nchaz/htm/case.htm

GEOGRAPHIC INFORMATION SYSTEMS (GIS) AND MAPPING

The National Spatial Data Infrastructure & Clearinghouse (NSDI) and Federal Geographic Data Committee (FGDC) Source for information on producing and sharing geographic data

http://www.fgdc.gov

The OpenGIS Consortium Industry source for developing standards and specifications for GIS data. http://www.opengis.org

Northeast States Emergency Consortium (NESEC): Provides information on various hazards, funding resources, and other information. http://www.nesec.org

US Dept of the Interior Geospatial Emergency Management System (IGEMS) provides the public with both an overview and more specific information on current natural hazard events. It is supported by the Department of the Interior Office of Emergency Management.

http://igems.doi.gov/

FEMA GeoPlatform: Geospatial data and analytics in support of emergency management

http://fema.maps.arcgis.com/home/index.html

DATA GATHERING

National Information Sharing Consortium (NISC): brings together data owners, custodians, and users in the fields of homeland security, public safety, and emergency management and response. Members leverage efforts related to the governance, development, and sharing of situational awareness and incident management resources, tools, and best practices http://nisconsortium.org/

The Hydrologic Engineering Center (HEC), an organization within the Institute for Water Resources, is the designated Center of Expertise for the US Army Corps of Engineers

http://www.hec.usace.army.mil/

National Water & Climate Center

http://www.wcc.nrcs.usda.gov/

WinTR-55 Watershed Hydrology

http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?&cid=stelprdb1042901

USACE Hydrologic Engineering Center (HEC)

http://www.hec.usace.army.mil/software/

Stormwater Manager's Resource Center SMRC

http://www.stormwatercenter.net

USGS Current Water Data for the Nation

http://waterdata.usgs.gov/nwis/rt

USGS Water Data for the Nation

http://waterdata.usgs.gov/nwis /

Topography Maps and Aerial photos

http://www.terraserver.com/view.asp?tid=142

National Register of Historic Places

http://www.nps.gov/nr/about.htm

National Wetlands Inventory

http://www.fws.gov/wetlands/

ICLUS Data for Northeast Region

http://www.epa.gov/ncea/global/iclus/inclus_nca_northeast.htm

PLANNING

American Planning Association

http://www.planning.org

PlannersWeb - Provides city and regional planning resources

http://www.plannersweb.com

FEMA RESOURCES

Federal Emergency Management Agency (FEMA)

www.fema.gov

National Mitigation Framework

http://www.fema.gov/national-mitigation-framework

Federal Insurance and Mitigation Administration (FIMA)

http://www.fema.gov/fima

Community Rating System (CRS) http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-rating-system

FEMA Building Science

http://www.fema.gov/building-science

National Flood Insurance Program (NFIP)

http://www.fema.gov/national-flood-insurance-program

Floodplain Management & Community Assistance Program

http://www.fema.gov/floodplain-management

Increased Cost of Compliance (ICC): ICC coverage allows homeowners whose structures have been repeatedly or substantially damaged to cover the cost of elevation and design requirements for rebuilding with their flood insurance claim up to a maximum of $30,000.

http://www.fema.gov/national-flood-insurance-program-2/increased-cost-compliance-coverage

National Disaster Recovery Framework

http://www.fema.gov/national-disaster-recovery-framework

Computer Sciences Corporation: contracted by FIMA as the NFIP Statistical Agent, CSC provides information and assistance on flood insurance to lenders, insurance agents and communities

www.csc.com

Integrating the Local Natural Hazard Mitigation Plan into a Community's Comprehensive Plan: A Guidebook for Local Governments

https://www.fema.gov/ar/media-library/assets/documents/89725

Mitigation Best Practices Portfolio

http://www.fema.gov/mitigation-best-practices-portfolio

FEMA Multi-Hazard Mitigation Planning Website

http://www.fema.gov/multi-hazard-mitigation-planning

FEMA Resources Page http://www.fema.gov/plan/mitplanning/resources.shtm

Local Mitigation Plan Review Guide http://www.fema.gov/library/viewRecord.do?id=4859

Local Mitigation Planning Handbook complements and liberally references the Local Mitigation Plan Review Guide above.

http://www.fema.gov/library/viewRecord.do?id=7209

HAZUS

http://www.fema.gov/protecting-our-communities/hazus

Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards

http://www.fema.gov/library/viewRecord.do?id=6938

Integrating Hazard Mitigation Into Local Planning: Case Studies and Tools for Community Officials

http://www.fema.gov/library/viewRecord.do?id=7130

Mitigation Planning for Local and Tribal Communities

Independent Study Course

http://training.fema.gov/EMIWeb/IS/is318.asp

REGION I MITIGATION PLANNING CONTACTS

Marilyn Hilliard, Senior Planner
Phone: (617) 956-7536
Email: marilyn.hilliard@fema.dhs.gov

Nan Johnson, Community Planner
Phone: 617-956-7672
Email: nan.johnson@fema.dhs.gov
Massachusetts; Rhode Island; Vermont

Brigitte Ndikum-Nyada, Community Planner
Phone: 617-956-7614
Email: brigitte.ndikum-nyada@fema.dhs.gov
Connecticut; Maine; New Hampshire

OTHER FEDERAL RESOURCES

U.S. Army Corps of Engineers: Provides funding for floodplain management planning and technical assistance and other water resources issues. www.nae.usace.army.mil

Natural Resources Conservation Service: Technical assistance to individual land owners, groups of landowners, communities, and soil and water conservation districts. www.nrcs.usda.gov

NOAA Coastal Services Center http://www.csc.noaa.gov/

Rural Economic and Community Development: Technical assistance to rural areas and smaller communities in rural areas on financing public works projects. www.rurdev.usda.gov

Farm Service Agency: Manages the Wetlands Reserve Program (useful in open space or acquisition projects by purchasing easements on wetlands properties) and farmland set aside programs www.fsa.usda.gov

National Weather Service: Prepares and issues flood, severe weather and coastal storm warnings. Staff hydrologists can work with communities on flood warning issues; can give technical assistance in preparing flood-warning plans. www.weather.gov

Economic Development Administration (EDA): Assists communities with technical assistance for economic development planning www.osec.doc.gov/eda/default.htm

National Park Service: Technical assistance with open space preservation planning; can help facilitate meetings and identify non-structural options for floodplain redevelopment. www.nps.gov

Fish and Wildlife Services: Can provide technical and financial assistance to restore wetlands and riparian habitats. www.fws.gov

Department of Housing & Urban Development www.hud.gov

Small Business Administration: SBA can provide additional low-interest funds (up to 20% above what an eligible applicant would qualify for) to install mitigation measures. They can also loan the cost of bringing a damaged property up to state or local code requirements. www.sba.gov/disaster

Environmental Protection Agency www.epa.gov

SUSTAINABILTY/ADAPTATION/CLIMATE CHANGE

Why the Emergency Management Community Should be Concerned about Climate Change: A discussion of the impact of climate change on selected natural hazards

http://www.cna.org/sites/default/files/research/WEB%2007%2029%2010.1%20Climate%20Change%20and%20the%20Emergency%20Management%20Community.pdf

Resilient Sustainable Communities: Integrating Hazard Mitigation& Sustainability into Land Use

http://www.earth.columbia.edu/sitefiles/file/education/documents/2013/Resilient-Sustainable-Communities-Report.pdf

U.S. EPA http://www.epa.gov/climatechange/

NOAA National Ocean Service (NOS)

http://oceanservice.noaa.gov/

The Northeast Climate Research Center (NRCC) folks were heavily involved in climate data in the NCA, below. They have a wealth of historic climate data and weather information, trends, etc. http://www.nrcc.cornell.edu/

NOAA RISA for the Northeast (Regional Integrated Sciences and Assessments) http://ccrun.org/home

Community and Regional Resilience: Perspectives from hazards, disasters, and emergency management

http://www.resilientus.org/library/FINAL_CUTTER_9-25-08_1223482309.pdf

National Fish, Wildlife and Plants Climate Adaptation Strategy www.wildlifeadaptationstrategy.gov

ICLEI Local Governments for Sustainability http://www.icleiusa.org/

Kresge Foundation Survey

http://www.kresge.org/news/survey-finds-communities-northeast-are-trying-plan-for-changes-climate-need-help-0

New England's Sustainable Knowledge Corridor http://www.sustainableknowledgecorridor.org/site/

The Strategic Foresight Initiative (SFI) http://www.fema.gov/pdf/about/programs/oppa/findings_051111.pdf

Northeast Climate Choices http://www.climatechoices.org/ne/resources_ne/nereport.html

Northeast Climate Impacts Assessment http://www.northeastclimateimpacts.org/

Draft National Climate Assessment Northeast Chapter released early 2013 http://ncadac.globalchange.gov/

Northeast Chapter of the National Climate Assessment of 2009: http://www.globalchange.gov/images/cir/pdf/northeast.pdf

NEclimateUS.org ClimateNE www.climatenortheast.com

Scenarios for Climate Assessment and Adaptation http://scenarios.globalchange.gov/

Northeast Climate Science Center http://necsc.umass.edu/

FEMA Climate Change Adaptation and Emergency Management

https://www.llis.dhs.gov/content/climate-change-adaptation-and-emergency-management-0

Climate Central http://www.climatecentral.org

OTHER RESOURCES

New England States Emergency Consortium (NESEC): NESEC conducts public awareness and education programs on natural disaster and emergency management activities throughout New England. Resources are available on earthquake preparedness, mitigation, and hurricane safety.

www.nesec.org

Association of State Floodplain Managers (ASFPM): ASFPM has developed a series of technical and topical research papers, and a series of Proceedings from their annual conferences. www.floods.org

National Voluntary Organizations Active in Disaster (VOAD) is a non-profit, nonpartisan membership organization that serves as the forum where organizations share knowledge and resources throughout the disaster cycle—preparation, response, recovery and mitigation. http://www.nvoad.org/

Additional Websites

Sponsor	Internet Address	Summary of Contents
U.S. Army Corp of Engineers	http://nae-rrs2.usace.army.mil:7777/pls/cwmsweb/cwms_web.cwmsweb.cwmsindex	Current water levels at MacDowell Lake
Natural Hazards Research Center, U. of Colorado	http://www.colorado.edu/hazards/	Searchable database of references and links to many disaster-related websites.
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://disasterfinder.gsfc.nasa.gov/Disaster_Management/	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://waterdata.usgs.gov/nwis/rt	Provisional hydrological data
Dartmouth Flood Observatory	http://www.dartmouth.edu/~floods	Observations of flooding situations.
FEMA, National Flood Insurance Program, Community Status Book	http://www.fema.gov/about/programs/nfip/index.shtm	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://thunder.msfc.nasa.gov/research.html	Space-based sensor of lightning strikes
LLNL Geologic & Atmospheric Hazards	http://www.llnl.gov/hmc/	General hazard information developed for the Dept. of Energy.
The Tornado Project Online	http://www.tornadoproject.com/	Information on tornadoes, including details of recent impacts.
National Severe Storms Laboratory	http://www.nssl.noaa.gov/	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/land	Information on forest fires and land management.

APPENDIX E:

TECHNICAL AND FINANCIAL ASSISTANCE FOR HAZARD MITIGATION

Process for Disaster Declaration in Peterborough

There are two phases to a disaster – first response and second recovery. The recovery phase, or clean-up efforts, is where the majority of grant funds could be applied for. Having a Hazard Mitigation Plan in place before a disaster occurs, according to the US Disaster Mitigation Act of 2000 and its amendments, has been required since November 2004 in order to be eligible to apply for these recovery funds. These grant programs are briefly explained later under the **Grant Programs for Disaster Relief** section.

FEMA Information

The Federal Emergency Management Agency (FEMA) has extensive resources related to disaster prevention and disaster recovery on its website at www.fema.gov. The following is an excerpt from their on-line library:

The first response to a disaster is the job of local government's emergency services with help from nearby municipalities, the state and volunteer agencies. In a catastrophic disaster, and if the governor requests, federal resources can be mobilized through the Federal Emergency Management Agency (FEMA) for search and rescue, electrical power, food, water, shelter and other basic human needs.

It is the long-term recovery phase of disaster which places the most severe financial strain on a local or state government. Damage to public facilities and infrastructure, often not insured, can overwhelm even a large city.

A governor's request for a major disaster declaration could mean an infusion of federal funds, but the governor must also commit significant state funds and resources for recovery efforts.

A Major Disaster could result from a hurricane, earthquake, flood, tornado or major fire which the President determines warrants supplemental federal aid. The event must be clearly more than state or local governments can handle alone. If declared, funding comes from the President's Disaster Relief Fund, which is managed by FEMA, and disaster aid programs of other participating federal agencies.

A Presidential Major Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, and designed to help disaster victims, businesses and public entities.

An Emergency Declaration is more limited in scope and without the long-term federal recovery programs of a Major Disaster Declaration. Generally, federal assistance and funding are provided to meet a specific emergency need or to help prevent a major disaster from occurring.

The Major Disaster Process

A Major Disaster Declaration usually follows these steps:

- The Local government responds, supplemented by neighboring communities and volunteer agencies. If overwhelmed, turn to the state for assistance;
- The State responds with state resources, such as the National Guard and state agencies;
- Damage assessment by local, state, federal, and volunteer organizations determines losses and recovery needs;

- A Major Disaster Declaration is requested by the governor, based on the damage assessment, and an agreement to commit state funds and resources to the long-term recovery;
- FEMA evaluates the request and recommends action to the White House based on the disaster, the local community and the state's ability to recover;
- The President approves the request or FEMA informs the governor it has been denied. This decision process could take a few hours or several weeks depending on the nature of the disaster.

Disaster Aid Programs

There are two major categories of disaster aid: Individual Assistance is for damage to residences and businesses or personal property losses, and Public Assistance is for repair of infrastructure, public facilities and debris removal.

- ***Individual Assistance***

Immediately after the declaration, disaster workers arrive and set up a central field office to coordinate the recovery effort. A toll-free telephone number is published for use by affected residents and business owners in registering for assistance. Disaster Recovery Centers also are opened where disaster victims can meet with program representatives and obtain information about available aid and the recovery process.

Disaster aid to individuals generally falls into the following categories:

Disaster Housing may be available for up to 18 months, using local resources, for displaced persons whose residences were heavily damaged or destroyed. Funding also can be provided for housing repairs and replacement of damaged items to make homes habitable.

Disaster Grants are available to help meet other serious disaster related needs and necessary expenses not covered by insurance and other aid programs. These may include replacement of personal property, and transportation, medical, dental and funeral expenses.

Low-Interest Disaster Loans are available after a disaster for homeowners and renters from the U.S. Small Business Administration (SBA) to cover uninsured property losses. Loans may be for repair or replacement of homes, automobiles, clothing or other damaged personal property. Loans are also available to businesses for property loss and economic injury.

Other Disaster Aid Programs include crisis counseling, disaster-related unemployment assistance, legal aid and assistance with income tax, Social Security and Veteran's benefits. Other state or local help may also be available.

Assistance Process -- After the application is taken, the damaged property is inspected to verify the loss. If approved, an applicant will soon receive a check for rental assistance or a grant. Loan applications require more information and approval may take several weeks after application. The deadline for most individual assistance programs is 60 days following the President's major disaster declaration.

Audits are done later to ensure that aid went to only those who were eligible and that disaster aid funds were used only for their intended purposes. These federal program funds cannot duplicate assistance provided by other sources such as insurance.

After a major disaster, FEMA tries to notify all disaster victims about the available aid programs and urge them to apply. The news media are encouraged to visit a Disaster Recovery Center, meet with disaster officials, and help publicize the disaster aid programs and the toll-free teleregistration number.

- ***Public Assistance***

Public Assistance is aid to state or local governments to pay part of the costs of rebuilding a community's damaged infrastructure. Generally, public assistance programs pay for 75 per cent of the approved project costs. Public Assistance may include debris removal, emergency protective measures and public services, repair of damaged public property, loans needed by communities for essential government functions and grants for public schools.

- ***Hazard Mitigation***

Disaster victims and public entities are encouraged to avoid the life and property risks of future disasters. Examples include the elevation or relocation of chronically flood damaged homes away from flood hazard areas, retrofitting buildings to make them resistant to earthquakes or strong winds, and adoption and enforcement of adequate codes and standards by local, state and federal government. FEMA encourages and helps fund damage mitigation measures when repairing disaster damaged structures.

For more information, FEMA should be contacted at (617) 223-9540 or at www.fema.gov, or contact the New Hampshire Homeland Security and Emergency Management (HSEM) at 603-271-2231.

Grant Programs for Disaster Relief

Through the NH Office of Emergency Management (NH OEM), the Federal Emergency Management Agency provides funds for assistance to municipalities in the event of a disaster. The programs are described briefly here; some of them may not be currently active. For more details about these funding sources, contact the NH OEM.

- Emergency Management Assistance (EMA)

This proactive funding program requires a 50% match from communities. It supports projects that will improve local emergency management preparedness and response in the following areas: planning, training, drills and exercise, and administration. It is designed to fund projects such as Hazard Mitigation Plans, Emergency Management/Action Plans, and other administrative projects.

- Mitigation Assistance Program (MAP)

This program requires a 25% match (in-kind or cash) and supports planning and implementation activities that reduce long-term hazard vulnerability and risk under the following categories: public awareness and education; mitigation planning and implementation; and preparedness and response planning.

Pre-Disaster Mitigation Program (PDM)

The Pre-Disaster Mitigation (PDM) program provides technical and financial assistance to States and local governments for cost-effective pre-disaster hazard mitigation activities that complement a comprehensive mitigation program, and reduce injuries, loss of life, and damage and destruction of property. FEMA provides grants to States and Federally recognized Indian tribal governments that, in turn, provide sub-grants to local governments (to include Indian Tribal governments) for mitigation activities such as planning and the implementation of projects identified through the evaluation of natural hazards.

Flood Mitigation Assistance Program (FMA)

This program requires a 25% match (half in-kind and half local cash) and awards funds for Planning Grants, Technical Assistance Grants, and Project Grants. A Flood Mitigation Plan must be in place before

funds can be sought for Technical Assistance or Projects. This program awards funding for Flood Mitigation Plans, structural enhancements, acquisition of buildings or land, and relocation projects.

Community Development Block Grant (CDBG)

A disaster must be declared to take advantage of this program, which awards emergency funds to cover unmet needs in a community. At least one of three national objectives must be met: the funds must have a direct benefit to low and moderate income persons; or must prevent or eliminate slums and blight in neighborhoods; or must eliminate conditions which threaten the public health and welfare. The NH Office of State Planning administers this program.

Hazard Mitigation Grant Program (HMGP)

A disaster must be declared to take advantage of this program, which is designed to protect public and private property from future disasters. This program typically awards funding for projects that are structural in nature or for the acquisition of buildings or land. For more information, for a listing of criteria, or to request an application to these or any other grant programs, please contact the New Hampshire Homeland Security and Emergency Management (HSEM) at 603-271-2231 or at http://www.nh.gov/safety/divisions/hsem/HazardMitigation/planning.html.

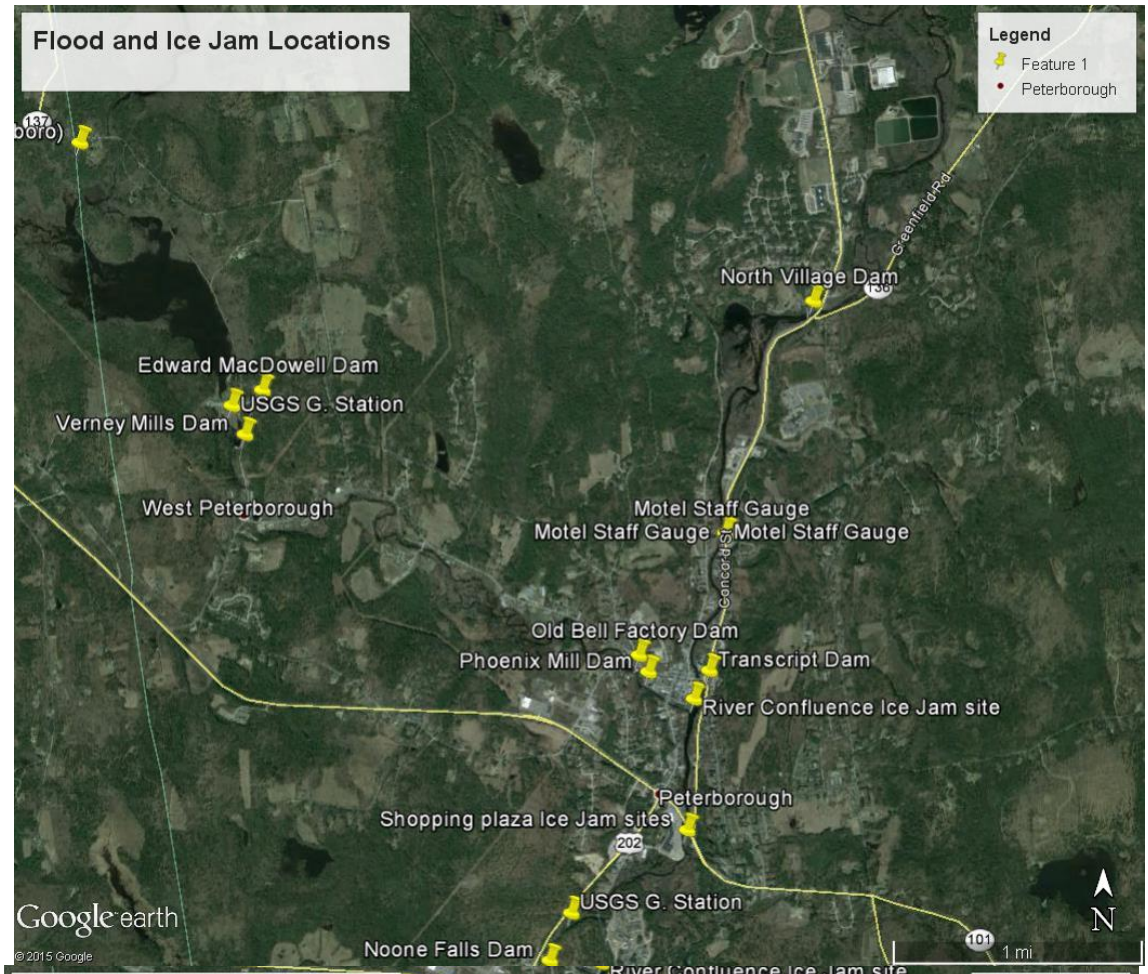
SUMMARY OF FUNDING SOURCES FOR LOCAL MITIGATION

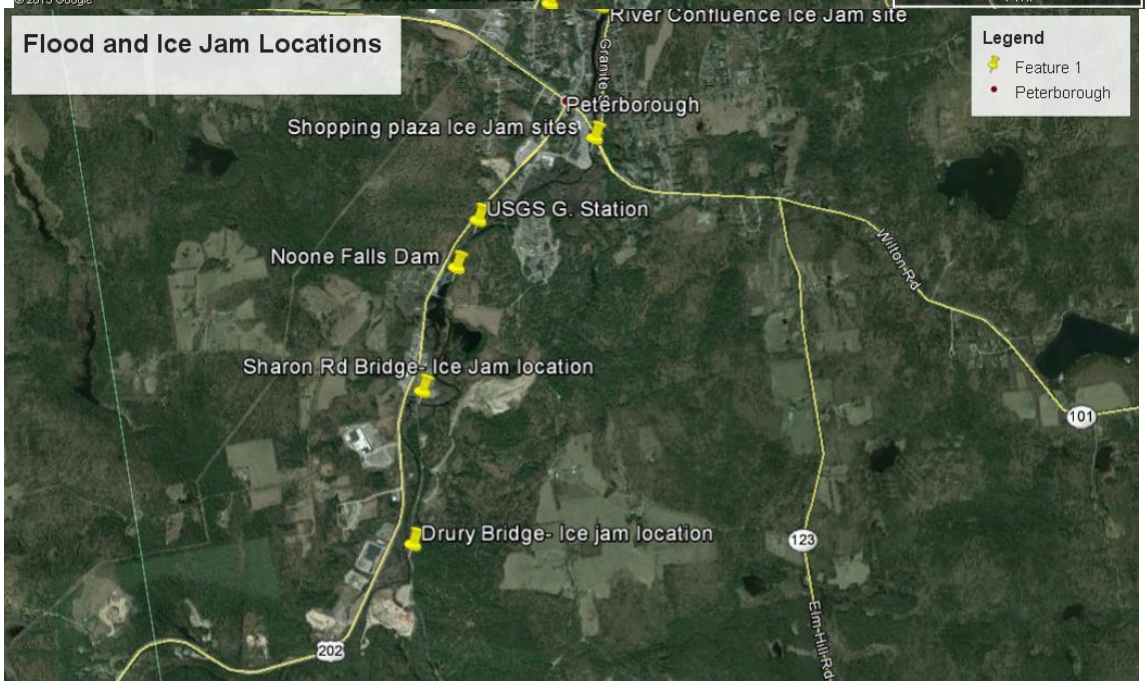
Funding Source	*Program Description*	*Eligible Projects*	*Responsible Agency*
Emergency Management Performance Grant (EMPG)	Federal grants to assist State, local, territorial, and tribal governments in preparing for all hazards.	Federal grants to assist State, local, territorial, and tribal governments in preparing for all hazards.	Homeland Security and Emergency Management (HSEM)
Pre-Disaster Mitigation Grant (PDM)	Federal grants to assist State, local, territorial, and tribal governments in mitigating natural hazards through cost effective measures.	Drainage improvements, planning initiatives, acquisitions and elevations	HSEM
Flood Mitigation Assistance Grant (FMA)	Implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP.	Soil stabilization, dry flood-proofing, acquisitions and elevations	HSEM
Hazard Mitigation Grant Program	Structural Mitigation Projects due to a Presidential Disaster Declaration.	Drainage improvements, planning initiatives, acquisitions and elevations	HSEM
FEMA Supplemental Funding	Funding assistance to State and Locals to assist financially for eligible projects	Clearance, removal, and/or disposal of storm-generated debris such as trees, sand, gravel, building materials, wreckage, vehicles and personal property.	HSEM
Citizen Corp	To support the formation of state and local Citizen Corps Councils to help drive local citizen participation by coordinating Citizen Corps programs.	Education, training and volunteer services to help prepare for the response to threats natural and human caused.	HSEM
School Emergency Response and Crisis Management Plan Discretionary Grant Program	To provide school districts with funds to strengthen and improve current school crisis plans in preparation for emergencies including potential terrorist attacks.	Emergency response and crisis plan writing and updating.	Department of Education
Community Development Block Grant (CDBG)	Provides annual grants on a formula basis to entitled cities, urban counties and states to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons	Improvements for Public Infrastructure and Housing. Property Acquisitions	Housing and Urban Development (HUD)

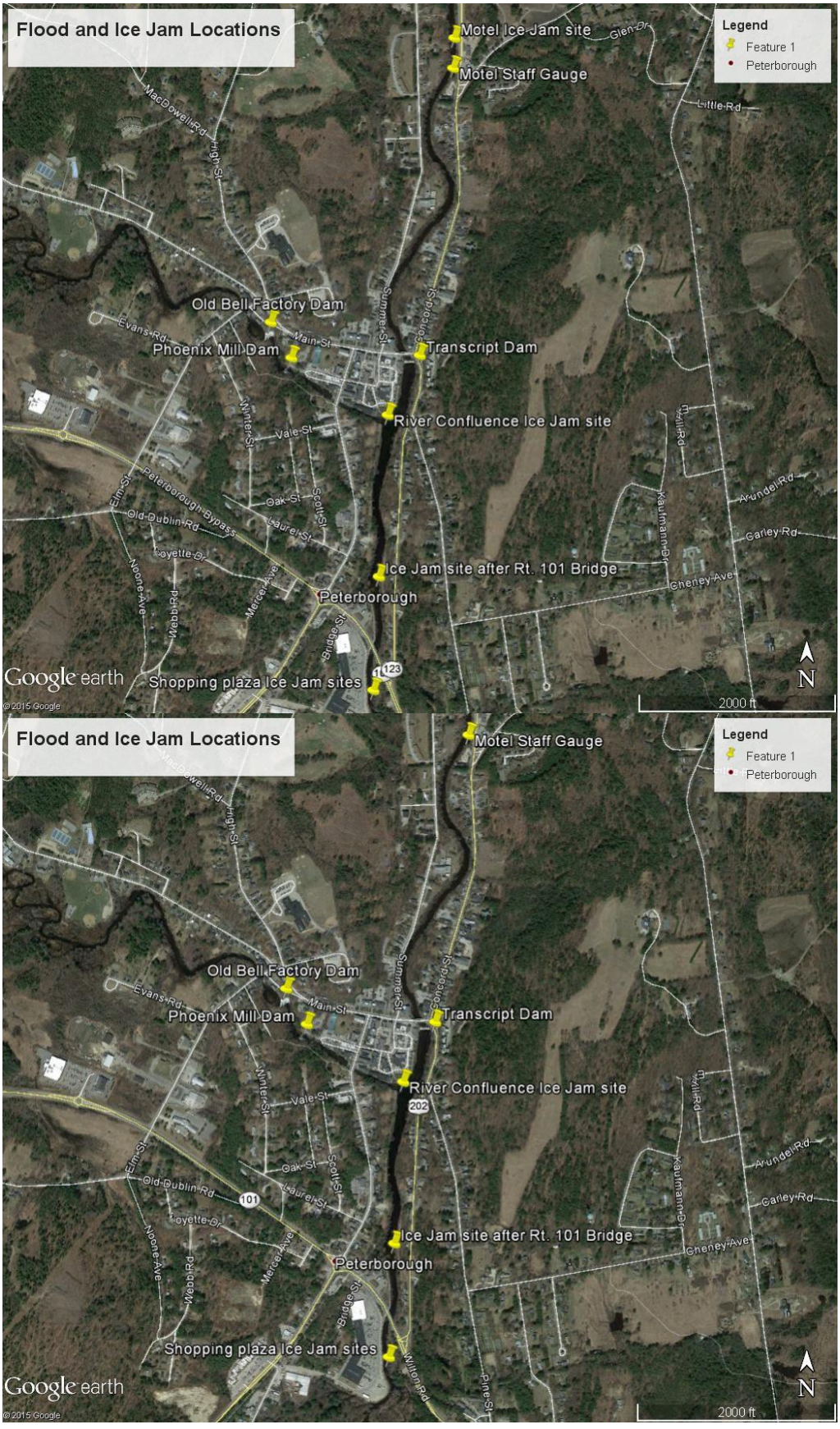
APPENDIX F:

MISCELLANEOUS DETAILED INFORMATION

1. Ice Jam Locations in Peterborough






Flood and Ice Jam Locations
Motel Ice Jam site
Motel Staff Gauge
Old Bell Factory Dam
Phoenix Mill Dam
Transcript Dam
River Confluence Ice Jam site
Ice Jam site after Rt. 101 Bridge
Peterborough
Shopping plaza Ice Jam sites
Legend
Feature 1
Peterborough
Glen Dr
Little Rd
MacDowell Rd
High St
Summer St
Concord St
Evans Rd
Main St
Winter St
Vale St
Mill Rd
Elm St
Peterborough Bypass
Oak St
Scott St
Laurel St
Old Dublin Rd
Arundel Rd
Carley Rd
Kaufmann Dr
Noone Ave
Webb Rd
Mercer Ave
Bridge St
Cheney Ave
Wilton Rd
Pine St
123
202
101
Google earth
© 2015 Google
2000 ft
N

2.

2. NH 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.

3. Data on Dams in and near Peterborough

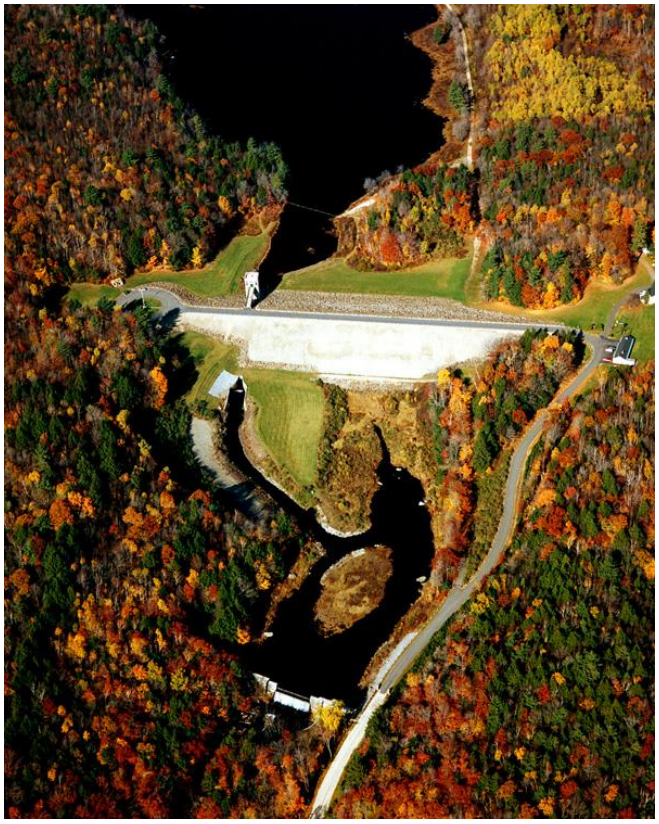
Hazard Class	NAME	TOWN	STATUS	TYPE	USE	CLASS/ OWN	OWNER
NM	SYKAS RECREATION POND	HANCOCK	ACTIVE	EARTH	R	P	
NM	FERGUSON BROOK II MILL POND DAM	HANCOCK	ACTIVE	EARTH/STONE	M	P	
L	OTTER BROOK DAM	PETERBOROUGH	ACTIVE	EARTH	R	P	
NM	HALF MOON POND DAM	HANCOCK	ACTIVE	EARTH	R	P	BOSTON UNIVERSITY SARGEANT CAMP
	NORTH VILLAGE DAM	PETERBOROUGH	RUINS	TIMBERCOMB	H	U	PSNH
NM	OTTER BROOK	PETERBOROUGH	ACTIVE	EARTH	C	P	
L	COMMERCE PARK WILDLIFE POND DAM	PETERBOROUGH	ACTIVE	EARTH	C	P	
L	OTTER BROOK DAM	PETERBOROUGH	ACTIVE	CONCRETE	R	P	
NM	OTTER BROOK DAM	PETERBOROUGH	ACTIVE	CONCRETE/EARTH	R	P	
NM	DAVIS RECREATION POND	DUBLIN	ACTIVE	EARTH	R	P	
S	PETERBOURGH TREATMENT LAGOON	PETERBOROUGH	ACTIVE	EARTH	L	L	TOWN OF PETERBOROUGH
	NUBANUSIT BROOK DAM	PETERBOROUGH	RUINS	TIMBERCOMB	H	U	PSNH
	BOGLIE BROOK DAM	PETERBOROUGH	EXEMPT	TIMBERCOMB	R	P	
L	WILDLIFE POND DAM	PETERBOROUGH	ACTIVE	EARTH	C	P	
	NUBANUSIT BROOK	PETERBOROUGH	EXEMPT	STONE/EARTH	C	P	
NM	RECREATION POND	PETERBOROUGH	ACTIVE	EARTH	R	P	
NM	BOGLIE BROOK	PETERBOROUGH	ACTIVE	CONCRETE	P	P	
L	MUD POND DAM	DUBLIN	ACTIVE	CONCRETE	R	L	TOWN OF DUBLIN
L	REYNOLDS POND DAM	PETERBOROUGH	ACTIVE	EARTH	R	P	
L	NORTH VILLAGE DAM	PETERBOROUGH	ACTIVE	STONE/CONC	R	L	TOWN OF PETERBOROUGH
H	MACDOWELL RESERVOIR	PETERBOROUGH	ACTIVE	EARTH	F	F	US ARMY CORP OF ENGINEERS
L	VERNEY MILL DAM	PETERBOROUGH	ACTIVE	CONCRETE	H	F	US ARMY CORP OF ENGINEERS
NM	FARM POND	PETERBOROUGH	ACTIVE	EARTH	C	P	
	CENTER DAM	PETERBOROUGH	BREACHED	CONCRETE	R	P	
	UNNAMED STREAM DAM	PETERBOROUGH	RUINS		R	P	
	UNNAMED STREAM DAM	PETERBOROUGH	RUINS		R	P	
	BAGLEY BROOK DAM	PETERBOROUGH	NOT BUILT	TIMBERCOMB	C	P	
L	UNION STREET DAM	PETERBOROUGH	ACTIVE	CONCRETE	H	P	
	NUBANUSIT BROOK DAM	PETERBOROUGH	RUINS		R	P	
NM	RECREATION POND	PETERBOROUGH	ACTIVE	EARTH	R	P	
	NUBANUSIT BROOK DAM	PETERBOROUGH	RUINS		R	P	
NM	BROWN SEWAGE LAGOON	PETERBOROUGH	ACTIVE	EARTH	L	P	
NM	ROBBINS RECREATION POND	TEMPLE	ACTIVE	EARTH	R	P	
NM	BRANCH BOGLIE BROOK	PETERBOROUGH	ACTIVE	EARTH	R	P	

Hazard Class	*NAME*	*TOWN*	*STATUS*	*TYPE*	*USE*	*CLASS/ OWN*	*OWNER*
NM	CRANBERRY MEADOW BROOK	PETERBOROUGH	ACTIVE	CONCRETE	C	P	
NM	FIRE POND	PETERBOROUGH	ACTIVE	EARTH	P	P	
L	CRANBERRY MEADOW POND DAM	PETERBOROUGH	ACTIVE	EARTH/MASONRY	R	P	
	AVIAN ESTATES DET POND	PETERBOROUGH	EXEMPT	EARTH	D	P	
	HARRIS DAM	PETERBOROUGH	EXEMPT	EARTH	R	P	
	BATCHELDER ICE POND LOWER DAM	PETERBOROUGH	BREACHED	EARTH/STONE	C	P	
L	NOONE MILL DAM	PETERBOROUGH	ACTIVE	CONCRETE	H	P	
	MILLARD DAM	PETERBOROUGH	EXEMPT	EARTH	R	P	
NM	CUNNINGHAM POND	PETERBOROUGH	ACTIVE	EARTH	R	L	TOWN OF PETERBOROUGH
NM	RECREATION POND	PETERBOROUGH	ACTIVE	EARTH	R	P	
NM	TEMPLE MOUNTAIN SKI CORP DAM	TEMPLE	ACTIVE	EARTH	R	P	
L	TOWN LINE BROOK DAM	PETERBOROUGH	ACTIVE	CONCRETE	R	P	
	CONTOOCOOK RIVER DAM	PETERBOROUGH	RUINS		M	P	
NM	UNNAMED STREAM DAM	SHARON	ACTIVE		R	P	
NM	BLAKE BROOK	PETERBOROUGH	ACTIVE	EARTH	C	P	
NM	BRANCH TOWNLINE BROOK DAM	SHARON	ACTIVE	CONCRETE/STONE	R	P	
	TOWNLINE BROOK DAM	SHARON	EXEMPT	STONE/EARTH	R	P	
NM	BRANCH TOWNLINE BROOK DAM	SHARON	ACTIVE	CONCRETE	R	P	
NM	FIRE POND DAM	SHARON	ACTIVE	EARTH	P	P	
NM	FARM POND DAM	JAFFREY	ACTIVE	EARTH	C	P	
NM	TRANSCRIPT PRINTING CO DAM	PETERBOROUGH	ACTIVE	CONCRETE	C	L	TOWN OF PETERBOROUGH
L	ELM ST DAM	PETERBOROUGH	ACTIVE	CONCRETE	H	P	
NM	BELL MILL DAM	PETERBOROUGH	ACTIVE	TIMBERCOMB	H	P	
L	GUERNSEY DAM, NUBANUSIT BRK	PETERBOROUGH	ACTIVE	STONE W/CONC.	R	P	
L	NUBANUSIT BROOK DAM	PETERBOROUGH	ACTIVE	CONCRETE	R	L	TOWN OF PETERBOROUGH
NM	BOYD FIRE POND DAM	SHARON	ACTIVE	EARTH	P	P	
NM	TOWN LINE BROOK DAM	PETERBOROUGH	ACTIVE	CONCRETE	C	P	
NM	WILDLIFE POND DAM	PETERBOROUGH	ACTIVE	EARTH	C	P	
NM	CASALIS MARSH POND	PETERBOROUGH	ACTIVE	EARTH	C	S	NH FISH & GAME DEPARTMENT
NM	BEAVER POND	GREENFIELD	ACTIVE	CONCRETE	R	S	DRED
	MONADNOCK COMMUNITY HOSP DET POND	PETERBOROUGH	EXEMPT	EARTH	D	P	
L	COLD BROOK DAM	PETERBOROUGH	ACTIVE	CONCRETE	R	P	
NM	FIRE POND	PETERBOROUGH	ACTIVE	EARTH	P	P	

Source: NH Department of Environmental Services

4. Data on MacDowell Lake and Dam

Edward MacDowell Lake Flood Risk Management Project



The dam at Edward MacDowell Lake is located on Nubanusit Brook in Peterborough, about 14 miles east of Keene. From Nashua, the dam can be reached by taking U.S. Route 3 to Route 101A west (which turns into Route 101) through Peterborough. Continue on Route 101 for about two miles and follow signs to the dam.

Edward MacDowell Lake provides flood protection primarily to Peterborough. The project also provides flood protection to the downstream communities of Hancock, Bennington, Antrim, Deering, Hillsboro, and Henniker, all on the Contoocook River.

Construction of the dam began in March 1948 and was completed in March 1950 at a cost of $2 million. The project has prevented $20.8 million in flood damages since it was built (as of September 2011).

Edward MacDowell Lake consists of an earthfill dam with stone slope protection 1,100 feet long and 67 feet high; a gated concrete conduit, seven feet high, seven feet wide, and 275 feet long; and a chute spillway cut in rock. The spillway at Edward MacDowell Lake is unusual in that instead of being located adjacent to the dam as most spillways are, it is located 3.2 miles northeast of the dam, at Halfmoon Pond. The spillway has a concrete weir 100 feet long with a crest elevation 21 feet lower than the top of the dam. Discharges from the spillway flow from Halfmoon Pond into Ferguson Brook which, in turn, discharges into the Contoocook River.

There is a conservation pool at Edward MacDowell Lake covering an area of 165 acres and having a maximum depth of about seven feet. The flood storage area of the project totals 840 acres and covers parts of Hancock, Dublin, and Harrisville. The lake and all associated project lands cover 1,469 acres. Edward MacDowell Lake can store almost 4.2 billion gallons of water for flood control purposes. This is equivalent to 5.4 inches of water covering its drainage area of 44 square miles.

Hydrologists and engineers in the Reservoir Control Center (RCC) in Concord, Massachusetts, make flood control decisions for all of New England based on data collected from many sources, including USACE Park Rangers and the National Weather Service. The highly sophisticated "Automated Data Collection System", relays lake and river levels and weather conditions to the RCC computer system via the Geostationary Operational Environmental Satellite.

Water flow is regulated through the dam by opening and closing the steel gates in the gatehouse. MacDowell Dam has three gates each weighing 4 tons. The project staff lower the gates to hold back flood waters behind the dam when the Contoocook River and the Merrimack River reach high levels. When these two rivers return to normal flows, the gates are raised enough to allow the water behind the dam to return to its normal pool elevation.

For more information, or for recreation opportunities, call (603) 924-3431 or visit the website at: http://www.nae.usace.army.mil/Missions/Recreation/EdwardMacDowellLake.aspx.

The fall of Nubanusit Brook from the dam to the Contoocook River is 68 feet in 2.8 miles and occurs largely at the following six dams:

Verney Mills Dam (former power dam, now owned by Corps) Union Street Dam (mill dam, owned by Peterborough Mills, Inc.) Elm Street Dam (tinnier mill dam, owned by S. C. White and A. E. Goybtte) Old Bell Mill Dam (mill dam, owned by M. Blodgett and C. Hammond) Historical Society Dam (former mill dam, owned by Peterborough, NH) Grove Street Dam (mill dam, owned by F. Mercer)

The fall of the Contoocook River from its confluence with Nubanusit Brook downstream to the Powder Mill Dam in Bennington is about 54 feet in 11 miles. As the Contoocook flows through Peterborough Village the valley is relatively narrow, however, downstream of North Village Dam, the stream meanders through broad swampy flood plains up to 6,000 feet wide with a drop of only 20 feet in 5 miles. The dams in this reach are:

1. Transcript Dam (former dam, owned by Peterborough, NH)
2. North Village Dam (stone dam, owned by Peterborough, NH)
3. Powder Mill Dam (hydropower dam, owned by Monadnock Mills)

Between MacDowell Dam and the Contoocook River, the Nubanusit Brook flows under six river crossings. From its confluence with the Nubanusit Brook, Contoocook River flows under six crossings.

Communities and Darns Affected by the Project. The river channel downstream of Edward MacDowell Dam to the headwaters of Hopkinton Lake reservoir flows through seven central New Hampshire communities: Peterborough (population – 6,688), Hancock (population 1,656), Bennington (population – 1,516), Antrim (population - 2,690), Deering (population - 1,973), Hillsborough (population – 6,002), and Henniker (population – 5,018).

In addition, there are two upstream communities, namely Harrisville and Dublin, which would be affected by pool inundation should the reservoir be filled to spillway crest, necessitating the setup of roadblocks.

The August 1980 Corps "Dam-Break Flood Analysis" study considered a reach of river extending from the dam downstream along the Nubanusit Brook 2.8 miles to the Contoocook River and then along that river about 11 more miles through the town of Hancock, ending at the Powder Mill Dam in Bennington. Within this reach there are six dams on the Nubanusit Brook and three in the Contoocook.

https://nae-cwms2.nae.usace.army.mil:7777/pls/cwmsweb/cwms_web.cwmsweb.cwmsindex

Edward MacDowell Lake Flood Control Project
Peterborough, NH

Authority:

The West Peterborough Reservoir was approved by the Chief of Engineers on 30 April 1940 as part of the comprehensive flood control plan for the Merrimack River Basin authorized by the Flood Control Acts approved 22, June 1936 **(Public Law No. 738, 74th Congress)** and 28 June 1938 **(Public Law No. 761, 75th Congress).**

Flood Control Act, approved 28 June 1938

(Public Law # 761 - 75th Congress, 3rd Session):

Sec. 4 ; That the following works of improvement for the benefit of navigation and the control of destructive flood waters and other purposes are hereby adopted and authorized to be prosecuted under the direction of the Secretary of War and supervision of the Chief of Engineers in accordance with the plans in the respective reports hereinafter designated:

Provided, that penstocks .or other similar Facilities adapted to possible future use in the development of hydroelectric power ·shall be installed in any dam herein authorized when approved by the Secretary of War upon the recommendation of the Chief of Engineers and of the Federal Power Commission.

"MERRIMACK RIVER BASIN"

The general comprehensive plan for flood control and other purposes as approved by the Chief of Engineers pursuant to preliminary examinations and surveys authorized by the Act of June 22, 1936, is approved and the project for flood control in the Merrimack River Basin as authorized by the Flood Control Act approved June 22, 1936, is modified to provide, in addition to the construction of a system of flood control reservoirs, related flood control works which may be found justified by the Chief of Engineers. Approval of the definite project report dated 5 August 1940 by the Chief of Engineers is contained in the 2nd Indorsement dated 22 September 1940, (File No. 7402 (Merrimack River Basin, West Peterborough Reservoir)-4) to letter forwarded by the District Engineer, U. S. Engineer Office, Boston, Massachusetts and to the Chief of Engineers, U. S. Army, dated 6 August 1940, Subject: Definite Project Report, West Peterborough Reservoir.

The Reports that lead up to the building of West Peterborough Reservoir (AKA: Edward MacDowell Dam) Authorized name changed in 1950 by Congress****

1. **1938 Report.** A report by the Chief of Engineers, dated 18 May 1938, and printed as House Document 689, 75th Congress, 3rd Session, presented a plan for flood control of the Merrimack River basin, which included construction of the following flood control reservoirs: Franklin Falls, River Hill, Allenstown, Hillsboro and Blackwater. Based on report findings, the 1938 Flood Control Act modified the Flood Control Act of 1936 and authorized the construction of this system of flood control reservoirs and related flood control works which may be found justified by the Chief of Engineers.
2. **Survey Report of April 1940.** A report on navigation, flood control and water power recommended the addition of Edward MacDowell Reservoir to the previously mentioned authorized flood control system. Reservoir design for flood control. The two maximum floods of record, March 1936 and September 1938, were adopted for reservoir design purposes.

The location of the MacDowell Dam spillway is quite unique in that it is located at the opposite end of the reservoir about 3 miles northeast of the dam. The reservoir fills up, rises up over a local roadway into

Halfmoon Pond, flows over the spillway, empties into Davis and Ferguson Brooks and then into the Contoocook River, downstream of Peterborough, thus bypassing populated areas.

The capacity was limited by fixing the spillway crest elevation at 946.0 to avoid damage to the Sargent Camp, and the outlet capacity is limited by the channel capacity for the safety of Peterborough. During large floods, discharge over the spillway will bypass the areas subject to damage immediately below the dam and will thereby avoid the necessity for outlet discharge greater than the channel capacity of the stream below the dam site.

Floods of record. - Records of great floods on Nubanusit Brook are incomplete. The maximum discharge during the period of the Peterborough record was 1130 c.f.s, on.11 April 1931. The peak of the-November 1927 flood was 1010 c,f.s. or 21 c.f.s. per square mile. The Geological Survey determined the peaks of the two greatest' floods at the Verney Mills Dam, which has a drainage area of 45 square miles. These maxima were 4140 c.f.s, in March 1936 and 4106 c.f.s. in September 1938.

Experienced Losses in the Merrimack River Basin:

1. 1927 Flood. There are no estimates available of flood losses sustained in the Merrimack River basin prior to 1927. Recorded losses' in. the flood of November 1927 amounted to $2, 365, 000, with the major portion of this damage concentrated in the headwater reaches.

2. 1936 Flood. The most damaging flood of record occurred in March 1936, causing widespread loss of life and destruction of property. Transportation and utility systems were disrupted and many remained inoperative for periods of up to several months. Experienced losses, at 1936 prices, were estimated to be $35 million in the entire basin, of which 60 percent was in Massachusetts and 40 percent in New Hampshire, Losses at damage centers along the main river accounted for about 80 percent of the total loss, and about 38 percent of the experienced loss was to industrial properties. Textile mills at Lawrence, Lowell, Nashua and Manchester, which were major factors in the economy of the basin, were seriously affected.

   What happened in March 1936; two weather events occurred which resulted in the greatest basin-wide flooding that the Merrimack River has ever experienced. The floods were associated with two periods of heavy rainfall - 11-13 and 17-19 March. The second period was generally much greater and associated with the more serious flood conditions; however, the floods were not due to rainfall alone, but rather to a combination of factors which normally cause the annual spring runoff. The combination of intense rainfall and warm temperatures melting a heavy snow cover reduced peak flows on the Merrimack River and its tributaries at were the greatest on record at practically all stations in the basin. In addition to the unusually heavy precipitation, which varied from 3 to nearly 20 inches for the 11-day period *over* the basin, there was nearly an equal amount of runoff from snowmelt. Ice jams also presented a problem. The total volume of runoff from 12-25 March was about 20 inches *over* the 104 square mile area above Lincoln, New Hampshire and about 10 inches over the 4, 672 square mile area above Lawrence, Massachusetts.

3. 1938 Flood. The second most damaging flood in the basin occurred in September 1938, when losses of $6 million were experienced - $5 million in New Hampshire and $1 million in Massachusetts, The major portion of this total was on western tributary streams, particularly the Contoocook River valley ($2, 100, 000). This great flood, resulting from a week of almost continuous rainfall, culminated when heavy rains associated with an intense hurricane passed through the basin on 21 September. A total of 17 inches of rainfall was recorded in limited areas, with a basin average of about 10 inches. Only minor flooding was experienced on the tributaries in the eastern portion of the basin, while western tributaries experienced floods approaching, and in some areas exceeding, the severity of the March 1936 event. On the Contoocook River at Henniker, the peak discharge of 22, 200 cfs is the maximum of record at the gauging station.

No records of the hydrographs of these floods were available for the Nubanusit Brook, but records of maximum stages at the Verney Mills dam, just below the site of the West Peterborough Dam, were available and a reasonably close computation of the peak rate of discharge for each of these floods was possible. They were 4140 c.f.s. for March 1936 and 4100 c.f.s. for September 1938.

4. Ice Jam Flooding. During ice breakups, many communities along the rivers face the additional threat of flooding caused by ice jams that occur on the tributaries as well as on the main river. However, the more serious are apt to be found in New Hampshire, where the longer periods of cold weather result in a thicker ice cover. The causes of ice jams vary somewhat at each location, but the resulting higher river stages are caused by the channel sections being restricted by the piling up of ice.

   Following is a list of New Hampshire areas that have experienced frequent ice jams:

   Plymouth - Ashland on the Pemigewasset River

   Peterborough on the Contoocook River

   Wilton on the Souhegan River

   Goffstown on the South Branch Piscataquog

5. March 1953 Flood. Precipitation during the month of March was very heavy throughout New England, and a monthly total of 8 to 10 inches of rain fell in the upper portion of the Merrimack River basin. In general; daily amounts of precipitation were not high, but the 3 to 4 inches of rainfall during the periods of 12-16 March and 24-27 March, combined with snowmelt from the headwater areas, were sufficient to produce a major flood on the Pemigewasset River and floods of lesser magnitude on other tributaries in the basin. The combined regulation of Franklin Falls, Blackwater and Edward MacDowell Reservoirs reduced all flood discharges on the Merrimack River by varying amounts: from 65, 000 to 33, 000 cfs at Concord, New Hampshire.

6. 1984 Flood; 2nd highest flood storage event since the dam was built.

7. 1987 Flood; The MacDowell Dam, located on Nubanusit Brook is regulated Primarily to provide protection to Peterborough and other communities along the upper Contoocook River, and during both floods the floodgates were throttled to minimum releases. However, on 6 April, floodwaters in the reservoir rose above spillway crest elevation and remained above crest level until 12 April.

   It was observed the roadway elevation at Sargent Camp Road was about 2 feet higher than the spillway crest and until the roadway was overtopped no significant spillway discharge occurred. Eventually the road was overtopped and partially washed out, and the water level at the weir crest rose to about 1.8 feet, with a spillway discharge of about 800 cfs. When downstream Contoocook River flooding receded, controlled releases from the dam were made into Nubanusit Brook and maintained *at* full channel capacity for more than two weeks until floodwaters were emptied.

8. Flood storage event 2010, 3rd highest impoundment for the dam. Operating for Henniker as the Contoocook River was cresting north of Peterborough.

9. Ice Jam 2011 affecting RT. 202 in Peterborough

10. Ice Jam 2014 affecting business in the Depot Squarer as river ice affected channel capacity for Nubanusit Brook.

OPERATING CONSTRAINTS:

Physical Property for flood storage: A total of 1, 194 acres has been purchased in fee by the Government to build the flood control project which has lands in four townships (Dublin, Peterborough, Hancock and Harrisville).

(1) Lands in and around the reservoir to elevation 949[3] (3 feet above spillway crest), with the exception of property bordering Halfmoon Pond,

(2) The land along the spillway channel to just below Middle Hancock Road,

(3) Verney Milts Dam, which is just downstream of MacDowell Dam and the surrounding 4 acres.

A total of 258 acres of flowage easement land was deeded:

(1) Land surrounding Halfmoon Pond to elevation 949 (Sargent Camp - Boston University),

(2) Lands bordering Davis and Ferguson Brooks between Middle Hancock Road and Route 202 that would be inundated by spillway discharges up to 3,000 cfs.

Maximum Release Rate. The maximum no damaging channel capacity of Nubanusit Brook downstream into Peterborough is 650 cfs; however, it is possible that during an extremely rare event or emergency this value may be exceeded. Since the prime purpose of the reservoir is to save lives and prevent or reduce damage, regulation during such unusual conditions may not follow the rules described herein, but will be governed by the urgency of the circumstances. During such conditions, the Project Manager has full authority to shut down immediately in the public interest. RCC will be notified as soon as possible of any unusual incident so that additional action may be taken to provide maximum protection.

The maximum no damaging stage of the Contoocook River at the Motel staff gage is about 5 feet, or about 1, 850 cfs. The section of the river behind the motel is the most restricted in the Peterborough area. Stages at this location are influenced by the North Village Dam, which is subject to ice jams. It should also be noted that MacDowell Dam controls 44 of the 118 square miles of upstream drainage area, equivalent to 37 percent.

Rainfall/ Watch and Observe.

(1) Rainfall of 2 inches on snow-covered, wet, or frozen ground or 3 inches on dry ground occurring within any 24-hour period

(2) Contoocook River Stages. Whenever the Contoocook River at Peterborough reaches a stage of 3.5 feet (640 cfs) and still rising, or the stage at the motel staff gage reaches 3.0 feet (1,000 cfs) and still rising.

(3) Conditions in Henniker. Whenever the Contoocook River at Henniker reaches a stage of 9. 5 feet (3, 000 cfs) and still rising.

This discharge is less than half the 6,600 cfs channel capacity during the non-growing season; however, MacDowell Dam controls only 44 of the 368 square miles above Henniker, or 12 percent, and there is about an 18-hour river travel time involved. Therefore, action will have to be taken far enough in advance in order to obtain the desired effect. An exact value of the no damaging channel capacity at Henniker for the growing season has not been determined; however, it is estimated to be at a stage of 10. 5 feet, equivalent to 4, 700 cfs. This should be considered by RCC during summer regulation, although

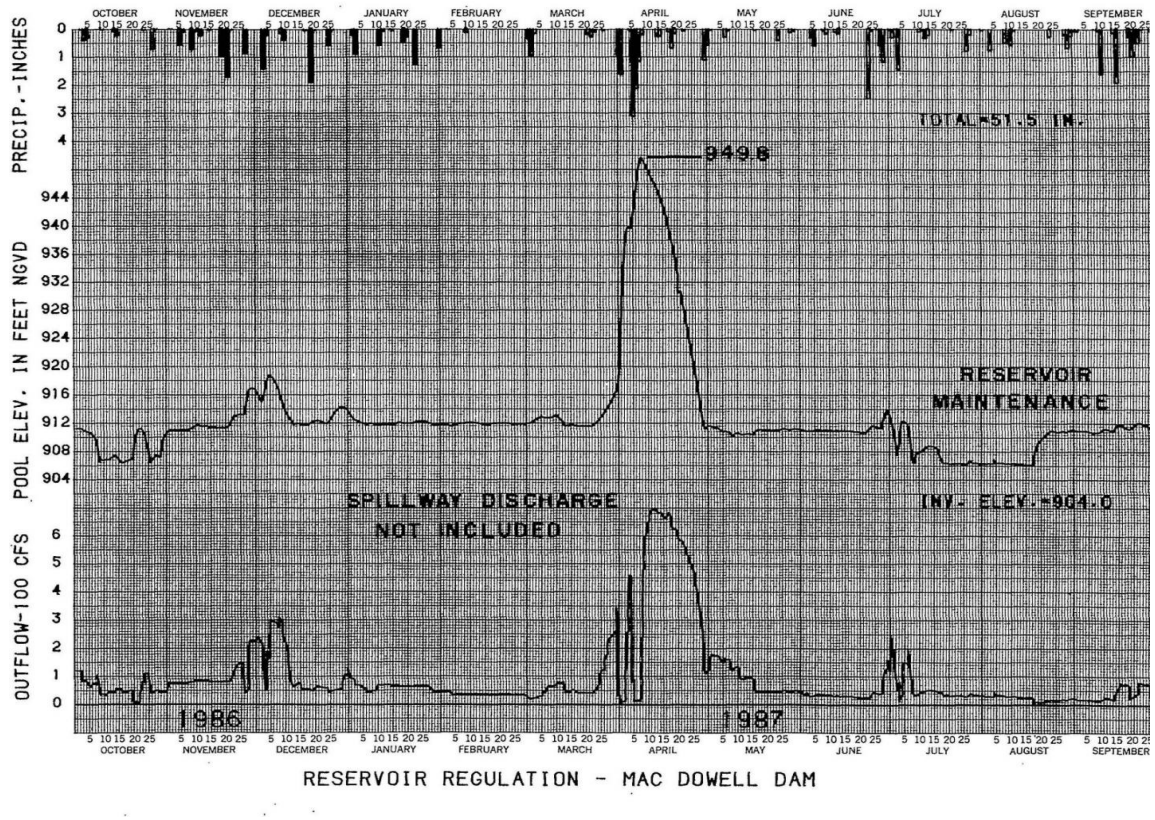
[3] 949 feet MSL (Mean Sea Level) was the record pool elevation in 1987 because of the sand bag operation that Hancock DPW did to save Sargent Camp Road. Jim Ward, Operations Manager for USACE went down there to explain that the spillway design required the water to back flow from the dam over the road into Half Moon Pond to escape through the spillway channel. Normally the spillway crest elevation in 946 feet MSL. 946 is the correct number and 949 is the record number hopefully never repeated again.

the effects of regulation at MacDowell Dam on low-lying agricultural lands this far downstream are minimal.

Continuation of Regulation. An important regulation activity during this period is the collection of hydrologic data such as: (I) precipitation, (2) snow cover, (3) temperature,(4) stage and discharge at downstream control points, and (5) other pertinent data which would assist in regulation. As a flood develops, considerable judgment and experience is necessary to vary the regulation in accordance with the amount of storage utilized, river stages in Peterborough, ice conditions, water content in snow, weather forecast, and travel times.

Emptying the Reservoir back to standard pool elevation:

Following recession of the flood peak at downstream locations, index stations on the Contoocook River, the reservoir will be emptied as rapidly as possible in accordance with instructions from RCC. In general, releases will be based upon conditions on the Contoocook River and the amount of storage utilized in MacDowell Reservoir. Readings will be obtained from the gage in Peterborough and the motel staff gage. Emptying the reservoir shall not be initiated until contact has been established with RCC. (Reservoir Control Center). Our standard pool elevation is 912 Mean Sea Level which is equivalent to 2% of our storage capacity. The standard conservation pool allows for recreation activities and supports aquatic life while still allowing the USACE the ability to utilize the maximum storage potential for flood water impoundment.



RESERVOIR REGULATION - MAC DOWELL DAM

FLOOD OF MARCH/APRIL 1987
RAINFALL TOTALS(INCHES)

	31 MARCH-1 APRIL	4-8 APRIL	TOTAL
MERRIMACK RIVER BASIN			
FRANKLIN FALLS	1.85	2.15	4.00
BLACKWATER	1.72	4.41	6.13
MACDOWELL	2.60	6.72	9.32
HOPKINTON	1.86	5.93	7.79
EVERETT	1.99	5.70	7.69
CONNECTICUT RIVER BASIN			
UNION VILLAGE	0.95	1.62	2.57
NORTH HARTLAND	1.56	1.41	2.97
NORTH SPRINGFIELD	1.60	1.90	3.50
BALL MOUNTAIN	2.15	4.15	6.30
TOWNSHEND	2.25	3.36	5.61
SURRY MOUNTAIN	2.21	2.18	4.39
OTTER BROOK	1.88	3.71	5.59
BIRCH HILL	2.55	3.81	6.36
TULLY	2.76	3.90	6.66
BARRE FALLS	3.21	5.10	8.31
KNIGHTVILLE	2.65	5.05	7.70
LITTLEVILLE	3.10	5.10	8.20
COLEBROOK	3.50	5.98	9.48
NAUGATUCK RIVER BASIN			
THOMASTON	3.66	6.17	9.83
BLACK ROCK	3.40	6.27	9.67
HOP BROOK	4.78	5.00	9.78
THAMES RIVER BASIN			
MANSFIELD HOLLOW	4.40	3.70	8.10
BUFFUMVILLE	4.90	4.67	9.57
HODGES VILLAGE	3.97	4.53	8.50
EAST BRIMFIELD	3.98	4.45	8.43
WESTVILLE	4.30	4.45	8.75
WEST THOMPSON	4.40	4.21	8.61
BLACKSTONE RIVER BASIN			
WEST HILL	4.00	5.31	9.31

Inventory of Dams within Peterborough's Flood Plain

Edward MacDowell Lake located on Wilder Street was completed in 1950 at an elevation of 969 feet (Federal Flood Control Dam administered by USACE) (N.42* 54' 1" / W. 71* 59' 33").

This dam has the capacity to hold 4.2 billion gallons of flood water and any excess water gets diverted through the spillway channel 3.5 miles north into Hancock, NH, bypassing downtown Peterborough.

The fall of Nubanusit Brook from the dam to the Contoocook River is 68 feet in 2.8 miles and occurs largely at the following six dams:

1. Verney Mills Dam (former power dam, now owned by Corps)
2. Union Street Dam (mill dam, owned by Peterborough Mills, Inc.)
3. Elm Street Dam (tinnier mill dam, owned by S. C. White and A. E. Goybtte)
4. Old Bell Mill Dam (mill dam, owned by M. Blodgett and C. Hammond)
5. Historical Society Dam (former mill dam, owned by Peterborough, NH)
6. Grove Street Dam (mill dam, owned by F. Mercer)

The fall of the Contoocook River from its confluence with Nubanusit Brook downstream to the Powder Mill Dam in Bennington is about 54 feet in 11 miles. As the Contoocook flows through Peterborough Village the valley is relatively narrow, however, downstream of North Village Dam, the stream meanders through broad swampy flood plains up to 6,000 feet wide with a drop of only 20 feet in 5 miles. The dams in this reach are:

1. Transcript Dam (former dam, owned by Peterborough, NH)
2. North Village Dam (stone dam, owned by Peterborough, NH)
3. Powder Mill Dam (hydropower dam, owned by Monadnock Mills)

Between MacDowell Dam and the Contoocook River, the Nubanusit Brook flows under six river crossings. From its confluence with the Nubanusit Brook, Contoocook River flows under six crossings.

Communities and Darns Affected by the Project. The river channel downstream of Edward MacDowell Dam to the headwaters of Hopkinton Lake reservoir flows through seven central New Hampshire communities: Peterborough (population - 4,895), Hancock (population 1,193), Bennington (population - 890), Antrim (population - 2,209), Deering (population - 1,041), Hillsborough (population - 3,437), and Henniker (population - 3,246). **[Note: Population numbers need to be updated.]**

In addition, there are two upstream communities, namely Harrisville and Dublin, which would be affected by pool inundation should the reservoir be filled to spillway crest, necessitating the setup of roadblocks.

The August 1980 Corps "Dam-Break Flood Analysis" study considered a reach of river extending from the dam downstream along the Nubanusit Brook 2.8 miles to the Contoocook River and then along that river about 11 more miles through the town of Hancock, ending at the Powder Mill Dam in Bennington. Within this reach there are six dams on the Nubanusit Brook and three in the Contoocook.

EDWARD MACDOWELL LAKE
PEAK POOL LEVELS
WATER-YEARS (1950 - PRESENT)

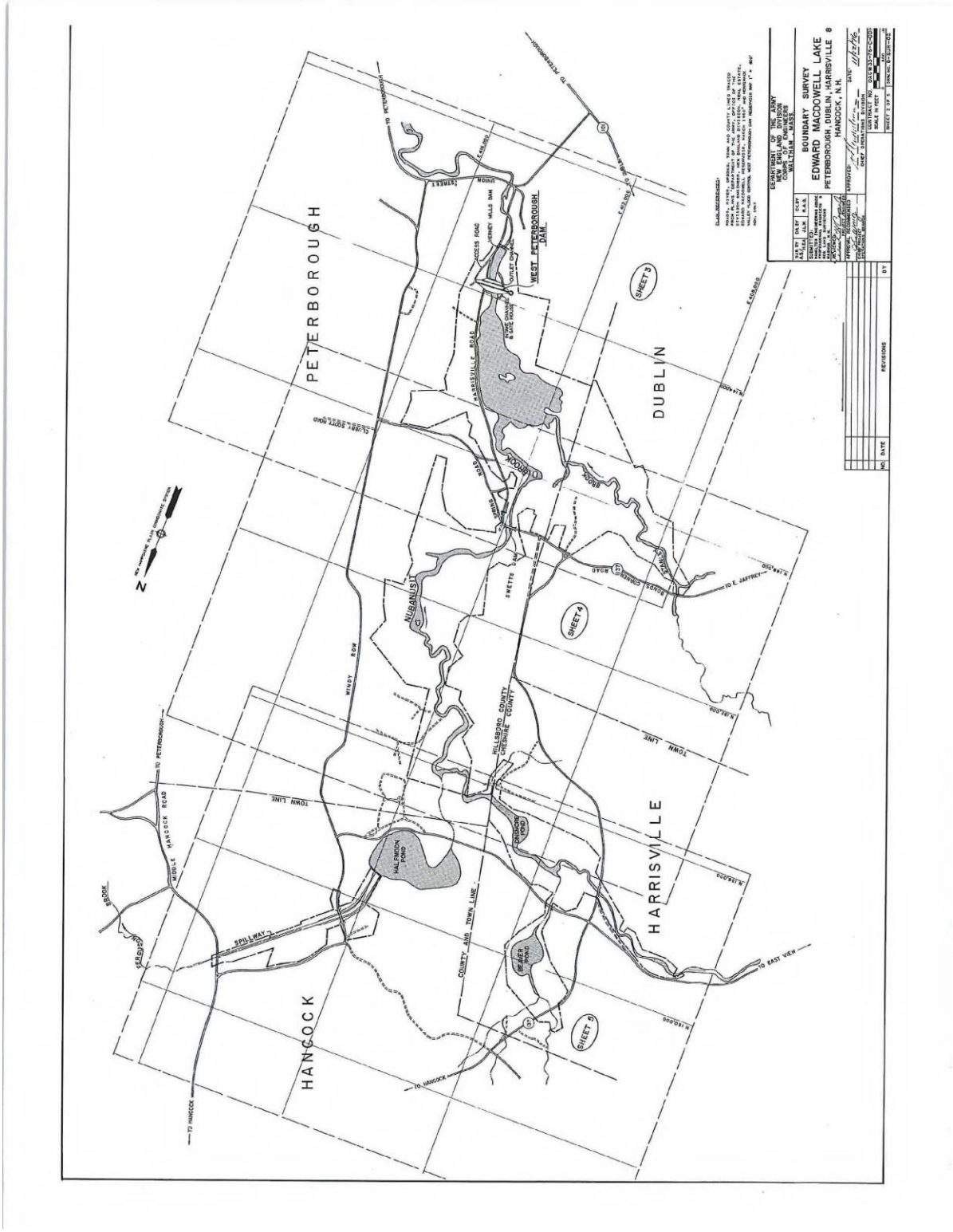
DA = 44.0 sq.mi. 1" Runoff = 2346 acre-feet Zero Stage = 904.0 ft. NGVD

Date	Annual Peak Pool Level	Storage Utilized Inches	Acre-Feet	Percent
1951 APR	934.0	2.8	6600	52
1952 APR	926.1	1.6	3832	30
1953 MAR	927.5	1.8	4300	34
1954 APR	919.5	0.8	1800	14
1955 APR	916.4	0.4	990	8
1956 JAN	935.6	3.1	7215	56
1957 JAN	918.8	0.7	1595	12
1958 APR	931.2	2.4	5595	44
1959 APR	924.6	1.4	3345	26
1960 APR	934.8	2.9	6900	54
1961 APR	914.4	0.2	555	4
1962 APR	921.5	1.0	2400	19
1963 MAR	917.7	0.6	1300	10
1964 APR	918.0	0.6	1375	11
1965 APR	914.5	0.2	575	4
1966 MAR	917.0	0.5	1125	9
1967 APR	920.8	0.9	2190	17
1968 MAR	929.6	2.1	5035	39
1969 APR	930.0	2.2	5175	40
1970 FEB	928.0	1.9	4475	35
1971 APR	920.5	0.9	2100	16
1972 APR	922.4	1.1	2670	21
1973 JUL	923.8	1.3	3090	24
1973 DEC	928.6	2.0	4685	37
1975 SEP	922.2	1.1	2610	20
1976 FEB	923.1	1.2	2880	22
1977 MAR	932.1	2.5	5910	46
1978 JAN	924.2	1.4	3215	25
1979 MAR	938.0	3.5	8210	64
1980 MAR	924.8	1.5	3410	27
1981 FEB	920.5	0.9	2100	16
1982 APR	920.6	0.9	2130	17
1983 MAR	926.2	1.6	3865	30
1984 JUN	943.2	4.6	10745	84
1985 MAR	916.4	0.4	990	8
1986 FEB	930.6	2.3	5385	42
1987 APR	949.8	SPILLWAY DISCHARGE		
1988 MAR	920.5	0.9	2100	16
1989 APR	921.8	1.1	2490	19
1990 MAR	924.0	1.3	3150	25
1991 AUG	920.1	0.8	1980	15
1991 NOV	918.8	0.7	1595	12
1993 APR	930.0	2.2	5175	40

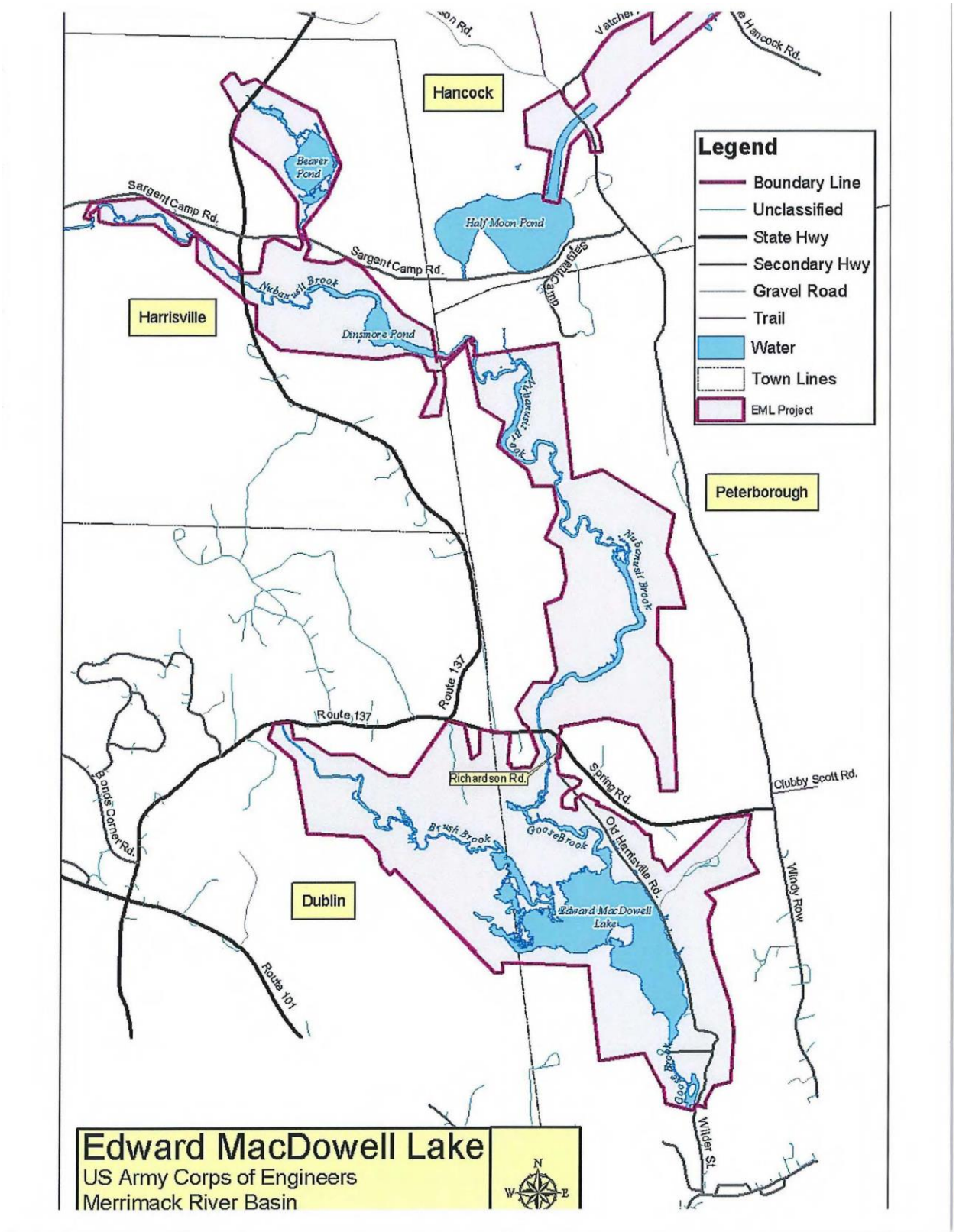
Date	Annual Peak Pool Level	Storage Utilized Inches	Acre-Feet	Percent
1993 DEC	916.6	0.4	1035	8
1994 DEC	920.3	0.9	2040	16
1996 APR	926.7	1.7	4031	31
1996 OCT	926.3	1.7	3904	31
1998 JUN	926.4	1.7	3936	31
1999 MAR	915.5	0.3	796	6
2000 APR	918.2	0.6	1422	11
2001 APR	926.0	1.6	3797	30
2002 APR	914.8	0.3	635	5
2003 APR	927.6	1.8	4328	34
2004 APR	929.2	2.1	4899	38
2005 APR	927.3	1.8	4300	34
2005 OCT	936.1	3.2	7525	59
2007 APR	938.8	3.7	8692	68
2008 APR	919.0	0.8	1800	14
2008 DEC	918.2	0.7	1583	12
2010 APR	941.7	4.3	9910	78
2011 MAR	926.8	1.8	4195	33
2011 DEC	917.7	0.6	1460	11
2012 NOV	916.0	0.4	1050	8
2014 APR	917.9	0.6	1507	12
2014 APR	917.9	0.6	1,507	12
2014 OCT	916.5	0.5	1,160	9
2016 FEB	915.5	0.4	940	7
2017 FEB	918.2	0.7	1,580	12
2018 JAN	922.6	1.2	2,867	22
2018 NOV	922.4	1.2	2,820	22
2019 DEC	918.5	0.7	1,648	13

Link to data:
https://nae-cwms2.nae.usace.army.mil:7777/pls/cwmsweb/cwms_web.cwmsweb.cwmsindex

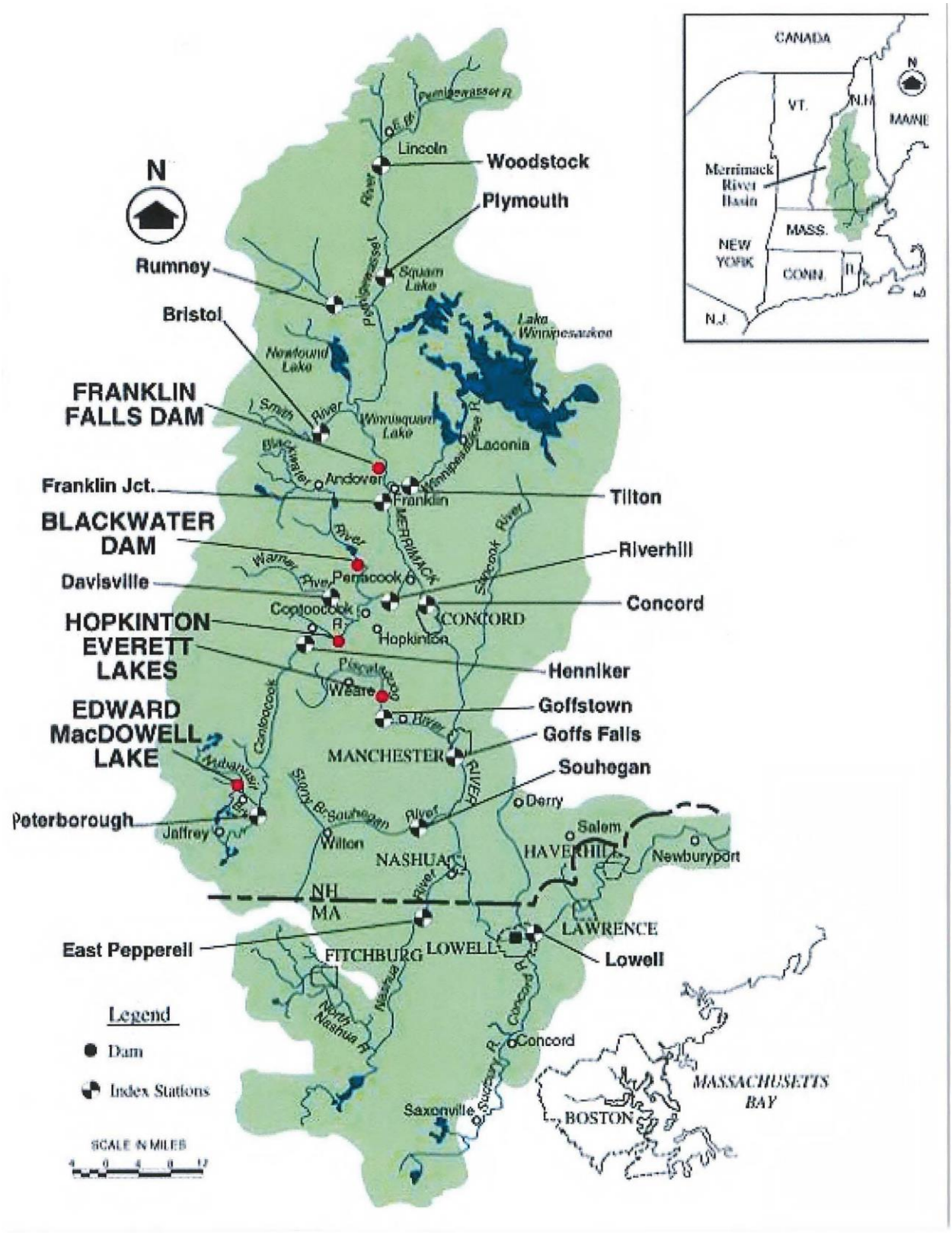
Boundary Survey of Edward MacDowell Lake



Boundary Limits of the MacDowell Project



Map of Merrimack River Basin with Dams and Index Stations



Map of Merrimack River Basin with Gauging Stations and High Flow Travel Times