Town of Brookline, New Hampshire

Hazard Mitigation Plan Update 2017

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CHAPTER 1. PLANNING PROCESS

Section 1.1 ~ Overview of Planning Process

The Brookline Hazard Mitigation Plan Update 2017 was prepared by the Nashua Regional Planning Commission (NRPC) for the Town of Brookline, NH. NRPC staff worked closely with the Brookline Hazard Mitigation Team to write this plan. The Brookline Hazard Mitigation Team includes:

- Charles Corey, Fire Chief, Town of Brookline, NH
- Lee Duval, Director, Brookline Ambulance Service and Emergency Management, Town of Brookline, NH
- Jerry Farwell, Road Agent, Town of Brookline, NH
- Tad Putney, Town Administrator, Town of Brookline, NH
- William Quigley, Chief of Police, Town of Brookline, NH
- Valerie Rearick, Town Planner, Town of Brookline, NH
- J.P. Royea, Fire Inspector, Town of Brookline, NH

NRPC staff will meet with the Brookline Hazard Mitigation Team for a series of 4 meetings in order to prepare the Brookline Hazard Mitigation Plan Update 2017. Agendas from these meetings appear in the Appendix to this Plan. In between meetings, NRPC worked directly with Brookline Hazard Mitigation Team members to obtain additional information needed to write the Plan.

The primary differences between the 2017 Plan and the 2012 Plan are 1) preparedness actions are not included in the 2017 Plan, 2) man-made hazards are not included in the 2017 Plan, and 3) climate change resiliency is addressed in the 2017 Plan.

Section 1.2 ~ Involvement of Neighboring Communities and Local/Regional Agencies

At the first Hazard Mitigation Team meeting, held on November 8, 2016, the group discussed who should be invited to participate on the planning team that was not currently represented. It was determined that the current Team provided adequate representation and no additional members were necessary. The Team also discussed who should be informed about the Plan, such as neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, and others. It was concluded that the following entities should be informed of the Plan update:

- Dartmouth Hitchcock Family Practice, Milford, NH
- St. Joseph Medical Center, Milford, NH
- Homeland Security and Emergency Management, Danielle Morse, Field Representative, Concord, NH
- American Red Cross, Nashua NH and Manchester, NH
- Southern NH Medical Center, Nashua, NH

- St. Joseph Medical Center, Nashua, NH
- Eversource, Manchester, NH
- Manchester-Boston Regional Airport, Manchester, NH
- Nashua Airport Authority, Nashua, NH
- Board of Selectmen, Town of Mason, NH
- Board of Selectmen, Town of Milford, NH
- Board of Selectmen, Town of Brookline, NH
- Board of Selectmen, Town of Hollis, NH
- Board of Selectmen, Town of Townsend, MA
- Board of Selectmen, Town of Pepperell, MA
- Nashua Community College, Nashua, NH
- Franklin Pierce College, Rindge, NH
- Southern NH University, Nashua, NH
- Daniel Webster College, Nashua, NH

A copy of the letter that was sent to these entities appears in the Appendix to this Plan. Elizabeth LaRocca, Community Relations for Eversource, responded and attended a Hazard Mitigation Team meeting to discuss how Eversource works with municipalities to keep lines of communication opened during storms and major power outages. She also discussed Eversource's role in identifying critical facilities and infrastructure and documenting this data in Eversource's Outage Management System.

The Brookline Board of Selectmen reviewed the Brookline Hazard Mitigation Plan Update 2017 and provided input during their meeting on April 24, 2017. The Brookline Planning Board was given opportunity to provide input on this Plan through the participation of Valerie Rearick, Brookline Town Planner, who served on the Hazard Mitigation Team and was a liaison to the Planning Board. Given the part-time nature of the position, the Brookline Building Inspector was not able to participate directly in Hazard Mitigation Team meetings. Instead, the Brookline Town Administrator served as a liaison for the Building Inspector and the two reviewed relevant components of the Plan as applicable outside of the formal meetings.

Section 1.3 ~ Public Participation

During the first Hazard Mitigation Team meeting, held on November 8, 2016, the Team brainstormed all the methods currently employed to notify the public of Town meetings and news. These methods include the Town's website (http://www.brookline.nh.us/) and Brookline's Public Access TV Channel (http://www.brookline.nh.us/channel-192). The Team determined that these methods should also be used to encourage public participation in the Hazard Mitigation Plan update process. In addition, announcements were made at various televised Board of Selectmen meetings regarding the update process. There was no public response to provide input to the Brookline Hazard Mitigation Plan Update 2017 process.

NRPC staff also developed a webpage for the Brookline Hazard Mitigation Plan Update 2017 (http://www.nashuarpc.org/energy-environmental-planning/hazard-mitigation-planning/), which allows members of the public to participate in the update process even if they cannot attend meetings. The webpage was updated throughout the planning process and includes the 2012 Brookline Hazard Mitigation Plan, 2017 Hazard Mitigation Plan Outline, and Hazard Mitigation Plan Review Checklist. It also provides meeting times, locations, agendas, and homework assignments. The Town of Brookline's website links to this webpage. The Nashua Regional Planning Commission will keep the website active and will add information about ongoing updates over the next 5 years. A screen shot of the website appears in the Appendix to this Plan.

Section 1.4 ~ Existing and Potential Authorities, Policies, Programs, and Resources

At the first Hazard Mitigation Team meeting, held on November 8, 2016, the Team discussed Brookline's existing authorities, policies, programs, and resources related to hazard mitigation and its ability to expand and improve on these. The purpose of this discussion was to determine the ability of the Town to implement its hazard mitigation strategies and to identify potential opportunities to enhance specific policies, programs, or projects. The evaluation of Brookline's existing authorities, policies, programs, and resources includes planning and regulatory capabilities, emergency management capabilities, floodplain management capabilities, administrative and technical capabilities, and fiscal capabilities. Each of these areas provides an opportunity to integrate hazard mitigation principles and practices into the local decision making process.

Planning and Regulatory Capabilities

Planning and regulatory capability is based on the implementation of plans, ordinances, and programs that demonstrate Brookline's commitment to guiding and managing growth in a responsible manner. The following is a summary of the relevant local plans, ordinances, and programs already in place in the Town of Brookline. Each one should be considered as an available mechanism for incorporating the recommendations of the Brookline Hazard Mitigation Plan Update 2017.

- Wetlands Conservation District—the purpose of the Wetlands Conservation District is to protect the public health, safety, and general welfare by controlling and guiding the use of land areas which have been found to be subject to high water tables for extended periods of time.
- Floodplain Ordinance—regulations in the Brookline Floodplain Ordinance apply to all lands designated as special flood hazard areas by the Federal Emergency Management Agency (FEMA) in its "Flood Insurance Study for the County of Hillsborough, NH" dated September 25, 2009 or as amended, together with the associated Flood Insurance Rate Maps dated September 25, 2009 or as amended.
- Aquifer Protection Ordinance—the Town of Brookline adopted this ordinance for the promotion of the health, safety, and general welfare of its residents by preserving, maintaining, and protecting from contamination the existing and potential groundwater resources of the Town and protecting the surface waters that are fed by groundwater.

- Open Space Development—the purpose of this ordinance is to promote the conservation of the natural environment and the development of the community in harmony with the natural features of the land.
- Restricted Water Use Ordinance—this ordinance was adopted on September 26, 2016 in response to the region's ongoing drought conditions. It is allowed for under RSA 41:11-d Restricting the Watering of Lawns. Its purpose is to protect public health and safety by restricting the use of water from private wells for residential outdoor lawn watering during a state or federally declared drought. The ordinance was effective beginning October 2, 2016.
- Brookline Master Plan 2011
- Land Use Zoning Ordinance
- Non-Residential Site Plan Regulations
- Subdivision Regulations
- International Building Code and International Residential Code
- National Flood Insurance Program
- Nashua Regional Water Resiliency Action Plan— Climate change in southern New Hampshire will impact the environment, ecosystem services, economy, public health, and quality of life. According to a 2014 study by the Sustainability Institute at the University of NH, southern NH is expected to become warmer and wetter over the next century with more extreme precipitation events. This weather pattern puts significant stress on the region's already aging water infrastructure. Furthermore, climate change is likely to cause a number of public health impacts on NH's most vulnerable residents. Despite efforts taking place to slow the rate of climate change, some level of change is inevitable. Therefore, municipalities must make sound decisions to help their communities adapt to a new climate normal. The goal of the Nashua Region Water Resiliency Action Plan is to help municipalities become more resilient to the impacts that climate change has on their water infrastructure and vulnerable populations.

Emergency Management Capabilities

Hazard mitigation is a key component of emergency management, along with preparedness, response, and recovery. Opportunities to reduce potential losses through mitigation practices are typically implemented before a hazard event occurs, such as enforcement of policies to regulate development that is vulnerable to hazards due to its location or design. Existing emergency management capabilities for the Town of Brookline include:

Emergency Management Plans

- Brookline Hazard Mitigation Plan 2012—this document provides a guide for the community to reduce the impact of natural hazards on its residents and the built environment.
- Brookline Emergency Operations Plan—this document outlines responsibilities and the means by which resources are deployed during and following an emergency or disaster. An update of this Plan will be complete in 2017.
- Regional Public Health Emergency Response Annex—in 2016 Brookline collaborated with the Nashua Public Health Emergency Preparedness Program to develop this document, which

describes critical operational functions during an emergency and what entities are responsible for carrying them out.

Emergency Management Departments, Facilities, Personnel, and Volunteers

- Brookline Emergency Management, Brookline Ambulance Service, Brookline Fire Department, Brookline Police Department—these departments provide policies, programs, and resources related to hazard mitigation and emergency preparedness.
- Souhegan Fire Mutual Aid—provides fire assistance for Brookline, NH; Pepperell, MA; and Dunstable, MA. Brookline also has a fire mutual aid agreement with Townsend, MA.
- Statewide Fire Mutual Aid
- Brookline Police also have mutual aid agreements with Pepperell, MA and Townsend, MA.
- Brookline Community Emergency Response Team (CERT)—an all-volunteer group whose members are trained in emergency procedures to enable them to assist the local Emergency Services during an emergency and through the recover stage of the event.
- Emergency Operations Center—located at the Safety Complex (backup EOC at Fire Station); provides radio, computer, and phone support in conjunction with the State EOC for allocation of resources, equipment, and personnel during an emergency situation.

Emergency Management Communications

- Dispatch—primary dispatch is through Town of Hollis, NH with backup provided by Milford, NH. If needed, Brookline can provide its own dispatch through its radios.
- Two antenna sites in Brookline with backup generators for emergency communications.
- Code Red—emergency alert system
- Brookline Community Access Television—emergency management announcements
- Brookline Municipal Website—emergency management announcements and education
- Brookline Emergency Management Facebook page

Floodplain Management Capabilities

The Town of Brookline participates in the National Flood Insurance Program (NFIP). This provides full insurance coverage based on risk as shown on detailed Flood Insurance Rate Maps (FIRMs). Brookline joined the NFIP on May 19, 1987. As a participant in the NFIP, communities must agree to adopt a floodplain management ordinance and enforce the regulations found in the ordinance. Brookline has adopted the "Floodplain Ordinance," found in Section 1200 of the Town of Brookline, NH Zoning and Land Use Ordinance. The Floodplain Ordinance is enacted to prevent the development of buildings and uses in areas that are unsatisfactory and hazardous due to the threat of flooding, protect natural flows and drainage, and comply with the requirements of the National Flood Insurance Act of 1968 (P.L. 90-488, as amended). Additional information on the Floodplain Ordinance and Brookline's participation in the NFIP will be located in Section 3.7 of this Plan.

Administrative and Technical Capabilities

Brookline's ability to develop and implement mitigation projects, policies, and programs is closely related to the staff time and resources it allocates to that purpose. Administrative capability can be improved by coordinating across departments and integrating mitigation planning into existing Town procedures. The following departments, boards, and personnel are critical to Brookline's hazard mitigation administrative and technical capabilities:

- Planning Department
- Fire Department
- Police Department
- Emergency Management
- Brookline Ambulance Service
- Building Inspector
- Health Officer
- Road Agent
- Town Administrator
- Board of Selectmen
- Zoning Board
- Planning Board
- Conservation Commission
- Finance Committee

Fiscal Capabilities

In addition to administrative and technical capabilities, the ability of the Town of Brookline to implement mitigation actions is closely associated with the amount of money available for these projects. Mitigation actions identified in this Plan, including those that will appear in Table 12—Implementation and Administration, may utilize the following funding sources.

- Congestion Mitigation and Air Quality (CMAQ) Program—this program is administered by the Federal Highway Administration and was implemented to support surface transportation projects and related efforts that contribute to air quality improvements and provide congestion relief.
- FEMA Hazard Mitigation Grant Program—the Hazard Mitigation Grant Program provides grants to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the Program is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster.
- FEMA Pre-Disaster Mitigation Program—the Pre-Disaster Mitigation Program provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster.
- Community Development Block Grant Program—the Community Development Block Grant (CDBG) program, administered through the US Department of Housing and Urban Development, provides communities with resources to address a wide range of unique community development needs, including Disaster Recovery Assistance. HUD provides flexible grants to

help cities, counties, and States recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations.

- Brookline Capital Improvements Plan 2017-2022— the Brookline Capital Improvements Plan (CIP) links local infrastructure investments with long-term planning. As authorized by RSA 674:5-8 the CIP is the responsibility of the Planning Board or a formally appointed capital improvements program committee, to prepare and amend a recommended program of municipal capital improvements projected over a period of at least six years. The following funding methods may be used:
  - 1-Year Appropriation—most commonly used financing option and refers to those projects that are to be funded by property tax revenues within a single fiscal year. Funds for projects that are financed using this method are most often included in the Town's operating budget, but can appear as warrant articles to be voted on individually.
  - Capital Reserve—a capital reserve account is a non-lapsing savings account, separate from the General Fund. Voters can deposit funds into with approval of a warrant article, with the intent of withdrawing the funds to use for the specific purpose or purchase for which the account was established. This method requires appropriations over more than one year, with the actual project being accomplished only when the total appropriations meet the project cost.
  - Lease Purchase—lease purchasing an item allows a municipality to spread the cost over a period of years, generally no more than 7. A municipal lease typically allows for Town ownership at the end of the lease term and usually enjoys lower tax-exempt interest rates. Unlike a bond or loan, a municipal lease has a "non-appropriation clause" that allows the town to cancel the lease if the annual payment is not appropriated. The town then loses the equipment that was financed. In Brookline, lease purchasing is typically used by departments to purchase vehicles.
  - Bonding—bonding allows the municipality to negotiate the purchase of goods or services at a set price and then pay for that item or service over a period of time. Bonds, unlike capital reserve accounts, allow the town to utilize the item being purchased or constructed while payments are being made. The most important part of a bond transaction is the promise of the town to repay the debt with interest. There are two major types of bond: general obligation and special revenue. General Obligation Bonds typically have lower interest rates than other types of long-term debt. Revenue Bonds rely on a set revenue source or sources as security for the bond. In Brookline, bonding in generally limited to the most expense capital projects, such as major renovations, additions, or construction of new school or municipal buildings and facilities.
  - Impact fees—these fees are collected from new development to pay for new facility capacity. Money collected is placed in a fund until it is either expended within six years or returned to the party from whom it was collected.

Summary and Analysis of Brookline's Existing Authorities, Policies, Programs, and Resources

Measures of Effectiveness are defined as follows:

- Excellent—the existing program works as intended and is exceeding its goals
- Good—the existing program works as intended and meets its goals
- Average—the existing program works as intended but could be improved to meet higher standards
- Poor—the existing program does not work as intended, often falls short of its goals, and/or may present unintended consequences

Capability	Description	Area of Town Covered	Responsible Entities	Effectiveness	Changes or Improvements Needed
Planning and Regulatory	Wetlands Conservation District, Floodplain Ordinance, Aquifer Protection Ordinance, Open Space Development, Land Use Zoning Ordinance, Non-Residential Site Plan Regulations, Subdivision, Regulations, Brookline Master Plan 2011, IBC, IRC, NFIP, Nashua Regional Water Resiliency Action Plan	Entire jurisdiction	Planning Board, Zoning Board, Town Planner	Good	Ordinances should be reviewed on a regular basis to ensure they are consistent with goals outlined in the Master Plan and Hazard Mitigation Plan. Consider conducting a Town specific vulnerability assessment to improve local resiliency to climate change impacts.
Emergency Management	Plans; Departments, Facilities, Personnel, and Volunteers; Communications	Entire jurisdiction	Brookline Fire Dept.; Brookline Police Dept.; Brookline Police Mutual Aid; Brookline Ambulance; Souhegan Fire Mutual Aid; Statewide Fire Mutual Aid; Fire Mutual Aid with Townsend, MA; CERT Team	Excellent	Utilize a variety of communications methods to ensure all residents are educated about emergency preparedness and hazard mitigation measures they can take.

Floodplain Management	Floodplain Ordinance, NFIP	Designated Flood Hazard Areas in Brookline	Brookline Planning Board	Good	Revise/adopt regulations to improve floodplain management if needed according to findings from 2017 regulatory audit. Incorporate updated floodplains for Merrimack Watershed into municipal planning activities when they become available.
Administrative and Technical	Planning Dept., Fire Dept., Police Dept., Emergency Management, Ambulance Service, Building Inspector, Health Officer, Road Agent, Town Administrator, Board of Selectmen, Zoning Board, Planning Board, Conservation Commission, Finance Committee	Entire jurisdiction	Entities listed in Description	Good	Promote communication across all departments and committees to ensure Hazard Mitigation Plan goals and actions are implemented.
Fiscal	Grant funding, Capital Improvements Program (CIP)	Entire jurisdiction	Board of Selectmen, Capital Improvements Committee, Planning Board	Good	Hazard mitigation actions should be considered for inclusion in the CIP and departmental budgets. Brookline's Hazard Mitigation Plan should be updated at least every 5 years in order to maintain eligibility for FEMA grants.

Section 1.5 ~ Review and Incorporation of Existing Documents

A number of existing documents were reviewed and incorporated into the Brookline Hazard Mitigation Plan Update 2017. The Brookline Zoning Ordinance was used to provide information on where and how

the Town builds. This was particularly helpful when mapping critical facilities corridors (Section 3.4). The Brookline Capital Improvements Plan was used to help document the Town's fiscal capabilities (Section 1.4). The Brookline Master Plan provided insight on future development patterns (Section 2.1) and helped to inform the analysis and prioritization of mitigation actions (Section 4.3). The Brookline Emergency Operations Plan was also used to inform the analysis and prioritization of mitigation actions. The State of New Hampshire Multi-Hazard Mitigation Plan Update 2013 provided insight when developing the description of natural hazards (Section 3.1), description of previous hazards (Section 3.2), probability of future hazards (Section 3.3), vulnerability by hazard (Section 3.5), and goals to reduce vulnerabilities (Section 4.1). The City of Nashua's Comprehensive Emergency Management Plan was referenced to write the hazard descriptions used to determine Brookline's vulnerability by hazard (Section 3.5). Finally, the Nashua Regional Planning Commission's "Nashua Regional Water Resiliency Action Plan" provided insight when developing the description of natural hazards (Section 3.1), probability of future hazards (Section 3.3), vulnerability by hazard (Section 3.5), and goals to reduce vulnerabilities (Section 4.1). It was used to inform the analysis and prioritization of mitigation actions (Section 4.3).

Section 1.6 ~ Updating the Plan

The Town of Brookline is required to update its Hazard Mitigation Plan at least every five years. In order to monitor, evaluate, and update the Mitigation Strategies identified in Table 12—Implementation and Administration, the Brookline Hazard Mitigation Team will meet annually. The Brookline Emergency Management Director is responsible for initiating this review and will consult with members of the Brookline Hazard Mitigation Team and the community. During this meeting, the Team will identify mitigation actions that can be conducted in the current year as well as mitigation actions that will require budget requests for the following year. These mitigation actions will be monitored throughout the year by the Team.

Changes should be made to the Plan to accommodate projects that have failed or are not considered feasible after an evaluation and review for their consistency with the benefit cost analysis, STAPLEE analysis, timeframe, community's priorities, and funding resources. Mitigation strategies that were not ranked as priorities during the 2017 update should be reviewed as well during the monitoring, evaluation, and update of this Plan to determine feasibility of future implementation. New mitigation actions or plans proposed upon adoption of this Plan should follow the benefit cost and STAPLEE analysis methods utilized in this Plan to ensure consistency with the adopted Plan and to help the Hazard Mitigation Team evaluate overall potential for success.

In addition to this annual meeting, the Hazard Mitigation Team will meet after any hazard occurrence as part of the Town's debriefing exercise. The Hazard Mitigation Plan will be updated following this meeting to reflect changes in priorities and mitigation strategies that have resulted from the hazard event. It is especially important to incorporate updates within one year after a Presidential Disaster Declaration.

The Town of Brookline will utilize its website and local cable channel to notify members of the public about the annual Hazard Mitigation Plan Update meeting and to involve them in the update process. Any public input that is received will be incorporated into the Plan update. In addition, following its annual meeting, the Hazard Mitigation Team will report the results of its update process to the Brookline Board of Selectmen. The Board of Selectmen's meetings are open to the public and are also broadcast on Brookline Community Access TV.

CHAPTER 2. CHANGES FROM PREVIOUS PLAN

Section 2.1 ~ Changes in Development

There have been no significant changes in development patterns in Brookline since the 2012 Hazard Mitigation Plan. Most of the Town's commercial and industrial development continues to be located along Route 13 and Route 130. Residential development has increased slightly and is concentrated in a handful of locations. In 2012 there were 15 new home permits issued; 26 permits were issued in 2013, 21 permits in 2014, and 22 permits in 2015. However, there have been no significant changes in development that have occurred in hazard prone areas that have increased Brookline's vulnerability to hazards.

Brookline has decreased its vulnerability to flooding since the 2012 Plan by making culvert improvements at Hood Road and North Mason Road.

One change that should be noted is that in April 2013 the Brookline Police Department moved out of Brookline Town Hall and into the Safety Complex. This move provided the Police Department with much needed additional space and a greatly improved facility. They share the Safety Complex with the Brookline Ambulance Service.

Section 2.2 ~ Progress on Local Mitigation Efforts

The mitigation actions and implementation framework identified in the Brookline Hazard Mitigation Plan Update 2017 have been revised to reflect progress in local mitigation efforts. Progress has been made on a number of local mitigation efforts identified in the 2012 Plan, including create a regional communication system with radio interoperability on the same frequency; survey elderly population and develop database of information; install generator at Ball Hill Cell Tower; ensure the SMART develops a notification, evacuation, and contingency plan that addresses hazardous materials spills along the roads and neighboring water bodies; distribute Community Hazard Guides to the general public; reconfigure the intersections at South Main Street/State Rt. 13 and Cross Road/State Rt. 130; and upgrade radio communications systems for fire department.

In order to assess progress on local mitigation efforts, the Hazard Mitigation Team reviewed the actions originally presented in the Brookline Hazard Mitigation Plan 2012 and determined if they had been completed, deleted, or deferred. Progress on each action and its current priority level were also

evaluated to determine if it should continue to be included in the mitigation actions identified in this Plan update.

Table 1—Status of Previous Actions

Mitigation Action	Description	Status	Explanation
Review and update Building Codes, Floodplain Ordinance, and Zoning Regulations.	Updated regulations will strengthen structural integrity, limit floodplain development, and limit need for emergency response to damaged structures.	Deferred	This is a mitigation action (Prevention). This action will continue to be tracked in the Hazard Mitigation Plan Update 2017. This action will be completed as part of a town-wide regulatory audit to be conducted by NRPC in 2017.
Update and reformat the Emergency Operations Plan.	Provide emergency response service to access properties Town-wide	Deleted	Updates to the Town's Emergency Operation Plan are in-progress and will be completed in September 2017. Future updates will be tracked through the EOP update process and therefore will not be tracked in future hazard mitigation plans.
Create regional communication system with radio interoperability on the same frequency	Will assist with emergency evacuations and procedures	Completed	Brookline Police, Fire, and Ambulance have the ability to talk to each other. Police and Ambulance are on the same frequency and all three can dedicate a radio channel for emergency use. In addition, Brookline can communicate with other towns. Work is currently in progress to utilize multiple dispatch centers. Because this is a preparedness action it will not be tracked in future hazard mitigation plans.
Survey elderly population and develop database of information	Provide emergency services to address special elderly needs	Completed and ongoing (this action will be completed on an ongoing basis throughout the life of the plan)	This is a mitigation action (Public Education). Brookline's Emergency Management Director maintains an internal, confidential list of vulnerable residents. Although it has been completed, the database will need to be updated to account for changes in the population. As such, it will continue to be tracked in the Hazard Mitigation Plan Update 2017.

Mitigation Action	Description	Status	Explanation
Install generator at Ball Hill Cell Tower	Would provide a backup power source for emergency management communications in the event of an electrical outage	Completed	This is a mitigation action (Emergency Services Protection). Because it has been completed it will not be tracked in future hazard mitigation plans.
Establish culvert improvement projects to enhance evacuation capabilities especially on all Town roadways leading to evacuations routes	Protect conditions of roads proposed for evacuation	Completed	This is a mitigation action (Structural, Emergency Services Protection). Culvert improvements have been completed on Mason Rd and Hood Rd. Culvert repairs have been completed in Mason Rd. NH DOT has replaced culverts along NH 130 and will repair/clean Village Brook culverts in fall of 2017. Because it has been completed it will not be tracked in future hazard mitigation plans.
Ensure the SMART develops a notification, evacuation, and contingency plan that addresses hazardous materials spills along the roads and neighboring water bodies	Training emergency personnel on evacuation procedures in case of a spill	Completed	SMART (Souhegan Mutual Aid Response Team) completed their plan in 2016. Because this is a preparedness action it will not be tracked in future hazard mitigation plans.
Distribute Community Hazard Guides to the general public	Provide information in a booklet for the public, outlining preventative measures and what to do in an emergency. Include measures for property and structural protection, as well as emergency contact information.	Completed and ongoing (this action will be completed on an ongoing basis throughout the life of the plan)	This is a mitigation action (Public Education). Because new residents move into town and education is a lifelong process, this action will continue to be tracked in the Hazard Mitigation Plan Update 2017.
Compile a Lightning Evacuation Plan that addresses departmental responsibilities, evacuation procedure, and safety precautions	Lightning protection for elevated and/or exposed structures	Deleted	This is a mitigation action (Prevention). This action is no longer a priority. Each department and organization (ex. youth sports teams) has its own evacuation plan and procedures in place.

Mitigation Action	Description	Status	Explanation
Assess past flooding events around West Hill Rd	Would determine whether further mitigation measures need to be enacted to prevent future flooding issues	Deferred	This is a mitigation action (Structural). This action will continue to be tracked in the Hazard Mitigation Plan Update 2017.
Install a generator at Richard Maghakian Memorial School to provide backup electricity to the school's well, sewage system, kitchen, and gym	The installation of a generator would protect this facility and potential shelter and will enable emergency preparations to be conducted at additional sites	Deleted	This action is no longer a priority. Neither RMMS nor CSDA qualifies as shelter and CSDA has a generator. In emergency situations, Brookline residents would be sent to Nashua or Milford for shelter.
Reconfigure the intersections at Old Milford Road/State Rt. 13, South Main Street/State Rt. 13, and Cross Road/State Rt. 130	Would help address high rate of vehicular accidents along these heavily traveled intersections	Completed or Deleted	Old Milford Rd/Rt 13— deleted from future hazard mitigation plans, currently in 10 Year Transportation Plan to add left turn lane. South Main St/Rt 13—completed, conducted turning movement counts and made parking lot at liquor store 1 way in and out. Cross Rd/Rt 130—completed, traffic island installed spring 2017. Because this addresses manmade hazards and not natural hazards, it will not be tracked in future natural hazard mitigation plans.
Repair and upgrade Bond Street Bridge	Would address safety and flooding issues and increase the longevity of this important river crossing	Deferred	This is a mitigation action (Structural and Emergency Services Protection). Brookline hired an engineering firm in 2016 to develop a long term plan. At March 2017 Town Meeting voters approved a warrant article to establish the Bond St Bridge Engineering and Reconstruction Capital Reserve Fund to defray costs of engineering and reconstruction. Residents also voted to raise and appropriate $167,000 to be placed in the

Mitigation Action	Description	Status	Explanation
			fund. This action will continue to be tracked in the Hazard Mitigation Plan Update 2017.
Upgrade radio communications systems for fire department	Would improve overall communications with other municipal departments	Completed	Because this is a preparedness action it will not be tracked in future hazard mitigation plans.

Section 2.3 ~ Changes in Priorities

Many of the "mitigation" actions identified in Brookline's 2012 Hazard Mitigation Plan were actually preparedness actions. While preparedness actions are important, the Brookline Hazard Mitigation Plan Update 2017 will focus exclusively on mitigation actions. Therefore, only true mitigation actions from the 2012 Plan will be addressed here.

The following mitigation actions rose in priority level from the 2012 Plan to the 2017 Plan:

- Survey elderly population and develop database of information.
- Distribute Community Hazard Guides to the general public
- Repair and upgrade Bond Street Bridge

The following mitigation actions dropped in priority level from the 2012 Plan to the 2017 Plan:

- Review and update Building Codes, Floodplain Ordinance, and Zoning Regulations.
- Install generator at Ball Hill Cell Tower
- Establish culvert improvement projects to enhance evacuation capabilities especially on all Town roadways leading to evacuations routes
- Compile a Lightning Evacuation Plan that addresses departmental responsibilities, evacuation procedure, and safety precautions
- Assess past flooding events around West Hill Rd

Table 2—Changes in Mitigation Priorities

2012 Mitigation Action	Current Status	Priority Level in 2012 Plan	Priority Level in 2017 Plan
Review and update Building Codes,	Deferred	STAPLEE Score = 19	STAPLEE Score = 10

2012 Mitigation Action	Current Status	Priority Level in 2012 Plan	Priority Level in 2017 Plan
Floodplain Ordinance, and Zoning Regulations.		Rank = 2 out of 6	Rank = 8 out of 13
Survey elderly population and develop database of information.	Completed and ongoing (this action will be completed on an ongoing basis throughout the life of the plan)	STAPLEE Score = 17 Rank = 3 out of 6	STAPLEE Score = 15 Rank = 5 out of 13
Install generator at Ball Hill Cell Tower	Completed	STAPLEE Score = 19 Rank = 2 out of 6	This action has been completed and is no longer considered a priority. A similar action was not identified in the 2017 Plan update.
Establish culvert improvement projects to enhance evacuation capabilities especially on all Town roadways leading to evacuations routes	Deferred	STAPLEE Score = 17 Rank = 3 out of 6	This action has been completed and is no longer considered a priority. A similar action was not identified in the 2017 Plan update.
Distribute Community Hazard Guides to the general public	Completed and ongoing (this action will be completed on an ongoing basis throughout the life of the plan)	STAPLEE Score = 17 Rank = 3 out of 6	STAPLEE Score = 16 Rank = 3 out of 13
Compile a Lightning Evacuation Plan that addresses departmental responsibilities, evacuation procedure, and safety precautions	Deleted	STAPLEE Score = 13 Rank = 5 out of 6	This action has been deleted and is no longer considered a priority. A similar action was not identified in the 2017 Plan update.
Assess past flooding events around West Hill Rd	Deferred	STAPLEE Score = 15 Rank = 4 out of 6	STAPLEE Score = 6 Rank = 12 out of 13
Repair and upgrade Bond Street Bridge	Deferred	STAPLEE Score = 13	STAPLEE Score = 18

2012 Mitigation Action	Current Status	Priority Level in 2012 Plan	Priority Level in 2017 Plan
		Rank = 5 out of 6	Rank = 1 out of 13

CHAPTER 3. HAZARD IDENTIFICATION AND RISK ASSESSMENT

Section 3.1 ~ Description of Natural Hazards

The Town of Brookline is susceptible to a variety of natural hazards, which are outlined in Table 3. For each hazard type, the hazard location within the Town, extent, and impact are also noted. Extent refers to how bad the hazard can be; it is not the same as location. Examples of extent include potential wind speed, depth of flooding, and existing scientific scales (ex. Fujita Tornado Damage Scale). Impact refers to damages or consequences resulting from the hazard.

Landslides and snow avalanches have not been included in the Brookline Hazard Mitigation Plan Update 2017. "A landslide is the downward or outward movement of slope forming materials reacting under the force of debris slides and earth flows" (State of NH Multi-Hazard Mitigation Plan Update 2013, pg 56). "A snow avalanche is a slope failure consisting of a mass of rapidly moving, fluidized snow that slides down a mountainside" (State of NH Multi-Hazard Mitigation Plan Update 2013, pg 77). While Brookline does have areas of hilly terrain, there have been no historic landslide or snow avalanche events in town. As such, the Hazard Mitigation Team did not feel it was necessary to include these hazards in this Plan.

Table 3—Natural Hazards in Jurisdiction

Hazard Type	Hazard Location within Jurisdiction	Hazard Extent	Impact
Climate Change	Entire jurisdiction.	See Hazard Extent descriptions for Drought, Extreme Temperatures, Flooding	See Impact descriptions for Drought, Extreme Temperatures, Flooding
Drought	Entire jurisdiction.	<u>NH DES Drought Management Plan</u> • Level 1—Alert • Level 2—Warning • Level 3—Emergency • Level 4—Disaster <u>US Drought Monitor</u> • D0—Abnormally Dry • D1—Moderate Drought • D2—Severe Drought • D3-Extreme Drought • D4—Exceptional Drought	<u>D0</u> • short term dryness slowing planting, growth of crops • some lingering water deficits • crops not fully recovered <u>D1</u> • some damage to crops • streams, reservoirs, or wells low, some water shortages developing or imminent

Hazard Type	Hazard Location within Jurisdiction	Hazard Extent	Impact
		• S—Short term, typically less than 6 months • L—Long term, typically more than 6 months	• voluntary water-use restrictions requested <u>D2</u> • crop losses likely • water shortages common • water restrictions imposed <u>D3</u> • major crop losses • widespread water shortages or restrictions <u>D4</u> • Exceptional & widespread crop loss • Shortages of water in reservoirs, streams, & wells creating water emergencies <u>S</u> • impacts on agriculture <u>L</u> • impacts on hydrology & ecology
Earthquake	Entire jurisdiction.	<u>Richter Scale</u> • <3.4—detected only by seismometers • >8—total damage, surface waves seen, objects thrown in air For full definitions of Richter Scale, see Section 3.5 Vulnerability by Hazard	Structural damage or collapse of buildings. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, 911 communications, radio system. Loss of water for fire protection. Increased risk of fire (gas break). Risk to life, medical surge.
Extreme Temperatures	Entire jurisdiction.	Extreme heat—period of 3 consecutive days when air temperature reaches 90°F or higher on each day. Extreme cold— period of 3 consecutive days of minimum temperatures at or below 0°F.	Overburdened power systems may experience failures due to extreme heat. Shortages of heating fuel in extreme cold due to high demand. Medical surge. Loss of municipal water supply

Hazard Type	Hazard Location within Jurisdiction	Hazard Extent	Impact
			for drinking water and fire protection due to freezing temperatures.
Flooding	Floodplains cover approximately 7.6% of Brookline—7.6% of Brookline is located in 1% annual floodplain and 0% of Brookline is located in the 0.2% annual floodplain. Areas prone to flooding include: • West Hill Rd • Dupaw Gould Rd • Mason Rd by Lake Potanipo bridge • Main St at General Store • Bohannon Bridge • Bond St at Nissitissit River See Section 3.5 for additional information on flood-prone areas.	FEMA flood probabilities: • 1% possibility per year • 0.2% possibility per year State of NH Dam Hazard Potential Classification system (for flooding resulting from dam/levee failure): • Class S—significant hazard • Class H—high hazard • Class L—low hazard • Class NM—non-menace For full definitions of Dam Hazard Classes, see Section 3.5 Vulnerability by Hazard	Water damage to structures and their contents. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, 911 communications, radio system. Environmental hazards resulting from damage. Isolation of neighborhoods resulting from flooding.
Lightning	Entire jurisdiction. Areas with large populations present outdoors and large open spaces are particularly vulnerable.	Lightning Activity Level: • Level 1 • Level 2 • Level 3 • Level 4 • Level 5 • Level 6 For full definitions of Lightning Activity Level, see Section 3.5 Vulnerability by Hazard	Smoke and fire damage to structures and property. Disruption to power lines, municipal communications, and 911 communications. Damage to critical electronic equipment. Injury or death to people involved in outdoor activity.
Severe Wind	Entire jurisdiction.	Saffir-Simpson Hurricane Wind Scale: • Category 1—sustained winds 74-95 mph • Category 2—sustained winds 96-	Wind damage to structures and trees. Water damage to structures

Hazard Type	Hazard Location within Jurisdiction	Hazard Extent	Impact
		110 mph • Category 3—sustained winds 111-129 mph • Category 4—sustained winds 130-156 mph • Category 5—sustained winds 157 mph or higher	and their contents. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, 911 communications, radio system. Environmental hazards resulting from damage. Isolation of neighborhoods resulting from flooding. Water pressure, quality, and capacity issues impacting fire protection. Loss of natural resources.
Severe Winter Weather	Entire jurisdiction.	Depth of snow in a given time frame (ex. 2 or more inches per hour over a 12 hour period). Blizzard—violent snowstorm with minimum winds of 35 mph and visibility less than ¼ mile for 3 hours. Ground snow load factor. Ice Storm—Sperry-Piltz Ice Accumulation Index: • 0—little impact • 5—catastrophic damage to exposed utility systems For full definitions of Sperry-Plitz Ice Accumulation Index, see Section 3.5 Vulnerability by Hazard	Disruption to road network. Damage to trees municipal communications, and 911 communications. Structural damage to roofs/collapse. Increase in CO, other hazards.
Tornado/Downburst	Entire jurisdiction.	Fujita Tornado Damage Scale: • F0—winds <73 mph • F1—winds 73-112 mph • F2—winds 113-157 mph • F3—winds 158-206 mph • F4—winds 207-260 mph • F5—winds 261-318 mph	Wind damage to structures and trees. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, 911 communications, radio system. Environmental hazards

Hazard Type	Hazard Location within Jurisdiction	Hazard Extent	Impact
			resulting from damage. Medical surge. Loss of natural resources.
Wildfire	Areas particularly prone to wildfire include forested areas near residential development.	NWCG Fire Size Classification: • A—greater than 0 but less than or equal to 0.25 acres • B—0.26 to 9.9 acres • C—10.0 to 99.9 acres • D—100-299 acres • E—300 to 999 acres • F—1,000 to 4,999 acres • G—5,000 to 9,999 acres • H—10,000 to 49,999 acres • I—50,000 to 99,999 acres • J—100,000 to 499,999 acres • K—500,000 to 999,999 acres • L—1,000,000+ acres	Smoke and fire damage to structures in wild land/urban interface. Damage to habitat. Impacts to air quality. Impact to roadways. Loss of natural resources.

Section 3.2 ~ Description of Previous Hazards

The first step in determining the probability of future hazard events in the Town of Brookline is to examine the location, extent, and impact of previous hazards. If a hazard event has not occurred within Brookline but has occurred in the region it is also noted.

Table 4—Previous Occurrences of Hazards in Jurisdiction

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
Climate Change	It is beyond the scope of this Plan to determine if a specific hazard event was the result of Climate Change.			
Drought	1960-1969	Entire jurisdiction	Long term drought—9 years of less than normal precipitation	Farms had minimal grass for grazing animals and poor crops. Wells went dry for 2 consecutive years in mid-1960s.
Drought	1999	Entire jurisdiction	Level 2—Warning. Drought warning issued on June 29, 1999.	Damage to crops. Low water levels in dug wells.

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
Drought	March 2002	Entire jurisdiction	Level 3—Emergency. First time Level 3 Drought Impact Level had been declared.	Damage to crops. Low water levels in dug wells.
Drought	2016	Entire jurisdiction	USDA D2 (Severe Drought)	Brookline BOS utilized RSA 41:11-d to restrict all residential lawn watering. Low water levels in wells.
Earthquake		There have been no earthquakes centered in Brookline to date. Earthquakes noted below were centered in NH.	Earthquakes noted below had a magnitude of 2.5 or greater.	
Earthquake	March 18, 1926	Manchester, NH	No historic data on extent	Intensity V effects observed in Amherst, Lyndeborough, Manchester, Mason, and Wilton.
Earthquake	December 20, 1940	Lake Ossipee, NH	Magnitude 5.5 on Richter Scale	No damage in Brookline
Earthquake	December 24, 1940	Lake Ossipee, NH	Magnitude 5.5 on Richter Scale	No damage in Brookline
Earthquake	December 4, 1963	Laconia, NH (43.6 latitude, -71.5 longitude)	Magnitude 3.7 on Richter Scale	No damage in Brookline
Earthquake	June 28, 1981	Sanbornton, NH (43.56 latitude, -71.56 longitude)	Magnitude 3.0 on Richter Scale	No damage in Brookline
Earthquake	January 19, 1982	Sanbornton, NH (43.5 latitude, -71.6 longitude)	Magnitude 4.7 on Richter Scale	No damage in Brookline
Earthquake	October 25, 1986	Northfield, NH (43.399 latitude, -71.59 longitude)	Magnitude 3.9 on Richter Scale	No damage in Brookline
Earthquake	October 20, 1988	Milan, NH (44.539 latitude, -71.158 longitude)	Magnitude 3.9 on Richter Scale	No damage in Brookline
Earthquake	November 22, 1988	Milan, NH (44.557 latitude, -71.183 longitude)	Magnitude 3.2 on Richter Scale	No damage in Brookline
Earthquake	April 6, 1989	Berlin, NH (44.511 latitude, -71.144 longitude)	Magnitude 3.5 on Richter Scale	No damage in Brookline

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
Earthquake	October 6, 1992	Canterbury, NH (43.324 latitude, -71.578 longitude)	Magnitude 3.4 on Richter Scale	No damage in Brookline
Earthquake	June 16, 1995	Lyman, NH (44.286 latitude, -71.915 longitude)	Magnitude 3.8 on Richter Scale	No damage in Brookline
Earthquake	August 21, 1996	Bartlett, NH (44.184 latitude, -71.352 longitude)	Magnitude 3.8 on Richter Scale	No damage in Brookline
Earthquake	January 27, 2000	Raymond, NH (43.00 latitude, -71.18 longitude)	Magnitude 3.0 on Richter Scale	No damage in Brookline
Earthquake	September 26, 2010	Boscawen, NH (43.2915 latitude, -71.6568 longitude)	Magnitude 3.4 on Richter Scale	No damage in Brookline
Earthquake	October 11, 2013	Contoocook, NH (43.255 latitude, -71.747 longitude)	Magnitude 2.6 on Richter Scale	No damage in Brookline
Earthquake	March 21, 2016	Contoocook, NH (43.264 latitude, -71.767 longitude)	Magnitude 2.8 on Richter Scale	No damage in Brookline
Earthquake		Earthquakes noted below were centered outside of NH but were felt by NH municipalities.		
Earthquake	November 18, 1929	Grand Banks, Newfoundland	Magnitude 7.2 on Richter Scale	No damage in Brookline
Earthquake	November 1, 1935	Timiskaming, Canada	Magnitude 6.25 on Richter Scale	No damage in Brookline
Earthquake	June 15, 1973	Near Canadian/NH border	Magnitude 4.8 on Richter Scale	No damage in Brookline
Earthquake	June 23, 2010	Buckingham, Quebec, Canada	Magnitude 5.0 on Richter Scale	No damage in Brookline
Earthquake	August 23, 2011	Washington, DC	Magnitude 5.8 on Richter Scale	No damage in Brookline
Earthquake	October 16, 2012	Hollis Center, ME	Magnitude 4.0 on Richter Scale	No damage in Brookline
Extreme Temperature (Cold)	January 16-20, 2000	Entire jurisdiction	5 consecutive days of minimum temperatures at or below 0°F: • 1/16/00: -3°F • 1/17/00: -2°F • 1/18/00: -5°F • 1/19/00: -6°F • 1/20/00: -4°F	No known impact in Brookline
Extreme Temperature (Cold)	January 28-30, 2000	Entire jurisdiction	3 consecutive days of minimum	No known impact in Brookline

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			temperatures at or below 0°F: • 1/28/00: -6°F • 1/29/00: -2°F • 1/30/00: -4°F	
Extreme Temperature (Cold)	January 18-20, 2003	Entire jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 1/18/00: -9°F • 1/19/00: -11°F • 1/20/00: -11°F	No known impact in Brookline
Extreme Temperature (Cold)	January 28-31, 2003	Entire jurisdiction	4 consecutive days of minimum temperatures at or below 0°F: • 1/28/03: -9°F • 1/29/03: -5°F • 1/30/03: -0°F • 1/31/03: -0°F	No known impact in Brookline
Extreme Temperature (Cold)	February 13-17, 2003	Entire jurisdiction	5 consecutive days of minimum temperatures at or below 0°F: • 2/13/03: -3°F • 2/14/03: -11°F • 2/15/03: -10°F • 2/16/03: -7°F • 2/17/03: -2°F	No known impact in Brookline
Extreme Temperature (Cold)	February 26-28, 2003	Entire jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 2/26/03: -4°F • 2/27/03: -6°F • 2/28/03: -1°F	No known impact in Brookline
Extreme Temperature (Cold)	January 9-12, 2004	Entire jurisdiction	4 consecutive days of minimum temperatures at or below 0°F: • 1/9/04: -7°F • 1/10/04: -8°F • 1/11/04: -8°F • 1/12/04: -7°F	No known impact in Brookline
Extreme Temperature (Cold)	January 14-17, 2004	Entire jurisdiction	4 consecutive days of minimum temperatures at or below 0°F: • 1/14/04: -10°F	Wind chills of -30°F, 6 fatalities in NH

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			• 1/15/04: -10°F • 1/16/04: -12°F • 1/17/04: -9°F	
Extreme Temperature (Cold)	January 24-27, 2004	Entire jurisdiction	4 consecutive days of minimum temperatures at or below 0°F: • 1/24/04: -4°F • 1/25/04: -6°F • 1/26/04: -6°F • 1/27/04: -0°F	No known impact in Brookline
Extreme Temperature (Cold)	January 18-25, 2005	Entire jurisdiction	8 consecutive days of minimum temperatures at or below 0°F: • 1/18/05: 0°F • 1/19/05: -8°F • 1/20/05: -3°F • 1/21/05: -5°F • 1/22/05: -12°F • 1/23/05: -9°F • 1/24/05: 0°F • 1/25/05: -1°F	No known impact in Brookline
Extreme Temperature (Cold)	January 28-30, 2005	Entire jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 2/28/05: -1°F • 2/29/05: -7°F • 2/30/05: -5°F	No known impact in Brookline
Extreme Temperature (Cold)	January 16-18, 2009	Entire jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 1/16/09: -16°F • 1/17/09: -16°F • 1/18/09: -9°F	No known impact in Brookline
Extreme Temperature (Cold)	January 25-27, 2009	Entire jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 1/25/09: -7°F • 1/26/09: -7°F • 1/27/09: -5°F	No known impact in Brookline
Extreme Temperature (Cold)	January 15-18, 2011	Entire jurisdiction	4 consecutive days of minimum temperatures at or below 0°F: • 1/15/11: -6°F	No known impact in Brookline

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			• 1/16/11: -5°F • 1/17/11: 0°F • 1/18/11: -2°F	
Extreme Temperature (Cold)	January 23-27, 2011	Entire jurisdiction	5 consecutive days of minimum temperatures at or below 0°F: • 1/23/05: -5°F • 1/24/05: -10°F • 1/25/05: -9°F • 1/26/05: -3°F • 1/27/05: -2°F	No known impact in Brookline
Extreme Temperature (Cold)	January 15-17, 2012	Entire jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 1/15/12: -2°F • 1/16/12: -2°F • 1/17/12: 0°F	No known impact in Brookline
Extreme Temperature (Cold)	February 11-13, 2014	Entire Jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 2/11/14: -7°F • 2/12/14: -7°F • 2/13/14: -7°F	No known impact in Brookline
Extreme Temperature (Cold)	February 1-4, 2015	Entire Jurisdiction	4 consecutive days of minimum temperatures at or below 0°F: • 2/1/15: 0°F • 2/2/15: 0°F • 2/3/15: -3°F • 2/4/15: -2	No known impact in Brookline
Extreme Temperature (Cold)	February 14-19, 2015	Entire Jurisdiction	6 consecutive days of minimum temperatures at or below 0°F: • 2/14/15: -7°F • 2/15/15: -4°F • 2/16/15: -5°F • 2/17/15: -2°F • 2/18/15: -3°F • 2/19/15: -4°F	No known impact in Brookline
Extreme Temperature (Cold)	February 14-16, 2016	Entire Jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 2/14/16: -11°F	No known impact in Brookline

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			• 2/15/16: -9°F • 2/16/16: -9°F	
Extreme Temperature (Heat)	May 3-5, 2001	Entire jurisdiction*	3 consecutive days of temperatures above 90°F: • 5/3/01—93°F • 5/4/01—92°F • 5/5/01—92°F	No known impact in Brookline
Extreme Temperature (Heat)	June 15-17, 2001	Entire jurisdiction	3 consecutive days of temperatures above 90°F: • 6/15/01—92°F • 6/16/01—95°F • 6/17/01—91°F	No known impact in Brookline
Extreme Temperature (Heat)	July 22-26, 2001	Entire jurisdiction	5 consecutive days of temperatures above 90°F: • 7/22/01—90°F • 7/23/01—90°F • 7/24/01—92°F • 7/25/01—95°F • 7/26/01—93°F	No known impact in Brookline
Extreme Temperature (Heat)	August 7-10, 2001	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 8/7/01—94°F • 8/8/01—97°F • 8/9/01—96°F • 8/10/01—100°F	No known impact in Brookline
Extreme Temperature (Heat)	July 2-5, 2002	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 7/2/02—90°F • 7/3/02—95°F • 7/4/02—98°F • 7/5/02—97°F	No known impact in Brookline
Extreme Temperature (Heat)	July 30-August 2, 2002	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 7/30/02—90°F • 7/31/02—91°F • 8/1/02—91°F • 8/2/02—93°F	No known impact in Brookline
Extreme Temperature (Heat)	August 13-20, 2002	Entire jurisdiction	8 consecutive days of temperatures above 90°F: • 8/13/02—94°F	No known impact in Brookline

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			• 8/14/02—96°F • 8/15/02—98°F • 8/16/02—95°F • 8/17/02—94°F • 8/18/02—92°F • 8/19/02—94°F • 8/20/02—92°F	
Extreme Temperature (Heat)	June 25-28, 2003	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 6/25/03—90°F • 6/26/03—93°F • 6/27/03—92°F • 6/28/03—92°F	No known impact in Brookline
Extreme Temperature (Heat)	July 5-7, 2003	Entire jurisdiction	3 consecutive days of temperatures above 90°F: • 7/5/03—91°F • 7/6/03—90°F • 7/7/03—91°F	No known impact in Brookline
Extreme Temperature (Heat)	July 17-19, 2006	Entire jurisdiction	3 consecutive days of temperatures above 90°F: • 7/17/06—90°F • 7/18/06—93°F • 7/19/06—94°F	No known impact in Brookline
Extreme Temperature (Heat)	August 2-4, 2006	Entire jurisdiction	3 consecutive days of temperatures above 90°F: • 8/2/06—96°F • 8/3/06—97°F • 8/4/06—92°F	No known impact in Brookline
Extreme Temperature (Heat)	August 16-20, 2006	Entire jurisdiction	5 consecutive days of temperatures above 90°F: • 8/16/09—90°F • 8/17/09—90°F • 8/19/09—91°F • 8/19/09—93°F • 8/20/09—90°F	No known impact in Brookline
Extreme Temperature (Heat)	July 4-10, 2010	Entire jurisdiction	7 consecutive days of temperatures above 90°F: • 7/4/10—90°F • 7/5/10—90°F • 7/6/10—97°F • 7/7/10—98°F • 7/8/10—97°F • 7/9/10—92°F	No known impact in Brookline

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			• 7/10/10—92°F	
Extreme Temperature (Heat)	July 17-20, 2010	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 7/17/10—93°F • 7/18/10—93°F • 7/19/10—93°F • 7/20/10—90°F	No known impact in Brookline
Extreme Temperature (Heat)	August 30-Sept. 3, 2010	Entire jurisdiction	5 consecutive days of temperatures above 90°F: • 8/30/10—92°F • 8/31/10—91°F • 9/1/10—94°F • 9/2/10—95°F • 9/3/10—96°F	No known impact in Brookline
Extreme Temperature (Heat)	July 21-24, 2011	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 7/21/11—92°F • 7/22/11—96°F • 7/23/11—101°F • 7/24/11—96°F	No known impact in Brookline
Extreme Temperature (Heat)	June 21-23, 2012	Entire jurisdiction	3 consecutive days of temperatures above 90°F: • 6/21/12—96°F • 6/22/12—94°F • 6/23/12—93°F	No known impact in Brookline
Extreme Temperature (Heat)	July 13-16, 2012	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 7/13/12—92°F • 7/14/12—92°F • 7/15/12—93°F • 7/16/12—91°F	No known impact in Brookline
Extreme Temperature (Heat)	August 3-6, 2012	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 8/3/12—91°F • 8/4/12—94°F • 8/5/12—95°F • 8/6/12—93°F	No known impact in Brookline
Extreme Temperature (Heat)	June 1-3, 2013	Entire jurisdiction	3 consecutive days of temperatures above 90°F: • 6/1/13—93°F • 6/2/13—92°F	No known impact in Brookline

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			• 6/3/13—91°F	
Extreme Temperature (Heat)	July 16-21, 2013	Entire jurisdiction	6 consecutive days of temperatures above 90°F: • 7/16/13—90°F • 7/17/13—91°F • 7/18/13—93°F • 7/19/13—93°F • 7/20/13—96°F • 7/21/13—91°F	No known impact in Brookline
Extreme Temperature (Heat)	July 29-31, 2015	Entire Jurisdiction	3 consecutive days of temperatures above 90°F: • 7/29/15—93°F • 7/30/15—94°F • 7/31/15—90°F	No known impact in Brookline
Extreme Temperature (Heat)	August 16-20, 2015	Entire Jurisdiction	5 consecutive days of temperatures above 90°F: • 8/16/15—90°F • 8/17/15—90°F • 8/18/15—91°F • 8/19/15 – 93°F • 8/20/15 – 90°F	No known impact in Brookline
Extreme Temperature (Heat)	September 2-4, 2015	Entire Jurisdiction	3 consecutive days of temperatures above 90°F: • 9/2/15—91°F • 9/3/15—92°F • 9/4/15—92°F	No known impact in Brookline
Extreme Temperature (Heat)	September 7-11, 2015	Entire Jurisdiction	5 consecutive days of temperatures above 90°F: • 9/7/15—90°F • 9/8/15—94°F • 9/9/15—94°F • 9/10/15 – 94°F • 9/11/15 – 93°F	No known impact in Brookline
Extreme Temperature (Heat)	July 22-29, 2016	Entire Jurisdiction	8 consecutive days of temperatures above 90°F: • 7/22/16—95°F • 7/23/16—93°F • 7/24/16—93°F • 7/25/16—92°F • 7/26/16—96°F • 7/27/16—96°F • 7/28/16—93°F • 7/29/16—93°F	No known impact in Brookline

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
Flooding	1927	Hillsborough County	No data on extent available	Damage to road network. Mason Road in Brookline flooded and bridge out.
Flooding	March 11-21, 1936	Hillsborough County	25-50 year recurrence interval	$133,000,000 in property damage and 77,000 homeless throughout New England. Primary impact to structures, infrastructure, and road network. Flooding caused by heavy snowfall totals, heavy rains, and warm weather. Impact listed here are general to Hillsborough County. Specific impacts to Brookline are unknown.
Flooding	July 11, 1973	Hillsborough County	No data on extent available	FEMA Disaster Declaration #399. Specific impacts to Brookline are unknown.
Flooding	July 29-August 10, 1986	Hillsborough County	No data on extent available	FEMA Disaster Declaration #771. Dupaw Gould bridge and North Mason Road bridge in Brookline washed out. Hundreds of tires floated down Nissitissit River near Bahannon bridge in Brookline. DOT worked with Brookline to rebuild and improve Dupaw Gould bridge. Many roads impassable in Hillsborough County.
Flooding	March 30-April 11,	Hillsborough County	25-50+ year	$4,888,889 in

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
	1987		recurrence interval	damage in NH. FEMA Disaster Declaration #789. Primary impact to agricultural fields in Hillsborough County. Specific impacts to Brookline are unknown.
Flooding	August 7-11, 1990	Hillsborough County	No data on extent available	$2,297,777 in damage in NH. FEMA Disaster Declaration #876. Primary impact to infrastructure in Hillsborough County. North Mason Road in Brookline closed and bridge out.
Flooding	March 11-21, 1996	Dupaw Gould Road area of Brookline	No data on extent available	Dupaw Gould bridge in Brookline out.
Flooding	October 20-23, 1996	Hillsborough County	No data on extent available	$2,341,273 in damage in NH. FEMA Disaster Declaration #1144. Primary impact to structures and infrastructure in Hillsborough County. Specific impacts to Brookline are unknown.
Flooding	July 2, 1998	Hillsborough County	No data on extent available	$3,400,000 in damage in NH, 6 counties impacted including Hillsborough. FEMA Disaster Declaration #1231. Primary impact to structures and infrastructure in Hillsborough County. Specific impacts to Brookline are unknown.
Flooding	October 26, 2005	Hillsborough County	50-100 year recurrence interval	5 counties impacted in NH, including Hillsborough. FEMA

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
				Disaster Declaration #1610. Primary impact to structures and infrastructure in Hillsborough County. Specific impacts to Brookline are unknown.
Flooding	May 12-23, 2006	Hillsborough County	As much as 14 inches of rainfall in region. 100-500 year recurrence interval.	7 counties impacted in NH, including Hillsborough. FEMA Disaster Declaration #1643. Specific impacts to Brookline are unknown.
Flooding	April 15, 2007	Hillsborough County	100-500 year recurrence interval	$27,000,000 in damages in NH; 2,005 home owners and renters applied for assistance in NH. FEMA Disaster Declaration #1695. Primary impact to structures and infrastructure in Hillsborough County. Specific impacts to Brookline are unknown.
Flooding	September 6-7, 2008	Hillsborough County	50-100 year recurrence interval	$6.90 per capita in damages in Hillsborough County. FEMA Disaster Declaration #1799 Primary impact to structures and infrastructure in Hillsborough County. Specific impacts to Brookline are unknown.
Flooding	March 14, 2010	Hillsborough County	50-100 year recurrence interval	$1,880,685 in FEMA public assistance in NH; $1.80 per capita in Hillsborough County. Flooding near Johnson Corner due to undersized

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
				culvert. FEMA Disaster Declaration #1913 Primary impact to roads and bridges in Hillsborough County. Specific impacts to Brookline are unknown.
Flooding	May 26, 2011	Hazard was not experienced in jurisdiction.	N/A	Disaster Declaration #4006. No impact to Brookline.
Flooding	May 29, 2012	Hazard was not experienced in jurisdiction.	N/A	Disaster Declaration #4065. No impact to Brookline.
Flooding	June 26, 2013	Hazard was not experienced in jurisdiction.	N/A	Disaster Declaration #4139. No impact to Brookline.
Severe Wind	Great Hurricane of 1938	Hillsborough County	No data on extent available	$12,337,643 total damages (not adjusted for inflation), 13 deaths and 494 injuries in NH. Damage to road network and structures caused by flooding.
Severe Wind	August 31, 1954 (Carol)	Hillsborough County	Saffir-Simpson Scale Category 3.	Extensive tree and crop damage.
Severe Wind	September 12, 1960 (Donna)	Hillsborough County	Saffir-Simpson Scale Category 3	Water damage to structures due to flooding.
Severe Wind	September 27, 1985 (Gloria)	Hillsborough County	Saffir-Simpson Scale Category 2	Damage to trees and power lines from high winds.
Severe Wind	August 19, 1991 (Bob)	Hillsborough County	Saffir-Simpson Scale Category 1	FEMA Disaster Declaration #917. Damage to structures, trees, and power lines from high winds.
Severe Wind	September 16-18, 1999 (Floyd)	Hillsborough County	Tropical Storm (winds 39-73 mph)	FEMA Disaster Declaration #1305. Primary impact to trees, infrastructure, and road network.
Severe Wind	February 17-18, 2006	Brookline	No data on extent available	Trees down. Much of Town without power. Emergency

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
				Operations Center remained open to provide shelter and food for any of the 649 families without power.
Severe Wind	August 28, 2011 (Irene)	Hillsborough County	Tropical Storm (winds 39-73 mph).	FEMA Disaster Declaration #4026. Damage to trees and power lines from high winds. Flash floods.
Severe Wind	October 26, 2012 (Sandy)	Hillsborough County	Tropical Storm (winds 39-73 mph).	FEMA Disaster Declaration #4095. Minimal damage.
Lightning	There has been no significant damage from lightning in Brookline to-date.			
Severe Winter Weather	March 11-14, 1888	Entire jurisdiction	30-50 inches of snow	No historic data on impact
Severe Winter Weather	1922	Entire jurisdiction	No historic data on extent	Extreme snow drifts paralyzed road network.
Severe Winter Weather	February 14-15, 1940	Entire jurisdiction	Over 30 inches of snow	Snow and high winds paralyzed road network.
Severe Winter Weather	February 14-17, 1958	Entire jurisdiction	20-33 inches of snow	Primary impact to road network.
Severe Winter Weather	March 18-21, 1958	Entire jurisdiction	22-24 inches of snow	Primary impact to road network.
Severe Winter Weather	March 2-5, 1960	Entire jurisdiction	Up to 25 inches of snow	Primary impact to road network.
Severe Winter Weather	January 18-20, 1961	Entire jurisdiction	Up to 25 inches of snow	Blizzard conditions paralyze road network.
Severe Winter Weather	February 22-28, 1969	Entire jurisdiction	24-98 inches of snow in Central NH	Primary impact to road network. Slow moving storm.
Severe Winter Weather	December 25-28, 1969	Entire jurisdiction	12-18 inches of snow	Primary impact to road network.
Severe Winter Weather	January 19-21, 1978	Entire jurisdiction	Up to 16 inches of snow	Primary impact to road network.
Severe Winter Weather	February 5-7, 1978 (Blizzard of ’78)	Entire jurisdiction	25-33 inches of snow	Snow paralyzed road network, trapped commuters in cars, and forced closure of businesses.

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
Severe Winter Weather	April 5-7, 1982	Entire jurisdiction	18-22 inches of snow	Primary impact to road network.
Severe Winter Weather	March, 1983	Entire jurisdiction	Over 18 inches of snow, 30-40 mph winds	Snow paralyzed road network and forced closure of businesses.
Severe Winter Weather	December 1996	Entire jurisdiction	14 inches of snow	Damage to power lines forces closure of businesses. Heavy wet snow caused many trees to come down. Power outage for 5 days.
Severe Winter Weather	January 7, 1998	Entire jurisdiction	Ice storm, no data on extent available	$12,446,202 in total damages, 1 death and 6 injuries in NH. $17,000,000 in damages to PSNH equipment. FEMA Disaster Declaration #1199. 20 major road closures; 67,586 without power; 2,310 without phone service; 1 communication tower failure.
Severe Winter Weather	January 24, 1998	Entire jurisdiction	No data on extent available	17 power lines down in Brookline
Severe Winter Weather	December 11, 2008	Entire jurisdiction	Ice storm, no data on extent available	$10,383,602 in FEMA public assistance in NH; $6.35 per capita in Hillsborough County. FEMA Disaster Declaration #1812 Damage to power and phone lines and trees.
Severe Winter Weather	February 23, 2010	Entire jurisdiction	Snow followed by rainfall between 2-6 inches. Winds over 70 mph.	$6,268,179 in FEMA public assistance in NH; $3.68 per capita in Hillsborough County. FEMA Disaster Declaration #1892 Damage to power

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
				and phone lines, trees, and road network. Over 330,000 customers without power state-wide.
Severe Winter Weather	October 29-30, 2011	Entire jurisdiction	15-20 inches of snow.	$3,052,769 in FEMA public assistance in NH; $5.11 per capita in Hillsborough County. FEMA Disaster Declaration #4049 Damage to power and phone lines, trees, and road network.
Severe Winter Weather	February 8-10, 2013	Entire jurisdiction	Snowfall totals of 12-18 inches across region, up to 30 inches in parts of NH. Winds 10-20 mph with gusts up to 40 mph. Visibility less than ¼ mile.	FEMA Disaster Declaration #4105
Severe Winter Weather	January 26-28, 2015	Entire jurisdiction.	Snowfall totals of 18-24 inches across region. Winds 35 mph. Visibility 0.	$3,293,059 in FEMA public assistance in NH; $3.88 per capita in Hillsborough County. FEMA Disaster Declaration DR-4209.
Tornado		There have been no tornados originating in Brookline to date. Tornados noted below originated in Hillsborough Co, NH.		
Tornado	July 2, 1961	Northern Hillsborough Co, originated near Weare, NH	Fujita Scale F2	0 fatalities, 0 injuries
Tornado	July 21, 1961	Central Hillsborough Co, originated near New Boston, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	May 9, 1963	Northeastern, Hillsborough Co, originated near Goffstown, NH	Fujita Scale F1	0 fatalities, 0 injuries

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
Tornado	May 20, 1963	Western Hillsborough Co, originated near Peterborough, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	June 9, 1963	Northeastern Hillsborough Co, originated near Manchester, NH	Fujita Scale F2	0 fatalities, 0 injuries
Tornado	August 28, 1965	Eastern Hillsborough Co, originated near Litchfield, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	July 19, 1966	Southern Hillsborough Co, originated near Amherst, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	July 17, 1968	Central Hillsborough Co, originated near Wilton, NH	Fujita Scale F2	0 fatalities, 0 injuries
Tornado	August 20, 1968	Northeastern Hillsborough Co, originated near Manchester, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	July 19, 1972	Southeastern Hillsborough Co, originated near Hudson, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	July 5, 1984	Western Hillsborough Co, originated near Harrisville, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	July 5, 1984	Southeastern Hillsborough Co, originated near Pelham, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	June 16, 1986	Western Hillsborough Co, originated near Swanzey, NH	Fujita Scale F1	0 fatalities, 0 injuries
Downburst	June 1992	Brookline, NH	Microburst	Many large trees down at Potanipo boat ramp and Camp Tevya, North Mason Road closed
Tornado	July 3, 1997	Central Hillsborough Co, originated near Greenfield, NH	Fujita Scale F2	0 fatalities, 0 injuries
Tornado	May 31, 1998	Western Hillsborough Co, orginated near Antrim, NH	Fujita Scale F2	0 fatalities, 0 injuries

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
Downburst	July 6, 1999	Merrimack, Grafton, and Hillsborough Co.	Macroburst	2 fatalities, 2 lost roofs, damage to trees and utility infrastructure
Wildfire	There has been no significant damage from wildfires in Brookline to-date.			

**NOAA does not have a full history of temperature data for the Town of Brookline, NH. Extreme Temperature data is based on readings from NOAA weather station in Milford, NH.*

Section 3.3 ~ Probability of Future Hazard Events

After documenting the occurrence of previous hazard events in the Town of Brookline and the surrounding region, the Hazard Mitigation Team used this information to calculate the annual probability of these events occurring in the future. The first step was to determine how many times a particular hazard had occurred in a given number of years. The number of occurrences was then divided by the number of years to determine annual probability. For example, if history shows that a particular hazard typically occurs 1 time every 4 years, the annual probability is 25%. Annual probability was calculated twice for each hazard. First, annual probability was calculated since the first recorded historic occurrence of the event. Second, annual probability was calculated based on occurrences since 2000 to reflect potential recent changes in hazard event occurrence rates. The probability of future hazard events for each hazard type in the Town of Brookline is outlined in Table 5.

Table 5—Probability of Future Hazard Events

Hazard Type	Probability of Future Event	Source
Climate Change—Drought	The frequency of short term drought (1-3 months) in New Hampshire is predicted to increase 2-3 times in the long term (2070-2099) under the higher emissions scenario. The state will experience a more significant increase in medium-term drought (3-6 months) during this period. Short and medium term droughts are primarily caused by evapotranspiration as a result of hotter summers. The frequency of long-term drought (6 plus months) does not change significantly in the future under the low or high emissions scenario	"Climate Change in Southern New Hampshire," Sustainability Institute, University of New Hampshire, 2014

Hazard Type	Probability of Future Event	Source
	compared to past long-term drought events in New Hampshire (Wake et al., "Climate Change in Southern New Hampshire," pg. 30-31).	
Climate Change— Increased Precipitation	Annual average precipitation is predicted to increase 17-20% in southern New Hampshire by the end of the century under both the low and high emissions scenarios. Larger increases in precipitation are expected in the winter and spring, while summer and fall will only experience slight increases (Wake et al., "Climate Change in Southern New Hampshire," pg. 29). Southern New Hampshire can also expect more extreme precipitation events, defined as those where more than 1 inch of rain falls within 24 hours or more than 2-4 inches falls in 48 hours. Under both low and high emissions scenarios, the frequency of extreme precipitation events in predicted to more than double by the end of the century (Wake et al., "Climate Change in Southern New Hampshire," pg. 29).	"Climate Change in Southern New Hampshire," Sustainability Institute, University of New Hampshire, 2014
Climate Change— Warmer Temperatures	Temperatures in southern New Hampshire will continue to rise under a lower or higher future emissions scenario. In the short-term (2010-2039), average annual temperatures are predicted to increase by approximately 2°F. Under a higher emissions scenario, long-term (2070-2099) average annual temperatures are predicted to increase by 8 to 9°F. If a lower emissions scenario is achieved, long-term average annual temperatures are predicted to increase by 4°F (Wake et al., "Climate Change in Southern New Hampshire," pg. 23). The region is also predicted to experience more extreme heat events. From 1970-1999, southern New Hampshire had an average of seven days above 90°F each year. In the long-term under a higher	"Climate Change in Southern New Hampshire," Sustainability Institute, University of New Hampshire, 2014

Hazard Type	Probability of Future Event	Source
	emissions scenario, southern New Hampshire is predicted to have over 54 days per year above 90°F. Under a lower emissions scenario, the region is predicted to have 23 days per year above 90°F in the long-term (Wake et al., "Climate Change in Southern New Hampshire," pg. 25).	
Drought	12 years of drought from 1960 through 2016. 12 events in 57 years = .21 events per year **Annual Probability = 21%** 2 years of drought from 2000 through 2016. 2 events in 17 years = .12 **Annual Probability = 12%**	NH DES Current Drought Conditions http://des.nh.gov/organization/divisions/water/dam/drought/drought-conditions.htm US Drought Monitor http://droughtmonitor.unl.edu/Home.aspx
Earthquake	History shows no known earthquakes centered in Brookline. However, this hazard is still possible. 6 magnitude 5.0 or greater earthquakes felt in NH from 1929 through 2016. 6 events in 88 years = .07 events per year **Annual Probability = 7%** 2 magnitude 5.0 or greater earthquakes felt in NH from 2000 through 2016. 2 events in 17 years = .12 events per year **Annual Probability = 12%**	US Geological Survey http://earthquake.usgs.gov/earthquakes/search/
Extreme Temperatures	26 extreme heat events from 2000 through 2016.	NOAA National Climatic Data Center https://www.ncdc.noaa.gov/cdo-web/search

Hazard Type	Probability of Future Event	Source
	26 event in 17 years = 1.53 event per year **Annual Probability = 100%** 20 extreme cold events from 2000 through 2016. 20 event in 17 years = 1.18 event per year **Annual Probability = 100%**	
Flooding	19 flooding events in Hillsborough County from 1927 through 2016. 19 events in 90 years = .21 events per year **Annual Probability = 21%** 5 flooding events in Hillsborough County from 2000 through 2016. 5 events in 17 years = .29 events per year **Annual Probability = 29%**	Local knowledge FEMA Presidential Disaster Declaration https://www.fema.gov/disasters/grid/year
Severe Wind	8 hurricanes/tropical storms from 1938 through 2016. 8 events in 79 years = .10 events per year **Annual Probability = 10%** 2 hurricanes/tropical storms from 2000 through 2016. 2 events in 17 years = .12 events per year **Annual Probability = 12%**	Local knowledge FEMA Presidential Disaster Declaration https://www.fema.gov/disasters/grid/year National Hurricane Center http://www.nhc.noaa.gov/data/tcr/index.php?season=2014&basin=atl
Lightning	Because of limited data on previous lightning events, probability cannot be calculated statistically. History shows no occurrences of lightning strikes causing damage in Brookline. However, this hazard is	Local knowledge and public input

Hazard Type	Probability of Future Event	Source
	still possible and therefore the probability is low. Low probability is defined as a 0-25% chance of occurrence annually.	
Severe Winter Weather	21 severe winter weather events from 1888 through 2016. 21 events in 129 years = .16 events per year **Annual Probability = 16%** 5 severe winter weather events from 2000 through 2016. 5 events in 17 years = .29 events per year **Annual Probability = 29%**	Local knowledge FEMA Presidential Disaster Declaration https://www.fema.gov/disasters/grid/year
Tornado/Downburst	16 tornados and 2 downbursts in Hillsborough Co. from 1961 through 2016. 18 events in 56 years = .32 events per year **Annual Probability = 32%** 0 tornados and 0 downbursts in Hillsborough Co. from 2000 through 2016. 0 events in 17 years = 0 events per year **Annual Probability = 0-25%**	Tornado History Project (Joshua Lietz, Storm Prediction Center, National Climatic Data Center) and public input http://www.tornadohistoryproject.com
Wildfire	Because of limited data on previous wildfire events, probability cannot be calculated statistically. History shows no occurrences of wildfires causing damage in Brookline. However, this hazard is still possible and therefore the probability is low. Low probability is defined as a 0-25% chance of occurrence annually.	Local knowledge and public input

Section 3.4 ~ Critical Facilities and their Vulnerability

The next step in determining Brookline's overall vulnerability was to inventory the Town's community assets and determine what assets would be affected by each type of hazard event. The Hazard Mitigation Team began by reviewing the Brookline Zoning Ordinance to provide information on where and how the Town builds and to identify the corridors where critical facilities would likely be located. The Team then identified the broad categories of important assets within Brookline, including critical facilities essential to health and welfare; vulnerable populations, such as children and the elderly; economic assets and major employers; areas of high-density residential and commercial development; and historic, cultural, and natural resources. The Team then further divided the Town's critical facilities into the following categories:

1. **General Occupancy**
    a. Commercial
    b. Education
    c. Government
    d. Recreation
    e. Religious
    f. Residential
2. **Essential Facilities**
    a. Fire Station
    b. Police Station
    c. Department of Public Works
    d. Schools
    e. Emergency Operations Centers
    f. Medical Care Facilities
3. **Transportation Systems**
    a. Highway Systems—Roads
    b. Highway Systems—Bridges
    c. Airport Systems
4. **Utility Systems**
    a. Communications
    b. Electric
    c. Water
5. **High Potential Hazard Facilities**
    a. Dams/Levees
6. **Hazardous Materials Facilities**
    a. EPA Toxics Release Inventory facilities (http://www2.epa.gov/toxics-release-inventory-tri-program)

The critical facilities within each category appear in the Tables 6.1-6.6 below. Each table includes the critical facility's name, content vulnerability, and locational vulnerability to hazards. Note that Climate

Change is not included as a hazard in this analysis because its effects on critical facilities are included under the hazards of Drought, Extreme Temperatures, and Flooding.

Table 6.1—General Occupancy Critical Facilities

Facility Type and Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Severe Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
Commercial—Big Bear Lodge	Potentially large population present	✓	✓			✓	✓	✓	✓	✓
Commercial—Brookline Event Center	Potentially large population present	✓	✓			✓	✓	✓	✓	✓
Commercial—Stoney Ledge	Potentially large population present	✓	✓			✓	✓	✓	✓	✓
Commercial—Stateline Convenience Mart	Potentially large population present	✓	✓			✓	✓	✓	✓	✓
Commercial—Brookline General Store	Potentially large population present, located in 1% annual floodplain	✓	✓		✓	✓	✓	✓	✓	✓
Commercial—Fine Lines Auto Body	Potentially large population present, potentially hazardous materials present	✓	✓			✓	✓	✓	✓	✓
Commercial—AF Fuels	Potentially large population present, potentially hazardous materials present	✓	✓			✓	✓	✓	✓	✓
Commercial—Superior Auto Repair	Potentially large population present, potentially hazardous materials present	✓	✓			✓	✓	✓	✓	✓
Commercial—Caryn's Convenience Store	Potentially large population present, potentially hazardous materials present	✓	✓			✓	✓	✓	✓	✓
Commercial—Bingham Lumber	Potentially large population present, potentially hazardous materials present	✓	✓			✓	✓	✓	✓	✓
Commercial—Sports Stop	Potentially large population present	✓	✓			✓	✓	✓	✓	✓

Facility Type and Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Severe Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
Commercial—Chrysanthi's Restaurant	Potentially large population present	✓	✓			✓	✓	✓	✓	✓
Commercial—Dunkin Donuts	Potentially large population present	✓	✓			✓	✓	✓	✓	✓
Commercial—C.L. Farwell Construction	Potentially hazardous materials present	✓	✓			✓	✓	✓	✓	✓
Commercial—Monachelli Veterinarian Hospital	Potentially large population present, contents valuable to animal health	✓	✓			✓	✓	✓	✓	✓
Commercial—American Legion	Potentially large population present	✓	✓			✓	✓	✓	✓	✓
Education—Day Care, 12 Laurel Crest Drive	Potentially large population present	✓	✓			✓	✓	✓	✓	✓
Education—Neil Stone Karate School	Potentially large population present	✓	✓			✓	✓	✓	✓	✓
Government—Brookline Transfer Station	Potentially large population present, potentially hazardous materials present	✓	✓			✓	✓	✓	✓	✓
Government—Brookline Public Library	Official records and documents, potentially large population present	✓	✓			✓	✓	✓	✓	✓
Government—Brookline Historical Society	Official records and documents	✓	✓			✓	✓	✓	✓	✓
Government—Brookline Town Hall	Official records and documents, potentially large staff and population present, generator	✓	✓			✓	✓	✓	✓	✓
Government—Brookline Post Office	Contents important to communications	✓	✓			✓	✓	✓	✓	✓
Recreation— Oak Hill Park	Potentially large population present	✓					✓			
Recreation— Samuel Douglass Academy Field	Potentially large population present	✓					✓			

Facility Type and Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Severe Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
Recreation— Mountain Road Practice Field	Potentially large population present	✓					✓			
Recreation—Cohen Memorial Grove	Potentially large population present, located in the 1% annual floodplain	✓			✓		✓			
Recreation—Camp Tevya	Potentially large population present, located in the 1% annual floodplain	✓	✓		✓	✓	✓	✓	✓	✓
Recreation— Brookline Ballpark	Potentially large population present	✓					✓			
Recreation— Richard Maghakian Memorial School Field	Potentially large population present	✓					✓			
Religious—Brookline Community Church	Potentially large population present	✓	✓			✓	✓	✓	✓	✓
Religious—Brookline Chapel/Brusch Hall	Potentially large population present	✓	✓			✓	✓	✓	✓	✓
Residential—Mobile Home Park	Large population present, contents have personal value to owners	✓	✓			✓	✓	✓	✓	✓
Residential—17 Main Street	Large population present, contents have personal value to owners	✓	✓			✓	✓	✓	✓	✓

Table 6.2—Essential Facilities

Facility Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Severe Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
Brookline Safety Complex—Police and Ambulance	Contents and staff valuable to emergency management, generator	✓	✓			✓	✓	✓	✓	✓

Facility Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Severe Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
Brookline Fire Department	Contents and staff valuable to emergency management, generator	✓	✓			✓	✓	✓	✓	✓
Brookline Town Hall	Contents valuable to municipal operations, parcel located in 1% annual floodplain (building footprint is outside of floodplain)	✓	✓		✓	✓	✓	✓	✓	✓
Captain Samuel Douglass Academy	Potentially large population present, generator	✓	✓			✓	✓	✓	✓	✓
Richard Maghakian Memorial School	Potentially large population present	✓	✓			✓	✓	✓	✓	✓

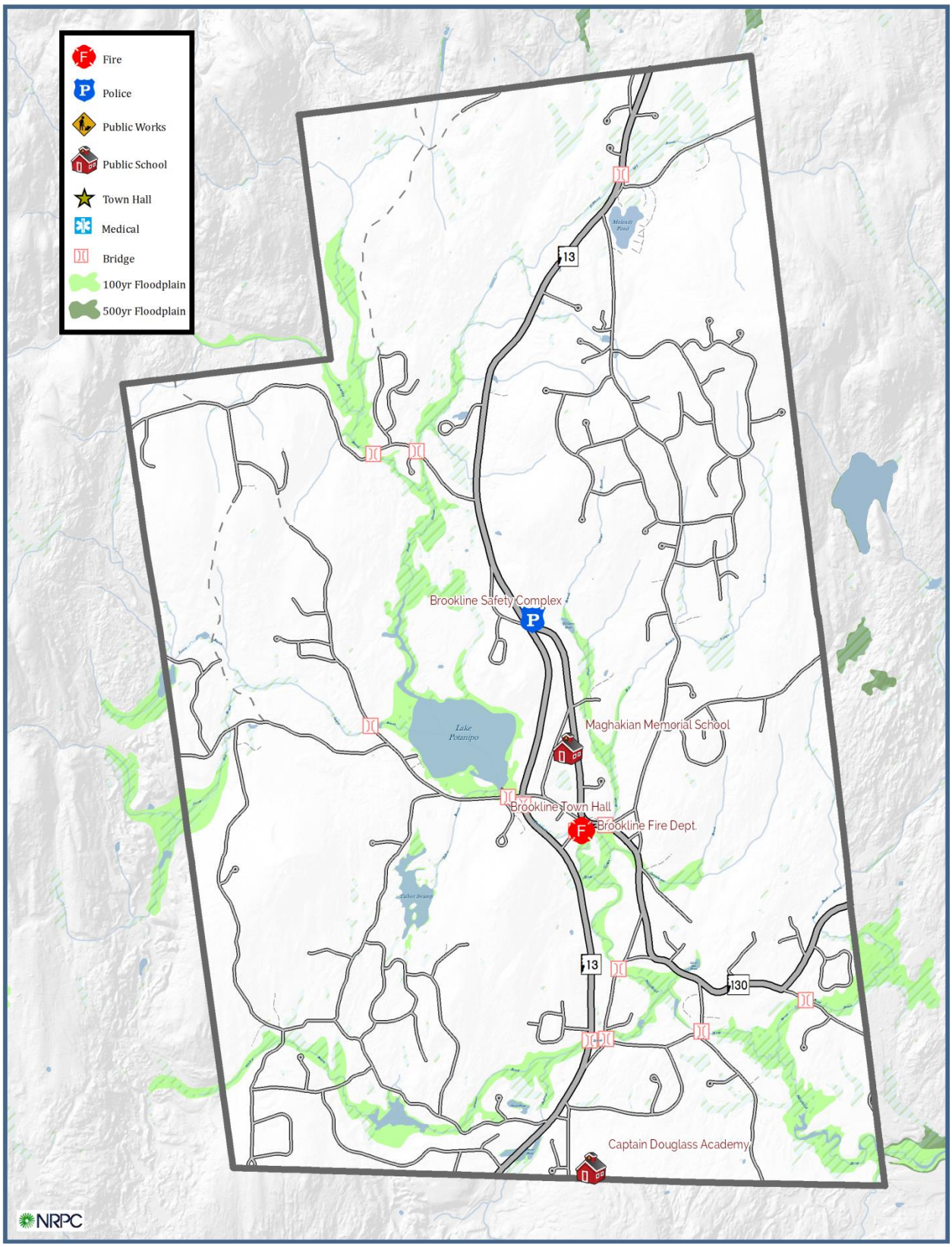
Fire
Police
Public Works
Public School
Town Hall
Medical
Bridge
100yr Floodplain
500yr Floodplain
Brookline Safety Complex
Maghakian Memorial School
Brookline Town Hall
Brookline Fire Dept.
Captain Douglass Academy
Lake Potanipo
13
130
NRPC

Table 6.3—Transportation Critical Facilities

Transportation infrastructure is particularly vulnerable to flooding hazards. Flooding events frequently cause culvert failures and undermine bridges and roads. Brookline has a total of 67.95 road miles, of which 8.68 miles or 13% are located in the 1% annual floodplain.

Facility Type and Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Sever Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
Highway System—Proctor Hill Road Bridge	Structure valuable to motor vehicle travel and safety		✓			✓		✓	✓	
Highway System—Main Street Bridge	Structure valuable to motor vehicle travel and safety, located in 1% annual floodplain		✓		✓	✓		✓	✓	
Highway System—Route 13 Bridge, near Averill Road	Structure valuable to motor vehicle travel and safety		✓			✓		✓	✓	
Highway System—Route 13 Bridge, near South Main Street	Structure valuable to motor vehicle travel and safety, located in 1% annual floodplain		✓		✓	✓		✓	✓	
Highway System—Route 13 Bridge, near Mason Road	Structure valuable to motor vehicle travel and safety, located in 1% annual floodplain		✓		✓	✓		✓	✓	
Highway System—Route 13 Bridge, near Hood Road	Structure valuable to motor vehicle travel and safety		✓			✓		✓	✓	
Highway System—Bond Street Bridge	Structure valuable to motor vehicle travel and safety, located in 1% annual floodplain		✓		✓	✓		✓	✓	
Highway System—West Hill Road culvert	Structure valuable to motor vehicle travel and safety, located in 1% annual floodplain		✓		✓	✓		✓	✓	
Highway System—North Mason Road	Structure valuable to motor vehicle travel, portions located in 1% annual floodplain		✓		✓	✓		✓	✓	
Highway System—Mason Road	Structure valuable to motor vehicle travel, portions located in 1% annual floodplain		✓		✓	✓		✓	✓	

Facility Type and Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Sever Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
Highway System—Route 13	Structure valuable to motor vehicle travel, evacuation route, portions located in 1% annual floodplain		✓		✓	✓		✓	✓	
Highway System—Bond Street	Structure valuable to motor vehicle travel, portions located in 1% annual floodplain		✓		✓	✓		✓	✓	
Highway System—Main Street	Structure valuable to motor vehicle travel, portions located in 1% annual floodplain		✓		✓	✓		✓	✓	
Highway System—South Main Street	Structure valuable to motor vehicle travel, portions located in 1% annual floodplain		✓		✓	✓		✓	✓	
Highway System—Pepperell Road	Structure valuable to motor vehicle travel, portions located in 1% annual floodplain		✓		✓	✓		✓	✓	
Highway System—Averill Road	Structure valuable to motor vehicle travel, portions located in 1% annual floodplain		✓		✓	✓		✓	✓	
Brookline Airport	Structure valuable to air traffic		✓			✓	✓	✓	✓	✓

Table 6.4—Utility Systems

Facility Type and Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Severe Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
Communication—TCP Communications Tower	Structure valuable to communications and emergency management		✓			✓	✓		✓	✓

Facility Type and Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Severe Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
Communication—US Cellular Tower, Ball Hill	Structure valuable to communications and emergency management		✓			✓	✓		✓	✓
Communication—US Cellular Tower, Potanipo Hill	Structure valuable to communications and emergency management		✓			✓	✓		✓	✓
Electric (Eversource)—critical facilities are limited to distribution system (poles & wires), including transformers and other electrical equipment. Eversource has no substations or transmission lines in Brookline.	Structure valuable to utility network		✓			✓	✓	✓	✓	✓
Water—there are no community water supplies in Brookline. Water supply systems include private wells, transient non-community wellheads, and non-transient non-community wellheads.	Structures valuable to water supply, 6 transient non-community wellheads in 1% floodplain, 3 non-transient non-community wellheads in 1% floodplain, 11 active wellheads in 1% floodplain, 4 active pump houses in 1% floodplain	✓			✓					

Table 6.5—High Potential Hazard Facilities

Facility Type and Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Severe Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
Name—Lake Potanipo Dam Dam # D033004 Hazard Class—NM Water body—Nissitissit River Owner—privately held	Structure valuable to flood control, located in 1% annual floodplain		✓		✓	✓		✓	✓	

Facility Type and Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Severe Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
Name—Pierce Pond Dam Dam # D033006 Hazard Class—S Water body—Wolf Brook Owner—Town of Brookline	Structure valuable to flood control		✓		✓	✓		✓	✓	
Name—Pultz Dam Dam # D033009 Hazard Class—NM Water body—Rocky Pond Brook Owner—privately held	Structure valuable to flood control, located in 1% annual floodplain		✓		✓	✓		✓	✓	
Name—Rocky Pond Brook Dam Dam # D033010 Hazard Class—NM Water body—Rocky Pond Brook Owner—privately held	Structure valuable to flood control, located in 1% annual floodplain		✓		✓	✓		✓	✓	
Name—Branch Mitchell Brook Dam Dam # D033011 Hazard Class—NM Water body—Scabbard Brook Owner—privately held	Structure valuable to flood control		✓		✓	✓		✓	✓	
Name-Mountain Road Estates Dam Dam # D033012 Hazard Class—NM Water body—unnamed stream Owner—privately held	Structure valuable to flood control		✓		✓	✓		✓	✓	
Name—Taylor Pond Dam Dam # D033013 Hazard Class—L Water body—Talbot Brook Owner—Brookline Conservation Commission	Structure valuable to flood control		✓		✓	✓		✓	✓	
Name—Birch Hill Estates Det Pond Dam Dam # D033017 Hazard Class—NM Water body—runoff Owner—privately held	Structure valuable to flood control		✓		✓	✓		✓	✓	

Facility Type and Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Severe Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
Name—Williams Pond Dam Dam # D033018 Hazard Class—NM Water body—West Brook Owner—privately held	Structure valuable to flood control, located in 1% annual floodplain		✓		✓	✓		✓	✓	

Table 6.6—Hazardous Materials Facilities

Facility Type and Name	Content Vulnerability	Drought	Earthquake	Extreme Temperatures	Flooding	Severe Wind	Lightning	Severe Winter Weather	Tornado	Wildfire
There are no Hazardous Materials Facilities in Brookline as reported by the EPA Toxics Release Inventory Program.										

Section 3.5 ~ Vulnerability by Hazard

Climate Change

Climate change in southern New Hampshire will impact the environment, ecosystem services, economy, public health, and quality of life. According to a 2014 study by the Sustainability Institute at the University of NH, southern NH is expected to become warmer and wetter over the next century with more extreme precipitation events. This weather pattern puts significant stress on the region's already aging water infrastructure. Furthermore, climate change is likely to cause a number of public health impacts on NH's most vulnerable residents, including heat stress; flood related deaths and injuries; respiratory and cardiovascular illness, including asthma; allergies; vector, food, and water-borne disease; chronic disease; and mental health and stress-related disorders. Despite efforts taking place to slow the rate of climate change, some level of change is inevitable. Therefore, municipalities must make sound decisions to help their communities adapt to a new climate normal.

Temperatures in southern New Hampshire will continue to rise under a lower or higher future emissions scenario. In the short-term (2010-2039), average annual temperatures are predicted to increase by approximately 2°F. Under a higher emissions scenario, long-term (2070-2099) average annual temperatures are predicted to increase by 8 to 9°F. If a lower emissions scenario is achieved, long-term average annual temperatures are predicted to increase by 4°F (Wake et al., "Climate Change in Southern New Hampshire," pg. 23). The region is also predicted to experience more extreme heat events. From 1970-1999, southern New Hampshire had an average of seven days above 90°F each year. In the long-term under a higher emissions scenario, southern New Hampshire is predicted to have over 54 days per year above 90°F. Under a lower emissions scenario, the region is predicted to have 23 days per year above 90°F in the long-term (Wake et al., "Climate Change in Southern New Hampshire," pg. 25).

Annual average precipitation is predicted to increase 17-20% in southern New Hampshire by the end of the century under both the low and high emissions scenarios. Larger increases in precipitation are expected in the winter and spring, while summer and fall will only experience slight increases (Wake et al., "Climate Change in Southern New Hampshire," pg. 29). Southern New Hampshire can also expect more extreme precipitation events, defined as those where more than 1 inch of rain falls within 24 hours or more than 2-4 inches falls in 48 hours. Under both low and high emissions scenarios, the frequency of extreme precipitation events in predicted to more than double by the end of the century (Wake et al., "Climate Change in Southern New Hampshire," pg. 29).

The frequency of short term drought (1-3 months) in New Hampshire is predicted to increase 2-3 times in the long term (2070-2099) under the higher emissions scenario. The state will experience a more significant increase in medium-term drought (3-6 months) during this period. Short and medium term droughts are primarily caused by evapotranspiration as a result of hotter summers. The frequency of long-term drought (6 plus months) does not change significantly in the future under the low or high emissions scenario compared to past long-term drought events in New Hampshire (Wake et al., "Climate Change in Southern New Hampshire," pg. 30-31).

Climate Change Hazard Loss Estimate

Because the impacts of climate are wide ranging and have little historic data to draw from, it is beyond the scope of this Plan to estimate the dollar value of losses to the municipality resulting from climate change.

Some insights on the municipality's vulnerability to climate change may be gained by examining the results of the Nashua Region Water Vulnerability Assessment, conducted by the Nashua Regional Planning Commission in 2016. Based on the results of the vulnerability assessment, the Nashua Region is most vulnerable to threats related to warmer temperatures and threats that affect water supply.

Threats related to warmer temperatures are highly likely to occur, are broad ranging, have critical severity, and moderately effective mitigation options. In addition, while the region has experience with flooding (and drought to a smaller extent), the region has no experience with warming temperatures to provide historical guidance.

Threats that affect water supply are likely to occur, have moderate to critical severity, will likely affect between 10 and 50% of the region's population, and have moderately effective mitigation options. There are numerous threats in this category and they have broad implications from public health and safety to agriculture and the economy.

It may also be helpful to review the Drought, Extreme Temperatures, and Flooding sections in this Plan for more insight on the municipality's vulnerability to climate change.

Drought

Hydrological drought is evidenced by extended periods of negative departures from normal rainfall. New Hampshire has been under several drought warnings, including a drought emergency, since 1999. The most severe drought conditions occurred between 1960 and 1969; the event had a greater than 25 year recurrence interval. The southern New Hampshire region experienced a 100-year drought event from 1964 to 1965.

Southern New Hampshire also experienced a 50-year drought event beginning in the summer of 2016, which continues through the writing of this Plan. In September 2016, Brookline was under Long-term (L), Extreme Drought (D3) conditions, according to the US Drought Monitor. As of January 2017, Brookline continues to be in Long-term (L), Severe Drought (D2) conditions.

Although drought is not likely to damage structures, low water levels can have a negative impact on existing and future home sites, especially those that depend on groundwater for water needs. Additionally, the dry conditions of a drought may lead to an increase wild fire risk. Drought can cause the most significant impact to agricultural land and assets.

On September 26, 2016 the Brookline Selectmen adopted an ordinance prohibiting any residential law watering, per RSA 41:11-d. It became effective on October 2, 2016 and remains in effect as of the writing of this Plan. The ordinance was adopted in response to the historic drought, which left some Brookline residents experiencing water supply shortages.

Drought Hazard Loss Estimate

Because the impacts of drought are long lasting and wide ranging, it is beyond the scope of this Plan to estimate the dollar value of losses to Brookline resulting from drought. Instead, the Hazard Mitigation Team estimated the percentage of land in Brookline vulnerable to drought and the percentage of the population vulnerable to drought as a quantitative measure of this hazard's impact.

Total Acres of Land in Brookline	Total Acres of Agricultural Land in Brookline	% of Land in Brookline Vulnerable to Drought
12,756	0	0%

% of population with Public Drinking Water in Brookline	% of population with Private Well Water in Brookline	Water Utility	Primary Water Source	Secondary Water Source
0%	100%	None	Private Wells	None

Critical Facility Type	Total Number of this type of Critical Facilities in Brookline	Number of this type of Critical Facilities in Drought Hazard Area	Percentage of this type of Critical Facilities in Drought Hazard Area
General Occupancy	34	34	100%
Essential Facilities	5	5	100%
Transportation	17	0	0%
Utility System	5	1	20%
High Potential Hazard	9	0	0%
Hazardous Materials	0	0	0%

Earthquake

The Richter magnitude scale was developed by Charles F. Richter in 1935 as a way to compare the size of earthquakes. The magnitude of an earthquake is calculated from the logarithm of the amplitude of waves recorded by seismographs.

- Magnitude <2.0—micro-earthquakes. Recorded by seismographs, but not felt or rarely felt by people. Several million occur annually worldwide on average.
- Magnitude 2.0-2.9—felt slightly by some people. No damage to buildings. Over 1 million occur annually worldwide on average.
- Magnitude 3.0-3.9—often felt by people but very rarely cause damage. Shaking of indoor objects can be noticeable. Over 100,000 occur annually worldwide on average.
- Magnitude 4.0-4.9—noticeable shaking of indoor objects and rattling noises. Felt by most people in affected area. Generally causes minimal to no damage. Moderate to significant damage is very unlikely. 10,000-15,000 occur annually worldwide on average.
- Magnitude 5.0-5.9—felt by everyone. Can cause damage of varying severity to poorly constructed buildings; slight to no damage to all other buildings. Few, if any, casualties. 1,000-1,500 occur annually worldwide on average.
- Magnitude 6.0-6.9—felt up to hundreds of miles from epicenter. Strong to violent shaking in epicenter. Damage to many buildings in populated areas. Poorly designed structures have moderate to severe damage. Earthquake-resistant structures have slight to moderate damage.

Damage can be caused far from epicenter. Death toll up to 25,000. 100-150 occur annually worldwide on average.

- Magnitude 7.0-7.9—felt in very large area. Damage to most buildings, including partial or complete collapse. Death toll up to 250,000. 10-20 occur annually worldwide on average.
- Magnitude 8.0-8.9—felt in extremely large region. Major damage to buildings over large areas. Structures likely destroyed. Moderate to heavy damage to sturdy or earthquake-resistant buildings. Death toll up to 1 million. 1 occurs annually worldwide on average.
- Magnitude 9.0< —damage and shaking extends to distant locations. Near or total destruction. Severe damage and collapse to all buildings. Permanent changes in ground topography. 1 occurs every 10-50 years worldwide on average.

Since 1940, there have been 14 earthquakes centered in NH with a magnitude of 3.0 or greater and only two earthquakes with a magnitude of 5.0 or greater. There have been no recorded earthquakes to-date centered in Brookline, however, one could occur.

Earthquake Hazard Loss Estimate

Step 1. Determine potential earthquake strength in Brookline

- US Seismic Hazard, 2% in 50 years PGA is 0.14 to 0.2(g) in Brookline
- *Source: USGS NH Seismic Map 2014*

Step 2. Determine percent building damage ratio to single family residence from PGA (g) 0.15 earthquake

- Wood Frame Construction with Low general seismic design level = 1.3% building damage
- *Source: FEMA Identifying Hazards and Estimating Losses, pg 4-17*

Step 3. Determine percent of structures in Brookline that would be damaged by PGA (g) 0.15 earthquake

- 1-5% of structures estimated to be damaged by earthquake
- *Source: Brookline Hazard Mitigation Team (no historical data on earthquake damage in Brookline)*

Step 4. Determine total assessed value of structures in Brookline

- Total Assessed Value of all Structures in Brookline = $429,663,800
- *Source: Brookline Assessing Department (8/4/16)*

Step 5. Determine total loss from PGA (g) 0.15 Earthquake

- Total Loss from Earthquake = Total Assessed Value of all Structures *Percentage of Structures Estimated to be Damaged * Percent Building Damage Ratio
- Total Loss from Earthquake = $429,663,800 * .01 * .013 = $55,856.29
- Total Loss from Earthquake = $429,663,800 * .05 * .013 = $279,281.47
- **$55,856.29 to $279,281.47**

Critical Facility Type	Total Number of this type of Critical Facilities in Brookline	Number of this type of Critical Facilities in Earthquake Hazard Area	Percentage of this type of Critical Facilities in Earthquake Hazard Area
General Occupancy	34	28	82.4%
Essential Facilities	5	5	100%
Transportation	17	17	100%
Utility System	5	4	80%
High Potential Hazard	9	9	100%
Hazardous Materials	0	0	0%

Extreme Temperatures

Extreme temperatures can be broken into both extreme heat and extreme cold. Though the hazards are different, the effects would be similar to vulnerable populations in Brookline.

Extreme heat is defined as a period of three consecutive days during which the air temperature reaches 90 degrees Fahrenheit or higher on each day. Extreme heat should not be confused with a drought (extended periods of negative departures from normal rainfall). Overburdened power networks may experience failures due to the impacts of extreme heat.

Extreme cold is defined as a period of three consecutive days during which minimum air temperatures are at or below 0 degrees Fahrenheit. With the rising costs of heating fuel and electric heat, many low-income or homeless citizens are not able to adequately heat their homes, exposing themselves to cold related emergencies or death. Extremely cold winters can lead to shortages in heating fuels due to high demand.

Extreme Temperatures Hazard Loss Estimate

Because the impacts of extreme temperatures can result in the loss of life, it is beyond the scope of this Plan to estimate the dollar value of losses to Brookline resulting from extreme temperatures. Though the entire Brookline population may experience a thermal emergency, populations without adequate climate control are most at risk. Extreme temperatures are not likely to cause damage to structures, although pipes can burst in extreme cold conditions.

Flooding

Localized Flooding

Localized flooding can result from even minor storms. Runoff overloads the drainage ways and flows into the streets and low-lying areas. Homes and businesses can be inundated, especially basements and the lower part of first floors. Localized flooding poses most of the same problems caused by larger

floods, but because it typically has an impact on fewer people and affects small areas, it tends to bring less State or Federal involvement such as funding, technical help, or disaster assistance. As a result, the community and the affected residents or business owners are left to cope with the problems on their own. Finally, flooding of this type tends to recur; small impacts accumulated over time can become major problems.

Riverine Flooding

Riverine flooding involves the overflowing of normal flood channels, rivers or streams, generally as a result of prolonged rainfall or rapid thawing of snow cover. The lateral spread of floodwater is largely a function of the terrain, becoming greater in wide, flat areas, and affecting narrower areas in steep terrain. In the latter cases, riparian hillsides in combination with steep declines in riverbed elevation often force waters downstream rapidly, sometimes resulting in flash floods.

Floodplains cover approximately 7.6% of Brookline; 7.6% of the Town is within the 1% annual floodplain and 0% is within the 0.2% annual floodplain. Floodplains in Brookline are located along Scab Mill Brook, Spaulding Brook, North Stream, Lake Potanipo, Lancy Brook, Talbot Brook, Talbot Swamp, Gould Mill Brook, Wallace Brook, Pierce Pond, Rocky Pond Brook, Nissitissit River, Stonehouse Brook, and Village Brook.

Dam Failure

The NH Department of Environmental Services indicates several failure modes for dams. Most typical include hydraulic failure or the uncontrolled overflowing of water, seepage, or leaking at the dam's foundation or gate; structural failure or rupture; general deterioration; and gate inoperability. These modes vary between dams depending on their construction type.

The State of New Hampshire uses a hazard potential classification to define the extent of a dam breach or failure. All class S (Significant) and H (High hazard) dams have the potential to cause damage if they breach or fail.

Class H—high hazard: 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 probably 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 that is occupied under normal conditions; water levels rising above 1st floor elevation of a habitable residential structure or a commercial or industrial structure that is occupied under normal conditions when the rise due to dam failure is greater than 1 foot; structural damage to an interstate highway, which could render the roadway impassible or otherwise interrupt public safety services; release of a quantity and concentration of material that qualify as “hazardous waste” under RSA 147-A:2 VII; any other circumstance that would more likely than not cause one or more deaths.

Class S—significant hazard: dam 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 probably loss of lives; major economic loss to structures or property; structural damage to a Class I or Class II road that would

render the road impassable or otherwise interrupt public safety services; major environmental or public health losses.

Class L—low hazard: dam 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 impassible or otherwise interrupt public safety service; the release of liquid industrial, agricultural, or commercial wastes, septage, or contaminated sediment if the storage capacity is less than 2 acre-feet and is located more than 250 feet from a water body or water course; reversible environmental losses to environmentally-sensitive sites.

Class NM—non-menace: dam that is not a menace because it is in a location and of a size that failure or misoperation of the dam would not result in probable loss of life or loss to property, provided the dam is less than 6 feet in height it if has a storage capacity greater than 50 acre-feet; or less than 25 feet in height if it has a storage capacity of 15-50 acre-feet.

Brookline has 7 Class NM dams (Non-Menace), 1 Class L dams (Low hazard potential), 1 Class S dams (Significant hazard potential), and 0 Class H dams (High hazard potential). There have been no known dam breaches to-date in Brookline.

Flood Hazard Loss Estimate

Step 1. Determine percent building damage to a 1 or 2 story building with basement

- 1 foot flood depth = 15% building damage
- 2 foot flood depth = 20% building damage
- 3 foot flood depth = 23% building damage
- 4 foot flood depth = 28% building damage
- *Source: FEMA Identifying Hazards and Estimating Losses, pg 4-13*

Step 2. Determine number of structures in Brookline located in the floodplain

- 95 structures located in 1% floodplain
- 0 structures located in 0.2% floodplain—there are no 0.2% floodplains in Brookline
- *Source: Nashua Regional Planning Commission http://data-nashuarpc.opendata.arcgis.com/datasets/98afc8bbe9a14c5494c87cc92480b4b1_0*

Step 3. Determine total value of structures in Brookline located in 1% floodplain

- Average assessed value of all structures in Brookline = $186,648.05
- Total number of structures in Brookline located in 1% floodplain = 95
- Total assessed value of all structures in Brookline in 1% floodplain = $186,648.05 * 95
- Total assessed value of all structures in Brookline in 1% floodplain = $17,731,564.75
- *Source: Brookline Hazard Mitigation Team calculations based on Brookline Assessing data & NRPC GIS data*

Step 4. Determine total loss from flooding in 1% floodplain

- Total Loss from Flooding = Total Assessed Value of all structures in 1% Floodplain * Percent Building Damage Ratio
- Total Loss from 1 foot flood depth = $17,731,564.75 * .15 = **$2,659,734.71**
- Total Loss from 2 foot flood depth = $17,731,564.75 * .20 = **$3,546,312.95**
- Total Loss from 3 foot flood depth = $17,731,564.75 * .23 = **$4,078,259.89**
- Total Loss from 4 foot flood depth = $17,731,564.75 * .28 = **$4,964,838.13**

Critical Facility Type	Total Number of this type of Critical Facilities in Brookline	Number of this type of Critical Facilities in 1% Annual Floodplain	Percentage of this type of Critical Facilities in 1% Annual Floodplain	Number of this type of Critical Facilities in 0.2% Annual Floodplain	Percentage of this type of Critical Facilities in 0.2% Annual Floodplain
General Occupancy	34	3	8.8%	0	0%
Essential Facilities	5	1	20%	0	0%
Transportation	17	13	76.5%	0	0%
Utility System	5	1	20%	0	0%
High Potential Hazard	9	4	44.4%	0	0%
Hazardous Materials	0	0	0%	0	0%

Severe Wind

The Atlantic hurricane season lasts from June 1 through November 30 and peaks in late August and September. The Saffir-Simpson Hurricane Wind Scale categorizes hurricanes from 1 to 5 based on sustained wind speed. The National Weather Service National Hurricane Center provides the following estimates of potential property damage based on hurricane wind speed (http://www.nhc.noaa.gov/aboutsshws.php).

Category 1—sustained winds 74-95 mph. 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.

Category 2—sustained winds 96-110 mph. 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.

Category 3—sustained winds 111-129 mph. 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.

Category 4—sustained winds 130-156 mph. 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.

Category 5—sustained winds 157 mph or higher. Catastrophic damage will occur. A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possible months. Most of the area will be uninhabitable for weeks or months.

FEMA declared disasters in Hillsborough County during Hurricane Bob (1991) and Hurricane Floyd (1999). Though these were the only formally declared incidents, Brookline has experienced strong remnants of numerous tropical cyclones including Hurricane Carol (1954), Donna (1960), Gloria (1985), Irene (2011), and Sandy (2012).

Severe Wind Hazard Loss Estimate

There are no standard loss estimation models or tables for wind damage (*Understanding Your Risks,* FEMA, pg 4-30). As such, the Hazard Mitigation Team used data from previous hurricane events to determine damage estimates. Historically, the strongest hurricane seen in NH was a Category 3, so loss estimates were calculated based on a hurricane of that strength. Hurricanes have primarily damaged road networks and infrastructure in NH. It is beyond the scope of this project to estimate the costs of repairing or replacing transportation and utility infrastructure damaged by a hurricane. The Hazard Mitigation Team used the following calculations to estimate loss to single family residential structures from a hurricane.

Step 1. Determine percent building damage ratio to single family residence from Category 3 hurricane

- Wood Frame Construction, Low general hurricane design level = 20% building damage
- *Source: Brookline Hazard Mitigation Team*

Step 2. Determine percent of structures in Brookline that would be damaged by Category 3 hurricane

- 5% of structures estimated to be damaged by Category 3 hurricane
- *Source: Brookline Hazard Mitigation Team (no historical data on hurricane damage in Brookline)*

Step 3. Determine total assessed value of structures in Brookline

- Total Assessed Value of all Structures in Brookline = $429,663,800
- *Source: Brookline Assessing Department (8/4/16)*

Step 4. Determine total loss from Category 3 hurricane

- Total Loss from Hurricane = Total Assessed Value of all Structures *Percentage of Structures Estimated to be Damaged * Percent Building Damage Ratio
- Total Loss from Hurricane = $429,663,800 * .05 * .2 = **$4,296,638**

Critical Facility Type	Total Number of this type of Critical Facilities in Brookline	Number of this type of Critical Facilities in Severe Wind Hazard Area	Percentage of this type of Critical Facilities in Severe Wind Hazard Area
General Occupancy	34	28	82.4%
Essential Facilities	5	5	100%
Transportation	17	17	100%
Utility System	5	4	80%
High Potential Hazard	9	9	100%
Hazardous Materials	0	0	0%

Lightning

By definition, all thunderstorms contain 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. During a lightning discharge, the sudden heating of the air causes it to expand rapidly. After the discharge, the air contracts quickly as it cools back to ambient temperatures. This rapid expansion and contraction causes a shock wave that we hear as thunder.

Lightning is a major hazard to citizens involved in outdoor activities. A lightning strike at a densely attended special event has the potential to create a major mass casualty incident. Lightning also can create wildfires and structure fires and may cause power and/or communications outages.

The Lightning Activity Level (LAL) grid can be used to measure the extent of a lightning event.

LAL	**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 or 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	>25

	three-tenths and occasionally obscure the sky. Rian is moderate to heavy and lightning is frequent and intense.	
6	Similar to LAL 3 except thunderstorms are dry.	9-15

Lightning Hazard Loss Estimate

Losses from lightning would be on a small, localized scale. The Hazard Mitigation Team used the following calculations to estimate loss to single family residential structures from lightning.

Step 1. Determine percent building damage ratio to single family residence from lightning

- Wood Frame Construction = 5% building damage
- *Source: Brookline Hazard Mitigation Team*

Step 2. Determine percent of structures in Brookline that would be damaged by lightning

- 0.25% of structures estimated to be damaged by lightning
- *Source: Brookline Hazard Mitigation Team (no historical data on lightning damage in Brookline)*

Step 3. Determine total assessed value of structures in Brookline

- Total Assessed Value of all Structures in Brookline = $429,663,800
- *Source: Brookline Assessing Department (8/4/16)*

Step 4. Determine total loss from lightning

- Total Loss from Lightning = Total Assessed Value of all Structures *Percentage of Structures Estimated to be Damaged * Percent Building Damage Ratio
- Total Loss from Severe Thunderstorm = $429,663,800* .0025 * .05 = **$53,707.98**

Critical Facility Type	Total Number of this type of Critical Facilities in Brookline	Number of this type of Critical Facilities in Lightning Hazard Area	Percentage of this type of Critical Facilities in Lightning Hazard Area
General Occupancy	34	34	100%
Essential Facilities	5	5	100%
Transportation	17	1	5.9%
Utility System	5	4	80%
High Potential Hazard	9	0	0%
Hazardous Materials	0	0	0%

Severe Winter Weather

A heavy snowstorm is generally considered to be one that deposits two or more inches of snow per hour in a twelve-hour period. Heavy snow can immobilize a region, stranding commuters, closing businesses, and disrupting emergency services. Accumulating snow can collapse buildings and knock down trees and power lines. Snow removal from roadways, utility damage, and disruption to businesses can have a significant economic impact on municipalities and residents.

A blizzard is a violent snowstorm with winds blowing at a minimum speed of 35 miles per hour and visibility of less than one-quarter mile for three hours. A Nor'easter is a large weather system traveling from south to north, passing along the coast. As the storm's intensity increases, the resulting counterclockwise winds impact the coast and inland areas in a Northeasterly direction. Winds from a Nor'easter can meet or exceed hurricane force, knocking down trees, utility poles, and power lines.

Ice storms occur when a mass of warm, moist air collides with a mass of cold, arctic air. The less dense warm air rises and the moisture precipitates out in the form of rain. When this rain falls through the colder, more-dense air and comes in contact with cold surfaces, ice forms and can become several inches thick. Heavy accumulations of ice can knock down trees, power lines, and communications for extended periods of time. Ice Storm extent can be defined by the Sperry-Piltz Ice Accumulation Index:

- 0—minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages
- 1—some isolated or localized utility interruptions are possible, typically lasing on a few hours. Roads and bridges may become slick and hazardous.
- 2—scattered utility interruptions expected, typically lasing 12-24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
- 3—numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasing 1-5 days.
- 4—prolonged and widespread utility interruptions with extensive damage to main distribution feeder lines and some high voltage transmission lines/structures. Outages lasing 5-10 days.
- 5—catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed

In recent years, FEMA issued disaster declarations in Hillsborough County for severe winter weather in 1998, 2008, 2010, 2011, 2013, and 2015. Among these storms was a rare Nor'easter in late October of 2011 that caused major destruction in Hillsborough and Rockingham Counties. Heavy wet snow fell on trees that had much of their foliage remaining. Many trees could not withstand the extra weight of the snow and collapsed under the stress. Damage was very focused in the southern part of New Hampshire and caused nearly three times the amount of debris that the 2008 ice storm produced.

Severe Winter Weather Hazard Loss Estimate

Severe Winter Weather events have primarily damaged road networks and infrastructure in NH. It is beyond the scope of this project to estimate the costs of repairing or replacing transportation and utility infrastructure damaged by severe winter weather. The Hazard Mitigation Team used the following calculations to estimate loss to single family residential structures from severe winter weather.

Step 1. Determine percent building damage ratio to single family residence from severe winter weather

- Wood Frame Construction, no additional provisions for roof snow loads = 5% building damage
- *Source: Brookline Hazard Mitigation Team*

Step 2. Determine percent of structures in Brookline that would be damaged by severe winter weather

- 1% of structures estimated to be damaged by severe winter weather
- *Source: Brookline Hazard Mitigation Team*

Step 3. Determine total assessed value of structures in Brookline

- Total Assessed Value of all Structures in Brookline = $429,663,800
- *Source: Brookline Assessing Department (8/4/16)*

Step 4. Determine total loss from Severe Winter Weather

- Total Loss from Severe Winter Weather = Total Assessed Value of all Structures *Percentage of Structures Estimated to be Damaged * Percent Building Damage Ratio
- Total Loss from Severe Winter Weather = $429,663,800 * .01 * .05 = **$214,831.90**

Critical Facility Type	Total Number of this type of Critical Facilities in Brookline	Number of this type of Critical Facilities in Severe Winter Weather Hazard Area	Percentage of this type of Critical Facilities in Severe Winter Weather Hazard Area
General Occupancy	34	28	82.4%
Essential Facilities	5	5	100%
Transportation	17	17	100%
Utility System	5	1	20%
High Potential Hazard	9	9	100%
Hazardous Materials	0	0	0%

Tornado/Downburst

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of 1 mile wide and 50 miles long. Tornadoes are created when cold air overrides warm air, causing the warm air to rise rapidly.

A downburst is a severe localized wind blasting down from a thunderstorm. These 'straight line' winds are distinguishable from tornadic activity by their pattern of destruction and debris. Depending on the size and location of these events, the destruction to property may be devastating. Downbursts fall into two categories. Microbursts cover an area less than 2.5 miles in diameter and macrobursts cover an area at least 2.5 miles in diameter.

Hillsborough County has a higher risk of tornado activity compared to the rest of the State. Between 1961 and 1998 there were 15 known tornadoes in Hillsborough County. The most recent downburst activity occurred on July 6, 1999 in the form of a macroburst in Merrimack, Grafton and Hillsborough Counties. There were two fatalities as well as roof damage, widespread power outages, and downed trees, utility poles and wires.

Tornado Hazard Loss Estimate

There are no standard loss estimation models or tables for tornados (*Understanding Your Risks,* FEMA, pg 4-27). As such, the Hazard Mitigation Team used data from previous tornado events to determine damage estimates. Historically, the strongest tornado seen in Hillsborough County was a F2, so loss estimates were calculated based on a tornado of that strength.

Step 1. Determine percent building damage ratio to single family residence from F2 tornado

- Wood Frame Construction, Low general tornado design level = 50% building damage
- *Source: Brookline Hazard Mitigation Team*

Step 2. Determine percent of structures in Brookline that would be damaged by F2 tornado

- 1% of structures estimated to be damaged by F2 tornado
- *Source: Brookline Hazard Mitigation Team (no historical data on tornado damage in Brookline)*

Step 3. Determine total assessed value of structures in Brookline

- Total Assessed Value of all Structures in Brookline = $429,663,800
- *Source: Brookline Assessing Department (8/4/16)*

Step 4. Determine total loss from F2 Tornado

- Total Loss from Tornado = Total Assessed Value of all Structures *Percentage of Structures Estimated to be Damaged * Percent Building Damage Ratio
- Total Loss from Tornado = $429,663,800 * .01 * .5 = **$2,148,319**

Critical Facility Type	Total Number of this type of Critical Facilities in Brookline	Number of this type of Critical Facilities in Tornado Hazard Area	Percentage of this type of Critical Facilities in Tornado Hazard Area
General Occupancy	34	28	82.4%
Essential Facilities	5	5	100%
Transportation	17	17	100%
Utility System	5	4	80%
High Potential Hazard	9	9	100%
Hazardous Materials	0	0	0%

Wildfire

Wildfires are fires ignited in grassy or wooded areas. They may be ignited intentionally by humans, naturally through lightning, or accidentally due to spark ignition from sources such as power lines or fireworks. The interface between forested lands and developed lands poses an ongoing threat to property from wildfires. Potential wildfire areas outside of the recommended response time radius from the fire station may pose a higher risk to structures and residents than those located closer to the fire station.

Wildfire Hazard Loss Estimate

Step 1. Determine percent building damage ratio to single family residence from wildfire

- Wood Frame Construction, combustible siding and decking = 20% building damage
- *Source: Brookline Hazard Mitigation Team*

Step 2. Determine percent of structures in Brookline that would be damaged by wildfire

- 0.5% of structures estimated to be damaged by wildfire
- *Source: Brookline Hazard Mitigation Team*

Step 3. Determine total assessed value of structures in Brookline

- Total Assessed Value of all Structures in Brookline = $429,663,800
- *Source: Brookline Assessing Department (8/4/16)*

Step 4. Determine total loss from Wildfire

- Total Loss from Wildfire = Total Assessed Value of all Structures *Percentage of Structures Estimated to be Damaged * Percent Building Damage Ratio
- Total Loss from Wildfire = $429,663,800 * .005 * .2 = **$429,663.80**

Critical Facility Type	Total Number of this type of Critical Facilities in Brookline	Number of this type of Critical Facilities in Wildfire Hazard Area	Percentage of this type of Critical Facilities in Wildfire Hazard Area
General Occupancy	34	28	82.4%
Essential Facilities	5	5	100%
Transportation	17	1	5.9%
Utility System	5	4	80%
High Potential Hazard	9	0	0%
Hazardous Materials	0	0	0%

Section 3.6 ~ Overall Summary of Vulnerability

Table 7.1—Overall Summary of Vulnerability by Hazard

Hazard	Types of Critical Facilities Impacted by Hazard	Impact of Hazard	% of Critical Facilities in Hazard Area	% of Structures Estimated to be Damaged	$ Value of Loss
Climate Change	• General Occupancy • Essential Facilities • Transportation • Utility Systems • High Potential	See Impacts related to Drought, Extreme Temperatures, and Flooding below.	See Critical Facilities calculations for Drought, Extreme Temperatures, and Flooding	See damage estimates for Drought, Extreme Temperature, and Flooding below.	Calculating $ value of losses is beyond the scope of this Plan (see Section 3.5 Climate

Hazard	Types of Critical Facilities Impacted by Hazard	Impact of Hazard	% of Critical Facilities in Hazard Area	% of Structures Estimated to be Damaged	$ Value of Loss
	Hazard • Hazardous Materials • Agricultural Land		below.		Change for explanation)
Drought	Agricultural land. Not likely to have a significant impact on structures themselves, but can have significant impact on people's ability to utilize them.	Loss of crops. Inadequate quantity of drinking water—0% of Brookline population on public drinking water, 100% of Brookline population on private well water. Loss of water for fire protection. Increased risk of fire.	General Occupancy = 100% Essential Facilities = 100% Transportation = 0% Utility Systems = 20% High Potential Hazard = 0% Hazardous Materials = 0%	0 acres of agricultural land (0% of total land area)	Calculating $ value of losses is beyond the scope of this Plan (see Section 3.5 Drought for explanation)
Earthquake	• General Occupancy • Essential Facilities • Transportation • Utility Systems • High Potential Hazard • Hazardous Materials	Structural damage or collapse of buildings. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, radio system. Loss of water for fire protection. Risk to life, medical surge.	General Occupancy = 82.4% Essential Facilities = 100% Transportation = 100% Utility Systems = 80% High Potential Hazard = 100% Hazardous Materials = 0%	1-5%	$55,856.29 to $279,281.47
Extreme Temperatures	Not likely to have a significant impact on structures.	Overburdened power networks. Heating fuel	General Occupancy = 100%	0%	$0

Hazard	Types of Critical Facilities Impacted by Hazard	Impact of Hazard	% of Critical Facilities in Hazard Area	% of Structures Estimated to be Damaged	$ Value of Loss
		shortages. Risk to life from prolonged exposure.	Essential Facilities = 100% Transportation = 100% Utility Systems = 100% High Potential Hazard = 100% Hazardous Materials = 100%		
Flooding	• General Occupancy • Transportation • High Potential Hazard • Hazardous Materials	Water damage to structures and their contents. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, radio system. Environmental hazards resulting from damage. Isolation of neighborhoods resulting from flooding.	General Occupancy = 8.8% in 1% annual floodplain Essential Facilities = 20% in 1% annual floodplain Transportation = 76.5% in 1% annual floodplain Utility Systems = 20% in 1% annual floodplain High Potential Hazard = 44.4% in 1% annual floodplain Hazardous Materials = 0% in 1% annual floodplain	95 structures (3.9% of total) in 1% floodplain No 0.2% floodplains in Brookline	Loss in 1% floodplain: 1 foot flood = $2,659,734.71 2 foot flood = $3,546,312.95 3 foot flood = $4,078,259.89 4 foot flood = $4,964,838.13 No 0.2% floodplains in Brookline

Hazard	Types of Critical Facilities Impacted by Hazard	Impact of Hazard	% of Critical Facilities in Hazard Area	% of Structures Estimated to be Damaged	$ Value of Loss
			No 0.2% floodplains in Brookline		
Severe Wind	• General Occupancy • Essential Facilities • Transportation • Utility Systems • High Potential • Hazard • Hazardous Materials	Wind damage to structures and trees. Water damage to structures and their contents. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, radio system. Environmental hazards resulting from damage. Isolation of neighborhoods resulting from flooding.	General Occupancy = 82.4% Essential Facilities = 100% Transportation = 100% Utility Systems = 80% High Potential Hazard = 100% Hazardous Materials = 0%	5%	$4,296,638
Lightning	• General Occupancy • Essential Facilities • Utility System • High Potential Hazard • Hazardous Materials	Smoke and fire damage to structures. Disruption to power lines and municipal communications. Damage to critical electronic equipment. Injury or death to people involved in outdoor activity.	General Occupancy = 100% Essential Facilities = 100% Transportation = 5.9% Utility Systems = 80% High Potential Hazard = 0%	0.5%	$53,707.98

Hazard	Types of Critical Facilities Impacted by Hazard	Impact of Hazard	% of Critical Facilities in Hazard Area	% of Structures Estimated to be Damaged	$ Value of Loss
			Hazardous Materials = 0%		
Severe Winter Weather	• General Occupancy • Essential Facilities • Transportation • Utility • High Potential Hazard • Hazardous Materials	Disruption to road network. Damage to trees and power lines, communications. Structural damage to roofs/collapse. Increase in CO, other hazards.	General Occupancy = 82.4% Essential Facilities = 100% Transportation = 100% Utility Systems = 20% High Potential Hazard = 100% Hazardous Materials = 0%	1%	$214,831.90
Tornado/Downburst	• General Occupancy • Essential Facilities • Transportation • Utility System • High Potential Hazard • Hazardous Materials	Wind damage to structures and trees. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, radio system. Environmental hazards resulting from damage. Medical surge.	General Occupancy = 82.4% Essential Facilities = 100% Transportation = 100% Utility Systems = 80% High Potential Hazard = 100% Hazardous Materials = 0%	1%	$2,148,319
Wildfire	• General Occupancy • Essential Facilities • Utility System • High Potential Hazard • Hazardous	Smoke and fire damage to structures in wild land/urban interface. Damage to habitat.	General Occupancy = 82.4% Essential Facilities = 100%	0.5%	$429,663.80

Hazard	Types of Critical Facilities Impacted by Hazard	Impact of Hazard	% of Critical Facilities in Hazard Area	% of Structures Estimated to be Damaged	$ Value of Loss
	Materials	Impacts to air quality. Loss of natural resources.	Transportation = 5.9% Utility Systems = 80% High Potential Hazard = 0% Hazardous Materials = 0%		

Table 7.2—Overall Summary of Vulnerability by Facility Type

Note that Climate Change is not included as a hazard in this analysis because its effects on critical facilities are included under the hazards of Drought, Extreme Temperatures, and Flooding.

Facility Type	Total # of facilities	# susceptible to Drought	# susceptible to Earthquake	# susceptible to Extreme Temperatures	# susceptible to Flooding	# susceptible to Severe Wind	# susceptible to Lightning	# susceptible to Severe Winter Weather	# susceptible to Tornado/Downburst	# susceptible to Wildfire
General Occupancy	34	34	28	0	3 in 1% annual, 0 in 0.2% annual	28	34	28	28	28
Essential Facilities	5	5	5	0	1 in 1% annual; 0 in 0.2% annual	5	5	5	5	5
Transportation	17	0	17	0	13 in 1% annual; 0 in 0.2% annual	17	1	17	17	1
Utility	5	1	4	0	1 in 1% annual; 0 in 0.2% annual	4	4	1	4	4

Facility Type	Total # of facilities	# susceptible to Drought	# susceptible to Earthquake	# susceptible to Extreme Temperatures	# susceptible to Flooding	# susceptible to Severe Wind	# susceptible to Lightning	# susceptible to Severe Winter Weather	# susceptible to Tornado/Downburst	# susceptible to Wildfire
High Hazard	9	0	9	0	4 in 1% annual; 0 in 0.2% annual	9	0	9	9	0
Hazardous Materials	0	0	0	0	0 in 1% annual; 0 in 0.2% annual	0	0	0	0	0

Section 3.7 ~ National Flood Insurance Program

The Town of Brookline participates in the National Flood Insurance Program (NFIP). This provides full insurance coverage based on risk as shown on detailed Flood Insurance Rate Maps (FIRMs). Brookline joined the NFIP on May 19, 1987. The Town's initial Flood Hazard Boundary Map was identified on April 4, 1975 and its initial Flood Insurance Rate Map was identified on May 19, 1987. The current effective map date is September 25, 2009.

Brookline has 11 NFIP policies in force and $2,390,000 of insurance in force. There have been 6 paid losses totaling $56,026. Brookline has 1 repetitive loss property with total repetitive loss payments of $21,847. Brookline's repetitive loss property is classified as "other residential."

As a participant in the NFIP, communities must agree to adopt a floodplain management ordinance and enforce the regulations found in the ordinance. Brookline has adopted the "Floodplain Ordinance," found in Section 1200 of the Town of Brookline, NH Zoning and Land Use Ordinance. The Floodplain Ordinance is enacted to prevent the development of buildings and uses in areas that are unsatisfactory and hazardous due to the threat of flooding, protect natural flows and drainage, and comply with the requirements of the National Flood Insurance Act of 1968 (P.L. 90-488, as amended). The ordinance includes the following sections: Definition of Terms, Provisions, and Variance and Appeals Procedures.

To demonstrate Brookline's continued compliance with NFIP requirements, the Hazard Mitigation Team identified the follow mitigation actions as part of its comprehensive mitigation strategy. These actions also appear in Section 4.2, Table 9—Mitigation Actions.

Table 8—National Flood Insurance Program Mitigation Actions

National Flood Insurance Program Mitigation Actions			
Mitigation Action	**Mitigation Type**	**Hazard Addressed**	**Critical Facilities Addressed**
Establish mutual aid agreements with neighboring communities to address administering the NFIP following a major storm event.	• Emergency Services Protection	• Flooding	• General Occupancy • Essential Facilities • Transportation Systems • Utility Systems • High Potential Hazard • Hazardous Materials
Prepare, distribute, or make available NFIP, insurance, and building codes explanatory pamphlets or booklets.	• Public Information	• Flooding	• General Occupancy
Incorporate flood mitigation into local planning. Revise/adopt regulations to improve floodplain management in Brookline according to findings from 2017 regulatory audit.	• Prevention • Natural Resources Protection	• Flooding	• General Occupancy • Essential Facilities • Transportation Systems • Utility Systems • High Potential Hazard • Hazardous Materials

CHAPTER 4 MITIGATION STRATEGY

Section 4.1 ~ Goals and Objectives to Reduce Vulnerabilities to Hazards

The first step in developing a mitigation strategy is to establish goals that reflect what the municipality wishes to achieve through the implementation of its Hazard Mitigation Plan. The Brookline Hazard Mitigation Team established the following goals and objectives, based on its desire to protect the Town's population, critical facilities, infrastructure, emergency services, natural resources, and private property. These goals provided the basis for identifying and prioritizing mitigation actions.

Goal 1—Prevent the impacts of natural hazards on the Town's population, critical facilities, infrastructure, emergency services, natural resources, and private property whenever possible.

- Objective 1.1—Manage development in known hazard areas to avoid the risks associated with natural hazards.
- Objective 1.2—Plan to incorporate hazard mitigation into capital improvements and other future initiatives.
- Objective 1.3—Ensure building codes and other standards include requirements that make new construction more disaster resistant.
- Objective 1.4—Support the maintenance of this hazard mitigation plan.

Goal 2—Protect the Town's existing critical facilities, infrastructure, and private property from the impacts of natural hazards through cost effective mitigation activities.

- Objective2.1—Modify existing structures to reduce damage from future natural hazard events.
- Objective 2.2—Perform cost effective flood hazard mitigation measures to protect private property.

Goal 3—Educate and inform the Town's residents to help them become more resilient to natural hazards impacting the community.

- Objective 3.1—Utilize educational methods to change the perception from "disaster losses are acceptable" to "many disaster losses are preventable if mitigation practices are followed."
- Objective 3.2—provide educational opportunities across all age ranges.
- Objective 3.3—Develop and distribute public awareness materials regarding the relative risk of natural hazards and practical mitigation measures to reduce damages and injuries.

Goal 4—become more resilient to the impacts that climate change has on the Town's population, critical facilities, infrastructure, emergency services, natural resources, and private property.

- Objective 4.1—Utilize existing documents, including the Nashua Regional Water Resiliency Action Plan (NRPC, 2016) and "Climate Change in Southern New Hampshire" (Sustainability Institute, University of New Hampshire, 2014) to better understand predicted changes in the region's climate.
- Objective 4.2—Conduct a town-specific vulnerability assessment to better understand the municipality's strengths and weaknesses with respect to climate change readiness.
- Objective 4.3—Prioritize which climate change impacts to address and when. Prioritization could be based on vulnerability assessment results, current needs, upcoming plans, feasibility, or budget considerations.
- Objective 4.4—Develop an adaptation strategy, including potential mitigation measures, timelines, responsible parties, and available funding sources.
- Objective 4.5—Implement the adaptation strategy and incorporate finding into hazard mitigation plan updates.
- Objective 4.6—Track progress and monitor results to determine where improvements can be made. Adjust the implementation strategy as necessary.

Goal 5—Address the challenges of natural resource degradation and the associated increased risk from hazards.

- Objective 5.1—Ensure development in hazard areas does not destroy natural barriers to damage, such as floodplains and vegetation.
- Objective 5.2—Protect or recreate environmental assets to help safeguard the built environment.

Goal 6—Protect emergency services, critical facilities, and other critical capabilities from hazard damage in order for them to remain operational.

- Objective 6.1—Identify critical facilities, infrastructure, and emergency services and their vulnerabilities to natural hazards.
- Objective 6.2— Develop and implement programs to promote hazard mitigation actions that protect the provision of emergency services in Town.
- Objective 6.3—Identify, maintain, and protect evacuation routes from hazard damage so they are usable when needed.

Section 4.2 ~ Mitigation Actions

After establishing goals and objectives to reduce vulnerabilities to each hazard type, the Hazard Mitigation Team identified mitigation actions to achieve these goals. The resulting mitigation actions appear in Table 9 below.

Table 9—Mitigation Actions

Mitigation Action	Mitigation Type	Hazard Addressed	Critical Facilities Addressed
MITIGATION ACTIONS FROM 2012 PLAN			
Proactively enforce the International Building Code (IBC) and International Residential Code (IRC) to protect buildings and infrastructure from the impacts of earthquake, flooding, severe wind, severe winter weather, and tornado.	• Prevention • Property Protection	• Earthquake • Flooding • Severe Wind • Severe Winter Weather • Tornado	• General Occupancy • Essential Facilities • Hazardous Materials
Create a database to track those individuals at high risk of death during hazard events, such as the elderly, sick, and homeless. Coordinate with the Emergency Management Director to conduct in-person outreach to these individuals to ensure they are adequately protected from the impacts of hazard events, including severe winter weather and extreme temperatures.	• Public Information	• Extreme Temperatures • Severe Winter Weather	• Human lives
Distribute Community Hazards Guides and conduct outreach and education programs to increase awareness of drought, earthquake,	• Public Information • Prevention	• Drought • Earthquake • Extreme	• General Occupancy • Human lives

Mitigation Action	Mitigation Type	Hazard Addressed	Critical Facilities Addressed
extreme temperatures, flooding, lightning, severe wind, severe winter weather, tornado, wildfire, and carbon monoxide risks. Utilize Code Red, community access TV, Brookline website, and social media.	• Natural Resource Protection	Temperatures • Flooding • Lightning • Severe Wind • Severe Winter Weather • Tornado • Wildfire	
Assess past flooding events around West Hill Rd. Consider costs and benefits of a variety of infrastructure upgrades. Conduct needed infrastructure repairs or replacements to mitigate future flooding.	• Structural	• Flooding	• Transportation Systems • General Occupancy
Engineer and upgrade Bond Street Bridge.	• Structural	• Flooding	• Transportation Systems
NATIONAL FLOOD INSURANCE PROGRAM MITIGATION ACTIONS			
Establish mutual aid agreements with neighboring communities to address administering the NFIP following a major storm event.	• Emergency Services Protection	• Flooding	• General Occupancy • Essential Facilities • Transportation Systems • Utility Systems • High Potential Hazard • Hazardous Materials
Prepare, distribute, or make available NFIP, insurance, and building codes explanatory pamphlets or booklets.	• Public Information	• Flooding	• General Occupancy
Incorporate flood mitigation into local planning. Revise/adopt regulations to improve floodplain management in Brookline according to findings from 2017 regulatory audit. Update or strengthen floodplain development ordinances to reflect increased flood risk under climate change, such as prohibiting or limiting floodplain development, limiting the percentage of impervious surface allowed, prohibiting fill, and creating a stream buffer ordinance. Incorporate updated floodplains for Merrimack Watershed into municipal planning activities when they become available.	• Prevention • Natural Resources Protection	• Flooding	• General Occupancy • Essential Facilities • Transportation Systems • Utility Systems • High Potential Hazard • Hazardous Materials
ADDITIONAL MITIGATION ACTIONS			
Enforce RSA 41:11-d, which allows	• Prevention	• Drought	• General

Mitigation Action	Mitigation Type	Hazard Addressed	Critical Facilities Addressed
municipalities to restrict all residential lawn watering for properties on public water systems and those on private domestic wells within their political boundaries if the state or federal government declares a drought condition for that region of the state. The governing body can enforce the lawn watering restrictions by imposing fines in accordance with RSA 625:9. Notice shall be given at least 3 calendar days before the regulations are implemented and shall be published in a paper of general circulation in the municipality and shall be posted in at least 2 public places. Other outreach methods include Brookline town website, social media accounts, local cable, and Code Red.	• Natural Resources Protection • Public Information		Occupancy • Essential Facilities
Monitor water supply and drought conditions. Utilize NH Division of Forest and Lands reports and consult the New Hampshire Drought Management Team (DMT) and the State Drought Management Plan to monitor drought indicators. Drought regions and updates on the drought status may be found here.	• Natural Resources Protection	• Wildfire • Drought	• General Occupancy • Essential Facilities • Transportation Systems • Utility Systems • High Potential Hazard • Hazardous Materials
Protect vulnerable populations from the impacts of extreme temperatures and severe winter storms by establishing warming and cooling stations at the Safety Complex and Fire Station.	• Prevention • Public Information	• Extreme Temperatures • Severe Winter Weather	• Human lives
Protect critical facilities and equipment from lightning damage. Install and maintain surge protection on critical electronic equipment at Safety Complex and Fire Station.	• Property Protection	• Lightning	• Essential Facilities
Continue to work with Eversource to harden electrical infrastructure, including trimming trees near power lines.	• Prevention	• Severe Winter Weather • Severe Wind	• Transportation Systems • Utility Systems

Section 4.3 ~ Prioritizing Mitigation Actions

After identifying mitigation actions to address each hazard, the Team then began a two-step process to prioritize them. The first step was to conduct a benefit cost review. Benefit cost reviews provide a

comprehensive overview of the monetary and non-monetary costs and benefits associated with each action. During this process, the Hazard Mitigation Team asked a variety of questions such as, "How beneficial is this action to the entire Town?" "How many people will benefit from this action?" "How large of an area is impacted by this project?" "How costly is this project?"

Table 10—Benefit Cost Review

Mitigation Action	Likely Benefits	Likely Costs
Proactively enforce the International Building Code (IBC) and International Residential Code (IRC) to protect buildings and infrastructure from the impacts of earthquake, flooding, severe wind, severe winter weather, and tornado.	• This action would be effective at avoiding and reducing future losses. • This action is beneficial to all applicable buildings across the entire Town.	• This action may not benefit older structures not subject to newer building codes. • $40,201 *(source: Brookline Operating Budget, Building Inspection appropriation)*
Create a database to track those individuals at high risk of death during hazard events, such as the elderly, sick, and homeless. Coordinate with the Emergency Management Director to conduct in-person outreach to these individuals to ensure they are adequately protected from the impacts of hazard events, including severe winter weather and extreme temperatures.	• Helps vulnerable populations • Voluntary participation	• May be difficult to get personal contact information • Voluntary participation means not everyone would be covered • $750 annually *(source: Brookline Operating Budget, Emergency Management appropriation)*
Distribute Community Hazards Guides and conduct outreach and education programs to increase awareness of drought, earthquake, extreme temperatures, flooding, lightning, severe wind, severe winter weather, tornado, wildfire, and carbon monoxide risks. Utilize Code Red, community access TV, Brookline website, and social media.	• The Town currently has the capacity to implement this action. • This action is beneficial to all residents in Town.	• This action may have limited impact because it can be difficult to get people to pay attention to outreach campaigns. • $0 additional costs, percentage of $19,861 Emergency Management budget *(source: 2016 Brookline Operating Budget)*
Assess past flooding events around West Hill Rd. Consider costs and benefits of a variety of infrastructure upgrades. Conduct needed infrastructure repairs or replacements to mitigate future flooding.	• There are environmental benefits to surface water quality. • Addressing flooding on West Hill Rd. would eliminate the need to regrade the road after quick, hard rain events.	• It is expensive to upgrade culvert and stormwater drainage systems. • There are alternate routes if West Hill Rd is impassible. • West Hill Rd has never washed out completely. • Individual culvert and storm

Mitigation Action	Likely Benefits	Likely Costs
		drain repairs may only benefit a localized area, while the economic costs are shared among the entire population. • $2,500-$75,000 per drainage project depending on scale; $230,000 for vacuum sweeper; $5,000-$105,000 per culvert. Maintenance costs vary by type; see "Comparison of Maintenance Cost, Labor Demands, and System Performance for LID & Conventional Stormwater Management" for estimates. *(source: Brookline CIP and Brookline Operating Budget, Highway, Streets, & Bridges: General Maintenance-Drainage appropriation)*
Engineer and upgrade Bond Street Bridge.	• Taking this action helps reduce the risk of major repair costs that might occur if no action were taken. • This action has the potential to reduce flood related economic losses.	• It is expensive to upgrade a bridge, however, State Aid is available. • At March 2017 Town Meeting voters approved a warrant article to establish the Bond St Bridge Engineering and Reconstruction Capital Reserve Fund to defray costs of engineering and reconstruction. Residents also voted to raise and appropriate $167,000 to be placed in the fund. • $880,000 for replacement of deck and beams, rehabilitation of abutments; $1,825,000 for full replacement of deck, beams, and abutments *(source: Brookline CIP 2017-2022)*
Establish mutual aid agreements with neighboring communities to	• This action helps municipalities to share	• Establishing mutual aid agreements for public

Mitigation Action	Likely Benefits	Likely Costs
address administering the NFIP following a major storm event.	resources and decreases the burden on any one community. • This action would be most beneficial to residents in flood-prone areas of Town. • This action has the potential to reduce flood related economic losses.	works related support is difficult because Brookline does not have a municipal public works department. Public works related responsibilities fall under the town Highway Agent, pursuant to RSA 231:62, using his own equipment and labor. • Responding to a mutual aid call in a neighboring community could take away resources from Brookline. • Mutual aid calls for non-federally declared disasters would not be reimbursed by FEMA. • $0 additional cost to establish agreements; percentage of $699,199 Police Dept. budget and/or $361,239 Fire Dept. budget for response *(source: 2016 Brookline Operating Budget)*
Prepare, distribute, or make available NFIP, insurance, and building codes explanatory pamphlets or booklets.	• Educate residents, builders, and other professionals about NFIP • Reduce property loss costs associated with flooding	• Minimal, part of normal town operations • $500 annually; part of existing Building Inspection budget *(source: 2016 Brookline Operating Budget)*
Incorporate flood mitigation into local planning. Revise/adopt regulations to improve floodplain management in Brookline according to findings from 2017 regulatory audit. Update or strengthen floodplain development ordinances to reflect increased flood risk under climate change, such as prohibiting or limiting floodplain development, limiting the percentage of impervious surface allowed, prohibiting fill, and creating a stream buffer ordinance. Incorporate updated floodplains	• This action would be effective at avoiding and reducing future losses. • This action would be most beneficial to residents in flood-prone areas of Town. • This action has the potential to reduce flood related economic losses.	• This action would impact property owners subject to the revised regulations. • $5,000-$10,000 depending on scope; if possible complete in conjunction with similar measures (ex. regulatory audit) to reduce costs *(source: Brookline Operating Budget, Planning & Zoning appropriation)*

Mitigation Action	Likely Benefits	Likely Costs
for Merrimack Watershed into municipal planning activities when they become available.		
Enforce RSA 41:11-d, which allows municipalities to restrict all residential lawn watering for properties on public water systems and those on private domestic wells within their political boundaries if the state or federal government declares a drought condition for that region of the state. The governing body can enforce the lawn watering restrictions by imposing fines in accordance with RSA 625:9. Notice shall be given at least 3 calendar days before the regulations are implemented and shall be published in a paper of general circulation in the municipality and shall be posted in at least 2 public places. Other outreach methods include Brookline town website, social media accounts, local cable, and Code Red.	• This action has environmental benefits if residents comply with reduced water consumption measures. • The state may have educational materials that the Town could utilize.	• This action may have limited impact if there is not an accompanying enforcement mechanism. • There are social concerns about local government regulating what residents can do with private wells. • $0 additional costs, percentage of $225,267 Executive budget for implementation; percentage of $699,199 Police Dept. budget for enforcement *(source: 2016 Brookline Operating Budget)*
Monitor water supply and drought conditions. Utilize NH Division of Forest and Lands reports and consult the New Hampshire Drought Management Team (DMT) and the State Drought Management Plan to monitor drought indicators. Drought regions and updates on the drought status may be found here.	• This action has environmental benefits if residents comply with reduced water consumption measures. • This action may help ensure adequate water supply for firefighting and emergency management purposes.	• This action may have limited impact if there is not an accompanying enforcement mechanism. • $0 additional costs, percentage of $361,239 Fire Dept. budget *(source: 2016 Brookline Operating Budget)*
Protect vulnerable populations from the impacts of extreme temperatures and severe winter storms by establishing warming and cooling stations at the Safety Complex and Fire Station.	• This action would benefit the entire Town and particularly the most at risk and needy populations. • This action has broad social benefits for the community.	• $0 additional costs, percentage of $19,861 Emergency Management budget *(source: 2016 Brookline Operating Budget)*
Protect critical facilities and equipment from lightning damage. Install and maintain surge protection on critical electronic equipment at Safety Complex and	• Reduced inconvenience and loss associated with a shutdown of critical facilities due to lightning damage.	• $1,000-$5,000 per critical facility for lightning protection devices *(source: Brookline Operating Budget, General*

Mitigation Action	Likely Benefits	Likely Costs
Fire Station.		*Government Buildings appropriation)*
Continue to work with Eversource to harden electrical infrastructure, including trimming trees near power lines.	• Trimming trees near power lines would reduce the risk of outages. • Fewer trees directly along road would also reduce root systems in roadways, allow more sunlight for better snowmelt, and improve overall improve road conditions.	• Removal of trees along designated scenic roads requires Planning Board approval • Tree removal may be incompatible with local aesthetics • $1,200 per large tree for removal *(source: Brookline Operating Budget, Highways, Streets, & Bridges: Tree Warden appropriation)*

After completing a Benefit Cost review for each action, the Hazard Mitigation Team then prioritized the actions by conducting a STAPLEE Analysis, which stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental factors. For each mitigation action, the Team asked the following questions:

- Social— Will the action unfairly affect any one segment of the population? Will it disrupt established neighborhoods? Is it compatible with present and future community values? Will it adversely affect cultural resources?
- Technical—How effective is the action in avoiding or reducing future losses? Will it create more problems than it solves? What are some secondary impacts? Does it solve a problem or only a symptom?
- Administrative— Does the community have the capability to implement the action? Can the community provide the necessary maintenance? Can it be accomplished in a timely manner?
- Political— Is there public support both to implement and maintain the action? Is the political leadership willing to support it? Does it present a financial burden to stakeholders?
- Legal— Does the community have the authority to implement the action? Is enabling legislation necessary? What are the legal side effects? Will the community be liable for the actions, support of actions, or lack of actions?
- Economic— What are the costs of this action? How will the costs be borne? Are state/federal grant programs applicable? Does the action fit into existing capital improvements or economic development budgets?
- Environmental— How will this action affect the environment? Does it comply with local, state, and federal environmental regulations? Is it consistent with community environmental goals? Are endangered or threatened species likely to be affected?

The cost and benefit of each mitigation action were then evaluated and assigned a quantitative score based on the STAPLEE criteria.

Benefit Score Range: 0 = Not Beneficial, 1 = Somewhat Beneficial, 2 = Beneficial, 3 = Very Beneficial

Cost Score Range: 0 = Not Costly, -1 = Somewhat Costly, -2 = Costly, -3 = Very Costly

Next, the scores for each action were added to determine priority. Finally, the Hazard Mitigation Team reviewed the scores and resulting prioritization to make sure it was consistent with the Town's goals and Master Plan. The STAPLEE analysis and prioritized mitigation actions appear in Table 11 below.

Table 11—STAPLEE Analysis

Mitigation Action: Engineer and upgrade Bond Street Bridge.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	This action is compatible with present and future community values, including ensuring safe, reliable transportation. This action could be disruptive to residents living near construction.	0	3
Technical	This action solves the problem of bridge and roadway flooding.	0	3
Administrative (including responsible party)	Brookline has the capability to administer and maintain this action. The Brookline Road Agent is the responsible party. Actual implementation of this project will be subcontracted out to a construction and engineering firm.	0	3
Political	There is public and political support to implement and maintain this action. At March 2017 Town Meeting voters approved a warrant article to establish the Bond St Bridge Engineering and Reconstruction Capital Reserve Fund to defray costs of engineering and reconstruction. Residents also voted to raise and appropriate $167,000 to be placed in the fund.	0	3
Legal	Brookline has the legal authority to implement this action.	0	3
Economic (including direct cost)	Estimates range from $880,000 for replacement of deck and beams, rehabilitation of abutments to $1,825,000 for full replacement of deck, beams, and abutments. This action is in the 2017-2022 Brookline CIP. NH State Aid Program will provide 80% funding for bridge replacement, but the Town needs to contribute 20%.	-2	3
Environmental	This action is beneficial to the environment by reducing flooding and road washout.	0	2
Subtotal		**-2**	**20**
Total		**18**	
Priority		**1**	

Mitigation Action: Continue to work with Eversource to harden electrical infrastructure, including trimming trees near power lines.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	This action would not unfairly affect any segment of the population or disrupt established neighborhoods. It is compatible with community values that understand trees need to be trimmed for road maintenance and public safety.	0	3
Technical	This action would be effective in avoiding or reducing future losses. It is very likely that a severe winter storm or severe wind event will occur and impact power lines. It would not create more problems than it	0	3

	solves and it solves the problem rather than only a symptom. Fewer trees directly along the road would also improve drainage, reduce rood systems in the roadway, and allow more sunlight to melt the snow, all resulting in better road conditions.		
Administrative (including responsible party)	Brookline has the capacity to implement this action. The Brookline Road Agent and Eversource would be the responsible parties.	0	3
Political	In general there is political support for this action, although there may be some opposition to tree trimming along designated scenic roads.	-1	3
Legal	The Town does not have the authority to trim trees along scenic roads without first receiving approval from the Planning Board. The Planning Board has the legal authority to declare dead trees along a scenic road a public hazard and therefore allow them to be removed.	-1	3
Economic (including direct cost)	Some costs associated with this action would be borne by Eversource. The remaining costs would be borne by the Town. The removal of large trees would cost an estimated $1,200 per tree and would be performed by a hired contractor. The removal of small trees would be performed by the Road Agent. The benefits of a more resilient electrical infrastructure far outweigh the costs of this action.	-1	3
Environmental	This action would positively impact the environment by improving road drainage and decreasing the need to use ice melting agents.	0	2
Subtotal		**-3**	**20**
Total		**17**	
Priority		**2**	

Mitigation Action: Protect vulnerable populations from the impacts of extreme temperatures and severe winter storms by establishing warming and cooling stations at the Safety Complex and Fire Station.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	This action primarily benefits Brookline's most vulnerable residents. It is compatible with present and future community values.	0	2
Technical	This action does not solve the problem of extreme temperatures, but it does solve the symptom of exposure. Extreme temperatures are very likely to occur in Brookline, so mitigation measures are important.	0	3
Administrative (including responsible party)	Brookline has the capability to implement this action. The Brookline Emergency Management Director is responsible for it and it falls under ongoing emergency management operations. This action can be implemented in a very timely manner.	0	3
Political	There is public support to implement and maintain this action.	0	3
Legal	Brookline has the legal authority to implement this action.	0	3
Economic (including direct cost)	This action falls under Brookline's existing $19,861 Emergency Management budget and does not impose additional costs on the Town.	0	2
Environmental	There are no environmental impacts associated with this action.	0	0
Subtotal		**0**	**16**
Total		**16**	
Priority		**3**	

Mitigation Action: Distribute Community Hazards Guides and conduct outreach and education programs to increase awareness of drought, earthquake, extreme temperatures, flooding, lightning, severe wind, severe winter weather, tornado, wildfire, and carbon monoxide risks. Utilize Code Red, community access TV, Brookline website, and social media.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	This action does not unfairly affect any one segment of the population. It is available to all Brookline residents, provided that a variety of distribution methods are utilized.	0	2
Technical	There is a high likelihood that at least one of the hazards addressed through this action will occur. This action would help to decrease risk and avoid future loss, but only if residents take personal action as a result of this educational campaign.	-1	3
Administrative (including responsible party)	Brookline has the capability to implement this action. This action would be the responsibility of the Brookline Emergency Management Director.	0	3
Political	There is public support to implement and maintain this action.	0	2
Legal	Brookline has the legal authority to implement this action.	0	3
Economic (including direct cost)	There is $0 in additional costs to implement this action. It is part of the existing $19,861 Emergency Management budget.	0	3
Environmental	This action has the potential to reduce property damage and subsequent environmental impacts.	0	1
Subtotal		**-1**	**17**
Total		**16**	
Priority		**3**	

Mitigation Action: Create a database to track those individuals at high risk of death during hazard events, such as the elderly, sick, and homeless. Coordinate with the Emergency Management Director to conduct in-person outreach to these individuals to ensure they are adequately protected from the impacts of hazard events, including severe winter weather and extreme temperatures.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	This is a voluntary program, so it would not affect any one segment of the population. Helping vulnerable populations is compatible with community values.	0	3
Technical	This action is only effective at avoiding or reducing future losses if residents voluntarily participate in it.	0	2
Administrative (including responsible party)	The Town has the capability to implement this action if information is voluntarily provided by residents. The Brookline Emergency Management Director is responsible for implementing this action.	0	3
Political	There is political support for this action.	0	2
Legal	The Town has the authority to implement this action and no enabling legislation is necessary. Participation in this program in entirely voluntary.	0	2
Economic (including direct cost)	This action would cost roughly $750 annually. It is consistent with normal town operations and does not impose additional economic costs.	0	3
Environmental	This action would not impact the environment.	0	0

Subtotal		**0**	**15**
Total		**15**	
Priority		**5**	

Mitigation Action: Prepare, distribute, or make available NFIP, insurance, and building codes explanatory pamphlets or booklets.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	This action would not unfairly affect any segment of the population, disrupt established neighborhoods, or adversely affect cultural resources.	0	2
Technical	This action would help to avoid or reduce future losses. It has more potential to solve symptoms related to flooding than the underlying problem itself. It would not create additional problems or cause secondary impacts.	0	3
Administrative (including responsible party)	Brookline has the capability to implement this action. The Brookline Building Inspector would be responsible for it. It can be accomplished in a timely manner.	0	3
Political	There is public support to implement and maintain this action. The political leadership is also willing to support it.	0	2
Legal	Brookline has the legal authority to implement this action. The Town's role is only to provide and distribute the materials, not to make actual insurance determinations.	0	2
Economic (including direct cost)	This action is consistent with normal town operations and does not impose additional economic costs. It would cost $500 per year to implement and would come out of the Building Inspection budget.	-1	2
Environmental	This action has the potential to reduce property damage and subsequent environmental impacts only if the recommendations in the literature are implemented.	0	1
Subtotal		**-1**	**15**
Total		**14**	
Priority		**6**	

Mitigation Action: Monitor water supply and drought conditions. Utilize NH Division of Forest and Lands reports and consult the New Hampshire Drought Management Team (DMT) and the State Drought Management Plan to monitor drought indicators.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	This action does not unfairly impact any segment of the population and it is compatible with present and future community values.	0	2
Technical	This action helps to solve symptoms of drought my making emergency response personnel and residents aware of current conditions. Monitoring alone has limited ability to reduce future loss—additional action is needed.	-2	2
Administrative (including responsible party)	The Brookline Fire Dept. is responsible for monitoring water supply and drought conditions.	0	3
Political	There is public and political support for this action.	0	2

Legal	Brookline has the legal authority to implement this action.	0	2
Economic (including direct cost)	Monitoring costs are covered under the existing $361,239 Fire Dept. budget.	-1	2
Environmental	This action has a positive impact on the environment by providing the data needed to promote water conservation.	0	2
Subtotal		**-3**	**15**
Total		**12**	
Priority		**7**	

Mitigation Action: Proactively enforce the International Building Code (IBC) and International Residential Code (IRC) to protect buildings and infrastructure from the impacts of earthquake, flooding, severe wind, severe winter weather, and tornado.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	There are not social impacts associated with this action. Enforcement would apply evenly across all applicable buildings, including new construction, major renovations, and changes of use.	-1	2
Technical	This action is effective at avoiding and reducing future losses and it mitigates the impacts of these hazards.	0	2
Administrative (including responsible party)	Brookline has the capability to implement this action. Responsibility would fall under the Brookline Building Inspector.	0	2
Political	There is public support for this action. Concerns may exist among some property owners who would be directly impacted.	-1	2
Legal	Brookline has adopted these codes and has the legal authority to enforce them.	0	2
Economic (including direct cost)	There would be no additional costs associated with enforcing building codes, as it falls under the existing $40,201 Building Inspection budget. This action could have a positive economic impact by reducing the number of emergency response calls.	-1	2
Environmental	This action has the potential to reduce property damage and subsequent environmental impacts.	0	1
Subtotal		**-3**	**13**
Total		**10**	
Priority		**8**	

Mitigation Action: Protect critical facilities and equipment from lightning damage. Install and maintain surge protection on critical electronic equipment at Safety Complex and Fire Station.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	This action would not unfairly affect any segment of the population, disrupt established neighborhoods, or adversely affect cultural resources.	0	2
Technical	This action is effective in avoiding or reducing future losses. It would not create more problems than it solves. It would reduce the inconvenience from a shutdown of critical facilities resulting from power outages. However, incidents related to lightning are very rare	-1	2

	in Brookline.		
Administrative (including responsible party)	Brookline has the capacity to implement this action. Each critical facility department head is responsible for implementing the installation of lightning protection devices.	0	2
Political	There is political support to implement and maintain this action.	0	2
Legal	Brookline has the authority to implement this action.	0	1
Economic (including direct cost)	The cost of $1,000-$5,000 per critical facility for lightning protection devices would come out of the Brookline Operating Budget, General Government Buildings appropriation. The cost of taking this action is less than the potential costs of damage to critical electronics and facilities.	-1	2
Environmental	This action would not impact the environment.	0	0
Subtotal		**-2**	**11**
Total		**9**	
Priority		**9**	

Mitigation Action: Enforce RSA 41:11-d, which allows municipalities to restrict all residential lawn watering for properties on public water systems and those on private domestic wells within their political boundaries if the state or federal government declares a drought condition for that region of the state.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	This action does not unfairly affect any one segment of the population because it is applied evenly to all residents and businesses. There are social concerns about local government regulating how residents can use their private wells.	-2	2
Technical	The effectiveness of this action depends on the ability of the Town to enforce it. If followed, it would help to reduce the impacts of drought.	-1	2
Administrative (including responsible party)	Brookline has the capability to implement this action. The Brookline Board of Selectmen would be responsible for implementation and the Brookline Police Dept. would be responsible for enforcement.	0	3
Political	The Brookline Board of Selectmen support this action. There is general public support for this action, although some residents are unsatisfied with it.	-2	2
Legal	The Brookline Board of Selectmen have the legal authority to implement this action under NH RSA 41:11-d.	0	3
Economic (including direct cost)	There are no additional costs associated with this action. A percentage of $225,267 Executive budget would be used for implementation and a percentage of $699,199 Police Dept. budget would be used for enforcement.	-1	0
Environmental	This action would have a positive impact on the environment by reducing water use in a time of scarcity.	0	2
Subtotal		**-6**	**14**
Total		**8**	
Priority		**10**	

Mitigation Action: Incorporate flood mitigation into local planning. Revise/adopt regulations to improve floodplain management in Brookline according to findings from 2017 regulatory audit. Update or strengthen floodplain development ordinances to reflect increased flood risk under climate change, such as prohibiting or limiting floodplain development, limiting the percentage of impervious surface allowed, prohibiting fill, and creating a stream buffer ordinance. Incorporate updated floodplains for Merrimack Watershed into municipal planning activities when they become available.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	This action would impact property owners subject to revised floodplain designations. It would have a positive social impact on the community by reducing flooding.	0	2
Technical	This action helps solved the problem of flood related damage. It is effective in reducing future losses.	0	2
Administrative (including responsible party)	Brookline has the capability to implement this action. Revisions to regulations require a town vote and public hearing. The Brookline Planning Board would be responsible for this action.	-2	2
Political	There is public support to implement this action.	0	1
Legal	Brookline has the legal authority to implement this action.	0	1
Economic (including direct cost)	This action could cost $5,000-$10,000 depending on the scope. However, this expenditure would simultaneously accomplish a number of similar mitigation actions. This action could have a positive economic impact by reducing the number of emergency response calls.	-1	2
Environmental	This action has positive environmental impacts and is consistent with community environmental goals.	0	1
Subtotal		**-3**	**11**
Total		**8**	
Priority		**10**	

Mitigation Action: Assess past flooding events around West Hill Rd. Consider costs and benefits of a variety of infrastructure upgrades. Conduct needed infrastructure repairs or replacements to mitigate future flooding.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	Maintenance activities primarily impact the West Hill Rd area. There are alternate routes around West Hill Rd.	-1	2
Technical	This action helps to solve the problem of flooding rather than just a symptom. It can also help avoid or reduce future losses.	0	2
Administrative (including responsible party)	Brookline has the capability to implement this action, though it is costly. The Brookline Road Agent is the responsible party.	-2	2
Political	There is public support to implement and maintain this action.	0	2
Legal	Brookline has the legal authority to implement this action.	0	1
Economic (including direct cost)	This action is costly to implement. Estimates include $2,500-$75,000 per drainage project depending on scale; $230,000 for vacuum sweeper; $5,000-$105,000 per culvert. Maintenance costs vary by type; see "Comparison of Maintenance Cost, Labor Demands, and System Performance for LID & Conventional Stormwater Management" for additional estimates. The costs may outweigh the benefits, as West Hill Rd only floods after quick, hard rain events and has never completed washed out. Historically, it has only needed to be regraded.	-3	2

Environmental	This action has positive environmental benefits and is consistent with community environmental goals.	0	1
Subtotal		**-6**	**12**
Total		**6**	
Priority		**12**	

Mitigation Action: Establish mutual aid agreements with neighboring communities to address administering the NFIP following a major storm event.			
Criteria	**Evaluation**	**Cost**	**Benefit**
Social	This action would not unfairly affect any segment of the population, disrupt established neighborhoods, or adversely affect cultural resources. It would positively affect residents in Brookline as well as in other municipalities that take part in the mutual aid agreement.	0	2
Technical	This action is effective in avoiding or reducing future losses related to flooding. It does not create more problems than it solves. It solves the problem of flooding when used to implement mitigation actions. However, if public works mutual aid agreements cannot be established due to the nature of Brookline's Road Agent agreement, then this action's technical capabilities are limited.	-2	2
Administrative (including responsible party)	Brookline has the capability to implement this action for Fire and Police. The Fire Chief and Police Chief would be responsible for implementing this action. The Town already has mutual aid agreements in place for Police and Fire than can be used as a model. It can be accomplished in a timely manner. Establishing mutual aid agreements for public works related support is more difficult because Brookline does not have a municipal public works department. Public works related responsibilities fall under the town Highway Agent, pursuant to RSA 231:62, using his own equipment and labor. This does not fit into the existing model of Public Works mutual aid.	-3	1
Political	It is unclear whether there is political support to change the existing Road Agent agreement to allow for public works mutual aid.	0	0
Legal	Brookline has the legal authority to implement this action for police and fire. Legal considerations have already been addressed in the existing police and fire mutual aid agreements. Provisions would have to be made in the Road Agent Policy in order to accommodate public works related mutual aid.	-1	2
Economic (including direct cost)	The cost of responding to other municipalities would come out of the existing of $699,199 Police Dept. budget and/or $361,239 Fire Dept. budget. FEMA would reimburse the Town for response to federally declared emergencies. It is uncertain where funding for public works related mutual aid would come from. This action could economically beneficial because the Town would have assistance from surrounding communities following a major storm event.	-2	2
Environmental	This action would positively affect the environment by reducing the risk of flooding.	0	2
Subtotal		**-8**	**11**
Total		**3**	
Priority		**13**	

Section 4.4 ~ Implementing and Administering Mitigation Actions

The Town of Brookline has integrated its 2012 Hazard Mitigation Plan into a variety of other planning mechanisms, including the Brookline Emergency Operations Plan and Capital Improvements Plan. In addition, the Town of Brookline has incorporated and will continue to integrate requirements of the Brookline Hazard Mitigation Plan Update 2017 into other planning mechanisms and actions, such as the upcoming regulatory audit.

Updates to Brookline's Capital Improvement Plan will include any applicable mitigation projects identified in the Hazard Mitigation Plan, such as bridge improvements. The next update to the Town's Master Plan will also incorporate elements of the Hazard Mitigation Plan where applicable.

The Brookline Hazard Mitigation Team will be responsible for helping Town boards and departments to integrate the Hazard Mitigation Plan into their own planning mechanisms. The Hazard Mitigation Team developed Table 12, which is an action plan that outlines who is responsible for implementing the prioritized mitigation actions, how they will be funded, and when they will be completed.

Timeframe	
Short Term	1 year or less, or ongoing*
Medium Term	2 -3 years
Long Term	4-5 years

**Ongoing indicates that the action will be completed on an ongoing basis throughout the life of the Plan.*

Table 12—Implementation and Administration

Priority	Mitigation Action	Responsible Party	Cost & Funding	Timeframe
1	Engineer and upgrade Bond Street Bridge.	Brookline Road Agent	Cost = $880,000 for replacement of deck and beams, rehabilitation of abutments; $1,825,000 for full replacement of deck, beams, and abutments Funding Source: Brookline CIP, NH State Bridge Aid	Medium Term (design and permitting).
2	Continue to work with Eversource to harden electrical infrastructure, including trimming trees near power lines.	Brookline Road Agent	Cost = $1,200 per large tree for removal Funding Source: Brookline Operating	Short Term

Priority	Mitigation Action	Responsible Party	Cost & Funding	Timeframe
			Budget, Highways, Streets, & Bridges: Tree Warden appropriation	
3	Distribute Community Hazards Guides and conduct outreach and education programs to increase awareness of drought, earthquake, extreme temperatures, flooding, lightning, severe wind, severe winter weather, tornado, wildfire, and carbon monoxide risks. Utilize Code Red, community access TV, Brookline website, and social media.	Brookline Emergency Management Director	Cost = $0 additional costs, percentage of $19,861 Funding Source: Brookline Operating Budget, Emergency Management appropriation	Short Term
3	Protect vulnerable populations from the impacts of extreme temperatures and severe winter storms by establishing warming and cooling stations at the Safety Complex and Fire Station.	Brookline Emergency Management Director	Cost = $0 additional costs, percentage of $19,861 Funding Source: Brookline Operating Budget, Emergency Management appropriation	Short Term
5	Create a database to track those individuals at high risk of death during hazard events, such as the elderly, sick, and homeless. Coordinate with the Emergency Management Director to conduct in-person outreach to these individuals to ensure they are adequately protected from the impacts of hazard events, including severe winter weather and extreme temperatures.	Brookline Emergency Management Director	Cost = $750 annually Funding Source: Brookline Operating Budget, Emergency Management appropriation	Short Term
6	Prepare, distribute, or make available NFIP, insurance, and building	Brookline Building Inspector	Cost = $500 annually Funding Source:	Short Term

Priority	Mitigation Action	Responsible Party	Cost & Funding	Timeframe
	codes explanatory pamphlets or booklets.		Brookline Operating Budget, Building Inspection appropriation	
7	Monitor water supply and drought conditions. Utilize NH Division of Forest and Lands reports and consult the New Hampshire Drought Management Team (DMT) and the State Drought Management Plan to monitor drought indicators. Drought regions and updates on the drought status may be found here.	Brookline Fire Chief	Cost = $0 additional costs; percentage of existing $361,239 budget Funding Source: Brookline Operating Budget, Fire Dept. appropriation	Short Term
8	Proactively enforce the International Building Code (IBC) and International Residential Code (IRC) to protect buildings and infrastructure from the impacts of earthquake, flooding, severe wind, severe winter weather, and tornado.	Brookline Building Inspector	Cost = $40,201 Funding Source: Brookline Operating Budget, Building Inspection appropriation	Short Term
9	Protect critical facilities and equipment from lightning damage. Install and maintain surge protection on critical electronic equipment at Safety Complex and Fire Station.	Department Heads for each critical facility	Cost = $1,000-$5,000 per critical facility for lightning protection devices Funding Source: Brookline Operating Budget, General Government Buildings appropriation	Medium Term
10	Incorporate flood mitigation into local planning. Revise/adopt regulations to improve floodplain management in Brookline according to findings from 2017 regulatory audit. Incorporate updated floodplains for	Brookline Planning Board	Cost = $5,000-$10,000 depending on scope Funding Source: Brookline Operating Budget, Planning & Zoning appropriation	Medium Term (regulations), Long Term (updated floodplains).

Priority	Mitigation Action	Responsible Party	Cost & Funding	Timeframe
	Merrimack Watershed into municipal planning activities when they become available. Additional information on FEMA Risk MAP Discovery Project can be found here.			
10	Enforce RSA 41:11-d, which allows municipalities to restrict all residential lawn watering for properties on public water systems and those on private domestic wells within their political boundaries if the state or federal government declares a drought condition for that region of the state. The governing body can enforce the lawn watering restrictions by imposing fines in accordance with RSA 625:9. Notice shall be given at least 3 calendar days before the regulations are implemented and shall be published in a paper of general circulation in the municipality and shall be posted in at least 2 public places. Other outreach methods include Brookline town website, social media accounts, local cable, and Code Red.	Brookline Board of Selectmen, Brookline Police Department	Cost = $0 additional costs, percentage of $225,267 (Executive budget) for implementation; percentage of $699,199 (Police Dept. budget) for enforcement Funding Source: Brookline Operating Budget, Executive appropriation and Police Dept. appropriation	This action will start when a state or federal drought is declared and will be completed when drought conditions end.
12	Assess past flooding events around West Hill Rd. Consider costs and benefits of a variety of infrastructure upgrades. Conduct needed	Brookline Road Agent	Cost = $2,500-$75,000 per drainage project depending on scale; $230,000 for vacuum sweeper; $5,000-$105,000 per culvert.	Medium Term

Priority	Mitigation Action	Responsible Party	Cost & Funding	Timeframe
	infrastructure repairs or replacements to mitigate future flooding.		Maintenance costs vary by type; see "Comparison of Maintenance Cost, Labor Demands, and System Performance for LID & Conventional Stormwater Management" for estimates. Funding Source: Brookline CIP and Brookline Operating Budget, Highway, Streets, & Bridges: General Maintenance-Drainage appropriation	
13	Establish mutual aid agreements with neighboring communities to address administering the NFIP following a major storm event.	Brookline Fire Chief and Brookline Police Chief	Cost = $0 additional costs to establish agreements; percentage of $699,199 (Police Dept. budget) and/or $361,239 (Fire Dept. budget) for response Funding Source: Brookline Operating Budget; Police and Fire appropriations	Medium Term

CHAPTER 5. PLAN ADOPTION

Section 5.1 ~ Formal Adoption by Governing Body

CHAPTER 5. PLAN ADOPTION

Section 5.1 ~ Formal Adoption by Governing Body

CERTIFICATE OF ADOPTION

TOWN OF BROOKLINE, NH SELECTBOARD

A RESOLUTION ADOPTING THE TOWN OF BROOKLINE, NH HAZARD MITIGATION PLAN UPDATE 2017

WHEREAS, the Town of Brookline has historically experienced damage from natural hazards and it continues to be vulnerable to the effects of climate change, drought, earthquake, extreme temperatures, flooding, severe wind, lightning, severe winter weather, tornado, and wildfire, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Brookline has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its Hazard Mitigation Plan Update 2017 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held between November 8, 2016 and February 14, 2017 regarding the development and review of the Hazard Mitigation Plan Update 2017; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedures for the Town of Brookline; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Brookline, with the effect of protecting people and property from loss associated with those hazards; and

WHEREAS, adoption of this Plan will make the Town of Brookline eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Brookline Selectboard:

1. The Plan is hereby adopted as an official plan of the Town of Brookline
2. The respective officials identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them;
3. Future revisions and Plan maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as a part of this resolution for a period of five (5) years from the date of this resolution.

4. An annual report on the progress of the implementation elements of the Plan shall be presented to the Selectboard by the Brookline Hazard Mitigation Team.

Adopted this day, the 8th **of** May **, 2017.**

John Carr, Chair, Brookline Selectboard

Brendan Denehy, Vice-Chair, Brookline Selectboard

Tom Humphreys, Brookline Selectboard

Valerie Ogden, Brookline Selectboard

Eddie Arnold, Brookline Selectboard

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Brookline the 8th of May, 2017.

Witness

Section 5.2 ~ FEMA Approval Letter

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

FEMA

MAY 15 2017

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

Dear Ms. Dunkerley:

We would like to congratulate the Town of Brookline and the State of New Hampshire for their dedication and commitment to mitigation planning. The Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) Region I Mitigation Planning Team has completed its review of the Town of Brookline, New Hampshire Hazard Mitigation Plan Update 2017 and determined it meets the requirements of 44 C.F.R. Pt. 201.

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

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

The Town of Brookline, New Hampshire Hazard Mitigation Plan Update 2017 must be reviewed, revised as appropriate, and resubmitted to FEMA for approval within **five years of the plan approval date of May 10, 2017** in order to maintain eligibility for mitigation grant funding. We encourage the Town to continually update the plan's assessment of vulnerability, adhere to its maintenance schedule, and implement, when possible, the mitigation actions proposed in the plan.

MAY 15 2017

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

Sincerely,

Paul F. Ford
Acting Regional Administrator

PFF: ms

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

Enclosure