



Northborough Hazard Mitigation Plan



Wachusett Aqueduct, Northborough, Massachusetts

Adopted by the Select Board DATE

Prepared by the **Central Massachusetts Regional Planning Commission**
One Mercantile Street, Suite 520
Worcester, MA 01608
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&

Local Hazard Mitigation Team
Town of Northborough, Massachusetts

This Certificate of Adoption helps meet:

- F1. "For single-jurisdictional plans, has the governing body of the jurisdiction formally adopted the plan to be eligible for certain FEMA assistance?" (Requirement 44 CFR § 201.6(c)(5)).

< INSERT TOWN LETTERHEAD >

**CERTIFICATE OF ADOPTION
SELECT BOARD
TOWN OF NORTHBOROUGH, MASSACHUSETTS**

A RESOLUTION ADOPTING THE *NORTHBOROUGH HAZARD MITIGATION PLAN*

WHEREAS, the Town of Northborough established a Committee to prepare the 2024 update of the *Northborough Hazard Mitigation Plan*; and

WHEREAS, the updated *Northborough Hazard Mitigation Plan* contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Northborough; and

WHEREAS, duly-noticed public meetings were held by the LOCAL HAZARD MITIGATION PLANNING TEAM on DATE and DATE; and

WHEREAS, the Town of Northborough authorizes responsible departments and/or agencies to execute their responsibilities demonstrated in the plan.

NOW, THEREFORE BE IT RESOLVED that the Town of Northborough SELECT BOARD adopts the 2024 update of the *Northborough Hazard Mitigation Plan*, in accordance with M.G.L. 40 or the charter and bylaws of the Town of Northborough.

ADOPTED AND SIGNED this DATE, 2024.

Name	Mitch Cohen	Laura Ziton	Michael Tietjen
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Title	Chair	Vice Chair	Member
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Name	Lisa Maselli	Julianne S. Hirsh
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Title	Member	Member
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Signatures	_____	_____	_____
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ACKNOWLEDGEMENTS

This Acknowledgements section helps meet:

- A1. *“Does the plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement 44 CFR § 201.6(c)(1))”*

This Hazard Mitigation Plan (HMP) update was funded by the Federal Emergency Management Agency (FEMA) via the Massachusetts Emergency Management Agency (MEMA). This report was prepared for the community of Northborough by the Central Massachusetts Regional Planning Commission (CMRPC).

The Northborough Select Board extends its thanks to participants in the Local Hazard Mitigation Team for their time and hard work in participating in this timely project. Core Team members include:

Brian Griffin, Police Department, Chief
Bill Griffin, Police Department, Lieutenant
Scott Charpentier, Department of Public Works, Director
David Parenti, Fire Department, Chief and Emergency Management Director
Neal Aspesi, Fire Department, Deputy Chief
Michael Parr, Fire Department / Local Emergency Planning Committee, Hazmat Assistant
Vincent Vignaly, Conservation Commission, Conservation Agent
Laurie Connors, Planning Department, Director
Robert Fredrico, Building Department, Inspector of Buildings / Zoning Enforcement Officer
Michael Seager, Health Department, Health Agent
William Lyver, Police Department, Chief (former)

In addition, thanks are extended to the staff of the Central Massachusetts Regional Planning Commission for process facilitation and preparation of this document.

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Planning

Thanks are also due to the Massachusetts Emergency Management Agency (MEMA) for guidance and feedback regarding this plan.

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1.0 INTRODUCTION

1.1 DISASTER MITIGATION PLAN

Congress enacted the Disaster Mitigation Act of 2000 (DMA 2000) on October 10, 2000. Also known as the Stafford Act Amendments, the bill was signed into law by President Clinton on October 30, 2000, creating Public Law 106-390. The law established a national program for pre-disaster mitigation and streamlined the federal administration of disaster relief. Specific rules on the implementation of DMA 2000 were published in the Federal Register in February 2002 and required that all communities must have a Hazard Mitigation Plan in place in order to qualify for future federal disaster mitigation grants following a Presidential disaster declaration. The Hazard Mitigation Plan emphasizes measures that can be taken to reduce or prevent future disaster damage caused by natural hazards. In the context of natural hazard planning, Pre-Disaster Mitigation refers to any action that permanently reduces or eliminates long-term risks to human life and property.

1.2 PLAN PURPOSE

This plan identifies the natural hazards facing the Town of Northborough, assesses the vulnerabilities of the area's critical facilities, infrastructure, residents, and businesses, and presents recommendations to mitigate the adverse effects of typical natural hazards.

New England weather is renowned for its mercurial and dramatic nature. Late summer hurricanes, major winter blizzards, and summer droughts are all part of the climatic atmosphere in Central Massachusetts. These occur frequently enough to be familiar scenes to residents of Northborough. The intersection of these natural hazards with the built environment can transition these routine events into classified natural disasters. In addition, as climate change continues to progress, the severity and frequency of hazard risk will increase.

This planning effort has drawn on the knowledge of local municipal officials and residents. The recommendations presented in the following report are intended to be realistic and practical steps for mitigating natural hazards and preparing the community as best as possible for the effects of climate change. Implementation of these actions will translate into savings – fewer lives lost, less property destroyed, and less disruption to essential services and ecological systems.

1.3 PLANNING PROCESS

Section 1.3 helps meet:

- A1. “Does the plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction?” (Requirement 44 CFR § 201.6(c)(1));
- A2. “Does the plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development as well as businesses, academia, and other private and non-profit interests to be involved in the planning process?” (Requirement 44 CFR § 201.6(b)(2)); and
- A3. “Does the plan document how the public was involved in the planning process during the drafting stage and prior to plan approval?” (Requirement 44 CFR § 201.6(b)(1))

This Plan is funded through a Fiscal Year 2023 Pre-Disaster Mitigation grant to the Town of Northborough from the Federal Emergency Management Agency (FEMA) through the Massachusetts Emergency Management Agency (MEMA).

The planning process in Northborough was composed of two distinct but related phases: 1.) data collection and technical review, and 2.) public input and planning. Identification of natural hazards impacting the Town of Northborough was accomplished through review of available information from various sources. These included federal and state reports and datasets, existing plans, and in some cases engineering documents. An assessment of risks and vulnerabilities was performed primarily using geographic information systems (GIS) to identify the infrastructure (critical facilities, public buildings, roads, homes, businesses, etc.) at the highest risk for being damaged by hazards, particularly flooding. Local knowledge as imparted by Town officials, staff, emergency management volunteers and others was a critical element of this phase.

The second phase of the process was focused on outreach, public participation and input, and planning. This phase was critical to ensuring awareness of the planning process among a wide range of local officials, coordinating plan elements with other sectors of the community, and providing opportunities for public comment and input from a representative base of residents and other stakeholders in Northborough. Through this engagement, CMRPC was better able to gauge community priorities for mitigation and to understand local resources and existing policies and procedures. With this information in hand, the planning team was able to develop an informed list of mitigation strategies for the Town.

The Hazard Mitigation Planning team contained a group of local staff and volunteers including:

Brian Griffin, Police Department, Chief

Bill Griffin, Police Department, Lieutenant

Scott Charpentier, Department of Public Works, Director

David Parenti, Fire Department, Chief and Emergency Management Director

Neal Aspesi, Fire Department, Deputy Chief

Michael Parr, Fire Department / Local Emergency Planning Committee, Hazmat Assistant

Vincent Vignaly, Conservation Commission, Conservation Agent

Laurie Connors, Planning Department, Director

Robert Fredrico, Building Department, Inspector of Buildings / Zoning Enforcement Officer

Michael Seager, Health Department, Health Agent

William Lyver, Police Department, Chief (former)

To discuss hazard areas, critical infrastructure and other assets, and plan priorities and strategies, the Hazard Mitigation Planning team met NUMBER times on July 31st, 2023, September 25th, 2023, December 12th, 2023, March 5th, 2024, May 8th, 2024, ADDITIONAL MEETINGS. Between meetings and during development of the draft and final plans, information and comments were shared among the local team and CMRPC. On January 4th, 2024, the Hazard Mitigation Planning team launched a public survey to gauge resident, worker, visitor, and business owner concerns about and experiences with natural hazards in Town. The survey was distributed on the Town's website and social media pages, and flyers for and paper copies of the survey were distributed around Town. A total of 213 responses were collected. Survey responses were discussed by the local planning team at its May 2024 meeting and helped inform the development and prioritization of mitigation strategies. Representatives from the surrounding communities of Berlin, Boylston, Marlborough, Shrewsbury, Southborough, and Westborough were invited to comment on the draft plan during the public comment period in an effort gather input from surrounding communities who might have shared interests or concerns. As planning activities progressed, a public presentation was made by CMRPC and the local planning team on July 15th, 2024 at a Northborough Select Board meeting to provide a summary of key aspects of the draft Plan report then being finalized. The presentation was televised on the local cable access channel and the opportunity for public comment was emphasized. Materials and notes from the presentation and subsequent public discussion are included in the appendix. A full draft Plan was provided to the Town for distribution and made available online at CMRPC's website for public comment for two weeks starting on DATE. In addition, the final draft Plan was distributed to officials in all neighboring communities for review and input regarding shared hazards. _____ feedback was provided during the public forum or the public comment period.

The final draft Plan was submitted to MEMA for review on DATE, and was then relayed to FEMA for federal review. After receipt of FEMA's revisions on DATE, the plan was formally adopted by vote of the Board at the DATE meeting of the Select Board.

The Northborough Planning Board is the primary Town agency responsible for regulating development in town. Feedback to the Planning Board was ensured through the participation of the Town Planner on the local hazard planning team. In addition, CMRPC, the State-designated regional planning authority for Northborough, works with all agencies that regulate development in its region, including the municipal entities listed above and state agencies, such as Department of Conservation and Recreation and MassDOT. This regular involvement ensured that during the development of the Northborough Hazard Mitigation Plan, the operational policies and any mitigation strategies or identified hazards from these entities were incorporated. Engaging a diverse array of representatives, stakeholders, community lifelines, and organizations promoted the creation of mitigation strategies for local recovery and resilience efforts in town. Northborough's planning process exemplified engagement of stakeholders from a broad range of sectors whose inclusion in local government is critical for equitable, effective, and comprehensive risk reduction outcomes.

The following community lifelines were sent the full draft plan during the public comment period for their review and input. FEMA defines community lifelines as "the most fundamental services in the

community that, when stabilized, enable all other aspects of society to function.¹” In addition, these community lifelines were sent a survey in which they could describe any concerns related to natural hazards in Northborough they have as well as how they would like to participate in the Northborough HMP planning process. Nine of these community lifelines responded to this survey, and their input was considered by CMRPC and the HMP planning team in town during the planning process. The results of this survey are shown in Appendix B.

Safety and Security Lifelines:

- National Grid
- Lakeside Oil Co. (Richard’s Oil)
- Northborough Oil Co.
- Osterman Propane

Food, Water, and Shelter Lifelines:

- Melican Middle School
- Wegman’s
- American Red Cross
- Coleman House
- Whitney Place
- Northborough Housing Authority Properties
 - Heritage Village
 - Rutland Road
 - Colonial Village
 - Centre Drive
- Memory Care Units at 38-43 King Street (have not yet been developed, are in the design / permitting phase)
- The Bridge of Central Mass
- Teamworks, Inc.
- AMEGA
- Cornerstone Academy
- Goddard School
- Nativity Nursery School
- Skribbles Learning Center, LLC
- St. Bernadette’s School

¹ FEMA, “Local Mitigation Planning Policy Guide,” FEMA.gov, Federal Emergency Management Agency, April 19, 2022, page 17, https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-policy-guide_042022.pdf.

- Church of Christ
- Church of the Nativity
- First Parish Unitarian Church
- Jehovah Witness Church
- Rice Memorial Baptist Church
- Seventh Day Adventist Church
- Shri Gurusthan Sai Temple
- St. Bernadette's Church
- St. Rose of Lima Church
- Trinity Church
- Advocates, INC
- BJ's Wholesale Club
- Cumberland Farms
- Econolodge
- Walmart
- Bartlett Crossing
- Cold Harbor Mall
- Marketplace at 318 Main Street
- Northborough Crossing Mall
- Shopping Center at 292 Main Street
- Shopping Center at 276 West Main Street
- Shopping Plaza at 265 West Main Street
- Time Square Plaza

Health and Medical Lifelines:

- Carewell
- Pedi Q
- CVS Minute Clinic
- All Care Plus Pharmacy

Communications Lifelines:

- Crown Castle
- Verizon

Transportation Lifelines:

- CSX Rail Line

Hazardous Materials Lifelines:

- National Grid (Tier 2)
- Lakeside Oil Co. (Richard's Oil) (Tier 2)
- Northborough Oil Co. (Tier 2)
- Crown Castle (Tier 2)
- Verizon (Tier 2)
- A. Duie Pyle (Tier 2)
- Amazon (Tier 2)
- Bigelow Nurseries inc. (Tier 2)
- BJ's Wholesale Club (Tier 2)
- BJ's Wholesale Club, gas station (Tier 2)
- FedEx Freight (Tier 2)
- FedEx Ground (Tier 2)
- Iron Mountain (Tier 2)
- Juniper Hill Golf Course (Tier 2)
- Kimball Sand (Tier 2)
- Lowe's Pro Supply (Tier 2)
- Max Finkelstein, Inc. (Tier 2)
- McKesson Corporation (Tier 2)
- NewCorr Pkg (Tier 2)
- Northborough Oil (Tier 2)
- Richards / Lakeside Oil (Tier 2)
- Saint-Gobain (Tier 2)
- Sanofi Genzyme (Tier 2)
- Steris (Tier 2)
- Trelleborg Sealing Solutions (Tier 2)

Emergency Shelter Lifelines:

- Melican Middle School

2.0 COMMUNITY PROFILE AND DEVELOPMENT TRENDS

2.1 REGIONAL AND COMMUNITY PROFILE

The Central Massachusetts Regional Planning Commission (CMRPC) region occupies roughly 1,000 square miles in the southern two-thirds of Worcester County, Massachusetts. The area surrounds the City of Worcester, which is the second-largest city in Massachusetts and New England, with a population of 206,518 according to the 2020 United States Census. Nearly 588,141 people live in the CMRPC Region, of whom 15,741 reside in Northborough.²

The CMRPC area is framed on the west by the Central Massachusetts uplands, on the south by Rhode Island and Connecticut, on the east by the Boston metropolitan area, and on the north by the Montachusett region in northern Worcester County. The forty-community region has been divided for planning purposes into six sub-regions, determined by shared characteristics and roadway corridors. Northborough is located in the northeast sub-region consisting of 5 towns located to the east and northeast of Worcester, including: Berlin, Boylston, Northborough itself, Shrewsbury, and Westborough.

Massachusetts has a humid continental climate, with maritime influences increasing from northwest to southeast. According to the National Oceanic and Atmospheric Association's National Weather Service, between 2000 and 2021, nearby Worcester saw monthly mean temperatures ranging from 20.7 degrees in January to 78.7 in July. Precipitation is relatively high at 49.38 inches annually, including 73.9 inches of snowfall. Approximately 30 miles from the Atlantic coast, Northborough and its neighboring communities are subject to a variety of severe weather, including hurricanes, nor'easters, thunderstorms, and blizzards.

The Town of Northborough, Massachusetts was incorporated in 1766. Northborough is situated along several major east-west corridors which help connect Boston to Worcester and western Massachusetts. Interstate 290 runs across the north of town, while US Route 20 runs across the town from the east, through downtown, and to the southwest. State Route 9 crosses the southwest corner of the Town, where there is an interchange between it and Route 20, while State Route 135 runs from the Town's border with Westborough north to the town center, where it terminates. Northborough is known in the region for its quality schools and large, desirable businesses. Its employment base is healthy: as of May 2024, Northborough employs 7,920 people.³ Northborough is bordered by Berlin to the north, Boylston and Shrewsbury to the west, Westborough to the south, and Marlborough and Southborough to the east.

Northborough has a total area of 18.8 square miles and a population of 15,741.⁴ Northborough's population is projected to continue growing; according to the Central Massachusetts Regional Planning Commission's (CMRPC) Long Range Transportation Plan.⁵ The Town of Northborough is expected to grow approximately 24% between 2020 and 2050, reaching 19,502 residents. The

² "P1: Race," Data.Census.gov, United States Census Bureau, accessed June 21, 2024, <https://data.census.gov/table?q=northborough%20town%20Massachusetts>.

³ Massachusetts Department of Economic Research, "Municipal Employment Data: Northborough - 2010," lmi.dua.eol.mass.gov, March 2024, <https://lmi.dua.eol.mass.gov/lmi/MunicipalEmploymentData/LmiTown?A=000269>.

⁴ "P1: Race," Data.Census.gov

⁵ Central Massachusetts Metropolitan Planning Organization. "2050 Connections: 2024 Long Range Transportation Plan for the Central Massachusetts Metropolitan Planning Organization," Cmrpc.org, Central Massachusetts Regional Planning Commission, 2020, page III-5, <https://cmrpc.org/wp-content/uploads/2024/05/2050-Connections-Endorsed-Document.pdf>.

number of residents in town nearly tripled from 3,122 to 9,218 between 1950 to 1970; The Town's population has grown by at least 10% each decade between 1970 and 2020, except for between 2000 and 2010, when it only grew by around 1%.⁶ According to the 2020 US Census, 76.7% of Northborough's population identifies as white, 11.9% of the Town's population identifies as Asian, 1.4% of the Town's population identifies as Black or African American, 2.3% of the Town's population identifies as some other race, and 7.5% of the town's population identifies as belonging to two or more races.⁷ According to the 2020 Census, about 4.0% of Northborough residents identified as Latino or Hispanic. According to the 2020 US Census, 22.8% of the Town's population is under 18 years old, while 16.9% of the population is 65 years and over.⁸

The median age in town, according to the 2020 US Census, is 42.5 years old, which is comparatively higher than the State's median age at 39.9.⁹ At \$160,801, median household annual income in Northborough (according to 2022 American Community Survey 5-year estimates) is significantly higher than the State at \$96,505 and Worcester County at \$88,524.¹⁰ The poverty rate in town (according to 2022 ACS 5-year estimates) is 3.8%, less than half of the State's and Worcester County's rates of, respectively, 9.9% and 10.0%.¹¹ With a median value of owner-occupied housing units at \$548,400 according to 2022 ACS 5-year estimates, housing costs in Town are relatively higher compared to the State and to Worcester County, whose comparable numbers are \$483,900 and \$363,200, respectively.¹² According to 2022 ACS 5-year estimates, 84.9% of occupied homes are single-family homes (detached or attached), and 15.1% are multi-unit structures.¹³ With a 3.5% vacancy rate according to the 2020 US Census, vacancies in Northborough are relatively lower than the State and Worcester County with 8.3% and 5.7% vacancy rates respectively.¹⁴ Most homes in town are relatively new, with only 9.9% of them being built before 1940 according to 2022 ACS 5-year estimates.¹⁵

⁶ "Northborough," Cmrrpc.org, Central Massachusetts Regional Planning Commission, accessed June 21, 2024, <https://cmrrpc.org/data-center/community-snapshots/northborough/>.

⁷ "DP1: Profile of General Population and Housing Characteristics," Data.Census.gov, United States Census Bureau, accessed June 21, 2024, <https://data.census.gov/table?q=dp1%20northborough%20town%20ma>.

⁸ Ibid

⁹ Ibid

¹⁰ "S1903: Median Income in the Past 12 Months (in 2022 Inflation-Adjusted Dollars)," Data.Census.gov, United States Census Bureau, accessed June 21, 2024, https://data.census.gov/table/ACSST5Y2022.S1903?q=ACS%20Massachusetts%20s1903&g=050XX00US25027_060XX00US2502746820.

¹¹ "S1701: Poverty Status in the Past 12 Months," Data.Census.gov, United States Census Bureau, accessed June 21, 2024, https://data.census.gov/table/ACSST5Y2022.S1701?q=ACS%20Massachusetts%20s1701&g=050XX00US25027_060XX00US2502746820.

¹² "DP04: Selected Housing Characteristics," Data.Census.gov, United States Census Bureau, accessed June 21, 2024, https://data.census.gov/table/ACSDP5Y2022.DP04?q=ACS%20Massachusetts%20dp04&g=050XX00US25027_060XX00US2502746820.

¹³ "S2504: Physical Housing Characteristics for Occupied Housing Units," Data.Census.gov, United States Census Bureau, accessed June 21, 2024, https://data.census.gov/table/ACSST5Y2022.S2504?q=ACS%20Massachusetts%20s2504&g=050XX00US25027_060XX00US2502746820.

¹⁴ "DP1: Profile of General Population and Housing Characteristics," Data.Census.gov.

¹⁵ "S2504: Physical Housing Characteristics for Occupied Housing Units," Data.Census.gov.

2.2 DEVELOPMENT TRENDS

Section 2.2 helps meet:

- E1. “Was the plan revised to reflect changes in development?” (Requirement 44 CFR § 201.6(d)(3))

Town of Northborough Development Projects between 2018 - 2024

Name	Status	Year	Housing Units	Commercial SQ Feet	Project Type
1 & 2 family	complete	2018-2024	51	NA	Single & 2 Family Homes
301 Bartlett St.	complete	2019	XX	220,000	Warehouse/distribution
330 Bartlett St.	complete	2022	XX	330,000	Warehouse/distribution
350 Bartlett St.	complete	2022	XX	330,000	Warehouse/distribution
150 Hayes Memorial Dr.	complete	2020	XX	150,000	Warehouse/distribution
1008 Shops Way	complete	2024	XX	3600	School of Rock
50-52 SW Cutoff	complete	2022	XX	16,000	Contractor condos
442 W. Main St.	complete	2023	XX	4,600	Office building
66 Lyman St	complete	2021	XX	70,000	Addition to paper/box company
25 West Main St	complete	2023	XX	4,400	Addition to existing commercial for retail and medical
9 Monroe St	complete	2019	XX	8,000	Business offices
89 West Main St	In process	2020	7	4,700	Res upper, bus lower
5 Goddard Rd.	Complete	2022	XX	8,700	Contractor yard
273 Southwest Cutoff	complete	2021	XX	4,700	Dental facility
400 Cedar Hill St	complete	2022	XX	50,000	Indoor soccer facility

Town of Northborough Potential Future Development

Name	Status	Year	Housing Units	Commercial SQ Feet	Project Type
38 43 King Street Memory Care Facility	Design and permitting	2023	88	??	Memory Care facility
MBTA zoning	Passed Ann. Town Meeting	2024	??	??	High density residential
86 Lawrence St.	exploratory	2023	??	??	Multi family townhomes

The Town of Northborough is a suburban town with large business districts along the several major highways that cross the Town. The intersection of these factors contributes to ongoing development

and redevelopment throughout the Town. There are multiple industrial and commercial development projects that are currently underway in Town. At 333 Southwest Cutoff there is a 29-acre project which includes 3 retail shops, a restaurant, and a UMass Urgent Care Facility. 10,000 Shops Way is a 19-acre site which has 42,000 square feet of retail buildings, including: Mooyah's restaurant, Jimmy John's restaurant, Anzio's restaurant, Lux Nails, Sport Clips, Oasis Dental, St. Vincent's Hospital medical offices, Anytime Fitness, Huntington Learning Center, and Pure Barre Fitness. Bartlett Street contains: a newly proposed 150,000 square foot warehouse/distribution facility, a new 20,000 square foot warehouse/distribution facility, completely renovated contractor's yard at 200 Bartlett, and an expansion of the Fedex facility. A substantial expansion has been approved for 100 Bearfoot Road. All subdivisions and new developments in town are rigorously reviewed by the Planning Board, Fire Department, Police Department and other departments to ensure that new construction complies with bylaws and to ensure emergency vehicle access.

There are also numerous residential construction projects that have been recently completed or are under construction in town. 172 Howard Street is a newly constructed 5-lot subdivision, and there are also many single-family dwellings being constructed across town. If formal approval of development is made by appropriate boards, due consideration should be given to the protection of newly constructed residences. The clearing of brush and trees lessens the chance of wildfire near new development. However, an increase in storm runoff in localized areas of town caused by new development is possible, and proper drainage infrastructure is necessary to mitigate disruption to surrounding properties caused by development-induced runoff. Development is generally less vulnerable to hazards than non-developed areas: during the construction process, stormwater drainage is improved, trees are trimmed back from structures and power lines, roads are built wide enough to allow emergency vehicles to enter, modern building codes are followed, and setbacks from wetlands are required.

The Town and various responsible boards and commissions should ensure that new development processes take potential and known hazards into account and ensure mitigation of hazards occurs when needed. Northborough utilizes various methods to ensure new development conforms with current Massachusetts General Laws and the Town's Bylaws. The Planning Board, Conservation Commission and Zoning Board of Appeals (ZBA) consider water resource and open space preservation in decision making and, in the case of the ZBA, when hearing and deciding on appeals. This consideration includes specific evaluation criteria that are relevant to natural hazards – including requirements for preventing and mitigating flooding and stormwater impacts. The Town's Bylaws are amended and updated on an as needed basis to adapt to the needs and shifting forces that affect the Town.

New development in Northborough needs to be in line with the state building code. In addition, on July 1st, 2017, Northborough codified a Stretch Energy Code, based on the International Energy Conservation Code (IECC) 2009 building code created by the International Code Council.¹⁶ The Stretch Energy Code provides a more energy efficient alternative to the base energy code for new construction and existing buildings in Northborough, strengthening the town's climate resilience and hazard mitigation capabilities.

¹⁶ "Massachusetts Building Energy Code Adoption by Municipality," Mass.gov, Massachusetts Department of Energy Resources, May 28, 2024, <https://www.mass.gov/doc/building-energy-code-adoption-by-municipality/download>.

As the population of Northborough continues to grow and additional development occurs, officials should seek to further integrate hazard mitigation practices into its planning and development processes. In 2020, the Town of Northborough updated its Master Plan, and this was a process which gave the Town an opportunity to identify threats and prioritize strategies to address them. Climate change, according to current predictions, will lead to an increase in extreme storm events, including more rain in shorter amounts of time. Planning for the future impacts of climate change is imperative to protecting the citizens of Northborough.

DRAFT

3.0 CRITICAL FACILITIES AND VULNERABLE POPULATIONS

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

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

3.1 CRITICAL FACILITIES WITHIN NORTHBOROUGH

The Critical Facilities List for the Town of Northborough has been identified utilizing several sources, and the knowledge and expertise of the team:

- Northborough's Comprehensive Emergency Management Plan
- MassGIS data
- Critical infrastructure mapping undertaken by CMRPC under contract with the Central Region Homeland Security Advisory Council, which is charged by the Executive Office of Public Safety and Security to administer and coordinate the State Homeland Security Grant for central Massachusetts.

Northborough's Hazard Mitigation Team has broken up this list of facilities into four categories:

- Emergency Response Facilities needed in the event of a disaster
- Non-Emergency Response Facilities that have been identified by the Team as non-essential. These are not required in an emergency response event, but are considered essential for the everyday operation of Northborough
- Dams
- Facilities/Populations that the Team wishes to protect in the event of a disaster

Critical infrastructure and facilities are mapped in Appendix A.

3.2 CATEGORY 1 – EMERGENCY RESPONSE FACILITIES

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

Type	Name	Address	Details	Has Emergency Generator?
Emergency Operations Center/Police Station	Northborough Police Department/EOC	211 Main Street	This facility has been noted as vulnerable by the HMP core Team	Yes
Fire Station	Fire Station	11 Pierce Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes
Communications Facilities	Police/Fire Receiver, Fire Dept. Repeater	9000 Shops Way	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Voter and Tower – Radio	79 Bartlett Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Voter – Radio	300 Ball Street	This facility has been noted as vulnerable to locally identified flooding and winter storm hazards by CMRPC's GIS analysis.	No
	Voter	300 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Tower – Government	25 Gale Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Tower – Rooftop	456 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Tower	386 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Tower	119 Colburn Street	This facility has been noted as vulnerable to locally identified	No

			wildfire hazards by CMRPC's GIS analysis.	
	Cell Tower	119 Bearfoot Road	This facility has been noted as vulnerable to locally identified wildfire hazards by CMRPC's GIS analysis.	No
	Cell Tower	211 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Cell Tower – Boylston Emergency Management	351 Ball Street	This facility has been noted as vulnerable to locally identified flooding and winter storm hazards by CMRPC's GIS analysis.	No
	Verizon	125 High Street Oliver Tower Floor 2, Shrewsbury	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Crown Castle	273 Southwest Cutoff	This facility has been noted as vulnerable to locally identified flooding hazards by CMRPC's GIS analysis.	No
Highway Department	DPW Offices	63 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	DPW Barn / Highway Garage	190 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes, but it only covers 1/3 rd of this facility and does not cover the fuel island.
	DPW Water Barn	200 School Street at Brigham Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes
	MA Highway Depot	138 Lawrence Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Emergency Shelters	Robert E Melican Middle School	145 Lincoln Street	This shelter does not have air conditioning and is in a low-lying area which frequently floods. This facility has been noted as vulnerable to locally identified	Yes

			flooding hazards by CMRPC's GIS analysis.	
	Econolodge	380 Southwest Cutoff	This facility is a temporary emergency shelter. This facility has been noted as vulnerable to locally identified flooding hazards by CMRPC's GIS analysis.	No
Primary Evacuation Routes	I-290	I-290	This route has been noted as vulnerable to locally identified wildfire hazards by CMRPC's GIS analysis. The route also crosses locally identified flooding and winter storm hazard areas as well as 1% and 0.2% flood zones.	N/A
	Belmont Street / MA-9	Belmont Street / MA-9	The western part of this route has been noted as vulnerable to locally identified flooding hazards by CMRPC's GIS analysis and by the HMP core Team.	N/A
	Church Street	Church Street	This route has been noted as vulnerable to locally identified wildfire hazards by CMRPC's GIS analysis. The route also crosses locally identified flooding and winter storm hazard areas as well as 1% and 0.2% flood zones.	N/A
	Main Street	Main Street	This route has been noted as vulnerable by CMRPC's GIS analysis because it crosses a locally identified dam failure hazard area and the 1% flood zone and comes very near to the 0.2% flood zone.	N/A
	West Main Street	West Main Street	This route has been noted as vulnerable by CMRPC's GIS analysis because it crosses locally identified flooding, severe storm, and wildfire hazard areas and it	N/A

			comes very near to the 1% flood zone.	
	Southwest Cutoff/US-20	Southwest Cutoff/US-20	This route has been noted as vulnerable to locally identified flooding hazards by CMRPC's GIS analysis and by the HMP core Team. The route also crosses locally identified severe storm hazard areas and comes very near to the 1% flood zone.	N/A
	South Street/MA-135	South Street/MA-135	This route has been noted as vulnerable by CMRPC's GIS analysis because it crosses locally identified dam failure and severe storm hazard areas as well as the 1% flood zone.	N/A
	Bartlett Street	Bartlett Street	This route has been noted as vulnerable by CMRPC's GIS analysis because a portion of it lies along a locally identified dam failure hazard and the 1% flood zone.	N/A
	Crawford Street	Crawford Street	This route has been noted as vulnerable by CMRPC's GIS analysis because it crosses locally identified flooding hazard areas and the 1% flood zone, comes very near the 0.2% flood zone, and terminates to the north at a crossing with a locally identified wildfire hazard area.	N/A
Critical Bridges, Intersections, and Sites	Bridge	27 Allen Street	This bridge has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.	N/A
	Bridge	10 Church Street	This bridge has been noted as vulnerable to a locally identified wildfire hazard by CMRPC's GIS	N/A

			analysis. It is also within the 1% flood zone.	
	Bridge – CSX Rail Line	55 Lyman Street	This bridge has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.	N/A
	Bridge – CSX Rail Line	12 Rice Avenue	There are no noteworthy concerns regarding natural hazard impacts on this bridge.	N/A
	Bridge – CSX Rail Line	429 Whitney Street	There are no noteworthy concerns regarding natural hazard impacts on this bridge.	N/A
	Bridge	418 Davis Street	This bridge has been noted as vulnerable to a locally identified severe storm hazard by CMRPC's GIS analysis. It is also within the 1% flood zone.	N/A
	Bridge – I-290 Overpass	202 Brewer Street	This bridge has been noted as vulnerable to locally identified flooding and wildfire hazards by CMRPC's GIS analysis. It is also near the 1% flood zone.	N/A
	Culvert – MA-135	370 South Street at Davis Street	This culvert has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.	N/A
	Bridge – US-20	410 Main Street	This bridge has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.	N/A
	Crawford Street Stone Bridge	349 Crawford Street	This bridge has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.	N/A
	Church Street & I-290	370-500 Church Street	This site has been noted as vulnerable to locally identified flooding and wildfire hazards by	N/A

			CMRPC's GIS analysis. It is also in the 1% flood zone.	
	Hudson Street at Marlborough Boundary	405 Hudson Street	This site has been noted as vulnerable to a locally identified flooding hazard by CMRPC's GIS analysis. It is also near the 1% flood zone.	N/A
	Hudson Street & Solomon Pond Road	348 Hudson Street	There are no noteworthy concerns regarding natural hazard impacts on this site.	N/A
	US-20 at Marlborough Boundary	493 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this site.	N/A
	MA-135 & West Main Street	5 West Main Street	This site has been noted as vulnerable to a locally identified wildfire hazard by CMRPC's GIS analysis.	N/A
	US-20 / West Main Street & Church Street	36 West Main Street	This site has been noted as vulnerable to a locally identified wildfire hazard by CMRPC's GIS analysis and by the HMP core Team.	N/A
	US-20 & West Main Street	290 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this site.	N/A
	MA-135 at Westborough Boundary	370 South Street	This site has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.	N/A
	Solomon Pond Road & I-290	North of 35 Solomon Pond Road	There are no noteworthy concerns regarding natural hazard impacts on this site.	N/A
	West Main Street at Shrewsbury Boundary	540 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this site.	N/A
	68 Otis Street	68 Otis Street	There are no noteworthy concerns regarding natural hazard impacts on this site.	N/A

	MA-135 at Town line		There are no noteworthy concerns regarding natural hazard impacts on this site.	N/A
	I-290 overpass at Whitney Street	309-328 Whiney Street	This site has been noted as vulnerable to a locally identified wildfire hazard by CMRPC's GIS analysis.	N/A
	MA-9 & Southwest Cutoff	333-380 Southwest Cutoff	There are flooding issues at this interchange. This site has been noted as vulnerable to a locally identified flooding hazard by CMRPC's GIS analysis and by the HMP core Team.	N/A
Urgent Cares	Pedi-Q Urgent Care	10002a Shops Way	This facility has been noted as vulnerable to a locally identified flooding hazard by CMRPC's GIS analysis.	
	Carewell Urgent Care	333 Southwest Cutoff	This facility has been noted as vulnerable to a locally identified flooding hazard by CMRPC's GIS analysis.	
	CVS Urgent Care	24 West Main Street	This facility has been noted as vulnerable to a locally identified wildfire hazard by CMRPC's GIS analysis.	

3.3 CATEGORY 2 – NON-EMERGENCY RESPONSE FACILITIES

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

Type	Name	Address	Details	Has Emergency Generator?
Water Supply	Assabet Hill 3.5 MG Storage Tank	25 Gale Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Edmunds Hill 1MG Storage Tank	16 Edmunds Way	This facility has been noted as vulnerable to a locally identified wildfire hazard by CMRPC's GIS analysis.	No

DPW Water Barn	200 School Street at Brigham Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes
Public Water Supply, Former MWRA Connection	177A Hudson Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
MWRA Connection	400 Cedar Hill Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Well – Public	200 Brigham Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Well – Public	108 Crawford Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Well – Public	87 Howard Street	This facility has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.	No
Well – Public	40 Lyman Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Cistern	52 Moore Lane	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Cistern	60 Old Colonial Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Draft Site	32 Colburn Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Draft Site	222 Green Street	This facility has been noted as vulnerable to locally identified flooding and wildfire hazards by CMRPC's GIS analysis.	No
Draft Site	4 Hillside Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Draft Site	109 Howard Street	This facility has been noted as vulnerable to a locally identified flooding hazard by CMRPC's GIS analysis.	No
Draft Site	424 Howard Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Draft Site	5 Howe Lane	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Draft Site	90 Maynard Street	This facility has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.	No

Draft Site	320 Newton Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Draft Site	2 Tomblin Hill Road	This facility has been noted as vulnerable to locally identified flooding hazards by CMRPC's GIS analysis.	No
Draft Site	261 West Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Draft Site	2 Smith Road	This facility has been noted as vulnerable to locally identified flooding and wildfire hazards by CMRPC's GIS analysis.	No
Draft Site	37 Fisher Street	This facility has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.	No
Draft Site	309 Ball Street	This facility has been noted as vulnerable to locally identified flooding and winter storm hazards by CMRPC's GIS analysis.	No
Draft Site	55 Bearfoot Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Draft Site	65 West Street / Pond at Roadside	This facility has been noted as vulnerable to locally identified flooding hazards by CMRPC's GIS analysis. It is also near the 1% flood zone.	No
Draft Site	257 West Street / Pond 625 Feet from West Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Aqueduct – Hultman	N/A	This facility has been noted as vulnerable by CMRPC's GIS analysis because it crosses locally identified wildfire and dam failure hazard areas as well as the 1% and 0.2% flood zones.	No, but this aqueduct does not need an emergency generator because it is gravity powered and connected to MWRA facilities which have emergency power.

	Aqueduct – Cosgrove	N/A	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No, but this aqueduct does not need an emergency generator because it is gravity powered and connected to MWRA facilities which have emergency power.
Sewer	Wastewater Pump Station	79 Bartlett Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes
	Wastewater Pump Station	119 Bearfoot Road, at Senior Center	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes
	Wastewater Pump Station	11R Church Street	This facility has been noted as vulnerable to a locally identified wildfire hazard by CMRPC's GIS analysis.	Yes
	Wastewater Pump Station	30 Forbes Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes
	Wastewater Pump Station	282 Hudson Street	This facility has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.	Yes
	Wastewater Pump Station	76 Lincoln Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes
	Wastewater Pump Station	75 Otis Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes
	Wastewater Pump Station	306 Southwest Cutoff	This facility has been noted as vulnerable to a locally identified flooding hazard by CMRPC's GIS analysis.	Yes
	Wastewater Pump Station	101 Wesson Terrace	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes
	Wastewater Pump Station	63 Main Street, at Town Hall	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes
	Booster Pump Station	Church Street at Autumn Lane	This facility has been noted as vulnerable to a locally identified wildfire hazard by CMRPC's GIS analysis.	Yes

	Booster Pump Station	Southwest Cutoff at Shops Way	This facility has been noted as vulnerable to locally identified flooding hazards by CMRPC's GIS analysis. It is also close to the 1% and 0.2% flood zones.	Yes
	Sewer Station	235 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes
Town Facilities	Town Hall	63 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	Yes, the generator is new as of 2024 and only covers half of the building.
	Senior Center	119 Bearfoot Road	This facility has been noted as vulnerable to a locally identified wildfire hazard by CMRPC's GIS analysis. It is also close to the 0.2% flood zone.	Yes, but the generator only powers half of the building and does not cover the building's heating and cooling system.
	Cable Access TV	79 Bartlett Street, at Algonquin Regional High School	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Gale Library	34 Main Street	This facility has been noted as vulnerable to a locally identified dam failure hazard by CMRPC's GIS analysis.	Yes, but the town is not sure of if it covers the whole building or not.
Utilities	CSX Rail Line	360 Cedar Hill Street at Marlborough City line	This route has been noted as vulnerable by CMRPC's GIS analysis because it crosses locally identified wildfire and dam failure hazards as well as the 1% and 0.2% flood zones.	No
	Railroad dock – private	66 Lyman Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	CSX Rail Line Crossing	175 Bearfoot Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	CSX Rail Line Crossing	100 Brigham Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No

	CSX Rail Line Crossing	15 Main Street	This site has been noted as vulnerable to a locally identified dam failure hazard by CMRPC's GIS analysis.	No
	CSX Rail Line Crossing	31 Pierce Street	This site has been noted as vulnerable to a locally identified dam failure hazard by CMRPC's GIS analysis.	No
	CSX Rail Line Crossing	50 School Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Crown Castle	119 Colburn Street	This facility has been noted as vulnerable to a locally identified wildfire hazard by CMRPC's GIS analysis.	No
	Verizon	11 School Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	National Grid Service Center	55 Bearfoot Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	National Grid Woodside	193 Hudson Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Natural Gas Line	Belmont Street	This facility has been noted as vulnerable to a locally identified flooding hazard by CMRPC's GIS analysis.	No
	Northborough Oil Co.	247 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Lakeside Oil Co.	244 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
	Tradebe Treatment and Recycling	345 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Natural Resources and Natural Resource Protection Organizations	Central MA Mosquito Project	111 Otis Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No
Miscellaneous	U.S. Post Office	235 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.	No

3.4 CATEGORY 3 – DAMS¹⁷

The third category is a listing of dams in Northborough.

National ID	Dam Name	Owner	Regulatory Authority	Hazard Code	Notes
MA00959	Bartlett Pond Dam	Public – Town of Northborough	Office of Dam Safety	Low Hazard	This dam has been noted as vulnerable to a locally identified dam failure hazard by CMRPC's GIS analysis.
MA00995	Assabet River Dam	Private	Office of Dam Safety	Significant Hazard	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA00996	Cold Harbor Brook Dam	Public – MA Department of Conservation and Recreation (DCR)	Office of Dam Safety	High Hazard	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is extremely close to the 1% flood zone.
MA00998	Hop Brook Dam	Public – MA Department of Conservation and Recreation (DCR)	Office of Dam Safety	High Hazard	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone and is close to a locally identified flooding hazard. It is being rebuilt; the rebuilding is in the design process.
MA00999	Smith Pond Dam	Private	Office of Dam Safety	Low Hazard	There are concerns that this dam may fail.
MA01234	Northborough Reservoir Dam	Public – Town of Northborough	Office of Dam Safety	Significant Hazard	This dam is owned by the Town of Northborough, is located in Shrewsbury and Boylston, and is planned to be partially removed.
MA02843	Old Mill Pond Dam	Private	Non-Jurisdictional – Other	N/A	There are no noteworthy concerns regarding natural hazard impacts on this dam.
MA02845	Wallace Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable to a locally identified dam failure hazard by CMRPC's GIS analysis.

¹⁷ "MassGIS Data: Dams," Mass.gov, Massachusetts Bureau of Geographic Information, February 2012, <https://www.mass.gov/info-details/massgis-data-dams>.

MA02846	Old Saw Mill Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA02847	Old Adams Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA02848	Small Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA02849	Ellis Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA02850	Storage Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA02851	Cider Mill Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA02852	Old Mill Pond Dam	Private	Non-Jurisdictional - Other	N/A	There are no noteworthy concerns regarding natural hazard impacts on this dam.
MA02853	Farm Pond Dam	Private	Non-Jurisdictional - Other	N/A	There are no noteworthy concerns regarding natural hazard impacts on this dam.
MA02854	West Meadow Country Club Pond Dam	Private	Non-Jurisdictional - Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.

For additional information on dams and the dam failure hazard in Northborough, also see Chapter 4.

3.5 CATEGORY 4 – FACILITIES/POPULATIONS TO PROTECT

Type	Name	Address	Details
<p align="center">Special Needs Population/Apartment Complexes/Assisted Living/ Housing Authority</p>	Beaumont/Whitney Place	238 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Coleman House	112 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	The Bridge of Central Mass	59 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Avalon Bay Apartments	14 Avalon Drive	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Housing Authority – Heritage Village	5-19 Center Drive	This facility has been noted as vulnerable to a locally identified dam failure hazard by CMRPC's GIS analysis.
	Housing Authority – Rutland Road	2 Rutland Road	This facility has been noted as vulnerable to a locally identified flooding hazard by CMRPC's GIS analysis.
	Housing Authority – Colonial Village	26 Village Drive	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Housing Authority / Advocates Inc.	152 East Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Northborough Manor	39 Pleasant Street	This facility is extremely close to the 1% and 0.2% flood zones.
	Otis Street Adult Daycare	155 Otis Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Memory Care Facility	43 King Street	This facility has been noted as vulnerable to a locally identified flooding hazard by CMRPC's GIS analysis. It is also close to the 0.2% flood zone.
	Tougas Family Farm Worker Dorm	234 Ball Street	This facility has been noted as vulnerable to locally identified flooding and winter storm hazards by CMRPC's GIS analysis.
	Alcohol / Substance Recovery Center	144 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Alcohol / Substance Recovery Center	150 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.

	Luther Rice Home	81 Lincoln Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Justice Resource Institute Developing Abilities	453 Whitney Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Community Resources for Justice	490 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Residential Board and Care – Vinfen Group Home	165 Howard Street	This facility has been noted as vulnerable to a locally identified flooding hazard by CMRPC's GIS analysis.
	Residential Board and Care – Advocates Inc.	178 South Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Residential Board and Care – Advocates Inc.	29 Thoreau Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Residential Board and Care – Advocates Inc.	342 Boundary Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Residential Board and Care	8 Saddle Hill Drive	This facility is close to the 1% and 0.2% flood zones.
	Residential Board and Care – Mentor Neuro Restorative	6 Leland Drive	There are no noteworthy concerns regarding natural hazard impacts on this facility.
Services	TeamWorks, Inc.	185 Otis Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
Schools/Daycares¹⁸	Melican Middle School	145 Lincoln Street	This facility has been noted as vulnerable to a locally identified flooding hazard by CMRPC's GIS analysis.
	Algonquin Regional High School	79 Bartlett Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Fitzgerald Institute	261 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Lincoln Street School	76 Lincoln Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Peaslee School	31 Maple Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Proctor School	26 Jefferson Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.

¹⁸ "Licensed Child Care Search," Childcare.Mass.gov, Massachusetts Department of Early Education and Care, accessed June 21, 2024, <https://childcare.mass.gov/findchildcare>.

	St. Bernadette's School	266 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Marion E. Zeh School	33 Howard Street	This school is located in a flood zone. This facility has been noted as vulnerable to locally identified flooding and winter storm hazards by CMRPC's GIS analysis.
	Cornerstone Academy	5 Oak Avenue	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Goddard School	10 Davis Street	This facility has been noted as vulnerable to a locally identified severe storm hazard by CMRPC's GIS analysis.
	Nashoba Montessori School, Inc.	40 Church Street	This facility has been noted as vulnerable to locally identified flooding, winter storm, and wildfire hazards by CMRPC's GIS analysis.
	Amego, Inc.	71 Lyman Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Northborough Extended Day Program	76 Lincoln Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Northborough Extended Day Program	26 Jefferson Road	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Skribbles Learning Center, LLC	348 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Skribbles Learning Center, LLC	325 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Nativity Nursery School	45 Howard Street	This facility has been noted as vulnerable to locally identified flooding and winter storm hazards by CMRPC's GIS analysis. It is also near the 1% flood zone.
	Tiny Tomahawks - Algonquin Regional High School	79 Bartlett Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Aprende Spanish Immersion Daycare	300 West Main Street Building C	There are no noteworthy concerns regarding natural hazard impacts on this facility.
Faith Institutions	Church of Christ	456 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Church of the Nativity	45 Howard Street	This facility has been noted as vulnerable to locally identified flooding and winter storm

			hazards by CMRPC's GIS analysis. It is also near the 1% flood zone.
	First Parish Unitarian Church	40 Church Street	Structural work is needed for this church's steeple. This facility has been noted as vulnerable to locally identified flooding, winter storm, and wildfire hazards by CMRPC's GIS analysis.
	Jehovah Witness Church	419 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Rice Memorial Baptist Church	85 Lincoln Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Seventh Day Adventist Church	30 Brigham Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Shri Gurusthan Sai Temple	107 Otis Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	St. Bernadette's Church	266 Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	St. Rose of Lima Church	244 West Main Street	There are no noteworthy concerns regarding natural hazard impacts on this facility.
	Trinity Church	23 Main Street	This facility has been noted as vulnerable to a locally identified dam failure hazard by CMRPC's GIS analysis.
Historic Buildings/Sites¹⁹	<p>According to the Massachusetts Cultural Resources Information System (MACRIS) online database accessed in April 2024, there are 16 Areas, 322 Buildings, 2 Burial Grounds, 6 Objects, and 18 Structures listed for Northborough. 11 of these historic areas, 63 of these buildings, 1 of these burial grounds, 2 of these objects, and 9 of these structures lie within regulated or locally identified flood areas within town. The following historic sites were identified by the Northborough HMP Core Team as critical facilities or infrastructure: the Allen Street Bridge, the Church Street Stone Bridge, First Parish Unitarian Church, the Gale Library, the Juniper Hill Golf Course Club House, the Northborough Historical Society building, the Northborough Town Hall, the Old Mill Pond Dam, the Route 9 Bridge over Route 20, Trinity Church, and the Wachusett Aqueduct.</p>		

¹⁹ "Search Results," Mhc-macris.net, Massachusetts Historical Commission, accessed June 21, 2024, <https://mhc-macris.net/queryresults>.

EMPLOYMENT CENTERS

Based on data obtained from the Massachusetts Executive Office of Labor and Workforce Development (EOLWD),²⁰ the following table shows the largest employers in Northborough:

Company name	Address	Number of Employees	NAICS Code
Wegmans	Shops Way	500-999	4451
Algonquin Regional High School	Bartlett St	100-249	6111
Aspen Aerogels Inc	Forbes Rd # B	100-249	4441
Bigelow Nurseries Inc	W Main St	100-249	5617
Boston Group	SW Cutoff # 100	100-249	5415
Home Instead	W Main St # 14	100-249	6216
Kohl's	Shops Way	100-249	4551
Lexus of Northborough	Belmont St	100-249	4411
Northborough Selectmen	Main St	100-249	9211
St-Gobain Ceramics & Plastics	Goddard Rd	100-249	5417
Walmart Supercenter	Otis St # 2158	100-249	4551
Beaumont Rehabilitation	W Main St	50-99	6233
Bertucci's Corp	Otis St # 2	50-99	7223
Coldwell Banker Realty	Main St # 165	50-99	5312
Coleman House	W Main St	50-99	6233
DICK'S Sporting Goods	Shops Way	50-99	4591
Fedex Ground Economy	Beeman Rd	50-99	4841
Geological Survey United	Bearfoot Rd # 6	50-99	9211
Hope Group	Bearfoot Rd	50-99	4238
Isomedix Massachusetts Inc	Whitney St	50-99	5619
Juniper Hill Golf Course	Brigham St	50-99	7139
Lincoln Street School	Lincoln St	50-99	6111
Mainstreet Bank	W Main St	50-99	5221
Margaritas Mexican Restaurant	Shops Way	50-99	7225
Mass Electric Construction Co	Bearfoot Rd	50-99	2382
Mc Kesson Corp	Lyman St	50-99	4242

²⁰ "Largest 100 Employers in Northborough," [lmi.dua.eol.mass.gov](https://lmi.dua.eol.mass.gov/LMI/LargestEmployersArea/LEAResult?A=05&GA=000269), Massachusetts Department of Economic Research, accessed June 21, 2024, <https://lmi.dua.eol.mass.gov/LMI/LargestEmployersArea/LEAResult?A=05&GA=000269>.

Company name	Address	Number of Employees	NAICS Code
Newcorr Packaging LP	Lyman St	50-99	3222
Omark Consultants Inc	W Main St # 4	50-99	2382
Pepper's Fine Foods Catering	Hudson St	50-99	7223
Perimeter Brand Packaging	Main St # 190	50-99	3261
Premier Home Health Care Svc	W Main St	50-99	6216
Proctor Elementary School	Jefferson Rd	50-99	6111
TJ Maxx	Shops Way	50-99	4551
Toolmex Corp Inc	Talbot Rd	50-99	4237
Town of Northborough	Lincoln St	50-99	6111
Viewpoint Sign & Awning	Lyman St # 1	50-99	3399

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ENVIRONMENTAL JUSTICE AND VULNERABLE POPULATIONS

The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) Environmental Justice (EJ) policy sets the state office's definition for Environmental Justice areas. The policy states that EJ populations are groups within the larger populace that EEA has determined to be most at risk of being unaware of or unable to participate in environmental decision-making, to be most at risk of being unable to gain access to state environmental resources, or to be especially vulnerable. They are defined as neighborhoods (U.S. Census Bureau census block groups) that meet one or more of the following criteria:

- The annual median household income is not more than 65% of the statewide annual median household income (according to American Community Survey 2020 5-year estimate data);
- Minorities comprise 40 % or more of the population (according to 2020 US Census data);
- 25 % or more of households lack English language proficiency (according to American Community Survey 2020 5-year estimate data); or
- Minorities comprise 25 % or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 % of the statewide annual median household income (according to 2020 US Census data and 2020 5-year estimate American Community Survey data, respectively);

According to the EEA, there are no Environmental Justice populations in Northborough.²¹ Although there are no EJ populations in town, it is still important for the Town to consider EJ populations and other vulnerable community members in the hazard mitigation planning process. In Northborough, according to the 2020 US Census, 22.8% of the population is under the age of 18 and 16.9% of the population is 65 years and over.²² According to 2022 ACS 5-year estimate data, approximately 16.4% of the population in town speaks a language other than English at home.²³ Approximately 8.7% of the population in Northborough has a disability according to this same data.²⁴ This 2022 ACS 5-year estimate data also shows that people without health insurance account for about 1.2% of Northborough's population²⁵ and about 3.8% of the Town's population is living in poverty.²⁶

Outreach to vulnerable community members was a vital part of the public outreach strategy for the Northborough Hazard Mitigation Plan. Paper HMP surveys were available at the town hall, library, and senior center and CMRPC staff conducted a presentation at a hybrid Select Board meeting in town during the planning process; these measures allowed residents who lack access to reliable Internet service and/or who have difficulty using the Internet to have a chance to complete the survey and provide their feedback on the planning process. The public presentation for the draft plan was televised on local cable access TV, and a flyer on the presentation was sent to the HMP

²¹ "Massachusetts 2020 Environmental Justice Populations," Mass-eoeaa.maps.arcgis.com, Massachusetts Executive Office of Energy and Environmental Affairs, November 12, 2022, <https://mass-eoeaa.maps.arcgis.com/apps/webappviewer/index.html?id=1d6f63e7762a48e5930de84ed4849212>.

²² "DP1: Profile of General Population and Housing Characteristics," Data.Census.gov.

²³ "S1601: Language Spoken at Home," Data.Census.gov, United States Census Bureau, accessed June 21, 2024, <https://data.census.gov/table?q=s1601%20northborough%20town>.

²⁴ "S1810: Disability Characteristics," Data.Census.gov, United States Census Bureau, accessed June 21, 2024, <https://data.census.gov/table?q=s1810%20northborough%20town>.

²⁵ "S2701: Selected Characteristics of Health Insurance Coverage in the United States," Data.Census.gov, United States Census Bureau, accessed June 21, 2024, <https://data.census.gov/table?q=s2701%20northborough%20town>.

²⁶ "S1701: Poverty Status in the Past 12 Months," Data.Census.gov.

Team's contacts at the Northborough Housing Authority.

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4.0 HAZARD PROFILES, RISK ASSESSMENT & VULNERABILITIES

Sections 4.0-4.13 help meet:

- B1. “Does the plan include a description of the type, location, and extent of all natural hazards that can affect the jurisdiction? Does the plan also include information on previous occurrences of hazard events and on the probability of future hazard events?” (Requirement 44 CFR § 201.6(c)(2)(i));
- B2. “Does the plan include a summary of the jurisdiction’s vulnerability and the impacts on the community from the identified hazards? Does this summary also address NFIP-insured structures that have been repetitively damaged by floods?” (Requirement 44 CFR § 201.6(c)(2)(ii));
- C1. “Does the plan document each participant’s existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs?” (Requirement 44 CFR § 201.6(c)(3)); and
- E1. “Was the plan revised to reflect changes in development?” (Requirement 44 CFR § 201.6(d)(3))

The following section includes a summary of natural hazards that have affected or could affect Northborough in the future. Natural hazards are weather, climate, or environmental threats to lives, property, or other valuable assets to human society. By examining historical data on natural hazard occurrences, and future projections of how climate change will interact with natural hazards, it is possible to approximate the future risk of natural hazards. Historical research, discussions with local officials and emergency management personnel, available hazard mapping and other weather-related databases were used to develop this list.

The most significant identified hazards are the following:

- Flooding
- Severe Snowstorms / Ice storms/ Nor’easters
- Hurricanes
- Severe Thunderstorms / Wind / Tornadoes
- Wildfires / Brushfires
- Earthquakes
- Dam failure
- Drought
- Extreme Temperatures
- Invasive Species
- Other hazards

4.1 STATE-WIDE OVERVIEW OF HAZARDS

4.1.1 MASSACHUSETTS STATE HAZARD MITIGATION AND CLIMATE ADAPTATION PLANNING

The state of Massachusetts and Governor Healy’s administration has updated the 2018 State

Hazard Mitigation and Climate Adaptation Plan (SHMCAP) pursuant to Executive Order 569. The 2023 ResilientMass Plan updates and expands upon the previous SHMCAP and outlines how the state of Massachusetts must prepare strategies to prevent, respond, and mitigate natural hazards.²⁷ The plan is the first of its kind to incorporate climate change adaptations into the mitigation plan. The plan also makes Massachusetts eligible for federal disaster recovery and hazard mitigation. The plan is effective under FEMA from September 12, 2023, to September 13, 2028. The Massachusetts SHMCAP is a useful model for incorporating climate change interactions into the natural hazard mitigation planning process.

4.1.2 CLIMATE CHANGE INTERACTIONS

As part of the creation of the SHMCAP planning process the state of Massachusetts performed a statewide analysis that detailed the affects of climate change on the cities and towns of Massachusetts. This culminated with the release of the 2022 Climate Change Assessment, which details the impacts of climate change to the Central Region of Massachusetts (which includes 55 cities and towns spanning the middle of the State) among the other regions of the state. This report refocuses climate change impact assessment away from the specific hazards and towards how the most urgent of those hazards would affect the region in the following Sectors: Human, Infrastructure, Natural Environment, Governance and Economy. The hazards identified as having the most urgent impacts for Central Massachusetts are **Extremes in Temperature and Precipitation**, with wide fluctuations in both precipitation extremes (including both flooding and droughts) as well as extremes in temperatures (both in high heat days becoming more prevalent, as well as extreme lows in temperature) as having the greatest future risk to the central region across these sectors. The State plan, while being comprehensive, places different priorities on the impacts of climate change and natural hazards than the local planning team. This is based more on the local conditions rather than any contradictions with the State's Analysis, and the local hazard mitigation planning effort was informed by the state planning process.

- **Human Impacts:** The assessment identified a **Reduction in Food Safety and Security, and Health and Cognitive Effects** from extreme heat being the most urgent human sector impacts for the central region. The reduction in food safety and security is likely to be affected at all levels of production and distribution by both extremes in temperature causing spoilage, power outages as well as extremes in precipitation creating a more unpredictable environment for the growth of produce. According to the report Reduction in crop yields across the state and within the region plays a role in this impact with key commodity crop yields in the Central region could decline by 12 percent by 2030²⁸. These impacts to the supply chain for food regionally are expected to be reflected in state and national crop yields and distribution, and while currently our food supply networks are anticipated to be able to withstand these shocks, the subsequent increases in food prices will correspondingly see an increase in food insecurity within our region.

²⁷ "2023 ResilientMass Plan," Mass.gov, Massachusetts Executive Office of Energy and Environmental Affairs, accessed June 10, 2024, <https://www.mass.gov/info-details/2023-resilientmass-plan>.

²⁸ Estimates derived from application of data from the following two sources:

USEPA, "Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment," U.S. Environmental Protection Agency, 2017, EPA 430-R-17-001; Robert H. Beach et al., "Climate change impacts on US agriculture and forestry: benefits of global climate stabilization," *Environmental Research Letters* 10, no. 9 (2015). doi:10.1088/1748-9326/10/9/095004.

The impacts of Extreme Temperatures are also projected to have a significant impact on health and cognition within our region, particularly in our more urbanized areas. Currently, three annual premature deaths are attributable to extreme temperature in the region, but approximately 35 additional premature deaths per year are expected as a result of climate change by the end of the century²⁹, assuming that no mitigation measures are taken to reduce the threat of temperature extremes beyond what our regions current capabilities are. Even short of mortality, the impacts of heat on cognition could cause a further decline in learning outcomes, workplace productivity, and see an increase in usage and strain upon emergency rooms dealing with heat related illnesses and injuries.

Additional Human Sector impacts include: **Increases in Mental Health Stressors; Increases in Vector Borne Diseases Incidence and Bacterial Infections; Damage to Cultural Resources; Health Effects from Aeroallergens and Mold; Emergency Service Response Delays and Evacuation Disruptions; Health Effects of Extreme Storms and Power Outages; and Health Effects from Degraded Air Quality** as human impacts to the region.

- **Infrastructure Impacts:** The most urgent impacts to the infrastructure sector are the **Loss of Urban Tree Cover** and **Damage to Electric Transmission and Distribution Infrastructure**. Urban Trees face a broad range of climate impacts and stressors: from a projected increase in extreme event activity, increased threats from invasive pests and diseases, and reduced water and soil quality all correspond to an increased rate of tree mortality and associated costs of urban forest management for towns. Central Massachusetts features both urban and suburban centers where projected temperature increases make urban tree coverage particularly valuable at reducing the Heat Island Effect. A prime example of this is the City of Worcester, which is the state's second most populous city. 75 percent of the city's area falls within state-designated environmental justice block groups, but it has relatively low canopy coverage and is at disproportionate risk for urban tree loss.³⁰ Regionwide Damage to Electric Transmission and Distribution is projected to have increasing costs by orders of magnitude in the coming decades, with additional annual costs growing to \$6 million by 2030; \$12 million by 2050; \$19 million by 2070; and \$28 million by 2090.³¹ These costs are based on the need for repair activities in response to climate related damages and failures, and take into account a wide range of climate stressors beyond extremes in temperature and precipitation. Additional Infrastructure Sector Impacts include: **Damage to Roads and Loss of Road Service; Reduction in Clean Water Supply; Increased Risk of Dam Overtopping or**

²⁹ Estimates derived from application of David Mills et al., "Climate change impacts on extreme temperature mortality in select metropolitan areas in the United States.," *Climatic Change* 131 (2014): 83-95. <https://doi.org/10.1007/s10584-014-1154-8>.

³⁰ "2022 Massachusetts Climate Change Assessment," Mass.gov, Massachusetts Executive Office of Energy and Environmental Affairs and Massachusetts Emergency Management Agency, December 2022, <https://www.mass.gov/doc/2022-massachusetts-climate-change-assessment-december-2022-volume-iii-regional-reports/download>, pages RS36-RS37.

³¹ Estimates derived from application of Charles Fant et al., "Climate change impacts and costs to U.S. electricity transmission and distribution infrastructure," *Energy*, 195 (2020). <https://doi.org/10.1016/j.energy.2020.116899>.

Failure; Loss of Energy Production and Resources; Damage to Inland Buildings; and Damages to Rails and Loss of Rail/Transit Service.

- **Natural Environment Impacts:** The State Plan identified **Freshwater Ecosystem Degradation** and **Forest Health Degradation** as the most urgent impacts on this sector in the Central region. Increased nutrient load and harmful algal bloom growth from increased precipitation runoff, and increased concentrations of contaminants when drought conditions occur are all exacerbated by climate extremes. Shifts in habitat caused by increased average air and water temperatures in particular threaten the coldwater habitats and fisheries of the Central region.

The affect on the region's forests that climate change will have is harder to predict, however the potential for significant ecosystem loss from climatological changes cannot go understated. Statewide, a third of tree species are classified by the U.S. Forest Service as having low capacity for adapting to projected climate changes, and an increased frequency of extreme events poses an additional threat to forests in the Central region.³²

Additional impacts to the natural environment include: **Shifting Distribution of Native and Invasive Species and Soil Erosion.**

- **Governance Impacts:** The most urgent Impacts of climate change on the Governance Sector, as is true with the rest of the statewide impacts in this sector, is: an **Increase in Costs of Responding to Climate Migration; an Increase in Demand for State and Municipal Government Services; and a Reduction in State and Municipal Revenues** caused by climate change. Climate Migration, whether forced or voluntary, is already being felt by Massachusetts Communities, and has been identified in the state plan as having a major consequences in addition to having the largest adaptation gap for our region. Urban centers, particularly in and around Worcester as well as towns serviced by state and regional transit services, are likely to become receiving zones for climate migration based on a relative assessment of climate hazards nationwide. This new influx of population is expected to increase demand for government services. The need to increase government expenditures to maintain the current level of service for the existing population in addition to climate refugees represents a significant stressor to local government. Increased needs for MassHealth, food security support, and emergency services are expected, as are the effects on those systems due to climate change beyond rapid population growth. Many of these impacts are expected to be concentrated in low-income areas, as existing inequalities may become exacerbated by an influx of climate refugees that will require additional expenditure if steps are not taken to prepare for these Impacts. Disruptions to State and Municipal revenue generation through property tax losses as well as the loss of sales taxes from interruptions to business and the economy from natural

³² Estimates derived from application of US Forest Service Tree Atlas for Massachusetts.

Northern Research Station Landscape Change Research Group: Iverson, Peters, Prasad, Matthews. "Massachusetts - Climate Change Atlas Tree Species: Current and Potential Future Habitat, Capability, and Migration," Fs.usda.gov, United States Department of Agriculture Forest Service, September 2022,

<https://www.fs.usda.gov/nrs/atlas/combined/resources/summaries/states/Massachusetts.pdf>; "Climate Change Atlas," Fs.usda.gov, United States Department of Agriculture Forest Service, accessed June 10, 2024,

<https://www.fs.usda.gov/nrs/atlas/combined/resources/summaries/states>.

hazards is expected to increase over time.

Additional impacts to the Governance Sector are: **an Increased Need for State and Municipal Policy Review and Adaptation Coordination and Damage to Inland State and Municipal Buildings were identified in the state's assessment.**

- **Economic Impacts:** The Impacts to this sector identified as having the most urgency are a **Reduced Ability to Work** and a **Decrease in Agricultural Productivity** caused by climate change. In both of these areas an increase in temperature extremes corresponds to a decrease in worker's ability to work in dangerous conditions in addition to other natural hazards affecting workers ability to get to the job safely and increases in illnesses caused by primary or secondary effects of natural hazards and climate change. Workers in the region in high-risk industries (those exposed to outdoor conditions) are projected to lose 31 hours per worker each year by 2050 and 128 hours per worker each year by 2090, the highest in the Commonwealth by the end of the century.³³

While agriculture represents a smaller role in the Central region's economy, impacts to this sector of the economy through lower crop yields have the potential to severely disrupt the local economy and regional food systems. Key commodity crop yields in the Central region could decline by 12 percent by 2030, and by 14 percent by 2070 and carry potentially disproportionate impacts on the local economies that rely on agricultural production for both farm workers and employers.³⁴

Additionally, though not identified as the one of the most urgent impacts to the Central region in the state's assessment, the expected **Reduction in Availability of Affordably Priced Housing** has become more prevalent since the assessment was released. As affordable properties are typically situated in more hazard prone areas creating a decrease in supply over time and as increases in demand for housing continue, a disproportionate economic impact on working families is already decreasing the overall resiliency of the region to shocks.

Additional impacts to this sector include: **Damage to Tourist Attractions and Recreation Amenities and Economic Losses from Commercial Structure Damage and Business Interruptions.**

During the local Hazard Mitigation Planning process the Town noted that their chief concerns were also Extremes in Precipitation in the form of rain or snow, in concurrence with the state assessment.

4.2 NATURAL HAZARD IDENTIFICATION AND ANALYSIS

This section examines the hazards in the Massachusetts SHMCAP which are identified as likely to affect Northborough. The analysis is organized into the following sections: Hazard Description, Location, Extent, Previous Occurrences, Probability of Future Events, Impact, and Vulnerability. A description of each of these analysis categories is provided below.

³³ Estimates derived from application of Matthew Neidell et al., "Temperature and work: Time allocated to work under varying climate and labor market conditions," *PloS One*, 16, no. 8 (2021), <https://doi.org/10.1371/journal.pone.0254224>.

³⁴ Estimates derived from application of USEPA (2017) and Beach et al. (2015)

4.2.1 HAZARD DESCRIPTION

The natural hazards identified for Northborough are: Flooding, Severe snowstorms / Ice storms / Nor'easters, Hurricanes, Severe thunderstorms / Wind / Tornadoes, Wildfire / Brushfire, Earthquakes, Dam Failure, Drought, Extreme Temperatures, and Invasive Species. Many of these hazards result in similar impacts to a community. For example, hurricanes, tornadoes and severe snowstorms may cause wind-related damage.

4.2.2 LOCATION

Location refers to the geographic areas within the planning area that are affected by the hazard. Some hazards affect the entire planning area universally, while others apply to a specific portion, such as a floodplain or area that is susceptible to wildfires. Classifications are based on the area that would potentially be affected by the hazard, on the following scale:

Table 1: Percentage of Town Impacted by Natural Hazard

Land Area Affected by Occurrence	Percentage of Town Impacted
Large	More than 50% of the town affected
Medium	10 to 50% of the town affected
Small	Less than 10% of the town affected

4.2.3 EXTENT

Extent describes the strength or magnitude of a hazard. Where appropriate, extent is described using an established scientific scale or measurement system. Other descriptions of extent include water depth, wind speed, and duration.

4.2.4 PREVIOUS OCCURRENCES

Previous hazard events that have occurred are described. Depending on the nature of the hazard, events listed may have occurred on a local, state-wide, or regional level.

4.2.5 PROBABILITY OF FUTURE EVENTS

The likelihood of a future event for each natural hazard was classified according to the following scale:

Table 2: Frequency of Occurrence and Annual Probability of Given Natural Hazard

Frequency of Occurrence	Probability of Future Events
Very High	70-100% probability in the next year
High	40-70% probability in the next year
Moderate	10-40% probability in the next year
Low	1-10% probability in the next year
Very Low	Less than 1% probability in the next year

4.2.6 IMPACT

Impact refers to the effect that a hazard may have on the people and property in the community, based on the assessment of extent described above. Impacts are classified according to the following scale:

Table 3: Impacts, Magnitude of Multiple Impacts of Given Natural Hazard

Impacts	Magnitude of Multiple Impacts
Catastrophic	Multiple deaths and injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of facilities for 30 days or more.
Critical	Multiple injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 week.
Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 day.
Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of facilities.

4.2.7 POTENTIAL CLIMATE CHANGE EFFECTS

Each natural hazard is influenced by one or more of the climate change interactions listed in Section 4.1.2 Climate Change Interactions. Climate change interactions can modify the location, extent, and probability of future events depending on the hazard. The section of the hazard risk assessment lists climate change interactions as described by the 2023 ResilientMass Plan.

4.2.8 VULNERABILITY

Based on the above metrics, a hazard index rating was determined for each hazard. The hazard index ratings are based on a scale of 1 through 5 as follows:

- 1 – Highest risk
- 2 – High risk
- 3 – Medium risk
- 4 – Low risk
- 5 – Lowest risk

The ranking is qualitative and is based, in part, on local knowledge of past experiences with each type of hazard. The size and impacts of a natural hazard can be unpredictable. However, many of the mitigation strategies currently in place and many of those proposed for implementation can be applied to the expected natural hazards, regardless of their unpredictability.

MITIGATION STRATEGIES

Based on meetings with the local planning team, a selection of mitigation strategies that address

the specific hazard will be included at the end of each hazard analysis section.

Type of Hazard	Location of Occurrence	Probability of Future Events	Impact	Potential Climate Change Effects	Hazard Risk Index Rating
<i>Flooding</i>	Small	Moderate	Minor	Increase extent; increase probability	3
<i>Severe Snowstorms / Ice Storms/ Nor'easter</i>	Large	Very High	Limited	Increase extent	2
<i>Hurricanes</i>	Large	Low	Limited	Increase extent; increase probability	4
<i>Severe Thunderstorms/Wind</i>	Small	Moderate	Minor	Unclear	2
<i>Tornadoes</i>	Small	Very Low	Limited	Unclear	3
<i>Wildfire / Brushfire</i>	Small	Moderate	Minor	Increase extent; increase probability	4
<i>Earthquakes</i>	Large	Very Low	Minor	None	5
<i>Dam Failure</i>	Small	Very Low	Limited	Indirect effects related to flooding	4
<i>Drought</i>	Large	Very Low	Minor	Increase extent; increase probability	4
<i>Extreme Temperatures</i>	Large	Moderate	Limited	Increase in average temperature; increase in probability of extreme heat	4
<i>Invasive Species</i>	Medium	High	Limited	Increase in range and severity of invasive species	3

Source: based on Massachusetts Resilient Mass Plan 2023; modified to reflect conditions in Northborough.

4.3 FLOODING

Flooding was one of the most prevalent natural hazards identified by local officials in Northborough. Flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms. Global climate change has the potential to exacerbate these issues over time with the potential for more severe and frequent storm and rainfall events. There are several different types of flood hazards – from stormwater inundation and poor drainage infrastructure to riverine flooding and storm surges to dam failures. Riverine and stormwater flooding both occur in Northborough, though stormwater flooding is more common. Riverine flooding occurs when the surge of water comes from the top of streams, ponds, and rivers. Stormwater flooding occurs when the amount of precipitation in a storm is greater than the volume that the stormwater management system can handle.

LOCATION

Flooding and flood-prone areas in Northborough are closely associated with the 100-year flood areas, identified by FEMA. According to a GIS analysis performed by CMRPC, there are 776 parcels in Northborough that are susceptible to 100-year floods, with 103 of them containing structures. Much of Northborough is upland, away from rivers and ponds – as a result, the location of this hazard is relatively “small”. Map 2 in Appendix A illustrates the FEMA FIRM 100-year flood zones in town, as well as locally-identified flooding areas. See below for discussion of previous flood occurrences and their locations. Building footprints that overlap with these flood zones may be impacted by flooding of that magnitude, especially if homeowners have not taken action to mitigate their personal flood risk. Despite Northborough having numerous flooding problems, most of Northborough is upland and built away from rivers and ponds. Northborough’s affected area from this hazard, or, its location, is considered “small” (10% or less of the Town). Map 2 in Appendix A illustrates the FEMA FIRM 1% flood zones in town, as well as locally identified flooding areas.

As of September 2022, the Town of Northborough has no repetitive loss structures as defined by FEMA’s NFIP. As defined by the National Flood Insurance Program (NFIP), a repetitive loss property is any property which the NFIP has paid two or more flood claims of \$1,000 or more in any given 10-year period since 1978. For more information on repetitive losses see <https://www.fema.gov/repetitive-flood-claims-grant-program-fact-sheet>. The Town of Northborough does have 16 NFIP policy holders in town, insuring up to \$6,384,000.00 of property, and NFIP has paid out 6 claims in total to policy holders in Northborough³⁵.

EXTENT

The average annual precipitation for the closest weather station to Northborough (located at

FEMA Flood zones

FEMA creates and manages Flood Insurance Rate Maps (FIRMs) that identify local flood hazard areas. These Special Flood Hazard Areas (SFHA) are locations that will be inundated by a flood event with a 1% or greater chance of occurring in any year. These areas are also referred to as the base flood, or 1% flood zone. These areas are considered at high risk of flooding and have around a 1 in 4 chance of flooding during a 30-year mortgage.

FEMA FIRMs also identify areas with a “moderate” flood risk, defined as locations between the 1% annual chance flood and a .2% annual chance flood. These areas are also known as the 0.2% flood zone.

³⁵ NFIP Community Overview – Northborough, generated 11/06/2023

Worcester Regional Airport) has been 53.64 inches for the period from inches for the period from 2017 to 2024³⁶. Over the past five years, Northborough has received an average of 15 days annually with precipitation over 1 inch³⁷. Water levels in Northborough's rivers, streams, and wetlands rise and fall seasonally and during high rainfall events. High water levels are typical in spring, due to snowmelt and ground thaw. This is the period when flood hazards are normally expected. Low water levels occur in summer due to high evaporation and plant uptake (transpiration). Monthly precipitation levels are highly variable but for the period between 2017 and 2024 Northborough received on average the most precipitation in the months of July, September, October, and December, with July being uncharacteristically rainy in 2021 and 2023 causing this deviation from expected norms. At any time, heavy rainfall may create conditions that raise water levels in rivers and streams above bank full stage, which then overflow adjacent lands.

Based on past records and the knowledge and experience of members of the Northborough Hazard Mitigation team and residents, the extent of the impact of localized flooding would be "minor".

PREVIOUS OCCURRENCES

In addition to the floodplains mapped by FEMA for the 1% and .2% annual chance floods, Northborough periodically experiences minor flooding at isolated locations due to drainage problems, or problem culverts. Town staff have reported that flooding events are becoming more frequent in recent years. The following specific flooding locations (mapped in Appendix A) were identified by the Northborough Hazard Mitigation Team:

- Cherry St
- US-20 @ Tomblin Hill Rd
- Howard St
- Green St
- Ball St
- West St
- Southwest Cutoff
- Brewer St

Most of the flood hazard areas listed here were identified due to known past occurrences in the respective area. There are other areas with no record of previous flood incidents that could be affected in the future by heavy rain and runoff. Additionally, some areas have experienced erosion and stormwater drainage failures. It is important to note that many of these areas are near or on evacuation routes, causing a concern for evacuation from affected parts of town.

At the MVP Workshop, it was reported that major floods occurred in 1927, 1938, and 1955. The 1955 flood prompted major reconstruction of the Mill St. dam. In the past 10 years, there have been a number of flooding events that have occurred in and around the Northborough community.

³⁶ Temperature and precipitation data were obtained from the Applied Climate Information System (ACIS) provided by the NOAA Regional Climate Centers.

"Climate," Weather.gov, National Oceanic and Atmospheric Administration National Weather Service, accessed June 10, 2024, <https://www.weather.gov/wrh/Climate?wfo=box>.

³⁷ Ibid.

Major events are listed below:

- 7/01/2013 – Flash Flood: A series of shortwaves moved along a stationary boundary to the west of Southern New England, igniting showers and thunderstorms. An atmosphere characterized by low CAPE and decent deep layer shear resulted in showers and thunderstorms producing heavy rain and rotating thunderstorms. One of these storms produced a microburst in Agawam.
- 7/27/2014 – Flash Flood: An upper level disturbance moving out of the Great Lakes initiated showers and thunderstorms over New York and New England. Enough instability was present in the region for some of these storms to become severe, producing strong to damaging winds and at least one funnel cloud.
- 08/15/2015 – Flood: A weak cold front moving through southern New England brought showers and thunderstorms to the region. These storms produced hail and damaging winds as well as some poor drainage street flooding.
- 7/22/2016 – Flood: A cold front moved through southern New England and when coupled with the existing heat and humidity, resulted in showers and thunderstorms developing over much of the area late in the day and continuing into the evening and overnight hours. Minor street flooding occurred on Route 135 in Westborough.
- 10/21/2016 – Flash Flood: Low pressure tracking toward southern New England tapped into a plume of tropical moisture and produced torrential rainfall over parts of central and northeast Massachusetts in the matter of a few hours. This resulted in prolific urban flash flooding in the greater Worcester area and significant urban flooding in greater Boston. The highest single rainfall total from this event was within the City of Worcester, where a Skywarn Spotter reported 5.24 inches of rainfall.
- 06/27/2017 – Flood: A disturbance at mid-levels in the atmosphere moved from the Great Lakes across New England during the afternoon and evening. This along with daytime heating through partly sunny skies allowed afternoon and evening thunderstorms to develop.
- 10/24/2017 – Flood: Low pressure moved north through the Great Lakes. This swung a cold front slowly east into Southern New England on October 25. The front stalled over the region during the 25th before moving off to the east on the 26th. Strong low level winds brought a flow of tropical moisture ahead of the front. The strong winds aloft were brought to the surface in damaging wind gusts, with speeds reaching 45 to 55 mph. The tropical moisture was converted to heavy downpours, with storm rainfall totals ranging from 2 inches to 6 1/2 inches. This brought widespread urban and poor drainage flooding. State Route 9 at Saybrook Road in Shrewsbury was flooded.
- 7/17/2018 – Flash Flood: A cold front moved east from the Great Lakes, crossing Massachusetts during the night of the 17th. The thunderstorms brought strong wind gusts and wind damage during the afternoon and evening. Thunderstorms also brought downpours in Western, Central, and Northeast Massachusetts. Two to four inches of rain fell from Westfield through Worcester to Boston.
- 08/11/2018 – Flood: A cold front stalled over Southern New England on the 11th. Low

pressure from the Midwest then moved slowly east along the front. The weather system drew upon warm and very humid air to create showers with local downpours, resulting in rainfall amounts of two to five inches in Northern Massachusetts on August 11th and 12th. An exceptionally powerful downpour left 8.15 inches in the city of Lynn.

- 8/23/2020 – Flash Flood: Diurnally driven thunderstorms brought wind damage, hail, and some flooding to mainly western and central Massachusetts.
- 9/11/2023 – Flash Flood: A deamplifying mid level shortwave with dewpoints in the 70s and decent instability brought scattered thunderstorms and widespread flash flooding to Massachusetts and Rhode Island. There were many streets closed, many cars stranded in flood waters, and several houses with flooded basements or first floors.

PROBABILITY OF FUTURE EVENTS

Based upon previous data, there is a “moderate” probability of localized flooding occurring in Northborough in the next year. This represents a slight increase over the last plan due to increased precipitation from climate change.

IMPACT

The Town faces a minor impact, with less than 10% of the total Town area likely to be affected by a 1% annual chance flooding event. Based on the HAZUS analysis described below, a flood in Northborough is unlikely to completely destroy any buildings, but a .2% annual chance flood event could displace residents and come with a significant economic cost.

HAZUS- MH (multiple-hazards) is a computer program developed by FEMA to estimate losses due to a variety of natural hazards. The HAZUS software was used to model potential damages to the community from a .2% annual chance flood event, assuming a 1 square mile data resolution.

.2% annual chance flood event

Building Characteristics	
Estimated total number of buildings in Northborough	5,155
Estimated total building replacement value (2024 \$)	\$ 3,604,141,000.00
Building Damages	
# of buildings sustaining minor damage (1-10%)	3
# of buildings sustaining moderate damage (11-40%)	0
# of buildings sustaining severe damage (41-50%)	0
# of buildings destroyed	0
Population Needs	
# of households displaced	75
# of people seeking public shelter	55
Value of Damages	

Total property damage (buildings and content)	\$15,980,000.00
Total losses due to business interruption	\$ 17,800,000.00
Total Economic loss	\$33,780,000.00

Though there are no recorded instances of a flood event of this size in Northborough, this model was included in order to present a reasonable “worst case scenario” that would help planners and emergency personnel evaluate the impacts of flooding that might be more likely in the future, as we enter into a period of more intense and frequent storms. For more information on the HAZUS-MH software, go to <http://www.fema.gov/hazus-software>.

EXPOSURE

Certain features within Northborough’s community infrastructure, society, and environment may face more exposure to flooding, or be disproportionately impacted by it, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in Section 3. These features include:

- Low-lying areas, including but not limited to the FEMA 1% and .2% annual chance flood zones.
- Specific locations with undersized or outdated storm water infrastructure that cannot handle sudden surges in precipitation.
- Residents who may have trouble evacuating from their residence due to age, health concerns, or lack of a vehicle.
- Flood-prone municipal buildings and critical infrastructure.
- that are subject to flooding and potential contamination from flood waters.
- Septic systems, especially in flood prone areas or locations with high water tables.
- Aquatic ecosystems, which may suffer from erosion, eutrophication, or sedimentation due to stormwater.
- The municipal financial burden of infrastructure maintenance and upgrades meant to address flooding.
- Highway department staff, who sometimes must unclog storm drains during extreme weather events. Due to limited staffing, highway department employees often have to go out alone, making safety a concern.
- Sides of roadways, which may be erode due to excessive rainfall. Lack of funding to make road repairs may compound this issue.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2023 State Hazard Mitigation and Climate Adaptation Plan, climate change effects coupled with changes in development and population density increase the risk of flooding from precipitation. As noted earlier in the plan, the Central region in particular is most likely to be impacted by extremes in precipitation in the following ways:

- Climate change is projected to increase the variability of precipitation events within a year,

including the potential for extreme precipitation events. Instances of inland flooding, river overflows, and pressure on dams may result.

- Projected changes in precipitation patterns in all seasons, as well as higher frequency of extreme weather (including hurricanes and nor'easters), will change patterns of river flow and increase the frequency and severity of inland riverine flooding.

In summary, climate change is likely to increase the extent and probability of future flood events in Northborough which will make it more likely for multiple storms in a short duration to cause cumulative damage. This can impact land use and development, such as no longer being able to develop on parts of town that flood frequently and the need to zone for increased stormwater resilience.

VULNERABILITY

Based on this analysis and the assessment of the Northborough Core Team, Northborough faces a hazard index rating of “3 - medium risk” from flooding. A culvert along Route 135 is located within the 100-year flood zone. Additionally, sections of evacuation routes including Main St, Church St, South St/Route 135, West Main St, Hudson St, Whitney St, and I-290 are located in or adjacent to 100-year flood zones. Moreover, the local team identified 8 locations in Northborough susceptible to flooding, including those which are identified above under Previous Occurrences. If evacuation routes and critical facilities such as those listed above are flooded, emergency response and/or evacuations could be hampered, and some locations along Cherry St, Route 20 and the Southwest Cutoff among others are along secondary and tertiary evacuation routes and identified as potential flood hazard areas.

MITIGATION STRATEGIES

The Town of Northborough is currently able to effectively respond to flooding through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, the Town’s existing capabilities to mitigate and respond to flooding could be expanded upon through numerous avenues. The local planning team identified the following strategies that could be used to reduce the threat of Flooding in Northborough:

1. Explore options for working with MassDOT to construct water retention structures / swales at the RT-9 - RT-20 Interchange.
2. Protect additional open space for hazard mitigation purposes through acquisition or conservation restriction, especially floodplains, riverfront areas, wetlands, and steep slopes.
3. Protect municipal buildings and services against flooding and provide adequate staffing and training.
4. Educate the public about strategies for preventing basement flooding, such as with rain gardens or other nature-based and small-scale mitigation strategies.
5. Update subdivision regulations to incorporate current construction practices and stormwater mitigation measures. Create homeowners’ associations to permanently maintain stormwater basins and fire protection systems (such as cisterns). Update the common driveway bylaw.
6. Integrate hazard mitigation into subdivision, site plan review, 40B review, and other zoning

reviews. In particular, require the consideration of downstream flooding impacts caused by new projects. Enforce the reduction of impervious surface (pavement) and reserve parking for recharge and retention of stormwater. Enforce groundwater protection in overlay district.

DRAFT

4.4 SEVERE SNOWSTORMS / ICE STORMS / NOR'EASTERS

Severe winter storms can pose a significant risk to property and human life. Severe snowstorms and ice storms can involve rain, freezing rain, ice, snow, cold temperatures, and wind. Heavy snowfall and extreme cold can immobilize an entire region. Even areas that normally experience mild winters can be hit with a major snowstorm or extreme cold. Winter storms can result in flooding, storm surge, closed highways, blocked roads, downed power lines and hypothermia. A northeast coastal storm, known as a nor'easter, is typically a large counterclockwise wind circulation around a low-pressure center often resulting in heavy snow, high winds, and rain.

LOCATION

The entire town of Northborough is susceptible to severe snowstorms, which means the location of occurrence is "large." Because these storms occur regionally, they would impact the entire town is equally vulnerable.

EXTENT

The Northeast Snowfall Impact Scale (NESIS) characterizes and ranks high-impact Northeast snowstorms. These storms have large areas of 10-inch snowfall accumulations and greater. NESIS has five categories: Extreme, Crippling, Major, Significant, and Notable. The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Thus, NESIS gives an indication of a storm's societal impacts.

NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. The aerial distribution of snowfall and population information are combined in an equation that calculates a NESIS score which varies from around one for smaller storms to over ten for extreme storms. The raw score is then converted into one of the five NESIS categories. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers.

Table 4: Northeast Snowfall Impact Scale Categories³⁸

Category	NESIS Value	Description
1	1—2.499	Notable
2	2.5—3.99	Significant
3	4—5.99	Major
4	6—9.99	Crippling
5	10.0+	Extreme

³⁸ National Centers for Environmental Information. (n.d.). Regional Snowfall Index (RSI). National Oceanic and Atmospheric Association. Retrieved January 27, 2022, from <https://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis>

PREVIOUS OCCURRENCES

Based on data available from the National Oceanic and Atmospheric Administration, there are 88 high-impact snowstorms since 1958 that have affected the Northeast Corridor. Of these, approximately 38 storms resulted in snow falls in Northborough of at least 10 inches. These storms are listed in the table below:

Start Date	NESIS Value	NESIS Category	NESIS Classification
12/13/2022	8.52	4	Crippling
01/28/2022	1.73	1	Notable
01/04/2022	1.60	1	Notable
01/30/2021	4.93	3	Major
12/04/2020	3.21	2	Significant
03/03/2019	1.29	1	Notable
3/11/2018	3.16	2	Significant
1/3/2018	2.27	1	Notable
3/12/2017	5.03	3	Major
2/8/2015	1.32	1	Notable
1/29/2015	5.42	3	Major
1/25/2015	2.62	2	Significant
3/4/2013	3.05	2	Significant
2/7/2013	4.35	3	Major
1/26/2011	2.17	1	Notable
1/9/2011	5.31	3	Major
12/24/2010	4.92	3	Major
2/23/2010	5.46	3	Major
12/18/2009	3.99	2	Significant
3/15/2007	2.54	2	Significant
2/12/2006	4.10	3	Major
1/21/2005	6.80	4	Crippling
2/15/2003	7.50	4	Crippling
3/31/1997	2.29	1	Notable
2/8/1994	5.39	3	Major
3/12/1993	13.2	5	Extreme
2/10/1983	6.25	4	Crippling
4/6/1982	3.35	2	Significant
2/5/1978	5.78	3	Major
1/19/1978	6.53	4	Crippling
2/18/1972	4.77	3	Major
2/22/1969	4.29	3	Major
2/8/1969	3.51	2	Significant
2/5/1967	3.50	2	Significant

Start Date	NESIS Value	NESIS Category	NESIS Classification
2/2/1961	7.06	4	Crippling
1/18/1961	4.04	3	Major
12/11/1960	4.53	3	Major
3/2/1960	8.77	4	Crippling
2/14/1958	6.25	4	Crippling

Additionally, the NCEI database notes at least one instance of heavy snowfall in the area of Worcester County:

- 01/07/2024 – Heavy Snow: A strong storm moved up the east coast passing near the 70/40 benchmark brought heavy snow to southern New England beginning late Monday night and continuing on Sunday. The first round of heavy snow fell overnight followed by a lull in the snow and mixing with rain Sunday morning. Comma head snow then filled back into eastern MA and RI bringing moderate to heavy snow Sunday afternoon and evening. Snow amounts ranged from 2 to 18 inches.

PROBABILITY OF FUTURE EVENTS

Based upon the availability of records for Worcester County, the likelihood that a severe snowstorm will affect Northborough is “very high” (greater than 70 percent in any given year).

In the 2023 ResilientMass Plan notes that on average, Massachusetts experiences one to two nor’easters per year. In the past 10 years (2013– 2022), there have been 63 heavy snow days, 12 blizzard days, and two ice storm days in Massachusetts.

IMPACT

Northborough faces a “limited” impact or less than 10 percent of total property damaged, from snowstorms. The weight from multiple snowfall events can test the load ratings of building roofs and potentially cause significant damage. Multiple freeze-thaw cycles can also create large amounts of ice and make for even heavier roof loads.

Other impacts from snowstorms and ice storms include:

- Tree damage and fallen branches that cause utility line damage and roadway blockages
- Disrupted power and phone service
- Unsafe roadways and increased traffic accidents
- Infrastructure and other property are also at risk from severe winter storms and the associated flooding that can occur following heavy snow melt.
- Damage to telecommunications structures
- Reduced ability of emergency officials to respond promptly to medical emergencies or fires

The local planning team noted icing concerns along Green Street, Rockridge Road, Adin Street, Cemetery Street, and Hope Street. Snow drift was also identified as a concern along Fitzgerald Drive, Northborough Street, and Freedom Street.

EXPOSURE

Certain features within Northborough’s community infrastructure, society, and environment may face more exposure to winter storms, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in *Section 3*. These features include:

- Elderly residents, who may have more difficulty clearing snow and walking on icy or snow-covered sidewalks. Elderly residents may also be more vulnerable to extremely low temperatures.
- Households with low or fixed incomes who may be less able to afford sufficient heating or home improvements to improve energy efficiency and insulation.
- Renters, who may have less control over their living situation and indoor environment than homeowners.
- Public safety, utility, and highway department workers, who are tasked with responding to emergency calls, keeping the heat and power on, and keeping the streets clear during winter storms.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2023 ResilientMass Plan, Sea level rise, warming ocean temperatures, and changing atmospheric circulation patterns are likely to increase the frequency and severity of winter storms. Warmer temperatures indicate that more precipitation will fall as rain rather than snow throughout the 21st century. This essentially will create fewer overall snowstorms, but the snowstorms that do occur will likely be worse. This also creates a greater risk for Wintery Mix, Sleet and Ice Storms and hazardous roadway conditions as temperature drops over night will cause transportation infrastructure to ice over without mitigations in place.

In summary, climate change is likely to increase the extent and probability of future snowstorm events in Northborough. This may have societal impacts as more frequent severe winter storms may change land use and development protocols; more homes and community buildings may need to account for greater sheltering infrastructure to prepare for heavy snowfall. The Local Planning Team noted that extreme snowfall events were high on their list of concerns.

VULNERABILITY

Based on the above assessment, Northborough has a hazard index rating of “2 — high risk” from snowstorms and ice storms. Snowstorms, ice storms, Nor’Easters, and other forms of winter precipitation are a common occurrence in Massachusetts, and expected to only become more common over time. Additionally, the expected increase in “wintery-mix” precipitation may lead to increased roadway hazards as standing water may freeze in overnight temperatures creating hazardous road conditions for travelers and responders. The local team also notes that the Town Hall/Public Safety/Senior Center building has a flat roof and has needed shoveling off during snowy winters, to prevent collapse and protect pedestrians.

MITIGATION STRATEGIES

The Town of Northborough is currently able to effectively respond to severe snowstorms, ice storms, and Nor’easters through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. Being a town that experiences snowstorms frequently as do many Massachusetts towns, snow events are amply prepared for by local officials and emergency response personell. However, the Town’s existing

capabilities to mitigate and respond to severe snowstorms, ice storms, and Nor'easters could be expanded upon through numerous avenues. The local planning team identified the following strategies that could be used to reduce the threat of Snowstorms in Northborough:

1. Maintain and improve emergency services for vulnerable populations such as seniors, which could require increasing emergency transportation options (rideshare options), diversifying communications, expanding planning, and ensuring reliable power
2. Develop a back-up strategy for the town's DPW building, including the fuel island. Purchase a dedicated stationary generator for the DPW building, including the fuel island, to ensure that the town has access to fuel in the event of an emergency.

DRAFT

4.5 HURRICANES

Hurricanes begin as tropical storms that form over warm ocean waters in the Atlantic Ocean, Pacific Ocean, or off the west coast of Africa. The heated, moist air is drawn up into the atmosphere and begins circulating clockwise or counterclockwise depending on which hemisphere they are in. Tropical storms become hurricanes when their sustained winds exceed 74 miles per hour, or greater. The primary damaging forces associated with these storms are high-level sustained winds and heavy precipitation. Hurricanes winds can reach speeds of up to 200 miles per hour and can grow to 500 miles in diameter. In New England, hurricanes generally occur between August, September, and the first half of October, and can result in flooding and wind damage to structures and above-ground utilities.³⁹

LOCATION

Because of the hazard's regional nature, all of Northborough is at risk from hurricanes, meaning the location of occurrence is "large." Ridgetops are more susceptible to wind damage. Areas susceptible to flooding are also likely to be affected by heavy rainfall.

EXTENT

As an incipient hurricane develops, barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Hurricane Wind Scale, which rates hurricane wind intensity on a scale of 1 to 5, with 5 being the most intense.

Table 5: Saffir-Simpson Scale⁴⁰

Category	Maximum Sustained Wind Speed
1	74–95 mph; very dangerous winds will produce some damage
2	96–110 mph; extremely dangerous winds will cause extensive damage
3	111–129 mph; devastating damage will occur
4	130–156 mph; catastrophic damage will occur
5	157 + mph; catastrophic damage will occur

PREVIOUS OCCURRENCES

Hurricanes that have affected the region in which Northborough is located are shown in the following table:

Storm Name	Year	Saffir/Simpson Category (when reached MA)
Belle	1976	Tropical Storm
Gloria	1985	1

³⁹ 2023 ResilientMass Plan.

⁴⁰ National Hurricane Center and Central Pacific Hurricane Center. (n.d.). Saffir-Simpson Hurricane Wind Scale. National Oceanic and Atmospheric Association. Retrieved January 31, 2022, from <https://www.nhc.noaa.gov/aboutsshws.php>

Henri	1985	Tropical Storm
Chris	1988	Minor Storm
Bob	1991	2
Beryl	1994	Tropical Storm
Bertha	1996	Tropical Storm
Floyd	1999	Tropical Storm
Gordon	2000	Minor Storm
Hermine	2004	Tropical Storm
Barry	2007	Minor Storm
Hanna	2008	Minor Storm
Irene	2011	Tropical Storm
Sandy	2012	“Super Storm”
Andrea	2013	Minor Storm
Elsa	2021	Tropical Storm
Fred	2021	Extratropical Storm
Henri	2021	Tropical Storm/Depression

PROBABILITY OF FUTURE EVENTS

Northborough’s location in central Massachusetts approximately 45 miles inland reduces the risk of extremely high winds that are associated with hurricanes, although it can still experience some high wind events. Based upon past occurrences, it is reasonable to say that there is a “low” probability (1 percent to 10 percent in any given year) of hurricanes in Northborough. Climate change is projected to result in more severe weather, including increased occurrence of hurricanes and tropical storms. Because of this, the occurrence of hurricanes will increase in the future.

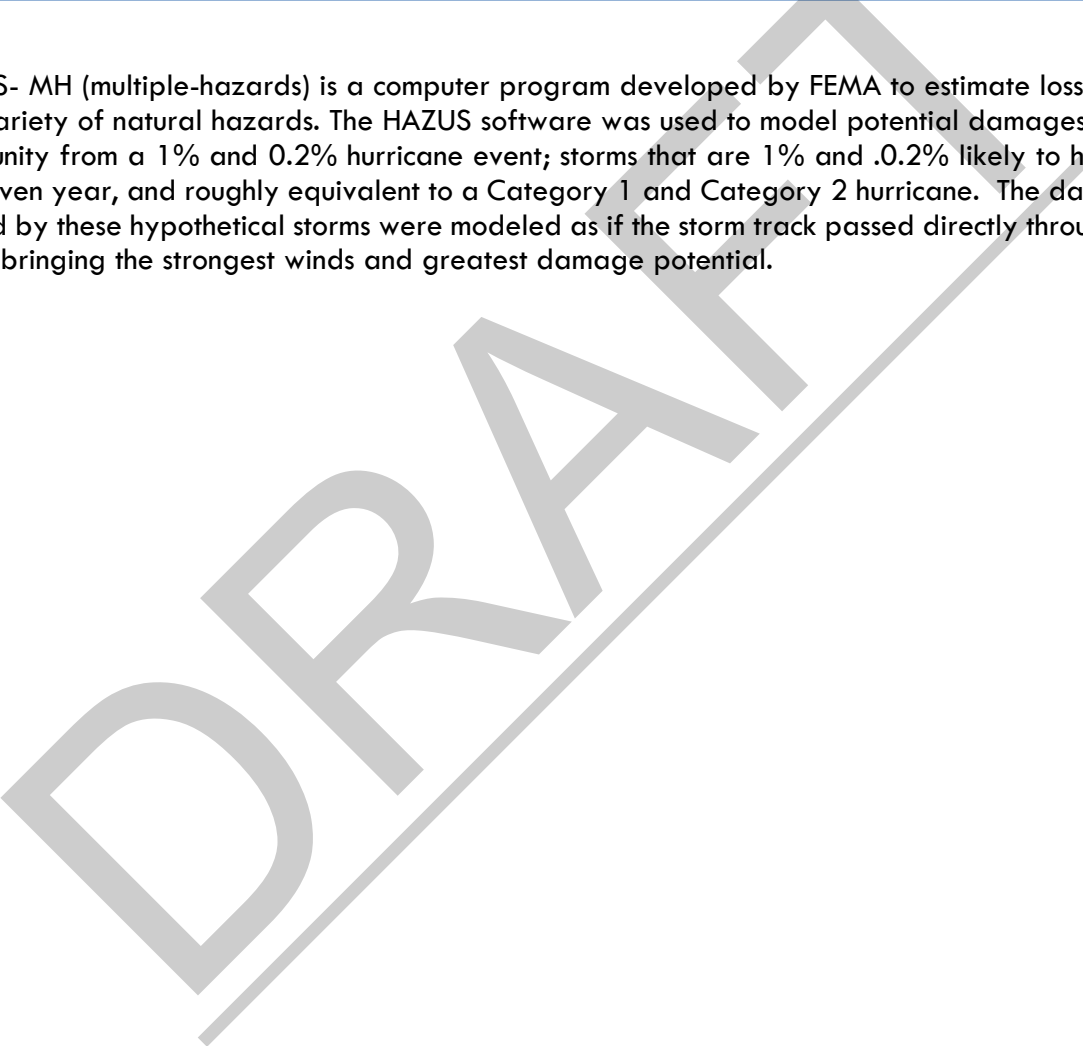
IMPACT

A description of the damages that could occur due to a hurricane is described by the Saffir-Simpson scale, as shown below:

Storm Category	Damage Level	Description of Damages	Wind Speed (MPH)
1	MINIMAL	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage. An example of a Category 1 hurricane is Hurricane Dolly (2008).	74-95
	Very dangerous winds will produce some damage		
2	MODERATE	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings. An example of a Category 2 hurricane is Hurricane Francis in 2004.	96-110
	Extremely dangerous winds will cause extensive damage		
3	EXTENSIVE	Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures, with larger structures damaged by floating debris.	111-129
	Devastating damage will occur		

		Terrain may be flooded well inland. An example of a Category 3 hurricane is Hurricane Ivan (2004).	
4	EXTREME	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland. An example of a Category 4 hurricane is Hurricane Charley (2004).	130-156
	Catastrophic damage will occur		
5	CATASTROPHIC	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required. An example of a Category 5 hurricane is Hurricane Andrew (1992).	157+
	Catastrophic damage will occur		

HAZUS- MH (multiple-hazards) is a computer program developed by FEMA to estimate losses due to a variety of natural hazards. The HAZUS software was used to model potential damages to the community from a 1% and 0.2% hurricane event; storms that are 1% and .0.2% likely to happen in a given year, and roughly equivalent to a Category 1 and Category 2 hurricane. The damages caused by these hypothetical storms were modeled as if the storm track passed directly through the Town, bringing the strongest winds and greatest damage potential.



	1% storm (89 mph winds)	0.2% storm (102-105 mph winds)
Building Characteristics		
Estimated total number of buildings	5155	
Estimated total building replacement value (2014 \$)	\$ 3,604,141,000.00	
Building Damages		
# of buildings sustaining minor damage	260	1197
# of buildings sustaining moderate damage	21	257
# of buildings sustaining severe damage	1	24
# of buildings destroyed	0	28
Population Needs		
# of households displaced	3	50
# of people seeking public shelter	3	26
Debris		
Building debris generated (tons)	5,031	17,465
Tree debris generated (tons)	5,091	13,135
# of truckloads to clear building debris	47	290
Value of Damages		
Total property damage (buildings and content)	\$ 25,600,980.00	\$128,661,980.00
Total losses due to business interruption	\$ 901,710.00	\$11,206,560.00

Though there are no recorded instances of a hurricane equivalent to a 0.2% storm passing through Massachusetts, this model was included in order to present a reasonable “worst case scenario” that would help planners and emergency personnel evaluate the impacts of storms that might be more likely in the future, as we enter into a period of more intense and frequent storms. For more information on the HAZUS-MH software, go to <http://www.fema.gov/hazus-software>.

The Town faces a “limited” impact from hurricanes, with 10 percent or less of Northborough affected.

EXPOSURE

Certain features within Northborough’s community infrastructure, society, and environment may face more exposure to hurricanes, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable

populations in Section 3. Vulnerable community features include:

- The electrical grid is vulnerable to outages from trees falling across power lines. National Grid proactively trims trees in their right of way, but outages are still common. Though concerns regarding street trees are a Town-wide issue, the local planning team identified Adin Street, Dutcher Street, Mill Street, and Freedom Street as particularly vulnerable. During Hurricane Irene in 2011, some neighborhoods in Northborough were without power for 3 to 4 days.
- Municipal buildings have been impacted by high winds in the past. Damage to these buildings could impact critical town functions and be a distraction from other essential emergency response and recovery activities.
- Public safety, utility, and highway department workers, who are tasked with responding to emergency calls and keeping the streets clear during hurricanes.

In addition to high winds, hurricanes can also bring heavy precipitation and cause flooding. The vulnerable features identified in the Flooding section above also apply to hurricanes.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2023 ResilientMass Plan, there are two major ways that hurricanes and tropical storms can be influenced by climate change:

- Warming oceans will provide more energy for hurricanes and tropical storms, which could lead to more intense or potentially damaging storms in the future, and larger storms could result in more storms that are likely to impact Massachusetts.
- Warmer air can hold more water vapor and will enable greater precipitation rates during future storms.

In summary, climate change is likely to increase the frequency and extent of hurricanes in Northborough.

VULNERABILITY

Based on the above analysis, Northborough has a hazard index rating of “4 – limited risk” from hurricanes. Its location and elevation decrease the risk of hurricane force winds and rains, though does not remove them entirely. Historically, by the time a hurricane has arrived in Northborough it is typically been downgraded to a tropical storm or tropical depression, though climate change may increase the severity of storms in the future.

MITIGATION STRATEGIES

The Town of Northborough is currently able to effectively respond to hurricanes through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, the Town’s existing capabilities to mitigate and respond to hurricanes could be expanded upon through numerous avenues. The local planning team identified the following strategies that could be used to reduce the threat of hurricanes in Northborough:

1. Maintain high degree of participation with National Grid through their First Responder App.
2. Continue to properly clean, at least annually, or more often as required, all stormwater structures and basins (currently budgeted).

3. Continue to develop and distribute educational materials for residents about protecting wetlands, preventing flooding, and stormwater mitigation.

DRAFT

4.6 SEVERE THUNDERSTORMS / WIND / TORNADO

A thunderstorm is a storm with lightning and thunder produced by a cumulonimbus cloud, usually producing gusty winds, heavy rain, and sometimes generating hail. Effective January 5, 2010, the NWS modified the hail size criterion to classify a thunderstorm as ‘severe’ when it produces damaging wind gusts in excess of 58 mph (50 knots), hail that is 1 inch in diameter or larger (quarter size), or a tornado.

Every thunderstorm has an updraft (rising air) and a downdraft (sinking air). Sometimes strong downdrafts known as downbursts can cause tremendous wind damage that is similar to that of a tornado. A small (less than 2.5 mile path) downburst is known as a “microburst” and a larger downburst is called a “macro-burst.” An organized, fast-moving line of microbursts traveling across large areas is known as a “derecho.” These occasionally occur in Massachusetts. The strongest downburst recorded was a downburst in North Carolina of 175 mph. Winds exceeding 100 mph have been measured from downbursts in Massachusetts.⁴¹

Wind is air in motion relative to surface of the earth. For non-tropical events over land, the NWS issues a Wind Advisory (sustained winds of 31 to 39 mph for at least 1 hour or any gusts 46 to 57 mph) or a High Wind Warning (sustained winds 40+ mph or any gusts 58+ mph). For non-tropical events over water, the NWS issues a small craft advisory (sustained winds 25-33 knots), a gale warning (sustained winds 34-47 knots), a storm warning (sustained winds 48 to 63 knots), or a hurricane force wind warning (sustained winds 64+ knots). For tropical systems, the NWS issues a tropical storm warning for any areas (inland or coastal) that are expecting sustained winds from 39 to 73 mph. A hurricane warning is issued for any areas (inland or coastal) that are expecting sustained winds of 74 mph. Effects from high winds can include downed trees and/or power lines and damage to roofs, windows, etc. High winds can cause scattered power outages. High winds are also a hazard for the boating, shipping, and aviation industry sectors.

Tornadoes are swirling columns of air that typically form in the spring and summer during severe thunderstorm events. In a relatively short period of time and with little or no advance warning, a tornado can attain rotational wind speeds in excess of 250 miles per hour and can cause severe devastation along a path that ranges from a few dozen yards to over a mile in width. The path of a tornado may be hard to predict because they can stall or change direction abruptly. Within Massachusetts, tornadoes have occurred most frequently in the Connecticut River Valley and in western Worcester County, with Northborough some 40 miles east of the zone of most frequent past occurrence. High wind speeds, hail, and debris generated by tornadoes can result in loss of life, downed trees and power lines, and damage to structures and other personal property.

LOCATION

As per the Massachusetts Hazard Mitigation Plan, the entire Town is at risk of high winds, severe thunderstorms, and tornadoes. The plan identifies Northborough and its surrounding communities as having a moderate frequency of tornado occurrence within the Massachusetts context. However, the actual area affected by thunderstorms, wind, or tornadoes is “small,” with less than 10 percent of the Town generally affected.

EXTENT

An average thunderstorm is 1.5 miles across and lasts 30 minutes; severe thunderstorms can be much larger and longer. Southern New England typically experiences 10 to 15 days per year with severe

⁴¹ 2023 Resilient Mass Plan.

thunderstorms. Thunderstorms can cause hail, wind, lightning damage, and flooding.

High wind can be linked to a number of different hazards, including hurricanes and winter storms, in addition to thunderstorms and tornadoes. High winds can cause damage to structures, trees, as well as increase the risk of wildfire.

Tornadoes are measured using the enhanced F-Scale, shown with the following categories and corresponding descriptions of damage:

Table 6: Enhanced Fujita Scale Levels and Descriptions of Damage⁴²

EF-Scale Number	Intensity Phrase	3-Second Gust (MPH)	Type of Damage Done
EF0	Gale	65–85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
EF1	Moderate	86–110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
EF2	Significant	111–135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	Severe	136–165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	Devastating	166–200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.

⁴² National Oceanic and Atmospheric Administration. (n.d.). The Enhanced Fujita Scale (EF Scale). National Weather Service; NOAA's National Weather Service. Retrieved January 31, 2022, from <https://www.weather.gov/oun/efscale>

Table 7: Extent Scale for Hail⁴³

HAIL SIZE (in.)	OBJECT ANALOG REPORTED
.50	Marble, moth ball
.75	Penny
.88	Nickel
1.00	Quarter
1.25	Half Dollar
1.50	Walnut, ping pong
1.75	Golf ball
2.0	Hen egg
2.5	Tennis ball
2.75	Baseball
3.00	Tea cup
4.00	Grapefruit
4.50	Softball

PREVIOUS OCCURRENCES

Because thunderstorms and wind affect the town regularly on an annual basis, there are not significant records available for these events. As per the Massachusetts Hazard Mitigation Plan, there are approximately 10 to 30 days of thunderstorm activity in the state each year.

In Worcester County, there have been several F1 tornadoes over the years. However, a data search for tornadoes rating 3 or above, or resulting in death/injury, or significant property damage, identifies the following events:

- In 1953, an F4 tornado struck Worcester. The event resulted in at least 90 fatalities, and more than 1,200 injured. There was extensive property damage. On the same date, an F3 tornado began in the Town of Sutton.
- In 1981 an F3 tornado struck Westminster, resulting in just 3 injuries and very little reported property damage.
- In June 2011, an F3 tornado struck Massachusetts. Few deaths were reported, all in Hampden County. No deaths were reported in Worcester County.

Within the last 5 years, there has only been one small tornado that has affected communities near Northborough:

- 2018 Tornado (East Douglas, Uxbridge, Upton)

⁴³ National Oceanic and Atmospheric Administration. (n.d.). Hail Size as Related to Objects. Storm Prediction Center. Retrieved January 31, 2022, from <https://www.spc.noaa.gov/misc/tables/hailsizes.htm>

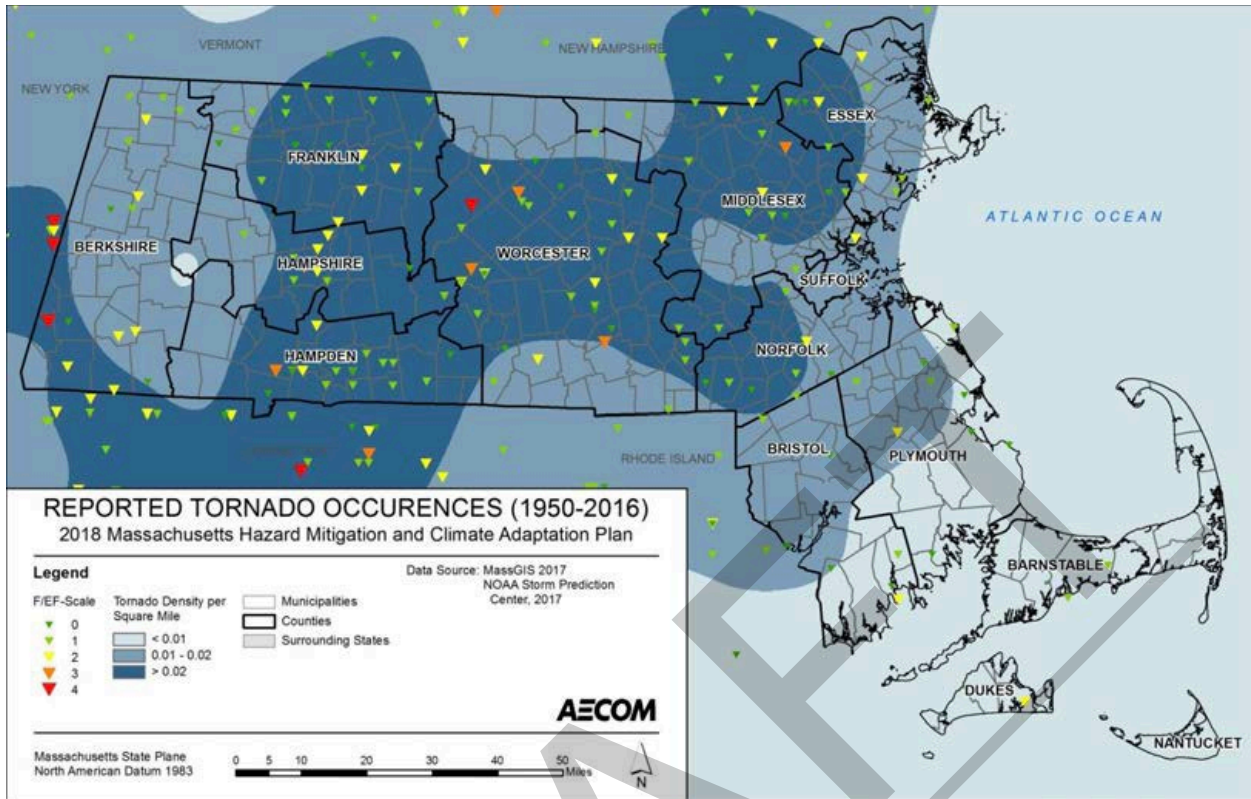


Image 1: Density of Reported Tornadoes per Square Mile (1950-2016). Source: Massachusetts State Hazard Mitigation and Climate Adaptation Plan, 2018.

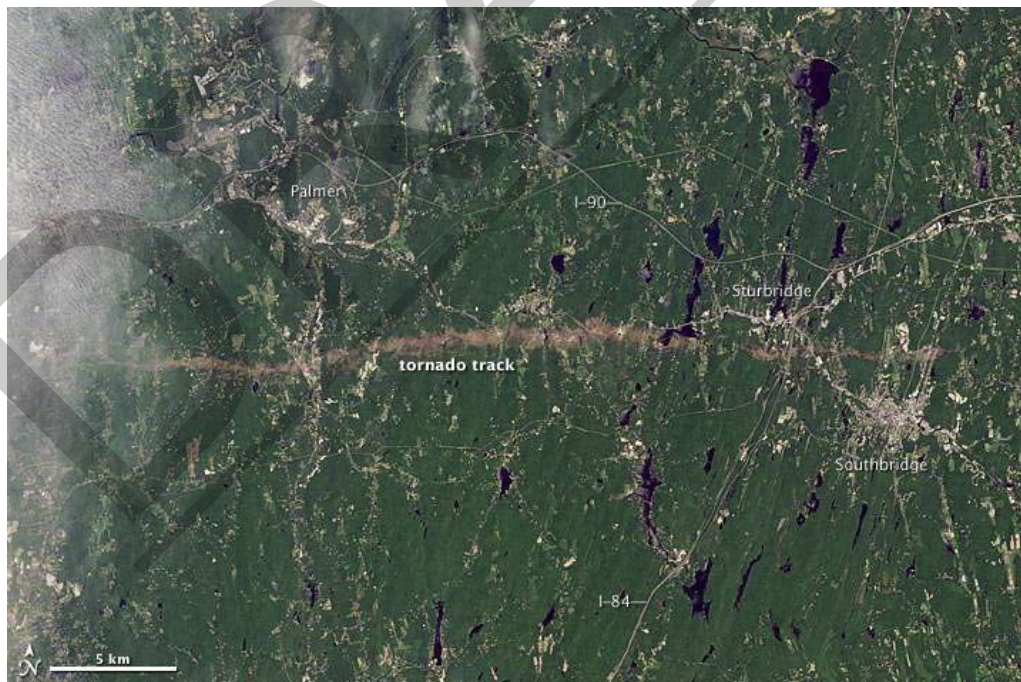


Image 2: Above: NASA released this image of part of the 39-mile-long tornado track through south-central Mass. The image was captured on June 5, 2011 by Landsat 5 satellite.

PROBABILITY OF FUTURE EVENTS

Thunderstorm occurrences are more frequent in Massachusetts than tornados, as Thunderstorms have the potential to produce tornadoes. However, the type of storm that most commonly produces tornadoes is supercells: severe, long-lived thunderstorms. Approximately 20 percent of supercells produce tornadoes. In Northborough there have been several severe thunderstorm/wind occurrences:

- 01/31/2013 – High Wind: A warm front moved northward across southern New England. This brought a period of mainly rain and warm temperatures. In addition, a strong low level jet (up to 80 kts) resulted in high winds across much of southern New England. There was some tree damage and downed power lines with winds gusting to 60 to 70 mph. An amateur radio operator in Milford recorded a wind gust to 64 mph on their home weather station. The Automated Surface Observation System at Worcester Regional Airport (KORH) recorded a wind gust to 55 mph.
- 02/25/2015 – High Wind: A storm moving north through the Great Lakes redeveloped along the Mid Atlantic coast on the 24th, then moved up the coast past Southern New England. This coastal storm brought damaging west-northwest winds to Massachusetts as it moved off through the Maritimes on the 25th.
- 07/17/2019 – Thunderstorm Wind: An approaching cold front, coupled with moisture associated with the remnants of Barry brought showers and thunderstorms to the region. A few of these storms were severe, with damaging wind gusts. There was also isolated flooding from heavy rainfall. In Northborough, trees were downed on School Street.
- 12/25/2020 – Thunderstorm Wind: An anomalously deep, full-latitude mid-level trough over the Mississippi Valley caused a strong frontal system to move up the Appalachians. It brought strong to damaging winds, heavy rain with minor flooding, and well above normal temperatures to southern New England early on Christmas Day. Winds generally gusted to 40 to 60 mph, except 65 to 70 mph along the southeast Massachusetts coast. South winds were blowing more than 100 mph only 2000 feet above the ground in eastern Massachusetts and Rhode Island, but despite temperatures in the lower 60s there, a surface inversion was strong enough to prevent these very damaging winds from reaching the surface. Two to four inches of rain fell across the region, with the highest totals from central Rhode Island northwestward across northern Connecticut and portions of western and central Massachusetts. Winds generally were gusting to around 50 mph. In Dudley at 333 AM EST, a large tree branch was down on Dresser Hill Road. In Upton at 530 AM EST, a tree was down on Glenview Street. In Southbridge at 604 AM EST, a tree was down on Main Street. In Northborough at 737 AM EST, a tree was down on Franklin Circle. In Webster at 940 AM EST, a tree was down on South Shore Road. In Milford at 10 AM EST, a large tree was down on Dogwood Lane by Wildwood Drive.
- 07/27/2021 – Thunderstorm Wind: A cold front entered a marginally unstable, but highly sheared environment during the late afternoon and evening hours. A broken line of severe thunderstorms moved across most of Massachusetts and a portion of northern Connecticut and northern Rhode Island. In Northborough, siding was blown off the side of a house at the intersection of Brigham Street and South Street.
- 02/28/2024 – High Wind: A strong cold front crossed southern New England on Wednesday night the 28th bringing soaking rains and strong wind gusts to southern New England followed by sharply falling temperatures. This cold frontal passage included a fine line stronger storms. Winds generally gusted 45 to 55 mph. The strongest gusts were

59 mph at the Worcester Airport ASOS (KORH) at 2:18 AM EST on the 29th and a gust to 55 mph at the Fitchburg Airport ASOS (KFIT) at 1:57 AM EST on the 29th.

PROBABILITY OF FUTURE EVENTS

According to the 2023 ResilientMass Plan, Massachusetts averages two to five tornadoes per year. Only two tornadoes (1953 and 2011) received disaster declarations. Massachusetts has experienced 12 tornadoes since 2018 (EF0 to EF1). Massachusetts experienced six tornadoes in 2021 (EF0), causing under \$50,000 in property damage. Because tornadoes are relatively rare in the Commonwealth, residents are less likely to be prepared. Populations in manufactured housing such as mobile homes are more at risk. Tornadoes can affect all sectors and populations, and their primary effect is damage from high winds to structures and the environment. Any structure located in a tornado zone or path is at risk. Tornado activity may become more variable due to climate change, so it is difficult to predict the likelihood of future events in Northborough.

Based upon the available historical record, as well as Northborough's location in a moderate-density cluster of tornado activity for Massachusetts, there is a "very low" probability (less than 1 percent chance in any given year) of a tornado affecting the town, and a moderate (10 percent to 40 percent chance in any given year) probability of a severe thunderstorm and/or high winds.

IMPACT

Overall, Northborough faces a "minor" impact from severe thunderstorms, and a "limited" impact from severe winds, or tornados, with 10 percent or less of the Town likely to be affected.

The Enhanced Fujita Scale Levels for tornados describes the likely impacts of tornados on the physical environment:

As indicated as part of the Enhanced Fujita Scale Levels for tornados, the following impacts can result from a tornado:

- EF0 - Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
- EF1 - The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
- EF2 - Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
- EF3 - Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
- EF4 - Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.

The potential for locally catastrophic damage is a factor in any tornado, severe thunderstorm, or wind event. In Northborough, a tornado that hit residential areas would leave much more damage than a tornado with a travel path that ran along the town's uplands, where less settlement has occurred. Most buildings in the town have not been built to Zone 1, Design Wind Speed Codes. The first edition of the Massachusetts State Building Code went into effect on January 1, 1975, and 63.0% percent of the town's 2,582 occupied housing units was constructed in 1979 or earlier

(American Communities Survey, 2020 5-year estimate).

Utilizing the Town's median home value of \$497,300.00 (American Communities Survey, 2020 5-year estimate), combined with the total value of all property, \$4,255,632,328 (Massachusetts Dept. of Revenue, 2024), and an estimated 10 percent of damage to 5 percent of all structures, the estimated amount of damage from a tornado is \$21,278,161.64. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

EXPOSURE

Certain features within Northborough's community infrastructure, society, and environment may face more exposure to severe thunderstorms/wind/tornadoes, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in Section 3. Vulnerable features to severe thunderstorms/wind/tornadoes overlap with features vulnerable to hurricanes and flooding.

POTENTIAL CLIMATE CHANGE EFFECTS

The 2023 ResilientMass Plan identifies that current climate models predict an increase in severe thunderstorms, which have the potential to produce tornadoes. However, it is unclear if tornado frequency will increase with climate change. Some studies suggest there will be a decrease in the number of tornado days, but an increase in the number of tornadoes per day. (pg. 5.1-56).

Without a clear understanding of how climate change will impact tornados, the town is not able to determine exactly how this hazard will impact population patterns and land use needs for the Town of Northborough. However, if climate change does increase the likelihood of tornado occurrence, the town may have to incorporate additional emergency shelters into development and land use.

VULNERABILITY

Based on the above assessment, Northborough has a hazard index rating of "2- high risk" from severe thunderstorms and winds, and a "3 – Medum risk" from tornadoes. This is due to the relative age of the housing stock in Northborough making it particularly vulnerable to Tornadoes, despite their relative infrequency.

MITIGATION STRATEGIES

The Town of Northborough is currently able to effectively respond to severe thunderstorms, wind, and tornadoes through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, the Town's existing capabilities to mitigate and respond to severe thunderstorms, wind, and tornadoes could be expanded upon through numerous avenues. The local planning team identified the following strategies that could be used to reduce the threat of severe thunderstorms and tornados in Northborough:

- Maintain and expand on vegetative debris program (e.g. by acquiring additional equipment), and thereby mitigate risks of stormwater flooding, riverine flooding, winter storm damage, etc., such as through the Central Massachusetts Mosquito Control Project. Possible funding through Capital Improvement Plan. Create a town debris management plan as an appendix to the Comprehensive Emergency Management Plan and have it approved by FEMA.

- Continue to utilize hazard warning systems and notifications: social media, town webpages, Code Red, and other communication methods. Interns are currently taking senior citizen information to sign them up for CodeRed. Post generator safety and use info on social media. Health Dept. to put out a brochure on 72-hr kits through Town-wide mailing, school children take-home, etc. Maintain internal instant messaging system, allowing for rapid response of emergency personnel.

DRAFT

4.7 WILDFIRES / BRUSH FIRES

Wildfires are typically larger fires, involving full-sized trees as well as meadows and scrublands. Brushfires are uncontrolled fires that occur in meadows and scrublands, but do not involve full-sized trees. Typical causes of brushfires and wildfires are lightning strikes, human carelessness, and arson. Relative humidity and wind are two weather-related factors that influence fire danger. Relative humidity refers to “the ratio of the amount of moisture in the air to the amount of moisture necessary to saturate the air at the same temperature and pressure.”⁴⁴ When relative moisture drops, light fuels like grasses become drier and burn more easily.⁴⁵

FEMA has classifications for 3 different classes of wildfires:

- Surface fires are the most common type of wildfire, with the surface burning slowly along the floor of a forest, killing or damaging trees.
- Ground fires burn on or below the forest floor and are usually started by lightning
- Crown fires move quickly by jumping along the tops of trees. A crown fire may spread rapidly, especially under windy conditions.

Potential vulnerabilities to wildfires include damage to structures and other improvements and impacts on natural resources. Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations including children, the elderly, and those with respiratory and cardiovascular diseases.

LOCATION

Approximately 64% of total land area in Northern Worcester County is forested land.⁴⁶ Much of this region of Massachusetts, including the Northborough area, have a high risk of wildfire. In Northborough, an estimated 46.5 % of the land is forested.⁴⁷ Northborough is developed in a mostly moderate suburban pattern, with few uninterrupted tracts of forest present. Although the substantial tree cover does present some risk for wildfires and brushfires, the total amount of town that could be affected by a wildfire is categorized as “small,” or less than 10 percent of the total area.

Northborough is vulnerable to interface problems (fires spreading from unoccupied land to human development) because of Mount Pisgah and its hiking trails. Human activity, which may involve cooking and camping fires as well as carelessly tossed cigarettes and other fire sources, in the Mount Pisgah area can potentially lead to problems for those living on Lyman Road, Howard Street, Howard Lane, Green Street, and other nearby areas. Additionally, lightning strikes and faulty power infrastructure can lead to wildfire development.

⁴⁴ “Understanding Fire Danger,” Nps.gov, United States National Park Service, August 17, 2023, <https://www.nps.gov/articles/understanding-fire-danger.htm>.

⁴⁵ Ibid.

⁴⁶ Massachusetts Bureau of Geographic Information, “MassGIS Data: 2016 Land Cover/Land Use,” Mass.gov, Massachusetts Executive Office of Technology Services and Security, May 2019, <https://www.mass.gov/info-details/massgis-data-2016-land-coverland-use>.

⁴⁷ Ibid.

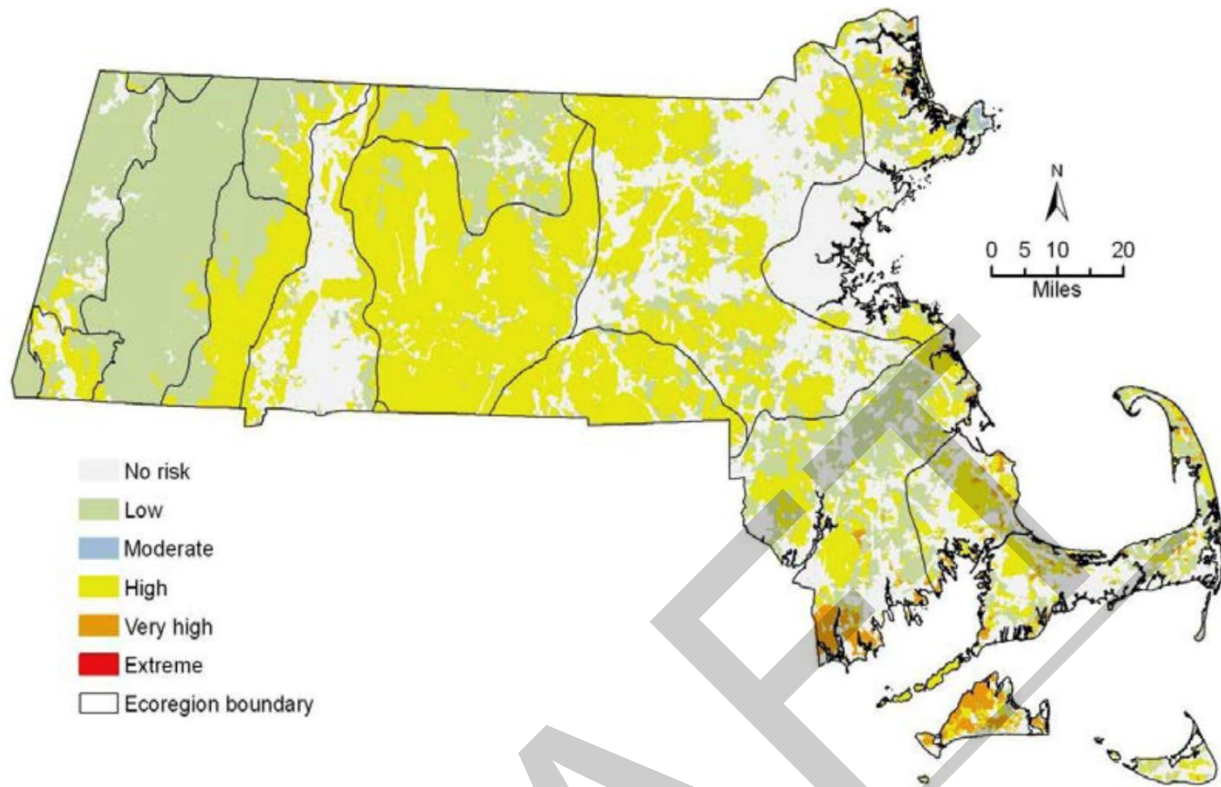


Figure 1: Wildfire Risk Areas for the Commonwealth of Massachusetts. Source: 2018 SHMCAP.

EXTENT

Wildfires can cause widespread damage. They can spread very rapidly, depending on local wind speeds and can be very difficult to get under control. Fires can last for several hours up to several days.

In Northborough, approximately 46.5 percent of the town's total land area is deciduous forest, evergreen forest, or forested wetland. These areas are at risk of fire and are spread evenly throughout the community, with developed areas, rivers, and major transportation corridors (Interstate 290) breaking up the forest. In drought conditions, a brushfire or wildfire would be a matter of concern.

The National Fire Danger Rating system illustrates the potential extent of wildfires should they occur under the described fire danger conditions:

Rating	Basic Description	Detailed Description
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CLASS 1: Low Danger (L) Color Code: Green	Fires not easily started	Fire starts are unlikely. Weather and fuel conditions will lead to slow fire spread, low intensity, and relatively easy control with light mop up. Controlled burns can usually be executed with reasonable safety.
CLASS 2: Moderate Danger (M) Color Code: Blue	Fires start easily and spread at a moderate rate	Some wildfires may be expected. Expect moderate flame length and rate of spread. Control is usually not difficult and light to moderate mop up can be expected. Although controlled burning can be done without creating a hazard, routine caution should be taken.
CLASS 3: High Danger (H) Color Code: Yellow	Fires start easily and spread at a rapid rate	Wildfires are likely. Fires in heavy, continuous fuel, such as mature grassland, weed fields, and forest litter, will be difficult to control under windy conditions. Control through direct attack may be difficult but possible, and mop up will be required. Outdoor burning should be restricted to early morning and late evening hours.
CLASS 4: Very High Danger (VH) Color Code: Orange	Fires start very easily and spread at a very fast rate	Fires start easily from all causes and may spread faster than suppression resources can travel. Flame lengths will be long with high intensity, making control very difficult. Both suppression and mop up will require an extended and very thorough effort. Outdoor burning is not recommended.
CLASS 5: Extreme (E) Color Code: Red	Fire situation is explosive and can result in extensive property damage	Fires will start and spread rapidly. Every fire start has the potential to become large. Expect extreme, erratic fire behavior. NO OUTDOOR BURNING SHOULD TAKE PLACE IN AREAS WITH EXTREME FIRE DANGER.

Beyond the direct hazards that wildfires pose, wildfires pose an additional indirect hazard of reducing air quality through smoke particulates. This is measured, along with other particulates that effect air quality, by the EPA’s Air Quality Index⁴⁸. For each pollutant an AQI value of 100 generally corresponds to an ambient air concentration that equals the level of the short-term national ambient air quality standard for protection of public health. AQI values at or below 100 are generally thought of as satisfactory. When AQI values are above 100, air quality is unhealthy: at first for certain sensitive groups of people, then for everyone as AQI values get higher. The EPA establishes an AQI for five major air pollutants regulated by the Clean Air Act. Each of these pollutants has a national air quality standard set by EPA to protect public health: ground-level ozone; particle pollution (also known as particulate matter, including PM2.5 and PM10); carbon monoxide; sulfur dioxide; and nitrogen dioxide.

The AQI is divided into six categories. Each category corresponds to a different level of health concern. Each category also has a specific color. The color makes it easy for people to quickly determine whether air quality is reaching unhealthy levels in their communities.

⁴⁸ "Air Quality Index (AQI) Basics," Airnow.gov, United States Environmental Protection Agency, accessed June 10, 2024, <https://www.airnow.gov/aqi/aqi-basics/>.

AQI Basics for Ozone and Particle Pollution

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

PREVIOUS OCCURRENCES

Northborough has an on-call paid professional fire department providing 24/7 coverage. In addition, Northborough is part of the South Middlesex County Fire Department (Mutual Aid District 14), with 23 other Towns. Northborough has experienced four brushfires between 2001-2020, however, each of these fires were quite small; the largest was only two acres in size, and altogether they consumed only three acres of brush/wildland (Massachusetts Fire Incident Reporting System). In 1995, one brushfire off of Greene Street consumed 50 acres of brush/wildland. This fire was of particular significance not only because of its size, but also because of the residential development contained in that area. Thankfully, no residential property was affected by this fire. The local planning team identified concerns regarding brush fires that are caused by sparking of the Grafton-Upton Railway, however, this railway was not the cause of the sizable fire in 1995, a permit fire was. In addition, the local planning team identified the Parklands as vulnerable to wildfires because of its large tracts of uninterrupted forested land. The local planning team noted that on April 14-15, 2023 a wildfire at Mount Pisgah Conservation Area in Northborough, MA, burned approximately 115 acres. The cause could not be determined. The emergency response involved nearly 150 people, using more than 45 pieces of apparatus and equipment. A Department of

Fisheries and Wildlife restoration ecologist from the suggested that impacts to the forest from the fire will likely be some short-term benefit to the integrity of this fire-influenced natural community, but over the long-term, a single fire in isolation won't have much of an impact. Regular prescribed fires will encourage growth of native pitch pine, oak, hickory, chestnut, blueberry, etc. In the absence of regular fires white pine and black birch, as well as many invasives, dominate these communities⁴⁹.

PROBABILITY OF FUTURE EVENTS

The 2023 ResilientMass Plan notes that changes in precipitation, prolonged drought conditions, rising temperatures, and increased frequency of thunderstorms are expected to increase the frequency and severity of wildfires. Particularly in drought conditions, forest types that are not typically prone to fire hazard will become more likely to burn. Globally, wildfires are projected to increase worldwide by 14% by 2030, 30% by 2050, and 50% by 2100.

Climate scenarios project that by mid-century, the mean summer temperatures in the Concord River basin will increase by 3.6° F to 8.1° F.⁵⁰ Combined with increasingly variable precipitation, rising temperatures could exacerbate summer drought and further promote high-elevation wildfires, releasing stores of carbon and further contributing to the buildup of greenhouse gases.

Climate change is also predicted to bring increased wind damage from major storms, as well as new types of pests to the region. Both increased wind and the introduction of new pests could potentially create more debris in wooded areas and result in a larger risk of fires.

IMPACT

While a large wildfire could in theory damage much of the landmass of Northborough, most forested areas are sparsely developed, meaning that wildfire affected areas are not likely to cause damage to property. For this reason, the town faces a “minor” impact from wildfires, with little damage likely to occur.

Both wildfires and brush fires can consume homes, other buildings and/or agricultural resources. The impact of wildfires and brush fires are as follows:

- Impact to benefits that people receive from the environment, such as food/water and the regulation of floods and drought
- Impact on local heritage, through the destruction of natural features
- Impact to the economy, due to damage to property and income from land following a wildfire
- Impact through the destruction of people and property

Utilizing the total value of all property, \$4,255,632,328 and an estimated 5 percent of damage to 1 percent of all structures, the estimated amount of damage from a wildfire is \$2,127,816.16.

⁴⁹ Northborough Trails Committee Notice on the Mount Pisgah Fire, [Microsoft Word - Mount Pisgah Fire 041523 Notice.docx \(northborough.ma.us\)](#)

⁵⁰ ResilientMass Maps and Data Center, “Climate Change Projections Dashboard,” Resilientma-mapcenter-mass-eoea.hub.arcgis.com, ResilientMass, accessed July 1, 2024, <https://resilientma-mapcenter-mass-eoea.hub.arcgis.com/#ClimateDashboard>.

The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

EXPOSURE

Certain features within Northborough's community infrastructure, society, and environment may face more exposure to wildfires/brushfires, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in Section 3. Vulnerable community features include:

- People who are sensitive to smoke, including children, the elderly, and individuals with other health conditions. Wildfires outside of Northborough may also impact the town residents. Air pollution from wildfires can be a severe public health concern. Smoke can exacerbate respiratory conditions like asthma and carry toxic chemicals and particulate matter. In 2021, wildfire smoke from western states and Canada extended across the continental US forced the Massachusetts Department of Environmental Protection to issue an air quality alert.⁵¹
- First responders, especially the town's firefighters.

Additionally, Wildfires do not have to take place within town to affect the town: in March through July of 2023, historic wildfires in Canada sent smoke across a broad swath of New England, peaking in June of that year. In Worcester County, Air quality was reduced throughout the months of May and June, with the AQI for Worcester County peaking at 148: Unhealthy for Sensitive Groups for fine particulate matter (PM2.5) on June 6th 2023⁵².

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2023 ResilientMass Plan, Precipitation changes, prolonged drought, rising temperatures, and increased frequency of lightning are expected to contribute to increased frequency and severity of wildfire. As droughts become more frequent and severe, forest types that do not usually burn and are not fire adapted will be more likely to burn. Wildfires are projected to increase worldwide by 14% by 2030, 30% by 2050, and 50% 2100.

Seasonal drought may also make it more difficult to ensure a reliable water source for firefighting.

In summary, climate change is likely to increase the frequency and extent of wildfires in Northborough. The increase in wildfires may result in changes in land use, such as the Town no longer being able to develop nearby dense forest. Additionally, if brush fires worsen significantly, residents may desire to move away from dense forest, shifting populations from more rural areas to cities or downtown communities. The future air quality risks to Northborough from wildfires are hard to predict with any certainty, and represent a threat to the broader region more than a single town, but air purifying equipment may need to be included within shelter planning within the foreseeable future.

VULNERABILITY

Based on the above assessment, Northborough has a hazard risk index of "4 – low risk" from

⁵¹ McAlpine, K. J. (2021, July 27). Wildfire Smoke in New England Is "Pretty Severe from Public Health Perspective." The Brink. <https://www.bu.edu/articles/2021/wildfire-smoke-in-new-england/>

⁵² "Pre-Generated Data Files," Aqs.epa.gov, United States Environmental Protection Agency, October 26, 2023, https://aqs.epa.gov/aqsweb/airdata/download_files.html.

wildfires. However, this risk assessment is highly dependent on short term weather patterns like wind, lightning, and rainfall, which are impossible for the town to predict with certainty.

MITIGATION STRATEGIES

The Town of Northborough is currently able to effectively respond to wildfires and brushfires through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, the Town's existing capabilities to mitigate and respond to wildfires and brushfires could be expanded upon through numerous avenues. The local planning team identified the following strategies that could be used to reduce the threat of wildfires / brush fires in Northborough:

- Dredge fire ponds which are too shallow and dry out during the summer months. This would also help with stormwater collection and help prevent flooding in the area of the ponds.
- Expand the capacity of the DPW; maintain the number of cisterns and fire ponds; continue to clear poison ivy from draft sites and dry hydrants, and to constantly clear the drain at Rte. 9 & Rte. 20 which causes flooding.

DRAFT

4.8 EARTHQUAKES

An earthquake is a sudden, rapid shaking of the ground that is caused by the breaking and shifting of rock beneath the Earth's surface. Earthquakes can occur suddenly, without warning, at any time of the year. Ground shaking from earthquakes can rupture gas mains and disrupt other utility service, damage buildings, bridges and roads, and trigger other hazardous events such as avalanches, flash floods (dam failure) and fires. Un-reinforced masonry buildings, buildings with foundations that rest on filled land or unconsolidated, unstable soil, and mobile homes not tied to their foundations are at risk during an earthquake.

LOCATION

Because of the regional nature of the hazard, the entire Town of Northborough is susceptible to earthquakes. This makes the location of occurrence "large," or over 50 percent of the total area.

EXTENT

The magnitude of an earthquake is sometimes measured using the Richter Scale, which measures the energy of an earthquake by determining the size of the greatest vibrations recorded on the seismogram. On this scale, one step up in magnitude (from 5.0 to 6.0, for example) increases the energy more than 30 times. Earthquakes are also commonly measured using the moment magnitude scale, which provides similar measurements to the Richter scale but more accurately measures earthquakes with magnitudes greater than 8.⁵³

Table 8: Richter Scale Magnitudes and Effects

Magnitude	Effects
< 3.5	Generally not felt, but recorded.
3.5 - 5.4	Often felt, but rarely causes damage.
5.4 - 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 - 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

⁵³ Michigan Tech. (n.d.). How Do We Measure Earthquake Magnitude? Michigan Technological University. Retrieved February 3, 2022, from <https://www.mtu.edu/geo/community/seismology/learn/earthquake-measure/>

The intensity of an earthquake is measured using the Modified Mercalli Scale. This scale quantifies the effects of an earthquake on the Earth’s surface, humans, objects of nature, and man-made structures on a scale of I through XII, with I denoting a weak earthquake and XII denoting an earthquake that causes almost complete destruction.

Table 9: Modified Mercalli Intensity Scale for and Effects⁵⁴

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs.	
II	Feeble	Some people feel it.	< 4.2
III	Slight	Felt by people resting; like a truck rumbling by.	
IV	Moderate	Felt by people walking.	
V	Slightly Strong	Sleepers awake; church bells ring.	< 4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves.	< 5.4
VII	Very Strong	Mild alarm; walls crack; plaster falls.	< 6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged.	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open.	< 6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread.	< 7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards.	< 8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves.	> 8.1

⁵⁴ U.S. Geological Survey. (n.d.). The Modified Mercalli Intensity Scale. UGGS. Retrieved February 3, 2022, from https://www.usgs.gov/programs/earthquake-hazards/modified-mercalli-intensity-scale?qt-science_center_objects=0#qt-science_center_objects

PREVIOUS OCCURRENCES

The last earthquake to cause major damage in New England occurred in 1755,⁵⁵ though seismologists state that another serious earthquake occurrence is possible. There are five seismological faults in Massachusetts, but there is no discernible pattern of previous earthquakes along these fault lines. Additionally, earthquakes that are based in more seismologically active regions like parts of Canada may also impact Massachusetts.⁵⁶ Earthquakes occur without warning and may be followed by aftershocks. Image 4 below shows the locations of earthquakes that have occurred across the New England region and beyond over the last 45 years.

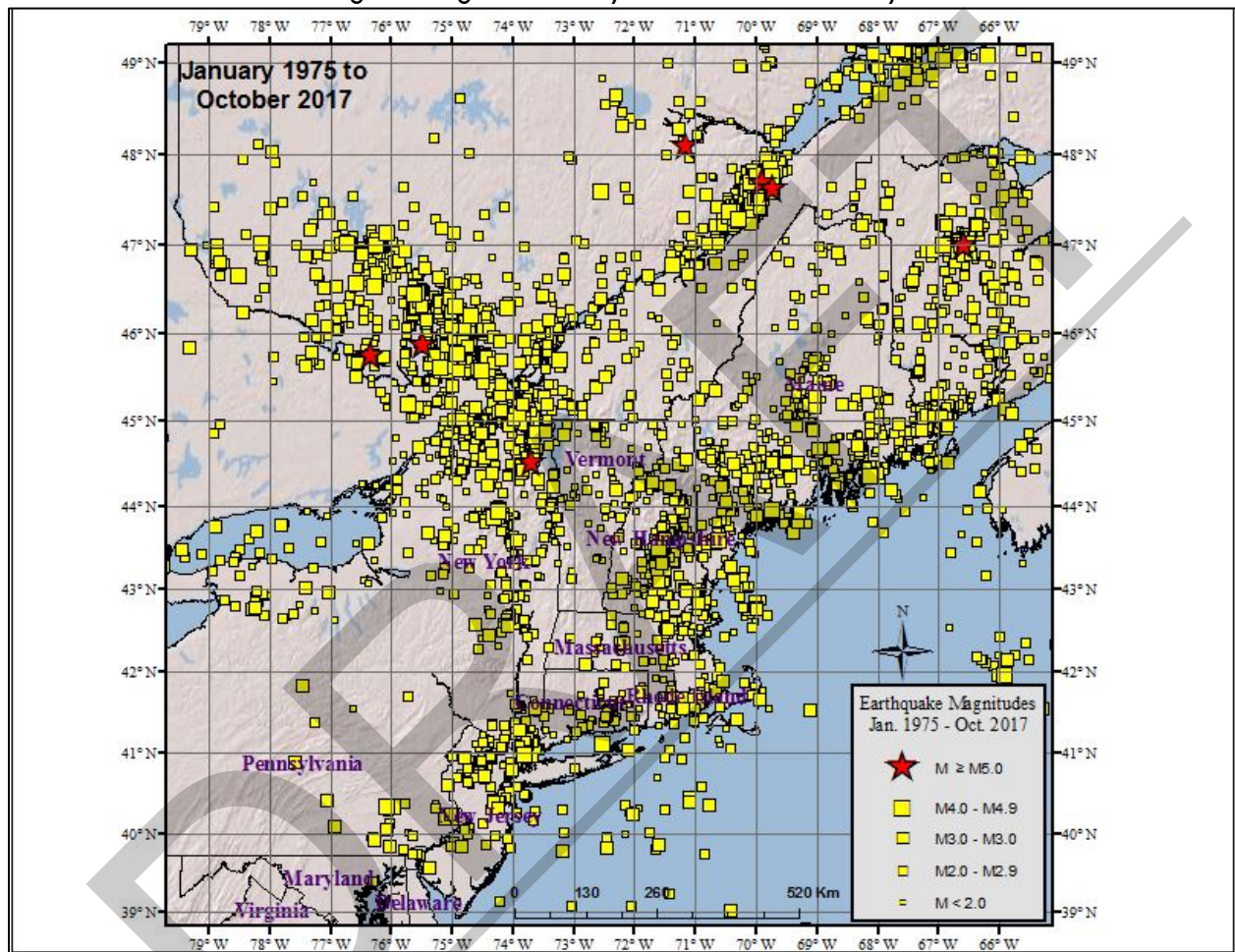


Image 3: Map of Earthquakes of the Northeastern US and Southeastern Canada 1975 to 2017. Source: The Northeast States Emergency Consortium website.

The local Hazard Mitigation Team reports that no earthquakes have been felt in Northborough. To determine whether earthquakes have occurred recently near Northborough, events listed by Weston Observatory in Boston College were reviewed for all towns in Massachusetts for a five-year lookback. Listed earthquakes above magnitude 2.0 include:

- 12/21/18 – 3 km WSW of Gardner, 2.1/2.1 [Mn*/Mc**]

⁵⁵ Northeast States Emergency Consortium. (n.d.). Massachusetts Earthquakes. Retrieved February 3, 2022, from <http://nsec.org/massachusetts-earthquakes/>

⁵⁶ 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.

- 8/21/19 – 2 km SSE of Wareham, 1.7/2.4
 - 12/3/19 – 4 km SSE of Plymouth, 1.6/2.2
 - 11/8/20 – 11 km SW of New Bedford, 3.8/3.4
 - 11/22/20 – 12 km WSW of New Bedford, 1.7/2.6
- *Mn is the Nuttli Magnitude (see below)
 **Mc is the Coda Duration Magnitude (see below)

Each of these earthquakes are minor. Additionally, earthquakes with a magnitude of about 2.0 or less are usually called "microearthquakes" and are generally only recorded locally.

The Weston Observatory utilizes two scales to track the magnitude of earthquakes. These include the Nuttli magnitude (Mn) for North America east of the Rocky Mountains. Weston Observatory also utilizes the Coda Duration magnitude (Mc), which is based on the duration of shaking at a particular station. The Coda Duration magnitude can quickly estimate the magnitude before the exact location of the earthquake is known.

On August 23, 2011, an earthquake measuring 5.8 on the Richter scale centered in Virginia was felt in much of the northeast, but was not felt in Northborough according to the local planning team.⁵⁷

PROBABILITY OF FUTURE EVENTS

The 2023 ResilientMass Plan notes that “The probability of a magnitude 5.0 or greater earthquake centered in New England in a 10-year period is about 10–15%⁵⁸” Additionally, the plan notes that while Massachusetts is not near any tectonic plate boundaries, it is still susceptible to earthquakes on the North American Plate. Earthquakes elsewhere could also have secondary effects to the state and the region, potentially disrupting supply chains or causing other secondary effects.

Based upon existing records, there is a “very low” frequency (less than 1 percent probability in any given year) of a damaging earthquake in Northborough.

IMPACT

Massachusetts introduced earthquake design requirements into their building code in 1975 and improved building code for seismic reasons in the 1980s. However, these specifications apply only to new buildings or to extensively modified existing buildings. Buildings, bridges, water supply lines, electrical power lines and facilities built before the 1980s may not have been designed to withstand the forces of an earthquake. The first edition of the Massachusetts State Building Code went into effect on January 1, 1975, and 63.0% percent of the town’s 2,582 occupied housing units was constructed in 1979 or earlier.⁵⁹ The seismic standards were upgraded with the 1997 revision of the State Building Code. Despite its fairly old average housing stock, Northborough faces a “minor” impact from earthquakes, with little damage likely to occur due to the extreme rarity of damaging events.

HAZUS-MH (multiple-hazards) is a computer program developed by FEMA to estimate losses due to a variety of natural hazards. The HAZUS earthquake module allows users to define an earthquake magnitude and model the potential damages caused by that earthquake as if its epicenter had been at the geographic center of the study area. For the purposes of this plan, a

⁵⁷ Weston Observatory Boston College

⁵⁸ “ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan,” page 5.1-42.

⁵⁹ US Census Bureau, 2020 American Community Survey 5-year estimates, DP04.

magnitude 5.0 earthquake was selected for analysis. Historically, major earthquakes are rare in New England, although a magnitude 5 event occurred in 1963.

Magnitude 5.0	
Building Characteristics	
Estimated total number of buildings	5155
Estimated total building replacement value (2024 \$)	\$ 3,604,141,000.00
Building Damages	
# of buildings sustaining slight damage	1,562
# of buildings sustaining moderate damage	756
# of buildings sustaining extensive damage	155
# of buildings completely damaged	30
Population Needs	
# of households displaced	83
# of people seeking public shelter	36
Debris	
Building debris generated (tons)	66,000
# of truckloads to clear debris (@ 25 tons/truck)	2,640
Value of Damages (dollars)	
Total property damage	\$428,383,100.00
Total losses due to business interruption	\$62,650,400.00

For more information on the HAZUS-MH software, go to www.fema.gov/hazus-software.

EXPOSURE

Certain features within Northborough’s community infrastructure, society, and environment may face more exposure to earthquakes, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in *Section 3*. Vulnerable community features include:

- Older buildings constructed prior to the first edition of the Massachusetts State Building Code.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2023 ResilientMass Plan, no climate change effects have been identified that pertain to earthquake hazards.

VULNERABILITY

Based on the above analysis, Northborough has a hazard index rating of “5- lowest risk” from earthquakes.

MITIGATION STRATEGIES

The Town of Northborough is currently able to effectively respond to earthquakes through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, the Town’s existing capabilities to mitigate and respond to earthquakes could be expanded upon through numerous avenues. The local planning team identified the following strategies that could be used to reduce the threat of Earthquakes in Northborough:

- Protect underground utilities like gas, water, and sewer by implementing redundancies to those systems.
- Continue to utilize hazard warning systems and notifications: social media, town webpages, Code Red, and other communication methods. Interns are currently taking senior citizen information to sign them up for CodeRed. Post generator safety and use info on social media. Health Dept. to put out a brochure on 72-hr kits through Town-wide mailing, school children take-home, etc. Maintain internal instant messaging system, allowing for rapid response of emergency personnel.
- Study the possibility of creating a regional shelter with a neighboring town. This would help limit the expense of maintaining separate shelters when towns have a limited budget.

4.9 DAM FAILURE

Dams and their associated impoundments provide many benefits to a community, such as water supply, recreation, hydroelectric power generation, and flood control. However, they also pose a potential risk to lives and property. Dam failure is not a common occurrence, but dams do represent a potentially disastrous hazard.

When a dam fails, the potential energy of the stored water behind the dam is released rapidly. Some dam failures occur when floodwaters above overtop and erode the material components of the dam. Other failures are caused by foundation defects, inadequate maintenance, internal erosion caused by seepage, and many other specific causes.⁶⁰ Dam failure may be influenced by storm floodwaters but most are caused by structural, mechanical, or hydraulic failures.⁶¹ Dam breaches can lead to catastrophic consequences as the water rushes in a torrent downstream flooding an area engineers refer to as an “inundation area.” The number of casualties and the amount of property damage will depend upon the timing of the warning provided to downstream residents, the number of people living or working in the inundation area, and the number of structures in the inundation area.

Many dams in Massachusetts were built during the 19th century without the benefit of modern engineering design and construction oversight. Dams of this age can fail because of structural problems due to age and/or lack of proper maintenance, as well as from structural damage caused by an earthquake or flooding. The Massachusetts Department of Conservation and Recreation Office of Dam Safety is the agency responsible for regulating dams in the state (M.G.L. Chapter 253, Section 44 and the implementing regulations 302 CMR 10.00). To be regulated, these dams are in excess of 6 feet in height (regardless of storage capacity) and have more than 15 acre-feet of storage capacity (regardless of height). Dam safety regulations enacted in 2005 transferred significant responsibilities for dams from the Commonwealth of Massachusetts to dam owners, including the responsibility to conduct dam inspections.

LOCATION

According to the Massachusetts Office of Dam Safety, there are 18 dams in Northborough. Of these, two are ranked as a Significant Hazard and one is ranked as a High Hazard. In addition to the 18 dams in Town, the Fiske Mill Pond Dam (Low Hazard, MA0062, privately owned) in neighboring Upton, lies roughly 0.8 miles upgradient from Mill Pond and the West Street Bridge, which straddles Primary Evacuation Route 140. The local planning team also identified concerns with dams upstream in Hopkinton that control water flowing into Northborough Pond, and the Milford Dam which is owned by 3 different Towns. The names and hazard levels of dam structures within Northborough are:

⁶⁰ Association of State Dam Safety Officials. (n.d.). Dam Failures and Incidents. Association of State Dam Safety Officials. Retrieved December 29, 2021, from <https://damsafety.org/dam-failures>

⁶¹ FEMA. (2013). Living with Dams: Know Your Risks (FEMA P-956; p. 9). Federal Emergency Management Agency. https://www.fema.gov/sites/default/files/2020-08/fema_living-with-dams_p-956.pdf

National ID	Dam Name	Owner	Regulatory Authority	Hazard Code	Notes
MA00959	Bartlett Pond Dam	Public – Town of Northborough	Office of Dam Safety	Low Hazard	This dam has been noted as vulnerable to a locally identified dam failure hazard by CMRPC's GIS analysis.
MA00995	Assabet River Dam	Private	Office of Dam Safety	Significant Hazard	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA00996	Cold Harbor Brook Dam	Public – MA Department of Conservation and Recreation (DCR)	Office of Dam Safety	High Hazard	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is extremely close to the 1% flood zone.
MA00998	Hop Brook Dam	Public – MA Department of Conservation and Recreation (DCR)	Office of Dam Safety	High Hazard	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone and is close to a locally identified flooding hazard. It is being rebuilt; the rebuilding is in the design process.
MA00999	Smith Pond Dam	Private	Office of Dam Safety	Low Hazard	There are concerns that this dam may fail.
MA01234	Northborough Reservoir Dam	Public – Town of Northborough	Office of Dam Safety	Significant Hazard	This dam is owned by the Town of Northborough, is located in Shrewsbury and Boylston, and is planned to be partially removed.
MA02843	Old Mill Pond Dam	Private	Non-Jurisdictional – Other	N/A	There are no noteworthy concerns regarding natural hazard impacts on this dam.
MA02845	Wallace Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable to a locally identified dam failure hazard by CMRPC's GIS analysis.
MA02846	Old Saw Mill Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis

					because it is in the 1% flood zone.
MA02847	Old Adams Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA02848	Small Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA02849	Ellis Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA02850	Storage Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA02851	Cider Mill Pond Dam	Private	Non-Jurisdictional – Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.
MA02852	Old Mill Pond Dam	Private	Non-Jurisdictional - Other	N/A	There are no noteworthy concerns regarding natural hazard impacts on this dam.
MA02853	Farm Pond Dam	Private	Non-Jurisdictional - Other	N/A	There are no noteworthy concerns regarding natural hazard impacts on this dam.
MA02854	West Meadow Country Club Pond Dam	Private	Non-Jurisdictional - Other	N/A	This dam has been noted as vulnerable by CMRPC's GIS analysis because it is in the 1% flood zone.

EXTENT

Often dam or levee breaches lead to catastrophic consequences as the water ultimately rushes in a torrent downstream flooding an area engineers refer to as an “inundation area.” The number of casualties and the amount of property damage will depend upon the timing of the warning provided to downstream residents, the number of people living or working in the inundation area, and the number of structures in the inundation area.

Dams in Massachusetts are assessed according to their risk to life and property. The state has three

hazard classifications for dams:

- **High Hazard:** Dams located where failure or improper operation will likely cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways, or railroads.
- **Significant Hazard:** Dams located where failure or improper operation may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways or railroads or cause interruption of use or service of relatively important facilities.
- **Low Hazard:** Dams located where failure or improper operation may cause minimal property damage to others. Loss of life is not expected.

Some dams do not have a hazard rating.

PREVIOUS OCCURRENCES

To date, there have been no catastrophic dam failures in Northborough.

PROBABILITY OF FUTURE EVENTS

Probability for future failure events is “very low” with less than 1 percent chance of a dam bursting in any given year.

IMPACT

The Town faces a “limited impact” from failure of dams with, with 10 to 25 percent of the Town likely to see damage.

It is not possible to estimate the property loss impacts of dam failure quantitatively given the large number of variables involved in failure events. Qualitatively, losses from failure of an individual dam could be significant but would be geographically limited to portions of the dam’s inundation zone. This may change with future improvements to dam breach modeling software being developed and that are currently in early trial stages, such as the DSS-WISE™ (Decision Support System for Water Infrastructural Security) program⁶².

POTENTIAL CLIMATE CHANGE EFFECTS

Dam failure through overtopping can be caused by floodwaters flowing into a dammed body of water, exceeding the spillway capacity of the dam, and causing water to flow over the top of the dam (overtopping). If the water flowing over the dam erodes the dam itself, then a dam failure can occur. Therefore, the risk of dam failure may be indirectly impacted by climate change through its impacts on flooding.

VULNERABILITY

Based on a mostly qualitative assessment, Northborough has a hazard index rating of “4 – low risk” from dam failure.

MITIGATION STRATEGIES

The Town of Northborough is currently able to effectively respond to Dam Failures through the

⁶² “About DSS-WISE™ Web,” Dsswiseweb.ncche.olemiss.edu, University of Mississippi, accessed June 10, 2024, <https://dsswiseweb.ncche.olemiss.edu/userpages/about.php>.

emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, the Town’s existing capabilities to mitigate and respond to dam failures could be expanded upon through numerous avenues. The local planning team identified the following strategies that could be used to reduce the threat of Earthquakes in Northborough:

- Repair Bartlett Pond Dam to mitigate / remove invasive species.
- Remove dams and restore streams, prioritizing continuing work on the removal of Northborough Reservoir Dam. Explore options for acquiring and removing other significant and high hazard dams within town.
- Communicate with the Office of Dam Safety on the condition of Smith Pond Dam / Otis Street Dam.

4.10 DROUGHT

Drought is a normal, recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region. In the most general sense, drought originates from a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group, or environmental sector. Reduced crop, rangeland, and forest productivity; increased fire hazard; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitat are a few examples of the direct impacts of drought. Of course, these impacts can have far-reaching effects throughout the region and even the country.

LOCATION

Because of this hazard’s regional nature, a drought would likely impact the entire community, meaning the location of occurrence is “large” or over 50 percent of the town.

EXTENT

The severity of a drought would determine the scale of the event. The National Drought Mitigation Center also records information on historical drought occurrence. Unfortunately, data are only available at the state level. The National Drought Mitigation Center categorizes drought on a D0-D4 scale as shown below.

Table 10: U.S. Drought Monitor⁶³

Classification	Category	Description
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed

⁶³ National Drought Mitigation Center. (n.d.). Drought Classification. U.S. Drought Monitor. Retrieved February 3, 2022, from <https://droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx>

D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies

DRAFT

PREVIOUS OCCURRENCES

In Massachusetts, nine extreme droughts have occurred statewide since 1930, though the Northborough area has been spared the most severe impacts in each case according to USGS Water Supply Paper for Massachusetts #2375. These historic major droughts range in severity and in length, lasting from three to eight years. In many of these droughts, water-supply systems around the state were found to be inadequate. Water was piped into urban areas, and water-supply systems were modified to permit withdrawals at lower water levels. The following table displays peak drought severity since 2000, from the National Drought Mitigation Center:

Table 11: Annual Drought Status⁶⁴

Year	Maximum Severity
2000	No drought
2001	D2 conditions in 21% of the state
2002	D2 conditions in 100% of the state
2003	No drought
2004	D0 conditions in 48% of the state
2005	D1 conditions in 7% of the state
2006	D0 conditions in 98% of the state
2007	D1 conditions in 71% of the state
2008	D0 conditions in 69% of the state
2009	D0 conditions in 45% of the state
2010	D1 conditions in 27% of the state
2011	D0 conditions in 0.01% of the state
2012	D2 conditions in 51% of the state
2013	D1 conditions in 60% of the state
2014	D1 conditions in 54% of the state
2015	D1 conditions in 58% of the state
2016	D3 conditions in 52% of the state
2017	D3 conditions in 9% of the state
2018	D1 conditions in 36% of the state
2019	D0 conditions in 85% of the state
2020	D3 conditions in 36% of the state
2021	D2 conditions in 1% of the state
2022 (to September)	D3 conditions in 39% of the state

In Northborough, there has not been a drought event with substantial impacts for many decades. Northborough has a Drought Management Plan to issue water bans on odd/even days, meaning

⁶⁴ National Drought Mitigation Center. (2016, 2022). Statistics by Threshold. U.S. Drought Monitor.

<https://droughtmonitor.unl.edu/DmData/DataDownload/StatisticsbyThreshold.aspx>

that Town water users with odd-numbered addresses are restricted to watering on odd-numbered days, and vice versa. Over the past few years, the local planning team noted that the Town has issued water bans every summer. More recently, the Town has been issuing water bans even when there is a substantial amount of rainfall. And in spring of 2022, the Town enacted a strict water ban, prohibiting outside watering during indicated periods. This stricter policy was to mitigate the inactivation of one of the Town’s water wells due to high concentrations of polyfluoroalkyl substances (PFAS).

PROBABILITY OF FUTURE EVENTS

In Northborough, as in the rest of the state, extreme and exceptional droughts occur at a “very low” probability (1 to 10 percent in the next year). Based on past events and current criteria outlined in the Massachusetts Drought Management Plan, it appears that Central Massachusetts may be slightly more vulnerable than parts of eastern Massachusetts to severe drought conditions. However, many factors, such as water supply sources, population, economic factors (i.e., agriculture-based economy), and infrastructure, may affect the severity and length of a drought event.

In the long-term, the risk of drought may increase in Northborough due to climate change influences, which will result in annual increases of consecutive dry days.

IMPACT

The specific impacts of drought in Massachusetts are categorized by the National Drought Mitigation Center in Table 23 below:

Table 12: Historic Impacts of Drought in Massachusetts⁶⁵

Category	Historically observed impacts
D0	Crop growth is stunted; planting is delayed
	Fire danger is elevated; spring fire season starts early
	Lawns brown early; gardens begin to wilt
	Surface water levels decline
D1	Irrigation use increases; hay and grain yields are lower than normal
	Honey production declines
	Wildfires and ground fires increase
	Trees and landscaping are stressed; fish are stressed
	Voluntary water conservation is requested; reservoir and lake levels are below normal capacity
D2	Specialty crops are impacted in both yield and fruit size
	Producers begin feeding cattle; hay prices are high
	Warnings are issued on outdoor burns; air quality is poor
	Golf courses conserve water
	Trees are brittle and susceptible to insects

⁶⁵ National Drought Mitigation Center. (n.d.). State Impacts. U.S. Drought Monitor. Retrieved February 3, 2022, from <https://droughtmonitor.unl.edu/DmData/StateImpacts.aspx>

	Fish kills occur; wildlife move to farms for food
	Water quality is poor; groundwater is declining; irrigation ponds are dry; outdoor water restrictions are implemented
D3	Crop loss is widespread; Christmas tree farms are stressed; dairy farmers are struggling financially
	Well drillers and bulk water haulers see increased business
	Water recreation and hunting are modified; wildlife disease outbreak is observed
	Extremely reduced flow to ceased flow of water is observed; river temperatures are warm; wells are running dry; people are digging more and deeper wells

The 2023 ResilientMass plan notes that while drought is a naturally occurring climate phenomenon, its impacts can be exacerbated by human behavior. The volume and rate of groundwater withdrawn from underground aquifers can impact the amount of water that flows through surface water bodies, negatively impacting aquatic ecosystems. Additionally, more impervious surface coverage, and some forms of stormwater infrastructure, can prevent natural infiltration of precipitation into groundwater.⁶⁶

Specific impacts in Northborough may vary among customers of the water system and private well users. So, while the impact of a drought can be assessed as “minor” overall, with very little damage to people or property likely to occur, impacts may be higher in the parts of Town that are not located within the Town’s water service area.

EXPOSURE

Certain features within Northborough’s community infrastructure, society, and environment may face more exposure to drought, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in Section 3. Vulnerable community features include:

- Residences or businesses with shallow wells.
- Wild plants and animals, including trees.
- Vegetation, which may become more vulnerable to wildfire due to prolonged drought.

Higher water bills or the cost of re-drilling private wells due to drought impacts, could also negatively affect local residents. Other factors like PFAS contamination of water sources could compound drought-related water supply challenges.

According to the 2023 ResilientMass Plan, there are two major ways that drought can be influenced by climate change:

- The frequency and extent of droughts are projected to increase in summer and fall as higher temperatures result in more evaporation, snow melts earlier in the year, and precipitation becomes less constant and more extreme.
- Rising temperatures and changes in precipitation will reduce the snowpack and hasten snowmelt. This could result in less snowmelt recharge of groundwater, less snowmelt feeding stream flows, and less snowmelt as a water source for agriculture.

In summary, climate change is likely to increase the frequency and extent of drought in Massachusetts. Drought that is worsened by climate change can have numerous social implications

⁶⁶ “ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan”

in Northborough.

VULNERABILITY

Based on the above assessment, Northborough has a hazard index rating of “4 – low risk” from drought. Minimal or no loss of property, or damage to people or property is expected due to this hazard.

MITIGATION STRATEGIES

The Town of Northborough is currently able to effectively respond to drought through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, the Town’s existing capabilities to mitigate and respond to drought could be expanded upon through numerous avenues. The local planning team identified the following strategies that could be used to reduce the threat of Drought in Northborough:

- Evaluate climate change’s impacts on private drinking water wells.
- Explore establishing a redundant MWRA connection, as recommended by MassDEP, to ensure a reliable water supply for the Town.

DRAFT

4.11 EXTREME TEMPERATURES

As per the 2023 ResilientMass Plan, there is no universal definition of “extreme heat,” “extreme cold,” or “extreme temperatures”: these terms are relative terms whose meaning depends on the normal average temperatures and climatic highs and lows in a region. Extreme heat in Massachusetts is typically defined as a period of 3 or more consecutive days with temperatures above 90 °F.⁶⁷ Extreme heat may also refer to any prolonged period of especially hot weather (a heat wave), which may also be accompanied by high humidity. Extreme cold is a dangerous situation that can result in health emergencies for susceptible people, such as those without shelter or who are stranded or who live in homes that are poorly insulated or without heat.

For Massachusetts, extreme temperatures can be defined as those that are far outside the normal ranges. Normal temperatures within the period ranging from 1991-2020 for the Northborough area are⁶⁸:

	July (Hottest Month)	January (Coldest Month)
Average High (°F)	78.0°	32.3°
Average Low (°F)	61.7°	17.1°

Specific criteria used by the National Weather Service for issuing extreme heat and extreme cold watches, warnings, and advisories, are described in Extent, below.

LOCATION

Extreme temperatures can be expected to be uniform across Northborough during a given weather event, due to the town’s lack of extreme elevations, urban areas, and coastal areas. Therefore, this hazard has a “large” geographic coverage.

EXTENT

2023 ResilientMass Plan notes that the extent (severity or magnitude) of extreme cold temperatures are generally measured through the Wind Chill Temperature Index. Wind Chill Temperature is the temperature that people and animals feel when outside and it is based on the rate of heat loss from exposed skin by the effects of wind and cold⁶⁹. In Massachusetts, a wind chill warning is issued by the National Weather Service (NWS) Norton Forecast Office when the Wind Chill Temperature Index, based on sustained wind, is –25°F or lower for at least three hours. NWS Windchill Chart (shows three shaded areas of frostbite danger. Each shaded area shows how long a person can be exposed before frostbite develops.

⁶⁷ “ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan,” pages 5.2-1-5.2-2.

⁶⁸ “Climate,” Weather.gov.

⁶⁹ “ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan,” pages 5.2-1-5.2-3.

Wind Chill Chart

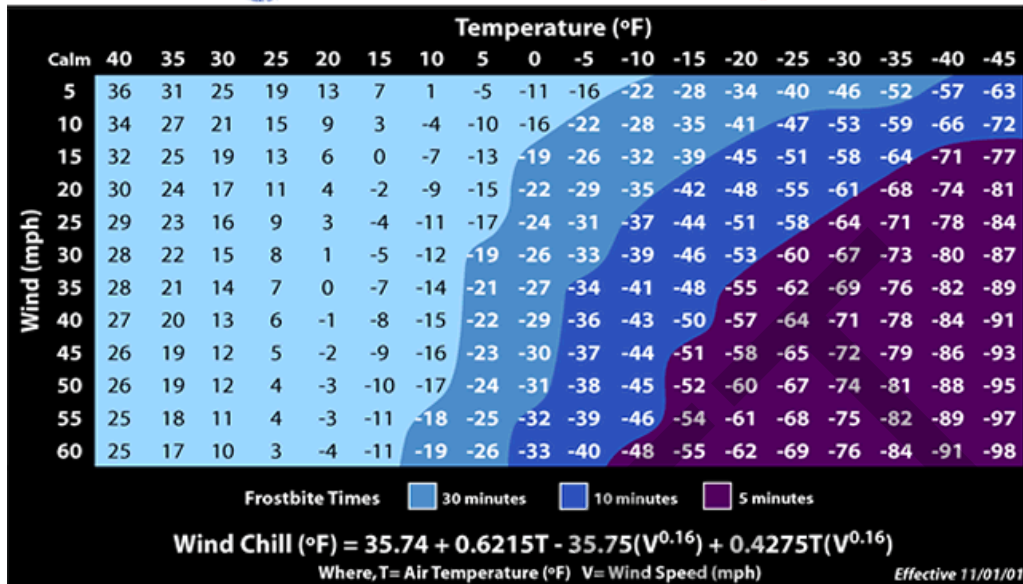


Figure 2: NWS Wind Chill Temperature (WCT) index. Source: <https://www.weather.gov/safety/cold-wind-chill-chart>

For extremely hot temperatures, the heat index scale is used, which combines relative humidity with actual air temperature to determine the risk to humans. The NWS issues an Excessive Heat Warning when the daytime heat index is forecasted to reach 105 degrees F for 2 or more hours. The NWS issues an Excessive Heat Advisory if the heat index is forecasted to reach 95°F-99°F for 2 or more hours over 2 consecutive days, or 100°F-104°F for 2 or more hours over 1 day. The NWS defines a heat wave as 3 or more days of ≥ 90°F temperatures. The following chart indicates the relationship between heat index and relative humidity:

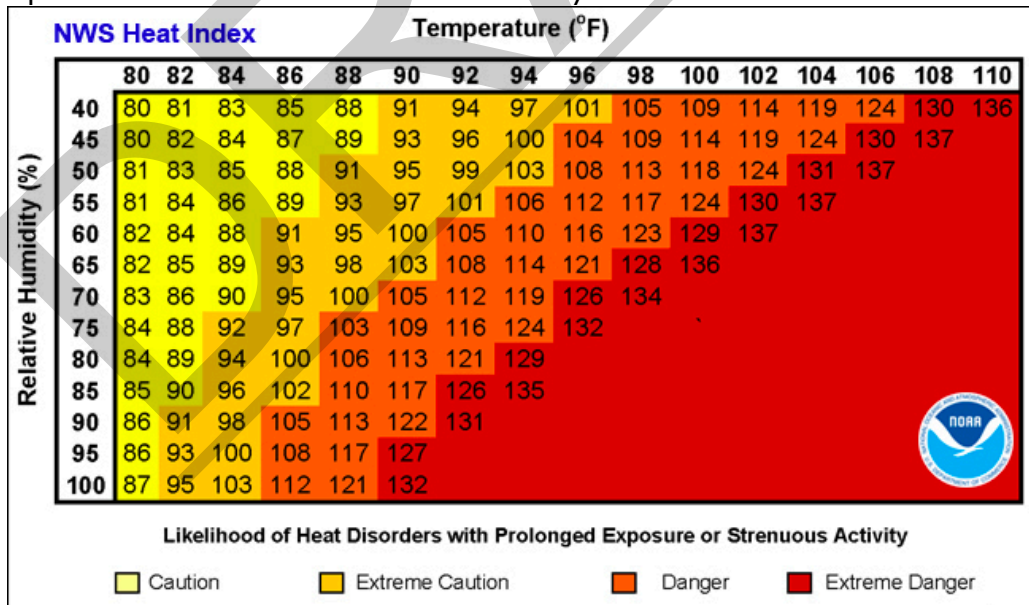


Figure 3: Heat Index. Source: <https://www.weather.gov/safety/cold-wind-chill-chart>

Extreme heat causes more fatalities in the United States than all other weather-related natural

Extreme heat causes more fatalities in the United States than all other weather-related natural hazards combined.⁷⁰ Extreme heat can be the underlying cause of death or can worsen other medical conditions like heart disease, hypertension, alcohol poisoning and drug overdoses.⁷¹ The heat-related mortality rate is higher among males and people aged 65 years and older.⁷²

Table 13: Heat Effects on Body lists the effects of the body at different levels of the heat index. It is important to note that while temperatures exceeding 100°F are unusual for Central Massachusetts, high humidity is very common during the summer and can drive the heat index to dangerous levels.

Table 13: Heat Effects on Body⁷³

Classification	Heat Index	Effect on Body
Caution	80°-90°F	Fatigue possible with prolonged exposure and/or physical activity.
Extreme Caution	90°-103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°-124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F+	Heat strokes highly likely.

Other impacts of high temperatures include drought, wildfire, and the formation of ground-level ozone.⁷⁴ Prolonged heat can cause power use to spike and overload the electrical grid, causing outages.⁷⁵ Cold temperatures are often combined with winter storms. Individuals may have to deal with the loss of heat and power due to storm damage, which could further subject them to the cold.⁷⁶ Carbon monoxide poisoning is another risk during cold weather, especially when households lack adequate power or heat.⁷⁷ Extreme heat and cold can both negatively impact transportation infrastructure. Railroad tracks are a particular concern because the metal rails can kink in high temperatures.⁷⁸

PREVIOUS OCCURRENCES

There is not a comprehensive data source listing instances when the National Weather Service has issued extreme heat or cold warnings or advisories in Worcester County. Across Massachusetts as a whole, there were 33 cold weather events between 1994 and 2018. The NOAA storm Events database lists the following Extreme Cold/ Wind Chill Events as having occurred in Southern Worcester County since the last Northborough HMP was developed in 2018:

- 01/06/2018: Strong west winds trailed the January 4 winter storm. These winds drew

⁷⁰ "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan,"

⁷¹ Ambarish Vaidyanathan et al., "Heat-Related Deaths—United States, 2004–2018," *Morbidity and Mortality Weekly Report* 69, no. 24 (2020): 729-734. <https://doi.org/10.15585/mmwr.mm6924a1>.

⁷² Ibid.

⁷³ National Weather Service, "What is the heat index?," Weather.gov, National Oceanic and Atmospheric Administration, accessed June 10, 2024, <https://www.weather.gov/ama/heatindex>.

⁷⁴ "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan,"

⁷⁵ Ibid.

⁷⁶ Ibid.

⁷⁷ Ibid.

⁷⁸ Ibid.

bitterly cold arctic air over Massachusetts. The combination of strong wind and low temperatures created a dangerous wind chill, with readings reaching 25 degrees below zero or colder in a couple of locations during the early mornings of January 6 and 7.

- 01/21/2019: Strong west to northwest winds trailing the January 20th storm drew cold air across Southern New England on January 21st and caused wind chill values of 25 below zero or colder in Central and Western Massachusetts. The wind diminished during the afternoon and evening of January 21st allowing wind chill values to become less extreme, in the teens below zero.

The Local Planning team identified an extreme cold weather event on February 3-4 2023, with an extreme cold blast and housefire in conjunction with it at Verjuniel Ave on 2/4/2023 at 2:02 in the morning.

According to the 2023 Resilient Mass Plan, there have been 118 warm weather events (heat and excessive heat events) between 1995 and 2022⁷⁹. In Massachusetts, 2010–2022 had seven of the 10 warmest summers on record. The hottest two summers on record for the Commonwealth were 2020 and 2022⁸⁰. August 2022 was the hottest August recorded in the Commonwealth, with temperatures more than 6°F greater than the 20th century average. In 2022, Boston experienced at least 17 days above 90 degrees and two six-day heat waves.

In 2012, Massachusetts temperatures broke 27 heat records⁸¹. Most of these records were broken between June 20 and June 22, 2012, during the first major heat wave of the summer to hit Massachusetts and the East Coast⁸². In July 2013, a long period of hot and humid weather occurred throughout New England. One fatality occurred on July 6, when a postal worker collapsed as the heat index reached 100°F⁸³.

Inland portions of Massachusetts are more subject to extreme temperatures because they lack the moderating effect of the Atlantic Ocean, and densely developed cities are more likely to be impacted by heat waves than smaller towns like Northborough.

PROBABILITY OF FUTURE EVENTS

The probability of future extreme heat or extreme cold is considered to be "moderate," or between 10 and 40 percent in the next year.

IMPACT

The impact of extreme heat or cold in Northborough is considered to be "limited," with no property damage and a limited effect on humans.

EXPOSURE

Certain features within Northborough's community infrastructure, society, and environment may face more exposure to extreme temperatures, or be disproportionately impacted by them, relative to the rest of the community. Some of these features may be documented in the list of critical facilities and vulnerable populations in Section 3. Vulnerable community features include:

⁷⁹ "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan," pages 5.2-7-5.2-8.

⁸⁰ Ibid.

⁸¹ Ibid.

⁸² Ibid.

⁸³ Ibid.

- Children and elderly residents, who may find it difficult to regulate their body temperatures in extremely hot or cold conditions.
- Low-income residents unable to afford adequate cooling or heating.
- Renters who may have few options for mitigating extreme heat and cold through home improvements.
- People who work outdoors such as construction or farm workers.
- The utility grid, which could be vulnerable to outages due to surges in power during extreme temperatures. Power outages during extremely hot or cold days could cause further problems to those who rely on air conditioners or electric heaters.
- Certain forms of agriculture may be negatively affected by extreme temperatures, especially extreme heat.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2023 ResilientMass Plan, climate change is already having an effect on temperatures within Massachusetts and beyond, with more high heat days and fewer extreme cold events. This will also shift the average temperature in Massachusetts higher, leading to longer warm seasons. The changes in temperature will also cause shifts to growing seasons, habitat and vegetation ecosystems, and migratory patterns. Rising temperatures will also cause warming seas, a degradation in air quality, impacts on health and an increased demand for energy and government services. Secondary climate risks include increased severity of wildfires, droughts, flooding and encroachment by invasive species as temperatures rise. According to the 2023 ResilientMass Plan,

- By 2050 average annual temperatures are expected to increase by 5.9 to 7.9°F. This is a drastically shortened timeline from the previous plan where increases of this magnitude were not expected until the end of the century.⁸⁴
- By 2100, annual average temperatures are expected to increase by 10.0 to 12.9°F compared to the 1971-2000 baseline.

According to the 2022 Massachusetts Climate Change assessment by 2030 The summer mean temperature could increase by 3.6°F from the historical period (1950-2013), worsening stress on electric transmission and utility distribution infrastructure⁸⁵.

In summary, climate change is likely to increase the frequency and duration of extreme heat events in Massachusetts. Changes to average annual temperatures will also impact Northborough. Seasonal temperatures will shift, with spring and summer temperatures extending through more of the year.⁸⁶ Winters may also be more mild than historical norms.⁸⁷ Changes to average temperatures could impact the agricultural industry and the natural environment. Farmers may need to shift their practices to account for new climate conditions, and certain specific plants and animals

⁸⁴ Central Massachusetts Regional Planning Commission and the Local Hazard Mitigation Team, the Town of Northborough, Massachusetts, "Northborough Hazard Mitigation Plan Update," Cmrpc.org, Central Massachusetts Regional Planning Commission and the Town of Northborough, Massachusetts, October 15, 2018, <https://cmrpc.org/wp-content/uploads/2024/02/Northborough-MA-Final.pdf>.

⁸⁵ "2022 Massachusetts Climate Change Assessment," page RS30.

⁸⁶ "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

⁸⁷ Ibid.

may need to migrate to new ranges to find suitable habitat.⁸⁸ In response, Northborough residents and businesses may have to alter work patterns during extreme heat days and events to reduce workplace injuries in vulnerable jobs such as construction trades and agricultural labor. The town may have to plan for more cooling stations to offer residents, particularly vulnerable populations, such as the elderly and low-income residents. Similarly to drought conditions, Northborough may have to account for an increase in population of people seeking refuge from extreme heat in other parts of the country.

⁸⁹

VULNERABILITY

Northborough's vulnerability from extreme heat and cold is considered to be, "4 - Low Risk." The town has operated heating and cooling shelters and continues to do so at their municipal building and other town facilities.

MITIGATION STRATEGIES

The Town of Northborough is currently able to effectively respond to extreme temperatures through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, the Town's existing capabilities to mitigate and respond to extreme temperatures could be expanded upon through numerous avenues. The local planning team identified the following strategies that could be used to reduce the threat of extreme temperatures in Northborough:

- Incorporate low-impact development (LID) measures to reduce heat island impacts and deal with stormwater mitigation issues.
- Encourage tree planting on public lands through collaboration between the DPW, local civic organizations, and the local school district. Incorporate nature-based mitigation measures and design into municipally/publicly owned lands.
- Install cooling and/or dehumidification at Melican Middle School, the Town's emergency shelter.

⁸⁸ Ibid.

4.1.2 INVASIVE SPECIES

Invasive species, as defined by the Invasive Species Advisory Committee (ISAC) on the U.S. Department of the Interior as “a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.”⁹⁰ This definition distinguishes invasives from other native pest species, such as beavers and deer, which will be discussed in greater detail in subsequent sections. The State of Massachusetts, being heavily forested with relatively new growth forest, as well as having a great deal of its water sourced from open reservoirs, is vulnerable to the threat of both land and aquatic invasives. Invasive species can damage and disrupt existing ecosystems by outcompeting the native flora and fauna and can have negative impacts to water quality for aquatic species and can increase wildfire risks for land born invasives. These effects are all species dependent, making invasives a challenge to address for municipalities affected by some invasives but not others.

LOCATION

Because of this hazard’s regional nature, broad swaths of the state are affected by one invasive species or another. In the central region, Emerald Ash Borer (*Agilus planipennis*) has been detected in every city and town within the region.⁹¹ However, since invasives and their effects are very species dependent, and their affects are localized in many instances, this hazard bears a resemblance to other more localized hazards.

EXTENT

The mercurial nature of and lack of verified data clearinghouses about invasive species, in addition to a lack of resources and capacity for local conservation officials to track invasives creates a dearth of knowledge about the extent of invasives. Very often, it is not until the damage caused by invasives is apparent that the true extent of the hazard is known. Still, there is some resources available to the local hazard mitigation planning team; the chief sources being utilized for this plan being the Massachusetts Department of Agriculture’s Invasive Pest Dashboard⁹²; the Center for Invasive Species and Ecosystem Health’s Early Detection and Distribution Mapping System (EDDMapS) hosted by the University of Georgia⁹³; and the Forest Ecosystem Monitoring Cooperative’s Northeastern Forest Health Atlas⁹⁴. In Worcester County, according to EDDMapS analysis of verified invasive species reporting from 2017 to 2024 there have been 378 records of locations with invasive species with 353 distinct sightings of invasive species ranging from plants to insects that have been left unchecked, with 2 invasive species being treated, and a total of 47 acres

⁹⁰ Definitions Subcommittee of the Invasive Species Advisory Committee (ISAC). “Invasive Species Definition Clarification and Guidance,” DoI.gov, United States Department of the Interior, April 27, 2006, https://www.doi.gov/sites/doi.gov/files/uploads/isac_definitions_white_paper_rev.pdf.

⁹¹ “ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan,” page 5.1-48.

⁹² “MDAR Invasive Pest Dashboard,” Experience.arcgis.com, Massachusetts Department of Agricultural Resources, accessed June 10, 2024, <https://experience.arcgis.com/experience/a25afa4466a54313b21dd45abc34b62d/page/Page-2/?views=Town-by-Town>.

⁹³ “My EDDMapS,” EDDMapS.org, Center for Invasive Species and Ecosystem Health, accessed June 10, 2024, <https://www.eddmaps.org/tools/query/index.cfm?observationDateStart=06/03/2017&observationDateEnd=06/03/2024&eradicationstatus=1,2&country=926&state=92625000&fipscode=92625027>.

⁹⁴ “Northeastern Forest Health Atlas,” UVM.edu, Forest Ecosystem Monitoring Cooperative, accessed June 10, 2024, <https://www.uvm.edu/femc/forest-health-atlas>.

considered to be infested⁹⁵.

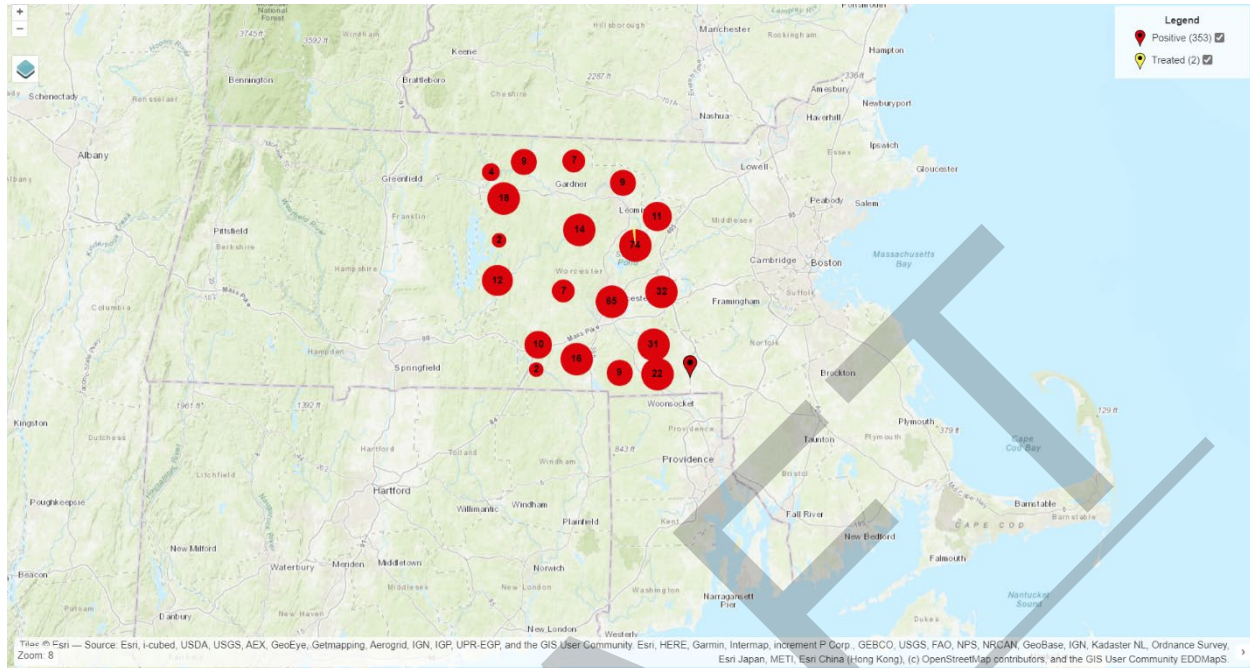


Figure 4: EDDMaps Analysis of Worcester County Invasives 2017-2024

In Northborough the Massachusetts Department of Agriculture’s Invasive Pests dashboard notes that Emerald Ash Borer has been detected in town in 2022, Mile-A-Minute Vine detected in 2020 and Beech Leaf Disease in 2024⁹⁶. However, a lack of reporting on invasives may yet prove that the extent is far greater than previously surmised from these databases.

PREVIOUS OCCURRENCES

In Massachusetts, according to the Northeast Forest Health Atlas, in the past 20 years of reporting Massachusetts has experienced tree damage (including defoliation and mortality events) to 43,127,411 Acres from a variety of invasive pests, alarmingly with the greatest proportion of that damage occurring in the past 3 years⁹⁷.

⁹⁵“My EDDMapS,” EDDMapS.org.

⁹⁶ “MDAR Invasive Pest Dashboard: Emerald Ash Borer (*Agrilus planipennis*),” Experience.arcgis.com, Massachusetts Department of Agricultural Resources, June 10, 2024, https://experience.arcgis.com/experience/a25afa4466a54313b21dd45abc34b62d/page/Page-2/?views=Emerald-Ash-Borer#data_s=id%3AdataSource_3-17f4202b73c-layer-3%3A87.

⁹⁷ “Northeastern Forest Health Atlas - Defoliation: Years of Damage,” UVM.edu, Forest Ecosystem Monitoring Cooperative, accessed June 10, 2024, https://www.uvm.edu/femc/forest-health-atlas?premade=All_Defo.

Area Damaged by Number of Years of Damage

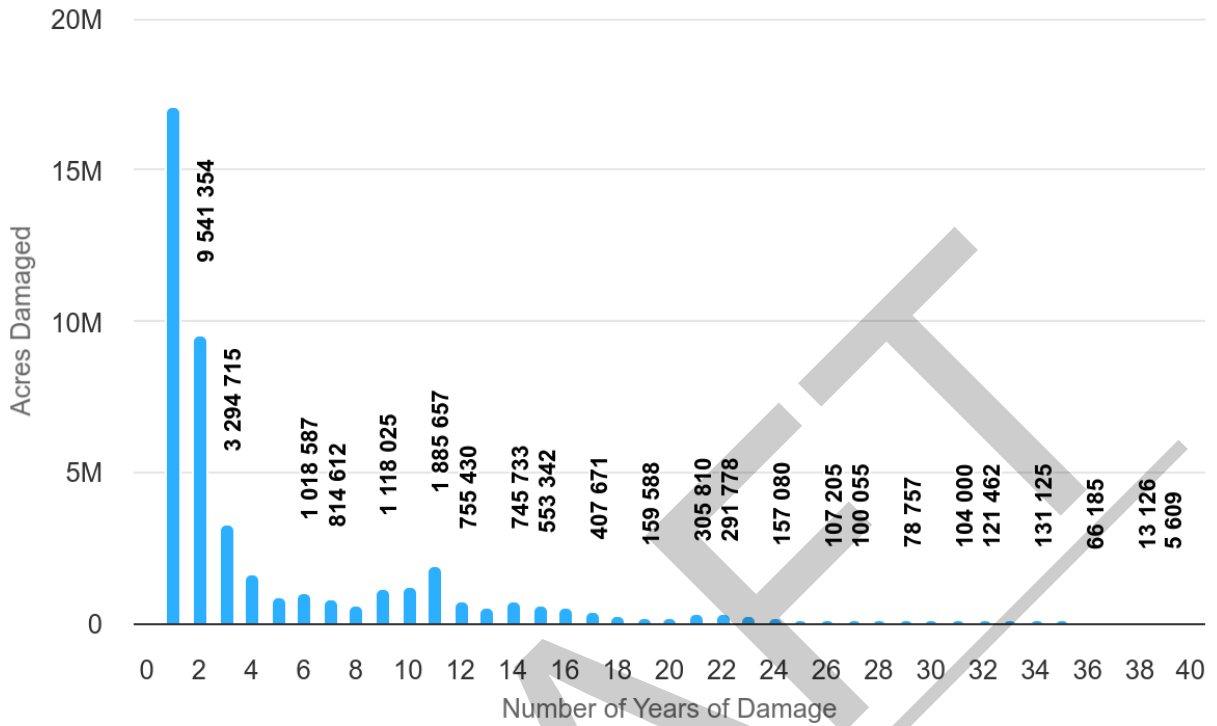


Table 14: Area Damaged by *Spongy Moth*, *Forest Tent Caterpillar*, and *Winter Moth* from 1979 to 2019

In Worcester County the vast majority of these damage events occurred in Southern Worcester County, as well as significant damages to the west and southwest of the county near the border with Hampshire and Hamden Counties, as well as localized defoliation events around the towns of Barre, the Tatnuck neighborhood of Worcester, and other towns. Tree mortality was concentrated in the southern half of Worcester County⁹⁸. In 2008, an outbreak of Asian long-horned beetles in Worcester destroyed nearly 30,000 trees⁹⁹.

Northborough experienced defoliation events from 1998 up to 2020, with significant mortality events occurring in 2018, 2019, and 2020. While the Atlas’s reporting years only run to 2019, based on trends identified in the atlas there is no reason to assume that the hazard has lessened in the subsequent years.

PROBABILITY OF FUTURE EVENTS

The 2023 ResilientMass Plan notes that increased globalization of trade has created new paths for invasives to spread. Climate change is also an aggravating factor, as natural ecosystems become strained by increased temperatures and shifting precipitation patterns, there will only be more opportunities for invasives to disrupt and already fragile ecology. Based on the previously identified occurrences and trends, the probability of an invasive species event in Northborough is Very High, with a 70-100% probability in the next year.

⁹⁸ Ibid.

⁹⁹ "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

IMPACT

Specific impacts in Northborough may vary, depending on the type of invasive, its habitat that it is supplanting within the native ecosystem, and other factors. Invasive species direct impact on the natural ecology has many notable secondary impacts. The 2023 ResilientMass plan identifies that Invasive species can bring with them new diseases to a region (such as the 2005 Chikungunya Epidemic, spread in part by a viral mutation that allowed for the virus to be more readily in the *Aedes albopictus* mosquito, an invasive subspecies)¹⁰⁰. Invasives are also one of the costliest natural hazards in terms of control efforts, costing the United States and estimated \$21 billion per year¹⁰¹. With what information we know about the extent of invasive species within Northborough, we can estimate a “Moderate” Impact on the town.

EXPOSURE

Certain features within Northborough’s community infrastructure, society, and environment may face more exposure to Invasives;

- People with compromised immune systems or preexisting health conditions, children under five, and people over 65 might be particularly vulnerable to new diseases or aggravated health problems caused by invasives.
- Japanese Knotweed, an invasive known to cause streambank destabilization, can contribute to flood damages as well as affect sightlights along roadways, potentially causing roadway hazards.
- Invasive species may pose a management cost burden that exceeds the local capacity to fund, especially in departments tasked with their management, and to the departments tasked with the maintenance of facilities that are impacted by invasives.
- Invasive Species can also change the local ecology to make it more fire prone, either by damaging the native plants or by being prone to fire themselves, increasing the vulnerability to wildfires.

POTENTIAL CLIMATE CHANGE EFFECTS

According to the 2023 ResilientMass Plan, climate change is predicted to increase the spread of invasive species and expand their range. Already fragile ecosystems if left unmanaged will suffer the worst effects, being supplanted invasive species that outperform or outright damage our native flora and fauna. The vast majority of invasive species introductions are caused by human activity and introduction, either accidentally or intentionally.

Both changes in temperature and precipitation may increase chances of successful invasion of ecosystems by non-native species. As warmer temperatures place stress on native cold-weather species in the region, the shift allows invasive species accustomed to higher temperatures to expand their habitat ranges northward.

1. Precipitation

¹⁰⁰ Konstantin A. Tsetsarkin et al., “A single mutation in chikungunya virus affects vector specificity and epidemic potential,” *PLOS Pathogens* 3, no. 12 (December 7, 2007): e201, <https://doi.org/10.1371/journal.ppat.0030201>.

¹⁰¹ Kerry Sheridan, “Invasive species cost the US \$21 billion per year, study finds,” WUSF.org, WUSF Public Media, January 4, 2022, <https://www.wusf.org/local-state/2022-01-04/invasive-species-cost-the-us-21-billion-per-year-study-finds>.

- a. Additionally, elevated atmospheric CO₂ concentrations could reduce the ability of ecosystems to recover from climate shocks creating an opportunity for invasive species, which can often establish more rapidly following a disturbance, to successfully propagate.
2. Temperature
 - a. Climate-driven temperature changes exacerbate the impacts of invasive species by altering ecosystem conditions in ways that enhance their ability to reproduce, spread, and in some cases outcompete native species.

Secondary hazards from invasive species include increased temperatures, damage to agriculture crops, and increased wildfire risk which as described in previous sections all have associated potential societal implications through population shifts and changes in land use and development.

VULNERABILITY

Based on the above assessment, Northborough has a hazard index rating of “3” from Invasive Species.

MITIGATION STRATEGIES

The Town of Northborough is currently able to effectively respond to invasive species through the emergency response facilities and services identified in the critical infrastructure and facilities and existing protection sections of this plan. However, the Town’s existing capabilities to mitigate and respond to invasive species could be expanded upon through numerous avenues. The local planning team identified the following strategies that could be used to reduce the threat of Invasives in Northborough:

- Seek out best practices and funding available to mitigate roadside invasive vegetation species
- Continue education and outreach on tick and mosquito-borne diseases and evaluate management of disease carrying insects.
- Educate residents about invasive species using existing and new resources. Provide the community with tools to manage invasive species.

4.13 OTHER HAZARDS

In addition to the hazards identified in previous sections, the Hazard Mitigation Team reviewed the other hazards listed in the Massachusetts Hazard Mitigation Plan: coastal hazards, atmospheric hazards, ice jams, coastal erosion, sea level rise, and tsunamis. It was determined that these hazards are irrelevant to Northborough due to the town’s location.

LANDSLIDES

One other hazard that can affect Northborough is landslides. Landslides occur in all U.S. states and territories. In a landslide, masses of rock, earth, or debris move down a slope. Landslides may be small or large, slow or rapid. They are generally activated by:

- storms
- earthquakes
- volcanic eruptions

- fires
- alternate freezing or thawing
- steepening of slopes by natural erosion or by human modification

Debris and mud flows are rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud or “slurry.” They can flow rapidly, striking with little or no warning at avalanche speeds. They also can travel several miles from their source, growing in size as they pick up trees, boulders, cars, and other materials.

There are no documented previous occurrences of significant landslides in Northborough. The town is relatively flat and most of its rivers are slow moving, frequently dammed and/or lined with riprap, which can minimize landslide risk. Roadways are not generally built close to river channels, reducing undercutting risk from stormwater-induced bank erosion. Should a landslide occur in the future, the type and degree of impacts would be highly localized. Vulnerabilities could include damage to structures, damage to transportation and other infrastructure, and localized road closures, though our data review and the local planning team noted no specific concerns. Injuries and casualties, while possible, would be unlikely given the low extent and impact of landslides in Northborough.

Landslides are therefore considered low frequency events that may occur once in 50 to 100 years (a 1% to 2% chance of occurring per year).

CHANGES IN GROUNDWATER

Another Hazard of concern that affects Blackstone is changes in groundwater. This hazard was identified primarily through the community survey with residents noting basement flooding from water intrusion as being a common concern among respondents, as well as concerns of wells drying up in the future. While the 2023 ResilientMass Plan notes Changes in Groundwater as a specific hazard, our plan identifies it as being secondary effects to drought/ flooding¹⁰². Northborough is no more or less vulnerable than any other community in the CMRPC region, with the town being reservoir fed and having the ability to connect to nearby water resources. The details of the specific vulnerabilities are included in both the drought and flooding sections of the plan.

According to the 2023 ResilientMass Plan, Climate change is predicted to have an effect on groundwater availability: Sea level rise, extreme temperature events, changes in precipitation patterns and the increased frequency and duration of drought conditions will all negatively impact the amount of available groundwater to the town¹⁰³.

5.0 EXISTING PROTECTION

Sections 5.0 and 5.1 help meet:

- C1. *“Does the plan document each participant’s existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs?”*

¹⁰² “ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan,” pages 5.1-34-5.1-35.

¹⁰³ Ibid.

(Requirement 44 CFR § 201.6(c)(3)) and

- C2. *“Does the plan address each jurisdiction’s participation in the NFIP and continued compliance with NFIP requirements, as appropriate?” (Requirement 44 CFR § 201.6(c)(3)(ii))*

The Town of Northborough currently makes use of most available locally controlled tools, including zoning regulations, planning, and physical improvements, to help mitigate the consequences of natural hazards. The Town does not participate in any federal programs such as StormReady certification or Firewise community certification, but it does utilize CodeRed and Reverse 911 for emergency notifications. The Town plans to research the utility of public awareness and education programs as a result of this planning process.

Northborough has most no-cost or low-cost hazard mitigation capabilities in place. These include land use, zoning, and subdivision regulations as well as an array of specific policies and regulations that include hazard mitigation best practices, such as limitations on development in floodplains, tree maintenance, and other practices. Northborough also has appropriate staff dedicated to hazard mitigation-related work for a community of its size, including a Town Administrator, an Emergency Management Director/Fire Chief, a Town Planner, a professionally run Department of Public Works, a Building Inspector, and a Tree Warden. Northborough has several relevant plans in place, including a Comprehensive Emergency Management Plan (2006), an Open Space and Recreation Plan (2020), and a Master Plan (2020). Not only does Northborough have these capabilities in place, but they are also deployed for hazard mitigation, as appropriate. The Town also has very committed and dedicated volunteers who serve on Boards, Commissions and Committees and in other volunteer positions. The Town collaborates closely with surrounding communities through its Local Emergency Planning Committee (LEPC), and has opted into fire protection and DPW mutual aid agreements through MEMA. Northborough is also an active member community of the Central Massachusetts Regional Planning Commission (CMRPC) and can take advantage of no cost local technical assistance provided by the professional planning staff at CMRPC as needed.

The table below describes existing mitigation protections in Northborough. It includes a brief description of each activity as well as a subjective evaluation of its effectiveness and of any need for modifications.

5.1 EXISTING PROTECTION MATRIX

Existing Measure	Description	Action	Effectiveness & Recommendations
Participation in National Flood Insurance Program (NFIP)	Provides flood insurance for structures located in flood- prone areas. Also, communities participating in the NFIP have adopted and enforce ordinances, bylaws and regulations that meet or exceed FEMA requirements to reduce the risk of flooding.	Northborough monitors building activity within the flood plain to ensure compliance with provisions of state building code.	<p>Effective</p> <p>There are no repetitive loss properties in Northborough. Northborough should seek to further limit development in the 1% flood zones. It should work to score in the Community Rating System (CRS) under NFIP to enable its residents to obtain lower flood insurance rates. Northborough should educate its residents about NFIP. The Town’s building inspector is the appointed designee who implements the addressed commitments and requirements of the NFIP in town and the Town has adopted the Flood Insurance Rate Map (FIRM) dated from July 16th, 2014;¹⁰⁴ this information is noted in the Floodplain Overlay District section of chapter 7-07 of Northborough’s Zoning Bylaw.¹⁰⁵ The</p>

¹⁰⁴ “NORTHBOROUGH, TOWN OF,” Msc.fema.gov, Federal Emergency Management Agency, June 26, 2024, <https://map1.msc.fema.gov/firm?id=25027C0629F>, <https://map1.msc.fema.gov/firm?id=25027C0631F>, <https://map1.msc.fema.gov/firm?id=25027C0632F>, <https://map1.msc.fema.gov/firm?id=25027C0633F>, <https://map1.msc.fema.gov/firm?id=25027C0634F>, <https://map1.msc.fema.gov/firm?id=25027C0641F>, <https://map1.msc.fema.gov/firm?id=25027C0642F>, <https://map1.msc.fema.gov/firm?id=25027C0643F>, <https://map1.msc.fema.gov/firm?id=25027C0651F>, <https://map1.msc.fema.gov/firm?id=25027C0653F>, <https://map1.msc.fema.gov/firm?id=25027C0654F>, <https://map1.msc.fema.gov/firm?id=25027C0661F>, <https://map1.msc.fema.gov/firm?id=25027C0662F>.

¹⁰⁵“Part 7: Zoning - Chapter 7-07: Overlay Districts,” Ecode360.com, the Town of Northborough, accessed June 26, 2024, <https://ecode360.com/41981579>.

			Town's Floodplain Overlay District, described in this same section of the Zoning Bylaw, includes all special flood hazard areas (SFHAs) designated as Zone A, AE, AH, or AO in town and regulates and permits development within these areas. In addition, this same section of the Zoning Bylaw also regulates the ability of development within floodways in Zones A, A1-30, and AE to be substantially improved to ensure that these improvements do not lead to an increase in damage when floods occur.
Stormwater Management policy and regulations in place	Planning Boards or Conservation Commissions review projects for consistency with MA DEP standards. This helps ensure adequate on site retention and recharge.	Northborough has enacted Stormwater Management Regulations which are included in the Town's General Bylaws. Northborough also participates in the Central Mass Stormwater Coalition. The town's new Stormwater Bylaw, which was updated in August of 2021, restricts development in flood zones, has led to improved operations and maintenance, and protects isolated wetlands not covered by state regulations).	Very effective No changes recommended

Existing Measure	Description	Action	Effectiveness & Recommendations
<p>Local Open Space and Recreation Plan</p>	<p>Local plan identifying significant natural resources and identifying mechanisms to ensure their protection. Following Mass. Department of Conservation and Recreation guidance for development of OSRPs, this document does not focus on specific hazards.</p> <p>Open Space Plans can provide many tools. Towns must commit to making the land acquisitions and regulatory changes, giving increased attention to preserving undeveloped flood-prone areas and associated lands</p>	<p>Northborough's Open Space and Recreation Plan was recently updated in 2020, was approved by the Massachusetts Division of Conservation Services in 2022 and is valid through January 2028. It included recommendations to include hazard mitigation considerations.</p>	<p>Effective / Very effective</p>

Existing Measure	Description	Action	Effectiveness & Recommendations
Separated Stormwater and Sewer Collection systems	Stormwater and municipal sewer systems remain separate to eliminate CSO's and SSOs, which compromise water quality and can increase flood risk during heavy storm events	Approximately 70% of the town is on private septic systems. Northborough completed a Comprehensive Wastewater Management Planning Process in 2007, which is a 30-year sewer master plan to determine where there are needs for sewer and to determine the best way to meet the need.	Very effective No changes recommended
Drainage system maintenance and repair program	Plan to keep municipal drainage facilities (storm drains, culverts, etc.) in good order	Northborough performs street sweeping and catch basin cleaning from April to November.	Effective Northborough provides stormwater public outreach and education in accordance with MS4 requirements.
Tree Trimming	Plan to ensure routine maintenance of trees to reduce likelihood of vegetative debris in response to storm events	Northborough conducts roadside mowing from April-November to remove juvenile trees. Tree trimming (take-downs and clearing dead branches) takes place as needed by the DPW as well as by National Grid, whom Northborough has a positive relationship with.	Effective Northborough should continue to work with its electrical utility to coordinate a more systematic tree trimming program

Existing Measure	Description	Action	Effectiveness & Recommendations
Culvert Maintenance and Replacement	Maintain existing culverts through regular maintenance and (in some cases) beaver controls; replace/expand culverts where needed to allow for adequate stormwater flow.	The Town has historically maintained and replaced problem culverts when needed and as funding allows.	Somewhat effective Current efforts are limited by available resources. Culvert failures are repaired and replaced as warranted. A townwide culvert inventory was completed in 2019 which provides location, size, and condition.
Mount Pisgah Conservation Area Forest Management Plan	This plan includes preservation, forest management, invasive plant management, and hazard mitigation aspects.	The Mount Pisgah Conservation Area Forest Management Plan was completed in July of 2022. The Northborough Conservation Commission intends to update this plan to comply with the new MA Climate Resiliency Program in 2024.	Effective Implementing this plan will be key. The town's Conservation Commission has approved a contract to hire a professional forester to evaluate and implement a Harvest Plan. This plan will lead to the evaluation and removal of standing dead and dangerous trees in town and will therefore significantly reduce wildfire/brushfire hazards.
Edmund Hill Conservation Area Forest Management Plan	This plan includes preservation, forest management, invasive plant management, and hazard mitigation aspects.	The Edmund Hill Conservation Area Forest Management Plan was completed in July of 2022. The Northborough Conservation Commission intends to update this plan to comply with the new MA Climate Resiliency Program in 2024 to improve carbon sequestration and forest resiliency.	Effective Implementing this plan will be key. The town's Conservation Commission has approved a contract to hire a professional forester to evaluate and implement a Harvest Plan. This plan will lead to the evaluation and removal of standing dead and dangerous trees in town and will therefore significantly reduce wildfire/brushfire hazards.

Existing Measure	Description	Action	Effectiveness & Recommendations
SAFE and Senior SAFE Disaster Training Programs	<p>These state grant programs help local fire departments teach fire safety to children in schools and seniors, respectively.</p>	<p>Northborough has participated in these programs for many years. As part of the SAFE program, children in Northborough schools are taught how to respond in case of an emergency. As part of the Senior SAFE program, seniors in town are taught how to replace smoke alarms and reduce tripping and falling hazards.</p>	<p>Effective</p>
Master Plan	<p>The Master Plan serves as a policy guide as well as the Town's future vision of itself.</p> <p>It compiles a comprehensive analysis of all aspects of community development and is designed to be a resource for the Town over the next 10-20 year time period.</p>	<p>The Northborough Master Plan was adopted in 2020. The Town has a very active Master Plan Implementation Committee. In 2024, the Town has been monitoring progress of the Master Plan. Developers of new developments in town have to provide a statement stating that each new development is in compliance with the Master Plan.</p>	<p>Very Effective</p> <p>In the future, the Town should review the implementation of the Master Plan on a biannual basis instead of every four years. The Town should continue to consider hazard mitigation concerns in Master Plan implementation.</p>

Existing Measure	Description	Action	Effectiveness & Recommendations
Municipal Vulnerability Preparedness (MVP) Plan	This plan is a guide for climate resiliency implementation projects in town. It includes a vulnerability assessment and an action-oriented resiliency plan. This plan makes the town eligible for MVP Action Grant funding.	<p>The Northborough Municipal Vulnerability Preparedness Plan was adopted in 2018.</p> <p>The Town has acted on some recommendations of this plan through other means, but it has not been successful with MVP Action Grant proposals. The town has not referred to this plan as a roadmap for future plans and actions.</p>	<p>Somewhat effective</p> <p>The Town should incorporate its MVP Plan recommendations into its broader planning goals and objectives.</p>
Floodplain Bylaw	The Town's Floodplain Bylaw is part of the Town's Zoning Bylaw, and it includes regulations relating to the Town's Floodplain Overlay District and subdivisions within floodplains in town.	Northborough's Floodplain Bylaw was updated in 2022 to match with the new FEMA flood zones.	<p>Effective</p> <p>The Town would like to further discourage building in flood zones.</p>
Downtown Revitalization Plan	This plan guides future development patterns in Northborough's downtown and promotes adaptive reuse of buildings as well as downtown walkability.	This plan will be updated in 2024, and it will recommend utilizing green infrastructure and street trees to mitigate flood impacts caused in part by climate change in the town center.	<p>Effective</p> <p>The Town approved its MBTA Communities / Multi-Family Development Overlay District bylaw in the Spring of 2024. The Town has also bought planters and has completed sign bylaw changes.</p>

Existing Measure	Description	Action	Effectiveness & Recommendations
Compliance with the state building code, AAB codes, and ADA codes	Compliance with the state building code means that buildings in town meet the minimum established requirements for structural strength, sanitation, and efficiency and are safe for regular use as well as during hazard events and other emergency situations. Compliance with the AAB and ADA codes means that buildings and facilities are accessible to and safe for use by people with disabilities.	The Town's Planning Board, Zoning Board of Appeals, and Building Inspector work to implement compliance with these codes. In 2023, the Town completed its ADA Self-Evaluation and Transition Plan. The state building code will be updated in 2025.	Very Effective
Zoning Bylaw	This part of the Town Charter establishes zoning districts and overlay districts in town as well as defines use regulations, density and dimensional requirements, nonconforming uses and structures, development regulations, and special regulations in town.	The Town's current zoning bylaw was adopted at the April 2009 Town meeting and has been amended several times since.	Very Effective

6.0 STATUS OF MITIGATION MEASURES FROM 2017 PLAN

Section 6.0 helps meet:

- E2. “Was the plan revised to reflect changes in priorities and progress in local mitigation efforts?” (Requirement 44 CFR § 201.6(d)(3))

Town staff provided updates on the status of mitigation measures from Northborough’s 2018 Hazard Mitigation Plan. Certain measures were incomplete as of 2024 and deemed “still relevant”. These actions were reviewed by the Core Team. Some actions were re-incorporated in the 2024 Hazard Mitigation Plan action strategy based on whether they could be completed in the next 5 years, and their perceived effectiveness.

2018 Task	2024 Status	2024 Notes	Include in 2024 Plan?
Structure & Infrastructure Strategies			
Dredge fire ponds which are too shallow and dry out during the summer months. This would also help with stormwater collection and help prevent flooding in the area of the ponds.	In Progress	The town has assigned a senior fire fighter to ascertain the conditions of the fire ponds twice a year. Dredging has not occurred because of the high cost of the water permits required for it. A fire pond was used extensively in April 2023 to fight a fire on Mount Pisgah.	YES
Expand the capacity of the DPW; increase the number of cisterns and fire ponds; increase staff to clear poison ivy from draft sites and dry hydrants, and to constantly clear the drain at Rte. 9 & Rte. 20 which causes flooding.	In Progress	The current number of cisterns and fire ponds works for the Town, a town fire fighter makes sure that cisterns are working each year. The State has addressed the Route 9/20 drainage issue as best as they can.	YES
Develop a back-up strategy for the town’s fuel island. Purchase a generator for the fuel island ensuring the town has access to fuel in the event of an emergency.	In Progress	FEMA rejected a grant application the Town submitted for a generator. The Town does have a backup generator which can give power to fuel island, but it is not an 100% connection. A dedicated stationary generator is still needed.	YES
Repair Bartlett Pond Dam.	No movement on this action yet	This dam is low hazard. The Town’s Conservation Commission just signed a contract for completing invasive plant management at the dam from 2024-2026, but no structural work is proposed under this contract.	YES

Maintain fire roads in the Mount Pisgah area and ensure proper functioning of dry hydrants around Town, especially near Crawford St, Little Chauncy Pond, and I-290	In Progress	The fire roads in town are in very good condition because of improvements made to many of them after the April 2023 Mount Pisgah wildfire. Difficulty of access to this infrastructure, a lack of accurate maps, and poor coordination with the Massachusetts DFW are still all issues for the Town.	YES
Purchase a Utility Vehicle (UTV) for the purpose of monitoring forested areas with limited accessibility.	Completed	The Town has purchased a utility vehicle to help town staff access areas of limited accessibility.	NO
Preparedness, Coordination & Response Action Strategies			
Implement steps from each dam's action/evaluation plan (i.e. Repair Plan), specifically Bartlett Pond Dam. Possible funding through Capital Improvement Plan.	No movement on this action yet	Bartlett Pond Dam is low hazard.	NO
Maintain high-degree of participation with National Grid through their First Responder App.	In Progress	Town staff now have this app on their phones and iPads and have received instructions on how to use it; most of Town's contact with National Grid is still via phone calls though.	YES
Maintain and expand on vegetative debris program (e.g. by acquiring additional equipment), and thereby mitigate risks of stormwater flooding, riverine flooding, winter storm damage, etc., such as through the Central Massachusetts Mosquito Control Project. Possible funding through Capital Improvement Plan.	In Progress	The Town has a debris processing/composting facility on its capital plan that has not been funded yet. The Town would like to create a town debris management plan as an appendix to the Town's Comprehensive Emergency Management Plan.	YES
Continue to sweep streets at least once per year to increase stormwater management capacity; capture and dispose of properly (currently budgeted).	In Progress	The Town's DPW staff sweeps streets in accordance with MS4 permits, starting in the fall of each year.	YES
Continue to properly clean, at least annually, or more often as required, all stormwater structures and basins (currently budgeted).	In Progress	The Town's DPW completed an inventory of stormwater basins in 2023 and is drafting standard operating procedures for preparing stormwater basins.	YES

<p>Continue building a strong relationship with utilities, i.e. National Grid. NE Operations Center on Barefoot Rd. Currently very responsive, including sending appropriate resources to downed poles and wires through picture messages. Build off recently adopted Stretch Code and apply for Green Communities designation.</p>	<p>In Progress</p>	<p>Northborough recently achieved Green Communities status.</p>	<p>YES</p>
<p>Continue to utilize hazard warning systems and notifications: social media, town webpages, Code Red, Warning Siren, and other communication methods. Interns are currently taking senior citizen information to sign them up for CodeRed. Post generator safety and use info on social media. Health Dept. to put out a brochure on 72-hr kits through Town-wide mailing, school children take-home, etc. Maintain internal instant messaging system, allowing for rapid response of emergency personnel.</p>	<p>In Progress</p>		<p>YES</p>
<p>Actively enforce and comply with the state building codes, promote successful working relationship between Fire Marshall and Building Inspector</p>	<p>In Progress</p>	<p>Compliance with state building codes (which were last updated in 2021) for the Town is on target, the Town has a revised energy code for residential and commercial buildings. On January 1st, 2023, the Massachusetts DOER promulgated their own building code guidelines which the Town is working to comply with.</p>	<p>YES</p>
<p>Actively enforce and comply with the Massachusetts Wetlands Protection Act, and enforce local wetlands bylaw.</p>	<p>In Progress</p>	<p>Northborough has a new land disturbance and stormwater management bylaw under the jurisdiction of the Town's Conservation Commission.</p>	<p>YES</p>
<p>Continue to engage with OARS (Organization for the Sudbury, Assabet, and Concord Rivers) and the Mass Association of Conservation Commissions to support wetlands protection, river corridor acquisition, etc.</p>	<p>In Progress</p>	<p>The Town is actively engaged in OARS.</p>	<p>YES</p>

<p>Continue to engage with the Local Emergency Planning Committee (LEPC) and Central Region Homeland Security Advisory Council (CRHSAC) for increased communication and coordination between local, regional, state, and federal agencies regarding disasters and emergencies.</p>	<p>In Progress</p>	<p>LEPC meetings are held twice a year.</p>	<p>YES</p>
<p>Education & Awareness Strategies</p>			
<p>Educate all segments of the community about hazard mitigation and the impacts that disasters can have on the community through social media, brochures, and mailings. Also, educate on water conservation methods.</p>	<p>In Progress</p>	<p>The Northborough Fire Department consistently makes posts on its social media accounts promoting awareness of hazard mitigation and high fire danger. They provide information such as “this is what red flag days mean.” The Town releases a water conservation report once a year, and the Town has not been under water use restrictions yet. The Town tries to reach as many audiences as possible in its hazard mitigation outreach. As a response to COVID, the Northborough Health Department recently put together a very comprehensive resource guide that can help people find assistance and includes the contact information of emergency personnel; continued outreach relating to this guide should be added to this strategy.</p>	<p>YES</p>
<p>Promote available educational material (state/federal) especially to students, regarding disasters at measures they can take to limit risks.</p>	<p>In Progress</p>		<p>YES</p>
<p>Pursue educational opportunities in regards to grant writing. Hold regional workshop about Hazard Mitigation Grant Writing.</p>	<p>No movement on this action yet</p>	<p>The Town applied for hazard mitigation grant for a generator at the Town’s fuel island but was unsuccessful due to FEMA not funding generators at the time; the Town will be applying for this generator again and has otherwise been fairly successful in receiving grants. This strategy should be reoriented</p>	<p>YES</p>

		towards town staff writing hazard mitigation grants.	
Fund mailings for Fire Safety	No movement on this action yet	The Town has not sent out any mailings yet relating to fire safety. The state SAFE and Senior SAFE programs, which, respectively, promote fire safety in schools and to seniors, were recently launched in town; this strategy should be reoriented towards these programs.	YES
Develop educational materials for residents about protecting wetlands	In Progress	The Town has yet provided education about protecting wetlands through the process of meeting its MS4 requirements. It wants to provide more of this type of education through SAFE grant funding in the future.	YES
Local Plan & Regulation Strategies			
Continue to share information at Local Emergency Planning Committee meetings, and Central Mass Regional Homeland Security Council meetings, about successful hazard mitigation planning and programs. Create a feedback loop to improve predisaster planning by establishing a formal post-disaster assessment process.	In Progress	This action has been ongoing.	YES
Expand the use of the Capital Improvement Program for vegetation removal equipment, paving, and dam repair. Encourage new Committee to look at hazard mitigation in their long term planning for improvements.	In Progress	Vegetation removal equipment, paving, and dam repair have been funded through the Capital Improvement Program.	YES
Enforce underground utility requirements in local subdivision regulations and retrofitting of existing infrastructure.	In Progress	The Town recently updated its site plan review requirements so that underground utilities are now required for new subdivisions and retrofits.	YES

<p>Integrate hazard mitigation into subdivision, site plan review, 40B review, and other zoning reviews. In particular, require the consideration of downstream flooding impacts caused by new projects. Enforce the reduction of impervious surface (pavement) and reserve parking for recharge and retention of stormwater. Enforce groundwater protection in overlay district.</p>	<p>In Progress</p>	<p>Northborough must rezone certain parcels because it is an MBTA community, and the Town is continuing 40b review of parcels. It has many wetlands and wellhead protection areas. The Town adopted a new Stormwater Management and Land Disturbance Bylaw in August 2021 which considers stormwater runoff treatment/mitigation, downstream flooding impact assessment, impervious area recharge and groundwater protection. The Town also needs to update its subdivision regulations as well as complete a zoning bylaw review. The Town's FEMA maps are being redrawn.</p>	<p>YES</p>
<p>Maintain Unified Incident Command program, continue training local officials in ICS</p>	<p>In Progress</p>	<p>Northborough town department heads are encouraged to get minimum Unified Incident Command training. The Town implemented an ICS structure in July 2023.</p>	<p>YES</p>
<p>Continue to inventory shelter supplies and emergency resources, identify resources that are available at any shelters and if the shelters would be impacted by an emergency. This would help ensure suitable shelters are available for different types of natural hazards. Plan and administer walkthroughs so emergency management knows shelter layouts. Overnight shelters should be inspected by the State Building Department for compliance.</p>	<p>In Progress</p>	<p>This action has been ongoing, the Town has a trailer that holds all shelter supplies and the Town's shelter manager makes sure that the supplies are available when they are needed. The Town updated their memorandums of understanding with its emergency shelters in July 2023. The Town does not currently have a pet friendly shelter, and the only overnight shelter in town is at the middle school. The Town's warming center is the Senior Center because this building is mostly (but not 100%) powered by a generator.</p>	<p>YES</p>
<p>Study the possibility of creating a regional shelter with a neighboring town. This would help limit the expense of maintaining separate shelters when towns have a limited budget.</p>	<p>In Progress</p>	<p>The Town has extensively discussed the potential for a regional shelter with officials in Shrewsbury.</p>	<p>YES</p>

Create a Road Bylaw, ensuring new development will have roads able to handle emergency vehicles and proper drainage infrastructure is built	In Progress	The Town has a common driveway bylaw and has adopted a Complete Streets Prioritization Plan.	NO
Continue to actively enforce and comply with State Building Code Requirements, ensure proper certification for inspectors	In Progress	This action has been ongoing.	YES
Enforce the Local Wetlands Bylaw	Completed	This action has been completed, as the Local Wetlands Bylaw was updated in September 2019 to include hazard mitigation consideration. The Town's 2021 stormwater bylaw also needs to be actively enforced.	NO
Update your Hazard Mitigation Plan every five years, and monitor implementation	In Progress	This action has been ongoing.	YES
Incorporate hazard mitigation into local and regional plans such as, Master Plan, land use, transportation, Open Space and Recreation Plan and Capital Improvement Plans	In Progress	Hazard mitigation considerations have been incorporated into the Town's recent Master Plan and Open Space and Recreation Plan (OSRP) updates as well as the Town's Municipal Vulnerability Preparedness (MVP) Plan.	YES
Establish Floodplain zoning district and bylaw to require all development to be in compliance with state building code requirements for construction in floodplains.	Completed	The Town's Floodplain Zoning District was updated in 2022 and is compliant with recent changes to the Town's stormwater regulations.	NO

7.0 MITIGATION STRATEGY

The Northborough Hazard Mitigation Planning team developed a list of mitigation strategies (both new and previously identified by local officials) and prioritized them using the criteria described below. This list of factors is broadly derived from FEMA's STAPLE+E feasibility criteria.

7.1 PRIORITY AND IMPACT

Section 7.1 helps meet:

- C5. "Does the plan contain an action plan that describes how the actions identified will be prioritized (including a cost-benefit review), implemented, and administered by each jurisdiction?" (Requirement 44 CFR § 201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))

Real world considerations were brought into the analysis to inform the priority ranking process for the different mitigation strategies. Factors considered in this step include costs and cost effectiveness (including eligibility and suitability for outside funding), timing, political and public support, and local administrative burden. Each strategy was ranked as being high, medium, or low priority.

- High priority strategies have obvious mitigation impacts that clearly justify their costs and to a large degree can be funded, can be completed in a timely fashion, can be administered effectively, and are locally supported.
- Medium priority strategies have some clear mitigation impacts that generally justify their costs and generally can be funded, can be completed in a timely fashion, can be administered effectively, and are locally supported.
- Low priority strategies have relatively low mitigation impacts that do not necessarily justify their costs and may have difficulty being funded, being completed in a timely fashion, being administered effectively, and garnering local support.

Costs and cost effectiveness – in order to maximize the effect of mitigation efforts using limited funds, priority is given to low-cost strategies. For example, regular tree maintenance is a relatively low-cost operational strategy that can significantly reduce the length of time of power outages during a winter storm. Strategies that have clear and viable potential funding streams, such as FEMA's Hazard Mitigation Grant Program (HMGP), are also given higher priority.

Time required for completion - Projects that are faster to implement, either due to short work duration, current or near-term availability of funds, and/or ease of permitting or other regulatory procedures, are given higher priority.

Political and public support - Strategies are given higher priority if they have political and/or public support which is shown through public feedback, prioritization in previous regional and local plans, initiatives that were locally initiated or adopted, and/or prioritization in the Community Resilience Building workshop process.

Administrative burden – Strategies that are realistically within the administrative capacity of the town and its available support network (CMRPC, local non-profit organizations, regional collaborative associations etc.) are prioritized. Grant application requirements, grant administrative requirements (including audit requirements), procurement, and staff time to oversee projects are all considered when figuring out the administrative burden of a strategy.

Impact – The HMP Core Team's consideration of each strategy included an analysis of the mitigation impact each can provide, regardless of cost, political support, funding availability, and other

constraints. The intent of this step is to separately evaluate the theoretical potential benefit of each strategy to answer the question: if cost were no object, what strategies have the most benefit? Factors considered in this analysis include the number of hazards each strategy helps mitigate (more hazards equals higher impact), the estimated benefit of the strategy in reducing loss of life and property (more benefit equals higher impact), and the geographic extent of each strategy's benefits (other factors being equal, a larger area equals higher impact).

- High impact actions help mitigate several hazards, substantially reduce loss of life and property (including loss of critical facilities and infrastructure), and/or aid a relatively large portion of the community.
- Medium impact actions help mitigate multiple hazards, somewhat reduce loss of life and property (including loss of critical facilities and infrastructure), and/or aid a sizeable portion of the community.
- Low impact actions help mitigate a single hazard, lead to little or no reduction in loss of life and property (including loss of critical facilities and infrastructure), and/or aid a highly localized area.

7.2 ESTIMATED COST

Each implementation strategy is provided with a rough cost estimate based on available third party or internal estimates and past experience with similar projects. Each includes hard costs (construction and materials), soft costs (engineering design, permitting, etc.), and where appropriate Town staff time (valued at appx. \$25/hour for grant applications, administration, etc.). Projects that already have secured funding are noted. Detailed and current estimates were generally not available, so costs are summarized within the following ranges:

- Low – less than \$50,000
- Medium – between \$50,000 – \$100,000
- High – over \$100,000

7.3 TIMELINE

Each strategy is provided with an estimated length of time it will take for implementation. For strategies for which funding has been secured, a specific future date is provided for when completion is expected. However, most projects do not currently have funding and thus it is difficult to know exactly when they will be completed. For these projects, an estimate is provided for the amount of time it will take to complete the project once funding becomes available. Each strategy has a timeframe of either a specified period of less than 5 years, a 5+ year timeframe, or an ongoing timeframe.

7.4 STRATEGY TYPES

Mitigation strategies are subdivided into the following four broad categories so that they can facilitate local implementation discussions, especially regarding budget considerations and roles/responsibilities:

Structure and Infrastructure Projects relate to constructing “brick & mortar” infrastructure and building improvements in order to eliminate or reduce hazard threats or in order to mitigate the impacts of hazards. Examples of this type of project include drainage system improvement, dam repair, and generator installation. Structure and infrastructure improvements tend to have the greatest level of support at the local level but are highly constrained by funding limits.

Preparedness, Coordination and Response Actions ensure that a framework exists to facilitate

and coordinate the administration, enforcement and collaboration activities described in this plan. They integrate disaster prevention/mitigation and preparedness into every relevant aspect of town operations, including the operations of the Police, Fire Department, EMD, EMS, DPW, Planning Board, Conservation Commission and Select Board; they also help the Town coordinate with neighboring communities where appropriate. Recommendations in this category often help standardize generally practiced activities.

Education and Awareness Programs help raise awareness of overall or hazard-specific risk and generate support for individual or community-wide efforts to reduce risk. Awareness and education seek to affect broad patterns of behavior. Awareness-building activity tends to have a fairly slow effect, although in the end it can provide extraordinary benefits with relatively little cash outlay.

Local Plans and Regulations propose updates to or formally update or establish local bylaws, ordinances and other regulations to protect vulnerable resources and prevent future natural hazard impacts on these resources. They can also review the effectiveness of past mitigation projects, programs, procedures, and policies so that strategies for making them more effective in the future can be formed. An example of a project which fits under this category is incorporating mitigation planning into master plans, open space plans, capital improvement plans, facility plans, and other town plans.

Planning and regulatory activity tends to provide extraordinary benefits to towns with relatively little cash outlay. However, in smaller communities where planning activities are largely the purview of volunteers, outside assistance from the state or regional levels may be required to maximize the benefits of planning. Political support may be difficult to achieve for some planning and regulatory measures, especially those that place new constraints on land use.

In addition to describing action items in each of these categories, the row for each strategy also identifies what hazard(s) the strategy is intended to address. Each row also identifies the lead organization who serves as the primary point of contact for coordinating efforts associated with that strategy and identifies potential funding sources for implementing the strategy.

7.5 TOWN OF NORTHBOROUGH 2024 HAZARD MITIGATION STRATEGIES

Section 7.5 helps meet:

- C3. “Does the plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards?” (Requirement 44 CFR § 201.6(c)(3)(i));
- C4. “Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure?” (Requirement 44 CFR § 201.6(c)(3)(ii)); and
- C5. “Does the plan contain an action plan that describes how the actions identified will be prioritized (including a cost-benefit review), implemented, and administered by each jurisdiction?” (Requirement 44 CFR § 201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))

OVERALL GOAL: Facilitate activity within the Town of Northborough that reduces the loss, and risk of loss, to persons, property, and the environment. Please view section 8.4, Potential Federal and State Funding sources, for more information on the funding sources listed below.

Actions	Hazards Addressed	Agencies Involved	Potential Funding Sources	Priority	Impact	Estimated Cost	Timeline
Structure & Infrastructure Strategies							
Dredge fire ponds which are too shallow and dry out during the summer months. This would also help with stormwater collection and help prevent flooding in the area of the ponds.	WF, FL, ST	Fire, DPW	Federal (FEMA Assistance to Firefighters Grant, other FEMA Grants), State (EEA grants), Local (general operating budget)	Low	Medium	High	2-3 years

Expand the capacity of the DPW; maintain the number of cisterns and fire ponds; continue to clear poison ivy from draft sites and dry hydrants, and to constantly clear the drain at Rte. 9 & Rte. 20 which causes flooding.	WF, DR, FL	State, DPW, Fire	State (EEA grants), Local (general operating budget)	Medium	Medium	Medium	3-5 years
Develop a back-up strategy for the town's DPW building, including the fuel island. Purchase a dedicated stationary generator for the DPW building, including the fuel island, to ensure that the town has access to fuel in the event of an emergency.	All	DPW	State (MassWorks) Federal (BRIC Grant, USDA Community Facilities Direct Loan & Grant Program), Local (general operating budget)	Low	Medium	High	2-3 years
Repair Bartlett Pond Dam to mitigate / remove invasive species.	DF, ST, FL, IS	CC	Local (general operating budget), State (MVP Action Grant), State / Federal (National Dam Safety Program)	Low	Medium	High	2-3 years
Map and maintain fire roads in conservation areas.	WF	DPW, Fire, Trails Committee, CC	Local (general operating budget), State (DLTA, LPA)	High	High	High	1-2 years
Ensure proper functioning of dry hydrants around Town, especially near Crawford St, Little Chauncy Pond, and I-290.	WF	DPW, Fire, CC	Local (general operating budget), State (EEA grants)	Medium	Medium	Medium	1-2 years
Incorporate energy efficiency measures as part of municipal building projects.	All	All town departments, Schools	Local (town appropriations), State (DEP funding, MVP Action Grant, DOER grants), Federal (BRIC Grant)	High	High	High	Ongoing

Incorporate low-impact development (LID) measures to reduce heat island impacts and deal with stormwater mitigation issues.	FL, XT	All town departments	Local (town appropriations), State (DEP funding, MVP Action Grant, DOER grants), Federal (BRIC, FMA Grants)	Medium	Medium	Medium	Ongoing
Explore options for working with MassDOT to construct water retention structures / swales at the RT-9 - RT-20 Interchange.	FL	DPW, MassDOT, CC	Local (town appropriations), State (MVP Action Grant, MassWorks), Federal (BRIC, FMA grants)	High	High	High	2-5 years
Explore establishing a redundant MWRA connection, as recommended by MassDEP, to ensure a reliable water supply for the Town.	DR, XT	DPW	State (Statewide Water Management Act Grant)	High	High	High	4 years
Remove dams and restore streams, prioritizing continuing work on the removal of Northborough Reservoir Dam. Explore options for acquiring and removing other significant and high hazard dams within town.	FL, DF	DPW, CC	State (EEA and DER grants), Federal (FEMA grants (incl. National Dam Safety Program, High Hazard Potential Dams Grant))	High	High	High	Ongoing, 1-2 years for the Northborough Reservoir Dam
Provide critical municipal facilities (such as the town hall, senior center, and library) with backup power to provide heating and cooling in extreme conditions.	All	DPW, Select Board, Council on Aging, Library	Local (town appropriations), Federal (FEMA BRIC Grant)	High	High	Medium / High	1-2 years

Install cooling and/or dehumidification at Melican Middle School, the Town's emergency shelter.	DR, XT	DPW, School Committee	Local (town appropriations), Federal (FEMA BRIC Grant)	Medium	Medium	Low / Medium	1-2 years
Establish alternative energy sources, such as rooftop solar panels, to provide energy resiliency for the community. Look into other resiliency projects surrounding green energy such as municipal power grids.	All	Planning Department, Select Board	Local (town appropriations) State (EEA and DOER grants), Federal (EPA grants)	Medium	Medium	High	1-2 years
Protect underground utilities like gas, water, and sewer by implementing redundancies to those systems.	All	DPW, National Grid	Local (town appropriations), National Grid funding	Medium	Medium	High	1-2 years
Drainage improvements at Church Street.	FL	DPW	Local (town appropriations), State (EEA and DER grants (the latter includes the Culvert Replacement Municipal Assistance Grant Program), Federal (National Culvert Removal, Replacement, and Restoration Grant, BRIC, FMA Grants)	High	Medium	High	2-5 years
Install air filters at emergency shelter locations to increase resiliency to wildfire hazards.	WF	DPW, Fire, Select Board	Local (town appropriations)	Low	Low / Medium	Low	0-1 years

Strive to meet gold or platinum LEED certification for new public building projects. These certifications can be achieved through daylighting, solar panel installations, green roofs, rain gardens, tree planting, and electric charging stations.	All	Planning Department, Select Board	Local (town appropriations), State (Green Communities Grants, MVP Action Grant), Federal (HUD Grants)	Medium	High	High	Ongoing
Preparedness, Coordination & Response Action Strategies							
Maintain high degree of participation with National Grid through their First Responder App.	All	Fire, Police, DPW	Local (general operating budget)	Medium	Medium	Low	Ongoing
Maintain and expand on vegetative debris program (e.g. by acquiring additional equipment), and thereby mitigate risks of stormwater flooding, riverine flooding, winter storm damage, etc., such as through the Central Massachusetts Mosquito Control Project. Possible funding through Capital Improvement Plan. Create a town debris management plan as an appendix to the Comprehensive Emergency Management Plan and have it approved by FEMA.	ST, SS, FL	DPW	State (EEA grants, DEP funding, MEMA Grants), Local (capital funding)	Low / Medium	High	Low	Ongoing

Continue to sweep streets at least once per year to increase stormwater management capacity; capture and dispose of properly (currently budgeted).	ST, SS, FL, HU	DPW, DOT	Local (general operating budget)	High	High	Low	Ongoing
Continue to properly clean, at least annually, or more often as required, all stormwater structures and basins (currently budgeted).	ST, SS, FL, HU	DPW	Local (general operating budget)	High	High	Low	Ongoing
Continue building a strong relationship with utilities, i.e. National Grid. NE Operations Center on Barefoot Rd. Currently very responsive, including sending appropriate resources to downed poles and wires through picture messages. Build off recently adopted Stretch Code and utilize Green Communities designation.	All	Local, State, Utilities	State (Green Communities grant funding), Local (general operating budget)	Medium	High	Low	Ongoing
Continue to utilize hazard warning systems and notifications: social media, town webpages, Code Red, and other communication methods. Interns are currently taking senior citizen information to sign them up for CodeRed. Post generator safety and use info on social media. Health Dept. to put out a brochure on 72-hr kits	All	Local	Local (general operating budget)	High	High	Low	Ongoing

through Town-wide mailing, school children take-home, etc. Maintain internal instant messaging system, allowing for rapid response of emergency personnel							
Actively enforce and comply with the 2021 update of the state building codes, promote successful working relationship between Fire Marshall and Building Inspector.	All	Building Dept., Fire, PB, CC, ZBA	Local (general operating budget)	High	High	Low	Ongoing
Actively enforce and comply with the Massachusetts Wetlands Protection Act and enforce local wetlands bylaw.	FL, ST	CC	Local (general operating budget)	High	High	Low	Ongoing
Continue to engage with the Watershed Organization for the Sudbury, Assabet, and Concord Rivers (OARS) and the Mass Association of Conservation Commissions to support wetlands protection, river corridor acquisition, etc.	FL, ST	CC	Local (general operating budget)	Medium	Medium	Low	Ongoing
Continue to engage with the Local Emergency Planning Committee (LEPC) and Central Region Homeland Security Advisory Council (CRHSAC) for increased communication and coordination between local, regional, state, and federal agencies regarding disasters and emergencies.	All	All	Federal Homeland Security grant funding through MEMA and CRHSAC, Local (general operating budget)	High	High	Medium	Ongoing

Plan for and actively manage forests owned by the Northborough Conservation Commission to reduce wildfire risks and prevent damage from invasive species.	WF, IS	CC, Trails Committee	State (MA DCR (community forest implementation grants, forest climate resilience grants)), Local (CPA, capital expenditure, town meeting, town budget)	Medium	Low / Medium	Medium	2 years
Continue to partner with utilities for local tree trimming measures and the removal of dead and dying trees.	WF, IS, XT	DPW, National Grid	National Grid, Local (general operating budget)	Medium	Medium	Low	Ongoing
Encourage tree planting on public lands through collaboration between the DPW, local civic organizations, and the local school district. Incorporate nature-based mitigation measures and design into municipally/publicly owned lands.	WF, IS, XT	DPW, Schools, Civic Organizations	National Grid, State (MVP Action Grant), Federal (EPA grant funding), Local (CPA), Arbor Day Foundation	Medium	High	Low	Ongoing
Protect additional open space for hazard mitigation purposes through acquisition or conservation restriction, especially floodplains, riverfront areas, wetlands, and steep slopes.	All, especially FL	Open Space Committee, CC, Metacomet Land Trust, DCR, Community Preservation Committee	Local (CPA), State (DCS LAND Grant, DFW grants, EEA grants), Federal (BRIC, FMA Grants)	Medium	Medium	High	Ongoing
Consider beaver removal strategies. Complete a beaver management plan.	FL, DF	DPW, CC	State (EEA grants), Local (general operating budget, town appropriations)	Low	Low	Low / Medium	3 years
Seek out best practices and funding available to mitigate roadside invasive vegetation species	IS	DPW	Local (town operating budget)	Medium	Medium	Medium	2-3 years

Communicate with the Office of Dam Safety on the condition of Smith Pond Dam / Otis Street Dam.	DF	DPW, DCR ODS, MEMA	Local (town operating budget)	Low	Medium	High	Ongoing
Evaluate and rank projects impacting flood prone streets/areas.	FL	Planning Department, DPW, CC	Local (general operating budget)	High	Medium	Low	0-1 years
Maintain and improve emergency services for vulnerable populations such as seniors, which could require increasing emergency transportation options (rideshare options), diversifying communications, expanding planning, and ensuring reliable power.	All	Fire, Council on Aging, Planning Department, Select Board, Police, DPW	Local (general operating budget, town appropriations), State (DLTA, Support and Incentive Grant, Green Communities Grants MassWorks), Federal (BRIC Grant, USDA Community Facilities Direct Loan & Grant Program), Federal Homeland Security grant funding through MEMA and CRHSAC	High	High	High	Ongoing
Evaluate climate change's impacts on private drinking water wells.	DR, XT, FL	BOH, Planning Department	Local (general operating budget)	Low / Medium	Low / Medium	Low	1-2 years, then ongoing
Protect municipal buildings and services against flooding and provide adequate staffing and training.	FL	DPW, Fire	Local (general operating budget, town appropriations), State (EEA grants, DER grants), Federal (BRIC and FMA Grants)	High	High	High	Ongoing

Prepare a communications plan and practice emergency protocols to ensure adequate staffing and equipment, spread knowledge of evacuation routes and services, and stock the materials needed to sustain evacuated residents.	All	All town departments	Local (general operating budget, town appropriations), State (MEMA grants), Federal Homeland Security funding through CRHSAC and MEMA	High	High	Medium	2-3 years
Add language options to the CodeRed system.	All	Fire	Local (general operating budget), State (LPA, MEMA grants), Federal (FEMA grants)	Medium	Medium / High	Low / Medium	0-1 years
Education & Awareness Strategies							
Educate all segments of the community about hazard mitigation and the impacts that disasters can have on the community through social media, brochures, the town website, and mailings. Educate on water conservation methods. Continue outreach of health department resource guide.	All	EMD, DPW, Fire, Police	Local (general operating budget), State (DLTA, LPA, MEMA grants), Federal (FEMA grants)	Medium	High	Low	Yearly
Promote available educational material (state/federal) especially to students, regarding disasters at measures they can take to limit risks.	All	Fire, Police, Schools	Local (general operating budget), State (DLTA, LPA, MEMA grants), Federal (FEMA grants)	Medium	High	Low	Yearly
Provide fire safety education through the SAFE and Senior SAFE programs, social media, the town website, and in-person outreach.	WF, DR	Fire	Local (general operating budget), State (SAFE and Senior SAFE, MEMA grants), Federal (FEMA grants)	Low	Low	Low	Ongoing

Continue to develop and distribute educational materials for residents about protecting wetlands, preventing flooding, and stormwater mitigation.	DR, WF, ST, HU	CC	Local (general operating budget)	Low	Low	Low	Ongoing
Support local public health initiatives and evaluate management of public health related concerns.	IS, XT, DR	BOH	Local (general operating budget)	Medium / High	Medium	Low	Ongoing
Utilize partners to communicate to vulnerable populations and broader audiences (schools, healthcare system, churches, community cable access TV, etc.)	All	All town departments	Local (general operating budget)	Low	Medium	Low	Ongoing
Continue education and outreach on tick and mosquito-borne diseases and evaluate management of disease carrying insects.	IS	BOH	Local (general operating budget)	Medium	Medium	Low	Ongoing
Educate residents about invasive species using existing and new resources. Provide the community with tools to manage invasive species.	IS	CC	Local (general operating budget)	Low	Low / Medium	Low	Ongoing

Educate the public about strategies for preventing basement flooding, such as with rain gardens or other nature-based and small-scale mitigation strategies.	FL	DPW	Local (general operating budget)	Low	Low	Low	Ongoing
Add links to online sustainability resources (such as Think Blue) to the town website.	All	Planning Department	Local (general operating budget)	Low	Low / Medium	Low	0-1 years
Local Plan & Regulation Strategies							
Continue to share information at Local Emergency Planning Committee meetings, and Central Mass Regional Homeland Security Council meetings, about successful hazard mitigation planning and programs. Create a feedback loop to improve pre- disaster planning by establishing a formal post-disaster assessment process.	All	EMD, LEPC, State	Local (general operating budget), State (MEMA Grants), Federal Homeland Security grant funding via MEMA and CRHSAC	Medium	Low	Low	1-2 years
Expand the use of the Capital Improvement Program for vegetation removal equipment, paving, and dam repair.	All	Capital Improvement Committee	Local (capital funding), State (MassWorks, EEA grants), Federal (BRIC Grant, National Dam Safety Program, Rehabilitation of High Hazard Potential Dam Program)	High	High	Medium	Ongoing

Write Hazard Mitigation grants.	All	Fire, Police, DPW, Planning Department	Local (general operating budget)	Medium	Medium / High	Medium	Ongoing
Enforce underground utility requirements in local subdivision regulations and zoning bylaw.	All	Planning Department	Local (general operating budget), State (EEA Planning Assistance Grant)	Medium	Medium	Low	1 year
Update subdivision regulations to incorporate current construction practices and stormwater mitigation measures. Create homeowners' associations to permanently maintain stormwater basins and fire protection systems (such as cisterns). Update the common driveway bylaw.	FL	Planning Department, DPW	Local (capital funding)	High	Medium	Low	1 year
Integrate hazard mitigation into subdivision, site plan review, 40B review, and other zoning reviews. In particular, require the consideration of downstream flooding impacts caused by new projects. Enforce the reduction of impervious surface (pavement) and reserve parking for recharge and retention of stormwater. Enforce groundwater protection in overlay district.	FL, ST	Building Department, Department, DPW, Fire, CC	Local (general operating budget), State (EEA Planning Assistance Grant)	Medium	Medium	Low	Ongoing

Maintain Unified Incident Command program, continue training local officials in ICS/NIMS	All	All Town Departments	Local (general operating budget), State (MEMA Grants), Federal Homeland Security funding via MEMA and CRHSAC	Medium	Medium	Low	Ongoing
Evaluate, update, and maintain public safety communications system infrastructure.	All	Police, Fire, IT, DPW	Local (Capital funding), State (Support and Incentive Grant), Federal (ARPA)	High	High	High	0-3 years
Continue to inventory shelter supplies and emergency resources, identify resources that are available at any shelters and if the shelters would be impacted by an emergency. This would help ensure suitable shelters are available for different types of natural hazards. Plan and administer walkthroughs so emergency management knows shelter layouts. Overnight shelters should be inspected by the State Building Department for compliance.	All	EMD, Shelter Coordinator, State Building Department	Local (general operating budget), State (MEMA Grants), Federal Homeland Security funding via MEMA and CRHSAC	Low	Low	Low	Ongoing
Study the possibility of creating a regional shelter with a neighboring town. This would help limit the expense of maintaining separate shelters when towns have a limited budget.	All	EMD, neighboring towns	Local (general operating budget), State (MEMA Grants), Federal Homeland Security funding via MEMA and CRHSAC	Medium	Medium	Low	1-2 years
Continue to actively enforce and comply with State Building Code	All	Building Department	Local (general operating budget)	High	Medium	Low	Ongoing

Requirements. Ensure proper certification for inspectors.							
Actively enforce and comply with the stormwater management bylaw under the jurisdiction of the Conservation Commission.	FL, ST	CC	Local (general operating budget)	High	High	Low	Ongoing
Update the Hazard Mitigation Plan every five years, and monitor implementation by meeting to review mitigation strategies annually.	All	Fire, Police, DPW, EMS, Planning, Con Com, EMD	Local (general operating budget)	High	Medium	Low	Ongoing
Continue to incorporate hazard mitigation into local and regional plans such as, Master Plan, land use, transportation, Open Space and Recreation Plan and Capital Improvement Plans.	All	All Town Departments, LEPC, PDA	Local (general operating budget), State (EEA Planning Assistance Grant), Federal (BRIC Grant)	Medium	Medium	Low	Ongoing

'Hazards Addressed' abbreviations:

- | | | | |
|----|--------------------------------------|----|---|
| DF | Dam Failure | DR | Drought |
| EQ | Earthquake | FL | Flooding |
| HU | Hurricane | IS | Invasive Species |
| OT | Other | SS | Severe Snowstorm / Ice Storm / Nor'easter |
| ST | Severe Thunderstorm / Wind / Tornado | WF | Wildfire / Brushfire |
| XT | Extreme Temperatures | | |

'Who? Agencies Involved' abbreviations:

- | | | | |
|-------|--|------|------------------------------------|
| CMRPC | Central Mass. Regional Planning Commission | CC | Conservation Commission |
| DPW | Department of Public Works | EMD | Emergency Management Director |
| PB | Planning Board | LEPC | Local Emergency Planning Committee |
| ZBA | Zoning Board of Appeals | | |

8.0 PLAN ADOPTION, IMPLEMENTATION, AND MAINTENANCE

8.1 PLAN ADOPTION

Update paragraph after plan finalization

A public meeting was held on July 15th, 2024 as part of the Select Board's meeting in order detail the planning process to date and to solicit comments and feedback from the public on the draft Northborough Hazard Mitigation Plan then being developed. The draft plan was provided to the Town for distribution and posted on CMRPC's website from DATE for public review and input. The Plan was then submitted to the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency (FEMA) for their review. Upon receiving conditional approval of the plan by FEMA, the final plan was adopted by vote of the Northborough Select Board and certified on [Insert Date].

8.2 PLAN IMPLEMENTATION

Section 8.2 helps meet:

- A4. "Does the plan describe the review and incorporation of existing plans, studies, reports, and technical information?" (Requirement 44 CFR § 201.6(b)(3)); and
- E2. "Was the plan revised to reflect changes in priorities and progress in local mitigation efforts?" (Requirement 44 CFR § 201.6(d)(3)).

The Town of Northborough has taken steps to implement findings from the 2018 Hazard Mitigation Plan into the following policy, programmatic areas and plans: the 2020 Municipal Vulnerability Preparedness Plan, the 2020 Master Plan, and the 2020 Open Space and Recreation Plan.

The implementation of the 2024 plan update began upon its formal adoption by the Select Board and approval by MEMA and FEMA. Town departments and boards responsible for ensuring the development of policies, ordinance revisions, and programs as described in Section 6 and Section 7 of this plan will be notified of their responsibilities immediately following approval. The Hazard Mitigation Team will oversee the implementation of the plan.

Incorporation with Other Planning Documents

Existing plans, studies, reports, and municipal documents were incorporated throughout the planning process. This included a review and incorporation of significant information from the following key documents:

- ***Northborough Comprehensive Emergency Management Plan*** (particularly the Critical Infrastructure Section) – the Critical Infrastructure section was used to help identify infrastructure components in Town that have been identified as crucial to the function of the Town; this resource was also used to identify potentially vulnerable populations and potential emergency response shortcomings.
- ***Regional Evacuation Plan*** – Funded by Homeland Security via the Commonwealth of Massachusetts and the Central Regional Homeland Security Advisory Council, the regional evacuation plan prepared by CMRPC was used to identify evacuation routes and shelters.
- ***Northborough Open Space and Recreation Plan*** – This Plan was used to identify the natural context within which mitigation planning would take place. This proved useful insofar as it identified water bodies, rivers, streams, infrastructure components (i.e., water and sewer, or the lack thereof), as well as population trends. This was incorporated to ensure that the

Town's mitigation efforts would be sensitive to the surrounding environment. It should be noted that this plan has expired and is in the process of being updated.¹⁰⁶

- **Northborough Zoning Bylaw** –Zoning was used to gather identify those actions that the town is already taking that are reducing the potential impacts of a natural hazard (i.e., floodplain regulations) to avoid duplicating existing successful efforts.¹⁰⁷
- **Northborough Master Plan** – This plan was used to identify the main priorities for the Town so that the Hazard Mitigation Plan's strategies can align with these priorities.¹⁰⁸
- **Northborough Municipal Vulnerability Preparedness Plan** – Recommendations from this plan deemed important to hazard mitigation by the planning team in town were incorporated into the Hazard Mitigation Plan's mitigation strategies.¹⁰⁹
- **ResilientMass State Hazard Mitigation and Climate Adaptation Plan** - This plan was used to ensure that the town's HMP data and priorities are consistent with the State's data and priorities.¹¹⁰
- **2022 Massachusetts Climate Change Assessment** - This plan was used to ensure that the town's HMP data and priorities, especially in the hazards section of the plan, are consistent with the State's data and priorities.¹¹¹

After this plan has been approved by both FEMA and the local government, links to the plan will be emailed to all Town staff, boards, and committees, with a reminder to review the plan periodically and work to incorporate its contents, especially the action plan, into other planning processes and documents. In addition, during annual monitoring meetings for the Hazard Mitigation Plan implementation process, the Hazard Mitigation Team will review whether any of these plans are in the process of being updated. If so, the Hazard Mitigation Team will remind people working on these plans, policies, etc., of the Hazard Mitigation Plan, and urge them to incorporate the Hazard Mitigation plan into their efforts. The Hazard Mitigation Team will also review current town programs and policies to ensure that they are consistent with the mitigation strategies described in this plan. The Hazard Mitigation Plan will also be incorporated into updates of the Town's Comprehensive Emergency Management Plan.

¹⁰⁶ Town of Northborough Open Space Committee et al., "Town of Northborough Open Space and Recreation Plan – 2020," Town.northborough.ma.us, The Town of Northborough, accessed June 21, 2024, https://www.town.northborough.ma.us/sites/g/files/vyhliif12221/f/news/northborough_open_space_and_recreation_plan_approved_12_2_22.pdf.

¹⁰⁷ "Town of Northborough, MA Municipal Code - Part 7: Zoning," Ecode360.com, The Town of Northborough, accessed June 21, 2024, <https://ecode360.com/41986945#41986945>.

¹⁰⁸ VHB in association with Landwise, "Town of Northborough 2020 Master Plan," Town.northborough.ma.us, The Town of Northborough, June 2020, https://www.town.northborough.ma.us/sites/g/files/vyhliif12221/f/pages/northborough_master_plan_-_complete_document.pdf.

¹⁰⁹ Weston & Sampson, "Community Resilience Building Workshop Summary of Findings," Town.northborough.ma.us, The Town of Northborough, January 2020, https://www.town.northborough.ma.us/sites/g/files/vyhliif12221/f/news/mvp_planning_report_final_2020.pdf.

¹¹⁰ "ResilientMass Plan: 2023 Massachusetts State Hazard Mitigation and Climate Adaptation Plan"

¹¹¹ "2022 Massachusetts Climate Change Assessment"

8.3 PLAN MONITORING AND EVALUATION

Section 8.3 helps meet:

- D1. “Is there discussion of how each community will continue public participation in the plan maintenance process?” (Requirement 44 CFR § 201.6(c)(4)(iii));
- D2. “Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a five-year cycle)?” (Requirement 44 CFR § 201.6(c)(4)(i)); and
- D3. “Does the plan describe a process by which each community will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate?” (Requirement 44 CFR § 201.6(c)(4)(ii))

The Town’s Emergency Management Director will call meetings of all responsible parties to review plan progress, on a yearly basis and/or as is needed based on the occurrence of hazard events. The public will be notified of these meetings in advance through a posting of the agenda at Town Hall. Responsible parties identified for specific mitigation actions will be asked to submit their reports in advance of meetings.

Meetings will involve evaluation and assessment of the plan. Responsible parties will review the plan’s effectiveness at achieving its goals and stated purpose at these meetings. The following questions will serve as the criteria that are used to evaluate the plan:

PLAN MISSION AND GOAL

- Is the Plan's stated goal and mission still accurate and up to date, reflecting any changes to local hazard mitigation activities?
- Are there any changes or improvements that can be made to the goal and mission?

HAZARD IDENTIFICATION AND RISK ASSESSMENT

- Have there been any new occurrences of hazard events since the plan was last reviewed? If so, these hazards should be incorporated into the Hazard Identification and Risk Assessment.
- Have any new occurrences of hazards varied from previous occurrences in terms of their extent or impact? If so, the stated impact, extent, probability of future occurrence, or overall assessment of risk and vulnerability should be edited to reflect these changes.
- Is there any new data available from local, state, or Federal sources about the impact of previous hazard events, or any new data for the probability of future occurrences? If so, this information should be incorporated into the plan.

EXISTING MITIGATION STRATEGIES

- Are the current strategies effectively mitigating the effects of any recent hazard events?
- Has there been any damage to property caused by natural hazards since the plan was last reviewed?
- How could the existing mitigation strategies be improved to reduce the impact from recent occurrences of hazards? If there are improvements, these should be incorporated into the plan.

PROPOSED MITIGATION STRATEGIES

- What progress has been accomplished for each of the previously identified proposed mitigation strategies?
- How have any recently completed mitigation strategies affected the level of impact in town of hazards that have occurred since the strategy was completed?
- Should the criteria for prioritizing the proposed mitigation strategies be altered in any way?
- Should the priority given to individual mitigation strategies be changed, based on any recent changes to financial and staffing resources and/or recent hazard events?

REVIEW OF THE PLAN AND INTEGRATION WITH OTHER PLANNING DOCUMENTS

- Is the current process for reviewing the Hazard Mitigation Plan effective? Could it be improved?
- Are there any Town plans in the process of being updated that should have the content of this Hazard Mitigation Plan incorporated into them?
- How can the current Hazard Mitigation Plan be better integrated with other Town planning tools and operational procedures, including the zoning bylaw, the Comprehensive Emergency Management Plan, and the Capital Improvement Plan?

Following these discussions, it is anticipated that the planning team may decide to reassign the roles and responsibilities for implementing mitigation strategies to different town departments and/or revise the goals and objectives contained in the plan. The team will review and update the Hazard Mitigation Plan every five years.

Public participation will be a critical component of the Hazard Mitigation Plan maintenance process. The Hazard Mitigation Team will hold all meetings in accordance with Massachusetts open meeting laws, and the public will be invited to attend these meetings. The public will be notified of any changes to the Plan via the meeting notices board at Town Hall, and copies of the revised Plan will be made available to the public at Town Hall.

8.4 POTENTIAL FEDERAL AND STATE FUNDING SOURCES

8.4.1 FEDERAL FUNDING SOURCES

The following is a summary of the programs which are the primary source for federal funding of hazard mitigation projects and activities in Massachusetts:

Table 15: Federal Hazard Mitigation Funding

Program	Type of Assistance	Availability	Managing Agency	Funding Source
National Flood Insurance Program (NFIP)	Pre-disaster insurance	Any time (pre & post disaster)	DCR Flood Hazard Management Program	Property Owner, FEMA
Community Rating System (CRS) (Part of the NFIP)	Flood insurance discounts	Any time (pre & post disaster)	DCR Flood Hazard Management Program	Property Owner

Hazard Mitigation Grant Program (HMGP)	Post-disaster cost-share grants	Post disaster program	MEMA	75% FEMA/ 25% non- federal
Building Resilient Infrastructure and Communities (BRIC)	National, competitive cost-share grant program for projects & planning	Annual, pre-disaster mitigation program	MEMA	75% FEMA/ 25% non- federal
Flood Mitigation Assistance (FMA) Program	Cost share grants for pre- disaster planning & projects	Annual pre-disaster grant program	MEMA	75% FEMA/ 25% non- federal
Public Assistance	Post-disaster aid to state & local governments	Post Disaster	MEMA	FEMA/ plus a non-federal share
Small Business Administration (SBA) Mitigation Loans	Pre- & Post- disaster loans to qualified applicants	Ongoing	MEMA	Small Business Administration
Hazard Mitigation Grant Program Post-Fire (HMGP-PF)	Cost-share post-wildfire disaster mitigation measures	Annual, within six months after FMAG declaration	FEMA	75% FEMA/25% non-federal
Assistance to Firefighters Grants (AFG)	Training & equipment for wildfire-related hazards	Annual	FEMA	FEMA
Fire Prevention & Safety Grant Program (AFG) (FP&S)	Cost-share funding to support projects that protect people from fire-related hazards	Annual	FEMA	95% FEMA, 5% non-federal
Fire Management Assistance Grants (F-MAG)	Cost-share funding to mitigate & manage major disasters caused by fire	Any time (pre- & post disaster)	FEMA	75% FEMA/25% non-federal
Emergency Management Performance Grant (EMPG)	Pre- & post-disaster management and implementation grants	Annual	FEMA	50% FEMA/50% non-federal match
Homeland Security Grant Program (HSGP)	Funding to prevent, respond to, and recover from acts of terrorism	Annual	FEMA	FEMA

National Dam Safety Program (State Assistance Grant Program) (NDSP)	Funding to improve dam safety & State dam safety programs	Annual	FEMA	FEMA, BIL
Rehabilitation of High Hazard Potential Dam Program (State Dam Safety Divisions) (HHPD)	Cost-share funding to plan and rehabilitate HHPD	Annual	FEMA	65% FEMA/35% non-federal
National Earthquake Hazards Reduction Program's State Assistance Program (NEHRP)	Cost-share funding for pre-earthquake risk management	Annual	FEMA	75% FEMA/25% non-federal
Emergency Food and Shelter Program (EFSP)	Grant funding for supplemental food & shelter for those experiencing/at risk of experiencing	Annual	FEMA	FEMA
Public Health Crisis Response Cooperative Agreement (PHCRCA)	Funding to support surge needs of existing public health programs responding to public health emergencies	Annual for ABU roster	CDC	Varies
Army Corp of Engineers Planning Assistance	Water supply, conservation, wetlands, & dam safety	Any time (pre & post disaster)	U.S. Army Corps of Engineers	50% Federal/ 50% non-federal
Forest Service Community Wildfire Defense Grant (USDA-FSCWDG)	Grant funding to plan for and reduce wildfire risk	Annual	USDA-FS	75% USDA, 25% non-federal
Emergency Watershed Protection Program (EWP)	Technical assistance and funding for helping communities mitigate natural disaster risks which	Ongoing	USDA-NRCS	75% USDA, 25% non-federal (90% USDA, 10% non-federal in limited resource areas)

<i>Agricultural Management Assistance (Drought Mitigation Funding Program) (AMA)</i>	Technical assistance for agricultural producers to manage financial risks	Ongoing	USDA-NRCS	75% USDA, 25% non-federal
<i>USDA Community Facilities Direct Loan & Grant Program (Rural Development) (CFDLGP)</i>	Improve essential community facilities	Annual	USDA-RD	Varies
<i>National Culvert Removal, Replacement, & Restoration Grant (NCRRRG)</i>	Competitive grant funding to replace, remove, and repair culverts or weirs	Annual	US DOT	Varies
<i>Bridge Investment Program (BIP)</i>	Competitive grant program for improving the conditions of existing bridges	Annual	US DOT	80% FHWA, 20% other

The FEMA web pages identify several funding opportunities. Please refer to <https://www.fema.gov/grants>. Some programs are described in more detail below:

NATIONAL FLOOD INSURANCE PROGRAM (NFIP) AND COMMUNITY RATING SYSTEM (CRS) (PART OF THE NFIP)

The National Flood Insurance Program (NFIP) provides insurance to communities required to manage and adopt mitigation practices for high flood-risk areas. The Community Rating System (CRS) incentivizes communities to incorporate flood management practices and mitigation strategies through discounted flood insurance rates. Incentives are available on a voluntary and participatory basis to encourage communities to meet the minimum requirements of NFIP. In encouraging communities to meet NFIP's minimum requirements, CRS can extend the availability of funding to homeowners, businesses, and renters for whom flood insurance may not be accessible. CRS allocates insurance discount rates according to a community's demonstrated efforts to implement the program's three goals:

- Reduce flood damage to insurable properties
- Strengthen and support NFIP
- Incentivize proactive floodplain management

Communities can CRS earn points based on their implementation of various flood mitigation initiatives, including but not limited to: (1) restricting development on flood prone areas, (2) extending public risk communication with flood warning systems, and (3) enhancing infrastructural resilience to flood damage. Please refer to <https://www.floodsmart.gov/> and <https://www.fema.gov/floodplain-management/community-rating-system> for more information.

HAZARD MITIGATION ASSISTANCE

The HMA grant programs provide funding opportunities for pre- and post-disaster mitigation.

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

Hazard Mitigation Grant Program (HMGP)

HMGP assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities. Please refer to <http://www.fema.gov/hazard-mitigation-grant-program> for additional information.

HMGP funds may be used to fund projects that will reduce or eliminate the losses from future disasters. Projects must provide a long-term solution to a problem, for example, elevation of a home to reduce the risk of flood damages as opposed to buying sandbags and pumps to fight the flood. In addition, a project's potential savings must be more than the cost of implementing the project. Funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. Examples of projects include, but are not limited to:

- Acquisition of real property for willing sellers and demolition or relocation of buildings to convert the property to open space use
- Retrofitting structures and facilities to minimize damages from high winds, earthquake, flood, wildfire, or other natural hazards
- Elevation of flood prone structures
- Development and initial implementation of vegetative management programs
- Minor flood control projects that do not duplicate the flood prevention activities of other Federal agencies
- Localized flood control projects, such as certain ring levees and floodwall systems, that are designed specifically to protect critical facilities
- Post-disaster building code related activities that support building code officials during the reconstruction process

Hazard Mitigation Grant Program Post-Fire (HMGP-PF)

The Hazard Mitigation Grant Program Post-Fire (HMGP-PF) is a program aimed at providing financial funding to localities in order to reduce risk of fire damage after a fire has occurred. Funds are determined through a Benefit-Cost Analysis software. For more information, please refer to: [Hazard Mitigation Grant Program Post Fire | FEMA.gov](#)

Building Resilient Infrastructure and Communities (BRIC)

The Building Resilient Infrastructure and Communities program aims to categorically shift the federal focus away from reactive disaster spending and toward research-supported, proactive investment in community resilience. Examples of BRIC projects are ones that demonstrate innovative approaches to partnerships, such as shared funding mechanisms, and/or project design. For example, an innovative project may bring multiple funding sources or in-kind resources from a range of private and public sector partners. Or an innovative project may offer multiple benefits to a community in addition to the benefit of risk reduction. The BRIC program is replacing the Pre-Disaster Mitigation grant program. More information on the BRIC program can be found here:

<https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities>.

The Massachusetts Emergency Management Agency (MEMA) coordinates BRIC applications for municipalities within the Commonwealth. Links to MEMA resources and BRIC application materials can be found here: <https://www.mass.gov/service-details/building-resilient-infrastructure-and-communities-bric-flood-mitigation-assistance-fma-grant-programs>.

FLOOD MITIGATION ASSISTANCE (FMA)

Flood Mitigation Assistance (FMA) provides funds on an annual basis so that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the National Flood Insurance Program. Please refer to the FMA website: <http://www.fema.gov/flood-mitigation-assistance-grant-program>.

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

- **Project Scoping Grants** are designed to develop mitigation strategies and obtain data to prioritize, select, and develop complete applications in a timely manner that result in either an improvement in the capability to identify appropriate mitigation projects or in the development of an application-ready mitigation project for FMA or another.
- **Planning Grants** to prepare Flood Mitigation Plans. Only NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project grants.
- **Technical Assistance Grants** are awards of up to \$50,000 federal cost share for Recipients to which FEMA obligated at least \$1 million federal share the previous FMA cycle.
- **Project Grants** to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures. States are encouraged to prioritize FMA funds for applications that include repetitive loss properties; these include structures with 2 or more losses each with a claim of at least \$1,000 within any ten-year period since 1978.

MEMA coordinates FMA applications for municipalities within the Commonwealth. Links to MEMA resources and FMA application materials can be found here: <https://www.mass.gov/service-details/building-resilient-infrastructure-and-communities-bric-flood-mitigation-assistance-fma-grant-programs>.

DISASTER ASSISTANCE

Disaster assistance is money or direct assistance to individuals, families and businesses in an area whose property has been damaged or destroyed and whose losses are not covered by insurance. It is meant to help with critical expenses that cannot be covered in other ways. This assistance is not intended to restore damaged property to its condition before the disaster. While some housing assistance funds are available through FEMA's Individuals and Households Program, most disaster assistance from the Federal government is in the form of loans administered by the Small Business Administration.

Disaster Assistance Available from FEMA

In the event of a Declaration of Disaster, assistance from FEMA is grouped in 3 categories:

A. Housing Needs

- **Temporary Housing** (a place to live for a limited period of time): Money is available to rent a different place to live, or a government provided housing unit when rental properties are not available.

- **Repair:** Money is available to homeowners to repair damage from the disaster to their primary residence that is not covered by insurance. The goal is to make the damaged home safe, sanitary, and functional.
- **Replacement:** Money is available to homeowners to replace their home destroyed in the disaster that is not covered by insurance. The goal is to help the homeowner with the cost of replacing their destroyed home.
- **Permanent Housing Construction:** Direct assistance or money for the construction of a home. This type of help occurs only in insular areas or remote locations specified by FEMA, where no other type of housing assistance is possible.

B. Other than Housing Needs

- Money is available for necessary expenses and serious needs caused by the disaster, including:
 - Disaster-related medical and dental costs.
 - Disaster-related funeral and burial cost.
 - Clothing; household items (room furnishings, appliances); tools (specialized or protective clothing and equipment) required for your job; necessary educational materials (computers, school books, supplies)
 - Fuels for primary heat source (heating oil, gas).
 - Clean-up items (wet/dry vacuum, dehumidifier).
 - Disaster damaged vehicle.
 - Moving and storage expenses related to the disaster (moving and storing property to avoid additional disaster damage while disaster-related repairs are being made to the home).
 - Other necessary expenses or serious needs as determined by FEMA.
 - Other expenses that are authorized by law.

C. Additional Services

- Crisis Counseling
- Disaster Unemployment Assistance
- Legal Services
- Special Tax Considerations

DISASTER LOANS AVAILABLE FROM THE SMALL BUSINESS ADMINISTRATION

The U.S. Small Business Administration (SBA) can make federally subsidized loans to repair or replace homes, personal property or businesses that sustained damages not covered by insurance. The Small Business Administration can provide three types of disaster loans to qualified homeowners and businesses:

- **Physical damage loans:** Loans to cover repairs and replacement of physical assets damaged in a declared disaster.
- **Mitigation assistance:** Funding to cover small business operating expenses after a declared disaster.

- Economic injury disaster loans: This loan provides economic relief to small businesses and nonprofit organizations that have suffered damage to their home or personal property.
- Military reservist loans: SBA provides loans to help eligible small businesses with operating expenses to make up for employees on active-duty leave.

For many individuals the SBA disaster loan program is the primary form of disaster assistance. Please find more information about this loan program here: <https://www.sba.gov/funding-programs/disaster-assistance>.

DISASTER ASSISTANCE FROM OTHER ORGANIZATIONS AND ENTITIES

[DisasterAssistance.gov](https://www.disasterassistance.gov) is a secure, user-friendly U.S. Government web portal that consolidates disaster assistance information in one place. If individuals need assistance following a presidentially declared disaster— which has been designated for individual assistance— they can now go to DisasterAssistance.gov to register online. Local resource information to help keep citizens safe during an emergency is also available. Currently, 17 U.S. Government agencies, which sponsor almost 70 forms of assistance, contribute to the portal.

DisasterAssistance.gov speeds up the application process by feeding common data to multiple online applications. Application information is shared only with those agencies individuals identify and is protected by the highest levels of security. DisasterAssistance.gov will continue to expand to include forms of assistance available at the federal, state, tribal, regional, and local levels.

ASSISTANCE TO FIREFIGHTERS GRANTS (AFG) AND FIRE PREVENTION & SAFETY GRANT PROGRAM (FP&S)

The FEMA Assistance to Firefighters Grants (AFG) program provides funds to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience. Under AFG, funds may be available for equipment, vehicles and/or training that can be used to mitigate and/or respond to wildfire-related hazards. AFG also has a Fire Prevention and Safety (FPS) component which funds public outreach programs and prevention activities, which can emphasize wildfire mitigation. More about these programs can be found at these links: [Assistance to Firefighters Grants Program | FEMA.gov](https://www.fema.gov/assistance-to-firefighters-grants-program), [Fire Prevention and Safety \(FP&S\) | FEMA.gov](https://www.fema.gov/fire-prevention-and-safety).

FIRE MANAGEMENT ASSISTANCE GRANTS (F-MAG)

The Fire Management Assistance Grants (F-MAG) Program supports in firefighting efforts in fire related disasters on public and private forests and grasslands at the state, local and tribal level. For more information, please refer to: [Fire Management Assistance Grants | FEMA.gov](https://www.fema.gov/fire-management-assistance-grants).

EMERGENCY MANAGEMENT PERFORMANCE GRANT (EMPG)

The Emergency Management Performance Grant (EMPG) provides resources for state, local, tribal and territorial emergency response organizations required for the National Preparedness System. EMPG supports efforts in building and strengthening capabilities in areas related to protection, mitigation, prevention, response and recovery. As of the 2024 fiscal year the grant has a total available funding of \$319.55 million. Please find more about this grant program at the link here: [Emergency Management Performance Grant | FEMA.gov](https://www.fema.gov/emergency-management-performance-grant).

HOMELAND SECURITY GRANT PROGRAM (HSGP)

The Homeland Security Grant Program provides a suite of grant opportunities in support of efforts

in the mitigation, prevention, protection and recovery from terrorist and other threats at the state, local, tribal and territorial levels. As of the 2024 fiscal year, the program with its three grants had \$1.008 billion in funding. The three grants available under the program are:

- State Homeland Security Program (SHSP)
- Urban Area Security Initiative (UASI)
- Operation Stonegarden (OPSG)

Please find more about this grant program at the link here: [Homeland Security Grant Program | FEMA.gov.](#)

NATIONAL DAM SAFETY PROGRAM (STATE ASSISTANCE GRANT PROGRAM) (NDSP)

The National Dam Safety Program (NDSP) provides financial assistance to strengthen the individual dam safety programs of states and territories. In the 2024 fiscal year, the program distributed \$24.2 million among 49 states and Puerto Rico. For more information, please refer to: [Grant Assistance to States | FEMA.gov.](#)

REHABILITATION OF HIGH HAZARD POTENTIAL DAM PROGRAM (STATE DAM SAFETY DIVISIONS) (HHPD)

The Rehabilitation of High Hazard Potential Dams Program (HHPD) provides technical, planning, design, and construction assistance in the form of grants for the rehabilitation of high hazard potential dams in eligible states and territories. For more information, please refer to: [Rehabilitation Of High Hazard Potential Dam \(HHPD\) Grant Program | FEMA.gov.](#)

NATIONAL EARTHQUAKE HAZARDS REDUCTION PROGRAM'S STATE ASSISTANCE PROGRAM (NEHRP)

The National Earthquake Hazards Reduction Program's State Assistance Program (NEHRP) provides funding to localities for the reduction of risk associated with earthquakes. This is done through two grants:

- Individual State Earthquake Assistance (ISEA)
- Multi-State National Earthquake Assistance (MSNEA)

More about this program can be found at this link: [National Earthquake Hazards Reduction Program's State Assistance Program | FEMA.gov.](#)

EMERGENCY FOOD AND SHELTER PROGRAM (EFSP)

The Emergency Food and Shelter Program (EFSP) assists and expands upon the work of local nonprofit and governmental social service organizations to provide shelter, food and other services to people experiencing, or at risk of hunger and/or homelessness. For more information, please refer to: [Emergency Food and Shelter Program | FEMA.gov.](#)

PUBLIC HEALTH CRISIS RESPONSE COOPERATIVE AGREEMENT (PHCRCA)

The Center for Disease Control and Prevention's Public Health Crisis Response Cooperative Agreement (PHCRCA) allows for opportunities for state, local and tribal government to receive funding in response to public health emergencies. For more information, please refer to: [The Centers for Disease Control and Prevention's Public Health Crisis Response Cooperative Agreement Program](#)

[Awards \(hhs.gov\)](https://www.hhs.gov).

ARMY CORP OF ENGINEER PLANNING ASSISTANCE

Under the authority provided by Section 22 of the Water Resources Development Act of 1974 (PL 93-251), as amended, the U.S. Army Corps of Engineers can provide states, local governments, other non-Federal entities, and eligible Native American Indian tribes assistance in the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources. Typical studies are only planning level of detail; they do not include detailed design for project construction. The program can encompass many types of studies dealing with water resources issues. Types of studies conducted in recent years under the program include the following: water supply/demand, water conservation, water quality, environmental/conservation, wetlands evaluation/restoration, dam safety/failure, flood damage reduction, coastal zone protection, and harbor planning. Please refer to:

<https://www.nae.usace.army.mil/missions/public-services/planning-assistance-to-states/>.

FOREST SERVICE COMMUNITY WILDFIRE DEFENSE GRANT (USDA-FSCWDG)

The Forest Service Community Wildfire Defense Grant Program (USDA-FSCWG) provides funding and assistance to at-risk local communities and tribes to reduce wildfire risk. This is primarily done through the revision and development of community wildfire protection plans and the assistance in implementing new projects in said plans. For more information, please refer to: [Community Wildfire Defense Grant Program | US Forest Service \(usda.gov\)](#).

EMERGENCY WATERSHED PROTECTION PROGRAM (EWP)

The Emergency Watershed Protection Program (EWP) provides technical and financial assistance to localities in response to imminent life and property threatening natural disasters which negatively impact the local watershed. For more information about this program, please refer to: [Emergency Watershed Protection | Natural Resources Conservation Service \(usda.gov\)](#).

AGRICULTURAL MANAGEMENT ASSISTANCE (DROUGHT MITIGATION FUNDING PROGRAM) (AMA)

Agricultural Management Assistance (AMA) is a program to help farmers build on and diversify their agricultural practices. The program is available in 16 states that have had historically low rates of participation in the Federal Crop Insurance Program. AMA covers up to 75% of funds needed to install conservation practices on farms, with a cap of \$50,000 per individual participant in a given fiscal year. For more information, please refer to: [Agricultural Management Assistance | Natural Resources Conservation Service \(usda.gov\)](#).

USDA COMMUNITY FACILITIES DIRECT LOAN & GRANT PROGRAM

The USDA Community Facilities Direct Loan & Grant program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings. Rural areas including cities, villages, townships and towns including Federally Recognized Tribal Lands with no more than 20,000 residents according to the latest U.S. Census Data are eligible for this program. Funds can be used to purchase, construct, and / or improve

essential community facilities, purchase equipment and pay related project expenses. For more information, please refer to:

<https://www.rd.usda.gov/programs-services/community-facilities/community-facilities-direct-loan-grant-program>.

NATIONAL CULVERT REMOVAL, REPLACEMENT, & RESTORATION GRANT (NCRRRG)

The National Culvert Removal, Replacement, and Restoration Grant Program (Culvert Aquatic Organism Passage (AOP) Program) assists eligible tribes, states and local governments in issues related to culverts and weirs to improve and/or restore passage for anadromous fish in freshwater waterways. Anadromous fish are those that spawn in freshwater, but live most of their lives in saltwater. More about this program can be found at this link: [Aquatic Organism Passage - Culvert Hydraulics - Hydraulics - Bridges & Structures - Federal Highway Administration \(dot.gov\)](https://www.fhwa.dot.gov/bridges/structures/aquatic_organism_passage/).

BRIDGE INVESTMENT PROGRAM (BIP)

The Bridge Investment Program (BIP) gives the opportunity for governments at all levels to receive funding to repair and restore aging bridge infrastructure. BIP grant applications have a maximum grant award of 80% of the total eligible bridge project costs. For more information regarding BIP, please refer to: [BIP - Funding Programs - Management and Preservation - Bridges & Structures - Federal Highway Administration \(dot.gov\)](https://www.fhwa.dot.gov/bridges/structures/bip/).

8.4.2 STATE FUNDING SOURCES

The following is a summary of state funding opportunities for hazard mitigation projects and activities in Massachusetts:

Table 16: State Hazard Mitigation Funding

Program	Type of Assistance	Availability	Managing Agency	Funding Source
604b	Grants focused on nonpoint source pollution assessment and watershed planning	Annual	Mass DEP	State funding (match not required but recommended)
Section 319 Nonpoint Source Competitive Grants Program	Competitive grant program funding projects that address the prevention, control, and abatement of nonpoint source (NPS) pollution	Annual	Mass DEP	State funding
Water Quality Monitoring Grant Program	Reimbursement funding for monitoring and/or data collection efforts that support water quality assessments	Annual	Mass DEP	State funding

Statewide Water Management Act Grant	Reimbursement grant funding for projects to help public water suppliers plan and manage water use	Annual	Mass DEP	Reimbursement grant
Massachusetts Gap Energy Grant Program (Gap III)	New program providing grant assistance up to (\$200,000 per community) for implementing energy efficiency and clean energy generation projects at water and wastewater plants	Annual (likely)	Mass DEP	State funding
State Revolving Fund	Low-interest loans	Annual	Mass DEP	Municipal funding with state loan
Municipal Vulnerability Preparedness (MVP) Action Grants	Competitive climate adaptation grants	Annual	EEA	75% EEA/ 25% non-state match
Planning Assistance Grants (EEA PAG)	Competitive grants that support efforts to plan, regulate (zone), and act to conserve and develop land consistent with	Annual	EEA	75% EEA / 25% non-state match
Dam and Seawall Repair or Removal Program	Competitive grants for dam and seawall repair and removal, as well as construction loans	Annual	EEA	State funding
Massachusetts Land & Water Conservation Fund Grant Program (LWCF)	Federal grant program to help improve access to and protection for public lands and waters	Annual	EEA	Federal program that funds up to 50% of total costs for acquisition, development, and renovation
Land Acquisition for Natural Diversity (LAND)	Financial assistance to municipalities for the acquisition of conservation land	Annual	EEA	Reimbursement grant, the reimbursement rate varies per Town

<i>Drinking Water Supply Grant</i>	Competitive grants for protection of drinking water supplies	Annual	DCS	State funding
<i>Land and Recreation Grants and Loans</i>	Varies, though primarily grant funding for conservation and recreation projects	Varies, generally annually	DCS	Varies
<i>Water Quality Management Planning Grant</i>	Competitive grant for water quality assessment and management planning	Annual	DCS	State funding
<i>Forest Legacy Grant Program (USDA-FS) (FLGP)</i>	Grant funding to protect environmentally important forestland from conversion	Annual	DCR	75% USDA FS, 25% non-federal
<i>Volunteer Fire Assistance Program (VFA)</i>	Reimbursement grant program that funds technical, financial and other assistance to fire departments for forest fire related purposes	Annual	DCR	State funding
<i>Culvert Replacement Municipal Assistance Grant Program</i>	Competitive grants for replacing an undersized, perched, and/or degraded culvert located in an area of high ecological value	Annual	DER	State funding
<i>Division of Ecological Restoration Priority Project Program</i>	State competitive grant program that funds projects that restore and protect the State's rivers, wetlands, and watersheds (priority projects may differ each year)	Annual	DER	State funding

Mass Wildlife Habitat Management Grant Program (MWHMGP)	Reimbursement grant funding to assist municipalities enhance wildlife habitat and increase recreational opportunities on protected lands	Annual	DFW	USDA NRCS
Agricultural Climate Resiliency and Efficiencies Program (ACRE)	Competitive, reimbursement grant funding that supports practices that mitigate the agricultural sector's vulnerability to climate change	Annually through Climate Smart Agriculture Program (CSAP)	MDAR	MDAR
Agricultural Preservation Restriction Program (APR)	Financial assistance in exchange for permanent deed restriction to protect the land's agricultural viability	Any time for owners of at least 5 acres of farmland	MDAR	MDAR
Hazard Mitigation Planning Grant Program (HMPG)	Grant program for communities, after a disaster, to reduce or eliminate future risk to lives and property from natural hazards	Annual	FEMA	75% federal/25% state/local match
Hazard Mitigation Grant Program (State) (HMGP)	Sub-grant programs for Hazard Mitigation Grant program	Annual	MEMA	State funding
Community Development Block Grants (CDBG)	Competitive community development grants	Annual	EOHED	US Department of Housing and Urban Development
Emergency Solutions Grant (ESG)	Competitive grant funding designed to support services that assist those experiencing/at risk of experiencing homelessness	Annual	EOHED	MA EOHLC
Mass Works	Competitive infrastructure grants	Annual	EOHED	State funding

Community Preservation Act (CPA)	Establishes a local community preservation fund through tax surcharge to support a variety of project related to conservation and housing	Ongoing	Department of Revenue (DOR)	Statewide Community Preservation Trust Fund / local Community Preservation Fund
Special appropriations and legislative earmarks	Varies	Infrequent, after natural disasters or legislature vote	Massachusetts General Legislature	State funding
District Local Technical Assistance (DLTA)	Funding to support planning and technical assistance for housing, economic growth, and regional projects	Varies, generally annually	Massachusetts General Legislature, CMRPC	State funding
Local Planning Assistance (LPA)	Planning and technical assistance	Annual	CMRPC	Planning assistance hours
Support and Incentive Grant	Reimbursement grant funding designed to assist in providing enhanced 911 service	Annual	MA EOPSS	MA EOPSS
Municipal Small Bridge Program	Competitive grants for small bridge replacement, preservation, and rehabilitation projects	Annual	Mass DOT	State funding
Chapter 90 Program (Transportation Capital Improvement Projects) (Chpt. 90)	Reimbursable grants to support capital improvements on local public ways	Ongoing	Mass DOT	State funding
State Transportation Improvement Program (STIP)	Competitive funding opportunity for transportation projects along federal-aid roadways	Annually updated five-year programming document	MassDOT	MassDOT

Complete Streets (CS)

Reimbursement grant funding to provide safe and accessible options for all travel modes	Annually available to municipalities that adopt a Complete Street Policy	MassDOT	State funding
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The Community Grant Funder web page includes the municipal grant programs listed above, as well as other funding opportunities: <https://www.mass.gov/lists/community-grant-finder>. Some programs in Table 15 are described in more detail on the following pages.

604B

The Water Quality Management Planning Grant Program provides funding opportunities to regional planning agencies, councils of governments, conservation districts, counties, cities and towns, federally and state recognized tribes, and other substate public planning agencies and interstate agencies to determine and correct water quality issues in Massachusetts. For more information on this program, please refer to: [Grants & Financial Assistance: Watersheds & Water Quality | Mass.gov](#)

SECTION 319 NONPOINT SOURCE COMPETITIVE GRANTS PROGRAM

Section 319 of the Clean Water Act provides funding opportunities for prevention, control, and abatement of nonpoint source (NPS) pollution. These grants are available to eligible Massachusetts public or private organization: State and Federally Recognized Tribes, Regional Planning Agencies, Councils of Governments, Counties, Conservation Districts, Cities and Towns, other substate public planning agencies, and interstate agencies. To be eligible, these entities' projects must include: have measures that address the prevention, control, and abatement of NPS pollution, target major sources of NPS pollution within the watershed, contain an appropriate method for evaluating the project results, and address activities in the current Massachusetts NPS Management Program Plan. For more information on this program, please refer to: [Grants & Financial Assistance: Watersheds & Water Quality | Mass.gov](#)

WATER QUALITY MONITORING GRANT PROGRAM

The Water Quality Monitoring Grant Program provides funding opportunities to eligible entities and organizations to increase the amount of external data on water quality in Massachusetts. For more information, please refer to: [Grants & Financial Assistance: Watersheds & Water Quality | Mass.gov](#).

STATEWIDE WATER MANAGEMENT ACT GRANT

The Statewide Water Management Act Grant provides grant funding for projects which improve the ecological conditions of specific watershed, projects aimed at reducing water demand and projects that address the following: improve or increase instream flow, keeping wastewater local, stormwater management, reduce impervious cover and/or improve water quality, water supply operational improvements, habitat improvement, reduction of wastewater inflow and infiltration, and other projects that can be demonstrated to mitigate the impacts of water withdrawals. This program awards approximately 10 grants a year and has a reimbursement rate of 80%. Grants are awarded to eligible public water suppliers and municipalities with Water Management Act permits. For more information, please refer to: [Water Management Act Grant Programs for Public Water Suppliers | Mass.gov](#).

MASSACHUSETTS GAP ENERGY GRANT PROGRAM (GAP III)

Through a partnership between the Massachusetts Department of Energy Resources (DOER) and the Massachusetts Clean Energy Center (MassCEC), this grant program provides funding to fill the last financial “gap” needed for clean energy projects by a variety of organizations to promote clean and efficient energy projects. In 2022, the GAP III program awarded a total of \$8.1 million in grants. For more information about this program, please refer to: [Massachusetts' Gap Energy Grant Program | Mass.gov](#).

PLANNING ASSISTANCE GRANTS (EEA PAG)

These grants are available to municipalities, and Regional - Planning Agencies acting on their behalf to financially support efforts to conserve and develop land consistent with the Massachusetts’s Sustainable Development Principles. Top priorities of the program include: zoning for sustainable housing production, mitigation of climate change through zoning and other regulatory actions, and zoning that results in permanent land conservation. For more information about these grants, please refer to: [Planning Assistance Grants | Mass.gov](#).

STATE REVOLVING FUND

This statewide loan program through the Massachusetts Department of Environmental Protection assists communities in funding local drinking water, wastewater, and storm water infrastructure improvements.

MUNICIPAL VULNERABILITY PREPAREDNESS ACTION GRANT PROGRAM

The MVP Action Grant offers financial resources to municipalities that are seeking to advance priority climate adaptation actions to address climate change impacts resulting from extreme weather, sea level rise, inland and coastal flooding, severe heat, and other climate impacts. Towns are eligible for this competitive grant program after successfully completing an MVP planning grant. A variety of project types are eligible for funding, but projects must address local vulnerabilities to climate change and incorporate MVP Core Principles. Grant application information can be found here: <https://www.mass.gov/service-details/mvp-action-grant>. MVP Core Principles can be found here: <https://www.mass.gov/doc/mvp-core-principles/download>.

DAM AND SEAWALL REPAIR OR REMOVAL PROGRAM

The EEA funds projects for the repair and removal of dams, levees, seawalls, and other forms of inland and coastal flood control. For additional information, please refer to <https://www.mass.gov/service-details/dam-and-seawall-repair-or-removal-program-grants-and-funds>.

MASSACHUSETTS LAND & WATER CONSERVATION FUND GRANT PROGRAM (LWCF)

This program provides up to 50% of total project funding to eligible municipalities, tribes and state agencies for park, trail and conservation area related projects. For more information, please refer to: [Massachusetts Land and Water Conservation Fund Grant Program | Mass.gov](#).

LAND ACQUISITION FOR NATURAL DIVERSITY (LAND)

This grant program assists cities and towns in acquiring new lands for conservation and passive recreation purposes. Grants are awarded at a maximum of \$500,000 with reimbursement rates ranging from 52-70%. For more information, please refer to: [Local Acquisitions for Natural Diversity](#)

DRINKING WATER SUPPLY GRANT

The DWSP grant program provides financial assistance to public water systems and municipal water departments for the purchase of land or interests in land for the following purposes: 1) protection of existing DEP-approved public drinking water supplies; 2) protection of planned future public drinking water supplies; or 3) groundwater recharge. It is a reimbursement program.

LAND AND RECREATION GRANTS AND LOANS

The Division of Conservation Services (DCS) manages several grant or loan programs that enable land preservation, natural resources conservation, and public recreation. Municipalities with an active Open Space and Recreation Plan are generally eligible to apply for these programs. Preserving natural open space can buffer natural systems from development impacts, protect open spaces from future development, and maintain ecosystem services like natural flood mitigation. The full list of DCS grant programs can be found here: <https://www.mass.gov/land-and-recreation-grants-loans/need-to-know>.

WATER QUALITY MANAGEMENT PLANNING GRANT

This grant program is authorized under the federal Clean Water Act Section 604(b) for water quality assessment and management planning. Eligible entities include: regional planning agencies, councils of governments, conservation districts, counties, cities and towns, and other substate public planning agencies and interstate agencies. No local match is required.

FOREST LEGACY GRANT PROGRAM (USDA-FS) (FLGP)

The Forest Legacy Program is a voluntary grant funding opportunity for private landowners to either sell their land outright or to sell a conservation restriction on their land. A conservation restriction is a legally binding agreement which limits the types of land use on a property, in this case restricting land to forestry, recreation or another conservationist use. For more information about the program, please refer to: [Forest Legacy Program | Mass.gov](#).

VOLUNTEER FIRE ASSISTANCE PROGRAM (VFA)

The Volunteer Fire Assistance Program (VFA) was born from a collaborative effort between the US Forest service and the Massachusetts DCR Bureau of Forest Fires and Forestry. This program aims to provide funding for volunteer fire departments in towns of under 10,000 people. For more information, please refer to: [Volunteer Fire Assistance \(VFA\) Program | Mass.gov](#).

CULVERT REPLACEMENT MUNICIPAL ASSISTANCE GRANT PROGRAM

This program provides funding opportunity for local governments to replace undersized, perched, and/or degraded culverts in areas of high ecological value. For more information on this program, please refer to: [Culvert Replacement Municipal Assistance Grant Program | Mass.gov](#)

DER PRIORITY PROJECTS

The Priority Project Program is an opportunity under the Division of Ecological Restoration for organizations to receive technical assistance, consulting and/or direct grant funding for wetland and river restoration projects through a state-wide, competitive process. DER chooses high-priority projects that bring significant ecological and community benefits to the Commonwealth. DER's most recent call for applications solicited projects located in Massachusetts that focus on cranberry bog wetland restoration, dam removal and river restoration, coastal wetland

restoration projects, or a combination of these topics. More information on the Priority Projects program can be found here: <https://www.mass.gov/how-to/become-a-der-priority-project>. This program can be used to remove significant or high hazards dams that communities no longer want to maintain, which may improve the health and resilience of aquatic systems.

MASS WILDLIFE HABITAT MANAGEMENT GRANT PROGRAM (MWHMGP)

This is a program dedicated to the protection and restoration of wildlife habitat. MWHMGP awards grants of \$10,000 to \$75,000 to private landowners with habitat restoration projects. The program also places emphasis on the protection of endangered species and the expansion of outdoor recreation opportunities, the enhancement of ecological communities disproportionately susceptible to climate change. For more information about this program, please refer to: [MassWildlife Habitat Management Grant Program | Mass.gov](#).

AGRICULTURAL CLIMATE RESILIENCY AND EFFICIENCIES PROGRAM (ACRE)

ACRE is a competitive grant program available to eligible farmers that funds materials and labor to improve climate change resilience, economic resiliency and to forward the goals of the Massachusetts Local Food Action Plan. For more about this program, please refer to: [Agricultural Climate Resiliency & Efficiencies \(ACRE\) Program | Mass.gov](#).

AGRICULTURAL PRESERVATION RESTRICTION PROGRAM (APR)

APR is a voluntary program that allows farmers to be paid the difference between the "fair market value" and the "agricultural value" of their farms in exchange for a permanent deed restriction by the state. This restriction is meant to prevent any use of the property that will negatively impact the land's future agricultural viability. To qualify for this program, a farm must be at least 5 acres in size, actively devoted to agriculture for at least the past 2 tax years and produce at least \$500 in gross sales per year for the first five acres plus \$5 for each additional acre or 50 cents per each additional acre of woodland and/or wetland, as well as various other considered criteria. For more information, please refer to: [Agricultural Preservation Restriction \(APR\) Program Details | Mass.gov](#).

HAZARD MITIGATION PLANNING GRANT PROGRAM (HMPG)

This program provides funding for cities, towns, state agencies and certain non-profit organizations for natural disaster mitigation after a Presidential Disaster Declaration has been issued. Grants on average are awarded from \$100,000 to \$500,000. For more information, please refer to: [Hazard Mitigation Grant Program | Mass.gov](#).

HAZARD MITIGATION GRANT PROGRAM (STATE) (HMGP)

HMGP provides funds to areas after a natural disaster with the purpose of lowering risk of damage and loss of life from future natural disasters. This grant program seeks to reduce the reliance on taxpayer-funded federal assistance for disaster recovery. For more information about this program, please refer to: [Hazard Mitigation Grant Program \(HMGP\) | Mass.gov](#).

COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)

CDBG remains the principal source of revenue for communities to use in identifying solutions to address physical, economic, and social deterioration in lower-income neighborhoods and communities. CDBG is primarily a housing and community development program administered through the Executive Office of Housing and Community Development (HCD). The program can fund certain critical infrastructure projects, and necessary housing improvements that benefit populations that may be more vulnerable to certain natural hazards. The program can also fund the

rehabilitation of municipal buildings such as town halls, which in many cases, also serve as Emergency Operations Centers for their communities.

EMERGENCY SOLUTIONS GRANT (EFG)

The Emergency Solutions Grant funds necessary services to help house/rehouse those who are homeless or at risk of homelessness and to provide shelter for those in need of emergency shelter. For more information on this program, please refer to: [Emergency Solutions Grant Program \(ESG\)](#) | [Mass.gov](#).

MASSWORKS INFRASTRUCTURE PROGRAM

The MassWorks Infrastructure Program provides a one-stop shop for municipalities and other eligible public entities seeking public infrastructure funding to support economic development and job creation. Although not specific to natural hazards per se, these infrastructure enhancements under MassWorks could also address identified needs for hazard mitigation. The MassWorks Infrastructure Program is administered by the Executive Office of Housing and Economic Development, in cooperation with the Department of Transportation and Executive Office for Administration & Finance. Please refer to <http://www.mass.gov/hed/economic/eohed/pro/infrastructure/massworks/> for additional information.

COMMUNITY PRESERVATION ACT (CPA)

The Community Preservation Act (CPA) is a smart growth tool that helps communities preserve open space and historic sites, create affordable housing, and develop outdoor recreational facilities. CPA also helps strengthen the state and local economies by expanding housing opportunities and construction jobs for the commonwealth's workforce, and by supporting the tourism industry through preservation of the commonwealth's historic and natural resources. All communities in Massachusetts pay into statewide Community Preservation Trust fund through a real estate excise tax. However, communities must set up a local Community Preservation Fund and governing committee to utilize the trust fund. CPA projects can build local resilience by protecting open spaces, and by creating affordable housing, which benefits residents who may be most vulnerable to natural hazards. More information on the CPA program can be found here: <https://www.communitypreservation.org/about>.

SPECIAL APPROPRIATIONS AND LEGISLATIVE EARMARKS

Although there is no separate state disaster relief fund in Massachusetts, the state legislature may enact special appropriations for those communities sustaining damages following a natural disaster that are not large enough for a Presidential disaster declaration. Since 2011, Massachusetts has issued 12 state of emergency declarations. Additionally, individual legislators may seek specific project funding for projects through the legislative budgeting and appropriations process.

DISTRICT LOCAL TECHNICAL ASSISTANCE

District Local Technical Assistance (DLTA) is funding allocated by the Massachusetts General Assembly (Legislature) to the Central Massachusetts Regional Planning Commission (CMRPC) to provide technical assistance to member communities on eligible projects. DLTA planning dollars help cities and towns take on necessary projects that they don't have the staff capacity to address on their own, and to partner with neighboring communities to tackle shared projects with reduced administrative burden.

According to the most recent guidelines of the Commonwealth's DLTA program, a proposed project must fall into one of the following four (4) general priority categories to be considered eligible for technical assistance:

1. Planning Ahead for Housing;
2. Planning Ahead for Growth;
3. Technical Assistance to support Community Compact Cabinet Activities including Regionalization; and
4. Supporting the Housing Choice Initiative

The goal of the DLTA Fund is to direct these funds to projects and activities that result in change in the municipality(ies) receiving these DLTA Fund services, whether in law, regulation, program management, or practice, that serve to further these objectives. Community Compact Cabinet (CCC) best practices should include both those that the Commonwealth of Massachusetts is seeking to fund as part of the CCC program as a first priority and also best practices that explicitly align with CCC best practices but are not best practices identified in a signed CCC agreement. COVID-19 relief/recovery activities that fall under the above priority categories are eligible.

LOCAL PLANNING ASSISTANCE

The Local Technical Assistance (LTA) program was initiated to improve the direct services of this agency to its member communities. Under the LTA program each community annually receives a set number of hours of technical assistance to be used in any reasonable planning project authorized by the community's commissioner.

SUPPORT AND INCENTIVE GRANT

The Support and Incentive Grant provides opportunity funding to public safety answering points (PSAPs) and regional emergency communication centers (RECC) in providing enhanced 9-1-1 service. Entities eligible for the Support Grant include: primary or regional public safety answering points, regional secondary public safety answering points and regional emergency communication centers. To be eligible for the Incentive Grant you must be an existing regional public safety answering point or regional emergency communication center that is expanding. For more on this program, please refer to: [Apply for the Support & Incentive Grant | Mass.gov](#).

MUNICIPAL SMALL BRIDGE PROGRAM

The Municipal Small Bridge Program offers funding opportunities to Massachusetts municipalities for small bridge replacement, preservation, and rehabilitation projects. For more information about this program, please refer to: [Municipal Small Bridge Program | Mass.gov](#)

CHAPTER 90 FUNDS

This statewide program reimburses communities for roadway projects, such as resurfacing and related work and other work incidental to the above such as preliminary engineering including State Aid/Consultant Design Agreements, right-of-way acquisition, shoulders, side road approaches, landscaping and tree planting, roadside drainage, structures (including bridges), sidewalks, traffic control and service facilities, street lighting (excluding operating costs), and for such other purposes as the Department may specifically authorize. Maintaining and upgrading critical infrastructure and evacuation routes is an important component of hazard mitigation. Chapter 90 funds could be used for roadway improvements.

STATE TRANSPORTATION IMPROVEMENT PROGRAM (STIP)

STIP is an annual list of transportation infrastructure projects, funded and planned through the combined effort of MassDOT and other state agencies. For more on this program, please refer to: [State Transportation Improvement Program \(STIP\) | Mass.gov](#).

COMPLETE STREETS (CS)

The Complete Streets Funding Program provides grants to municipalities in Massachusetts for projects that improve safety and accessibility for all modes of transportation. To qualify for the program, municipalities must pass a Complete Streets Policy and develop a Prioritization Plan. After these requirements have been met, municipalities can apply for up to \$500,000 in construction funding. For more information about this program, please refer to: [Complete Streets Public Overview \(site.com\)](#).

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APPENDIX A

Maps

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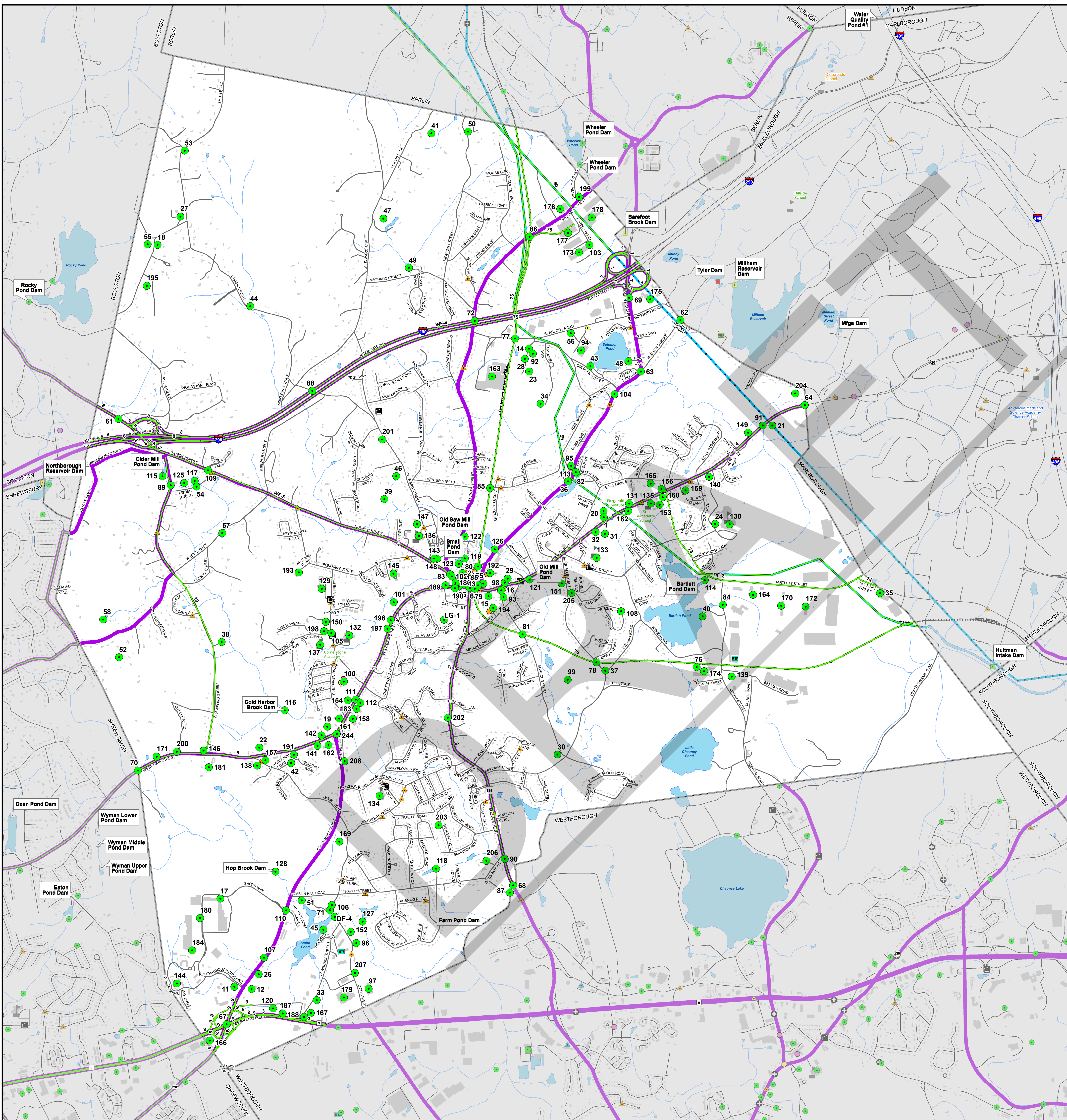
Hazard Mitigation Plan

Map 1

Critical Infrastructure and Facilities

Town of Northborough, Massachusetts

July 2024



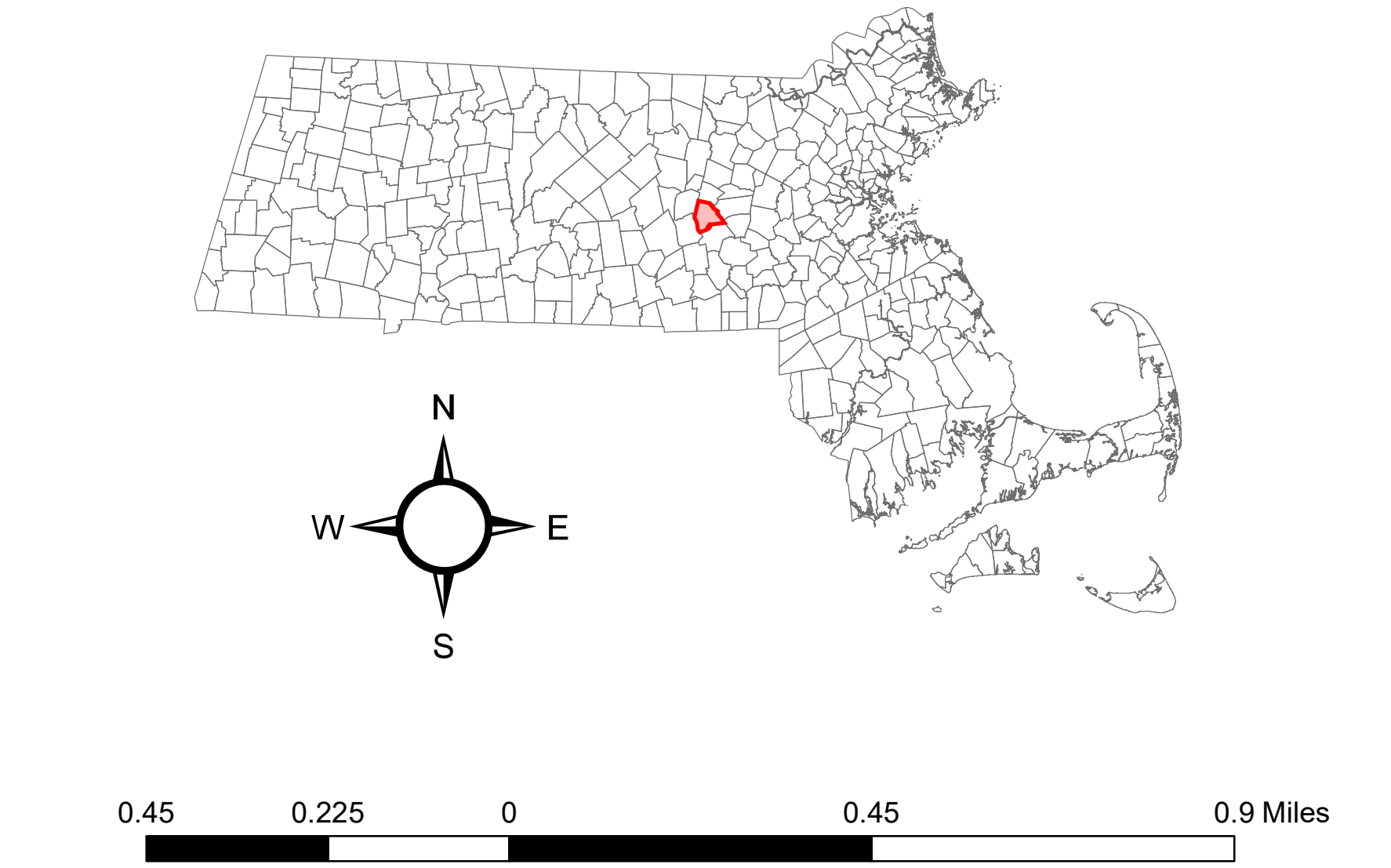
Legend

	Assisted Living		Town Halls
	Clinics		Local Police
	Elderly Housing		Fire Station
	Emergency Shelters		Schools (Pre-K through High School)
	End Of Life Facilities		Aqueducts
	Misc Data		Active Rail Line
	Nursing/Rest Homes		
	Daycare		
	Electric Distribution		
	Electric Substation		
	EOC		
	Courts		
	Water Treatment Plant		
	Waste Water Treatment Plant		
	Airports		

	Town Boundaries		Streams		Regionwide Evacuation Routes
	Structures		Roads		
	Water Bodies				

Dams (2/2012)		
	High Hazard	
	Significant Hazard	
	Low Hazard	
		N/A

Locally Defined		
	Critical Infrastructure	
	Critical Infrastructure	
	Critical Infrastructure	

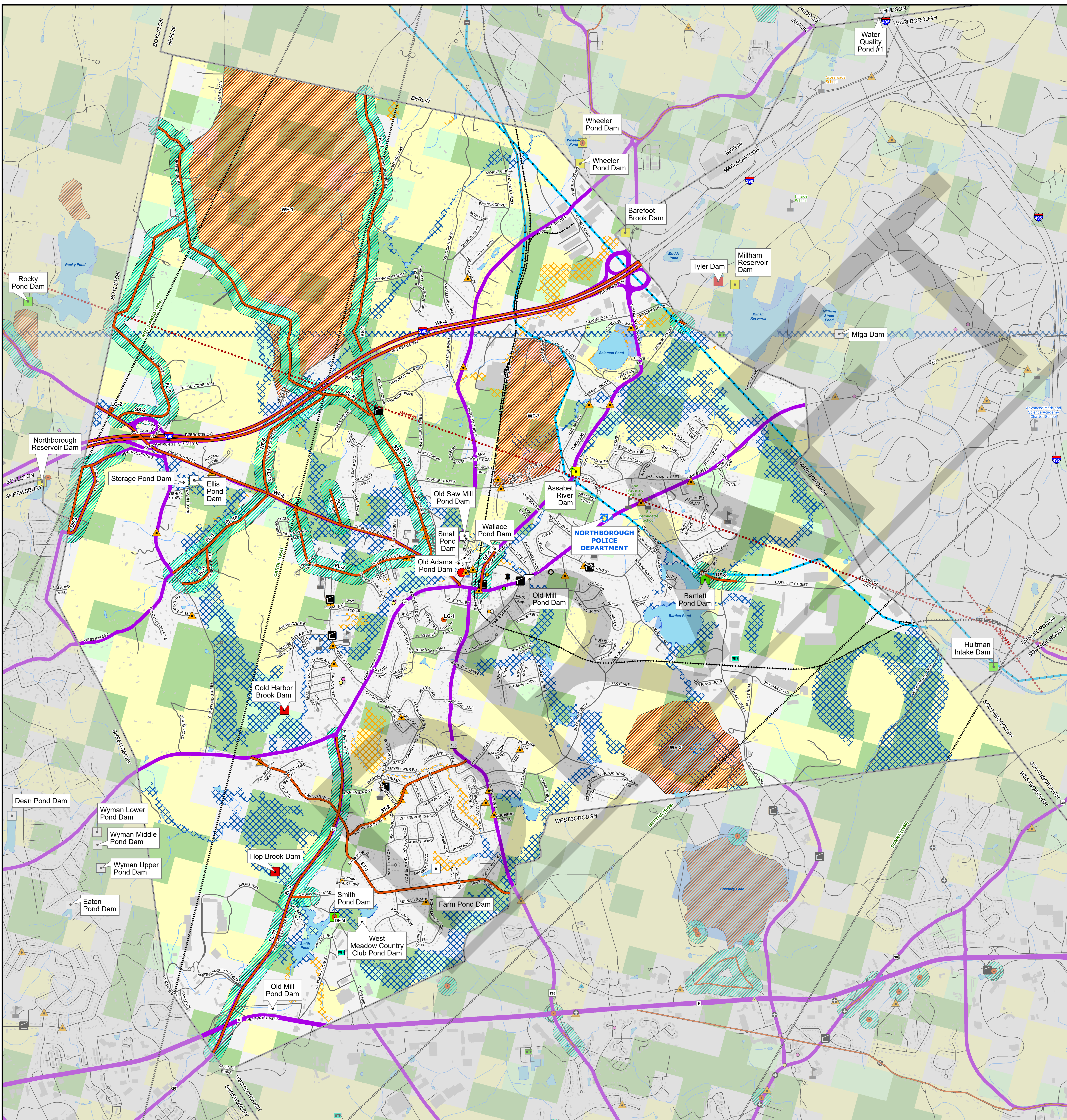


Hazard Mitigation Plan

Map 2 Hazards

Town of Northborough, Massachusetts

July 2024



Legend

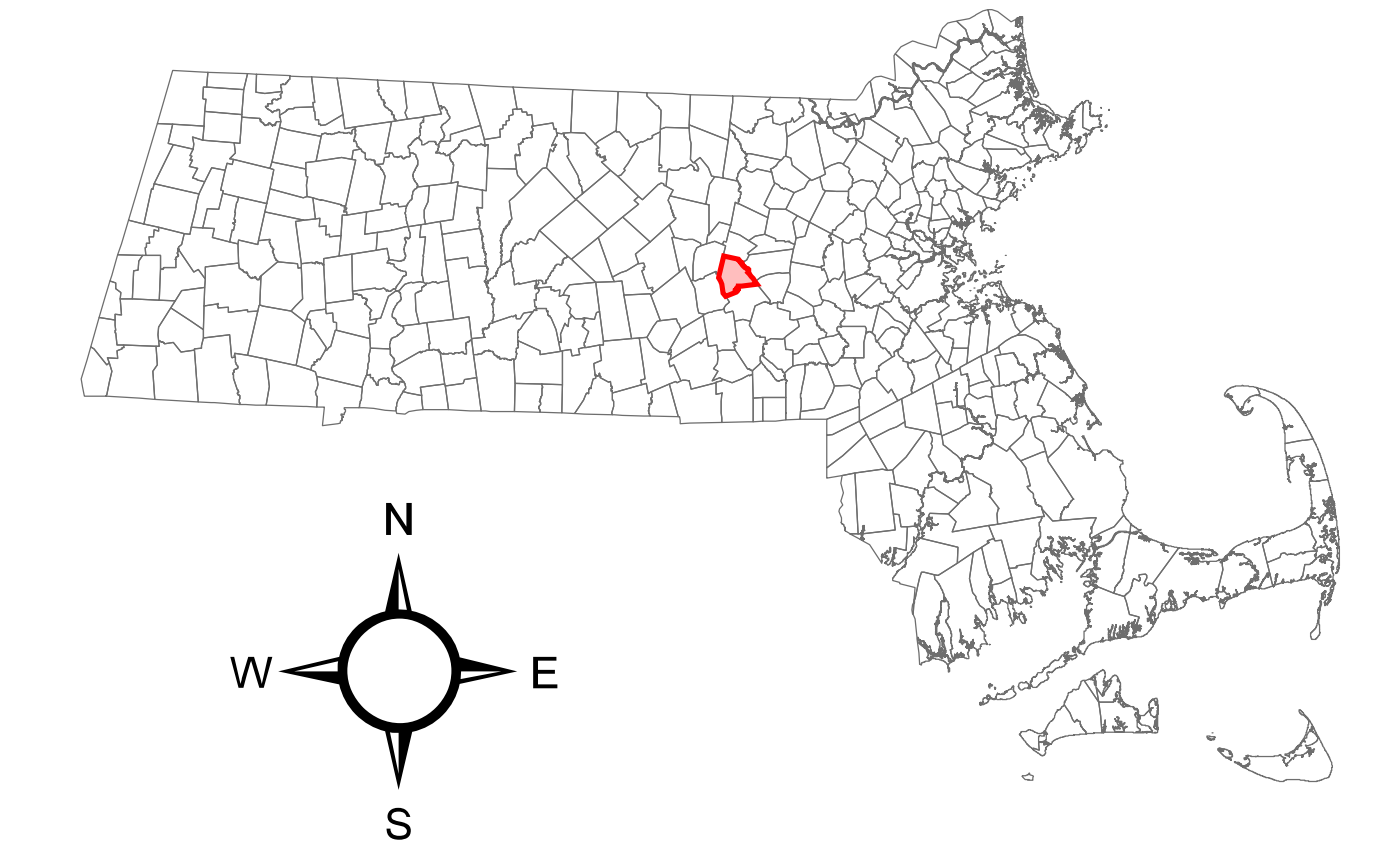
- Assisted Living
- Clinics
- Elderly Housing
- Emergency Shelters
- End Of Life Facilities
- Misc Data
- Nursing/Rest Homes
- Daycare
- Electric Distribution
- Electric Substation
- EOC
- Courts
- Water Treatment Plant
- Waste Water Treatment Plant
- Airports
- Town Halls
- Local Police
- Fire Station
- Schools (Pre-K through High School)
- Aqueducts
- Active Rail Line
- Town Boundaries
- Streams
- Roads
- Water Bodies
- Regionwide Evacuation Routes

Hazards

- Dams (2/2012)**
 - High Hazard
 - N/A
- FEMA DFIRM Flood Zones**
 - 100-year Flood Area*
 - 500-year Flood Area
 - Repetitive Loss Property Areas
- NOAA Historic Hurricane Tracks (1842-2022)**
 -
- USDA Wildfire Hazard Potential, Version 2023**
 - 1: Very Low
 - 2: Low
 - 3: Moderate
 - 4: High
 - 5: Very High
 - 6: Non-burnable
 - 7: Water

Locally Defined Hazards

- Hazard
- Hazard
- Possible Flood Area
- Hazard



Hazard Mitigation Plan

Map 3

Vulnerable Critical Infrastructure and Facilities

Town of Northborough, Massachusetts

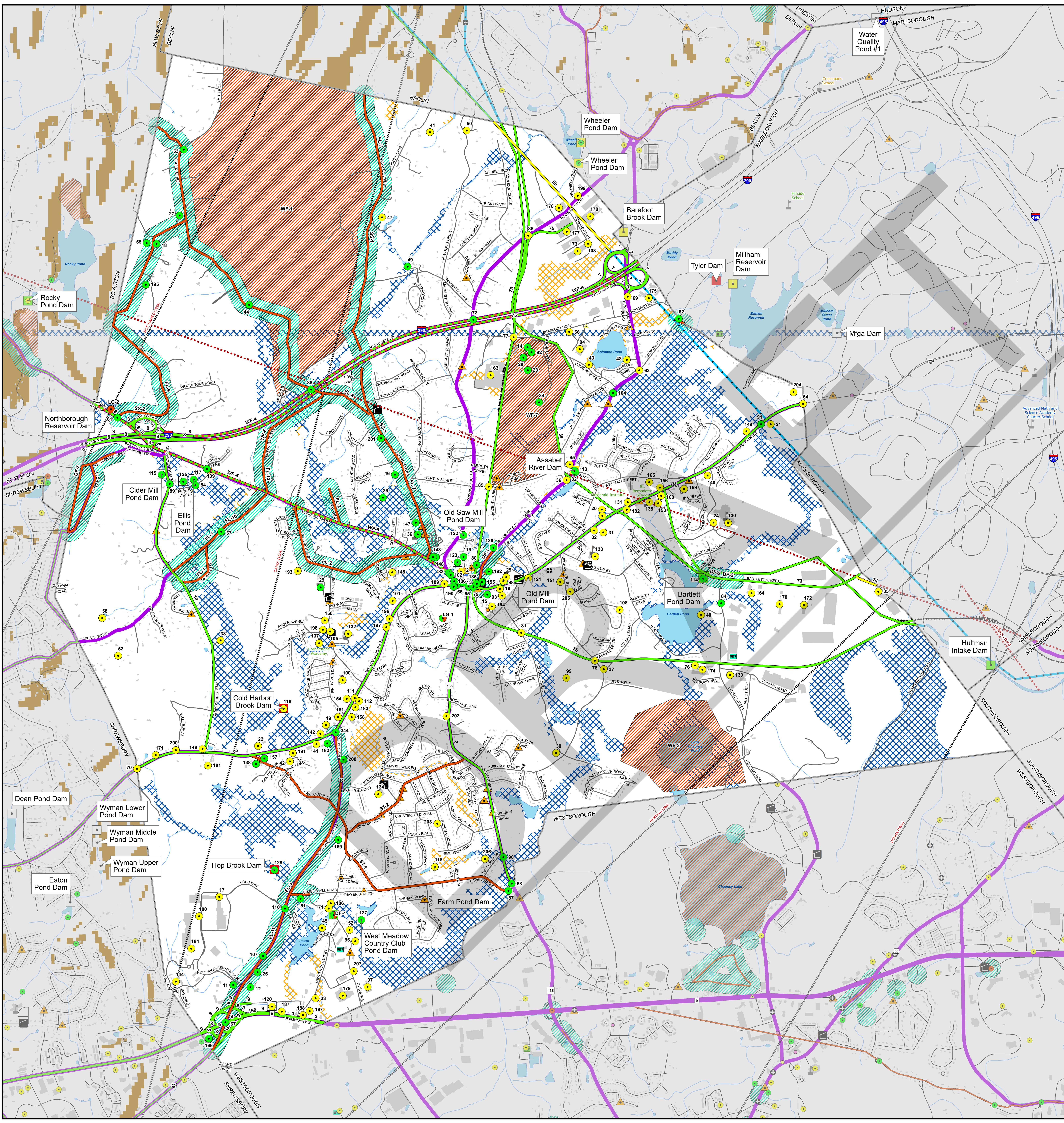
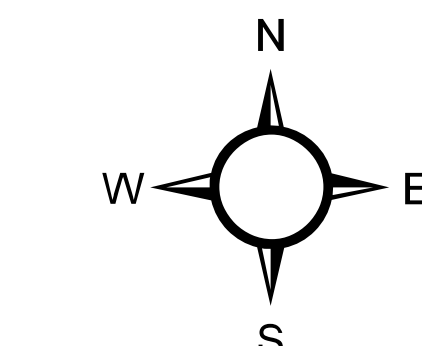
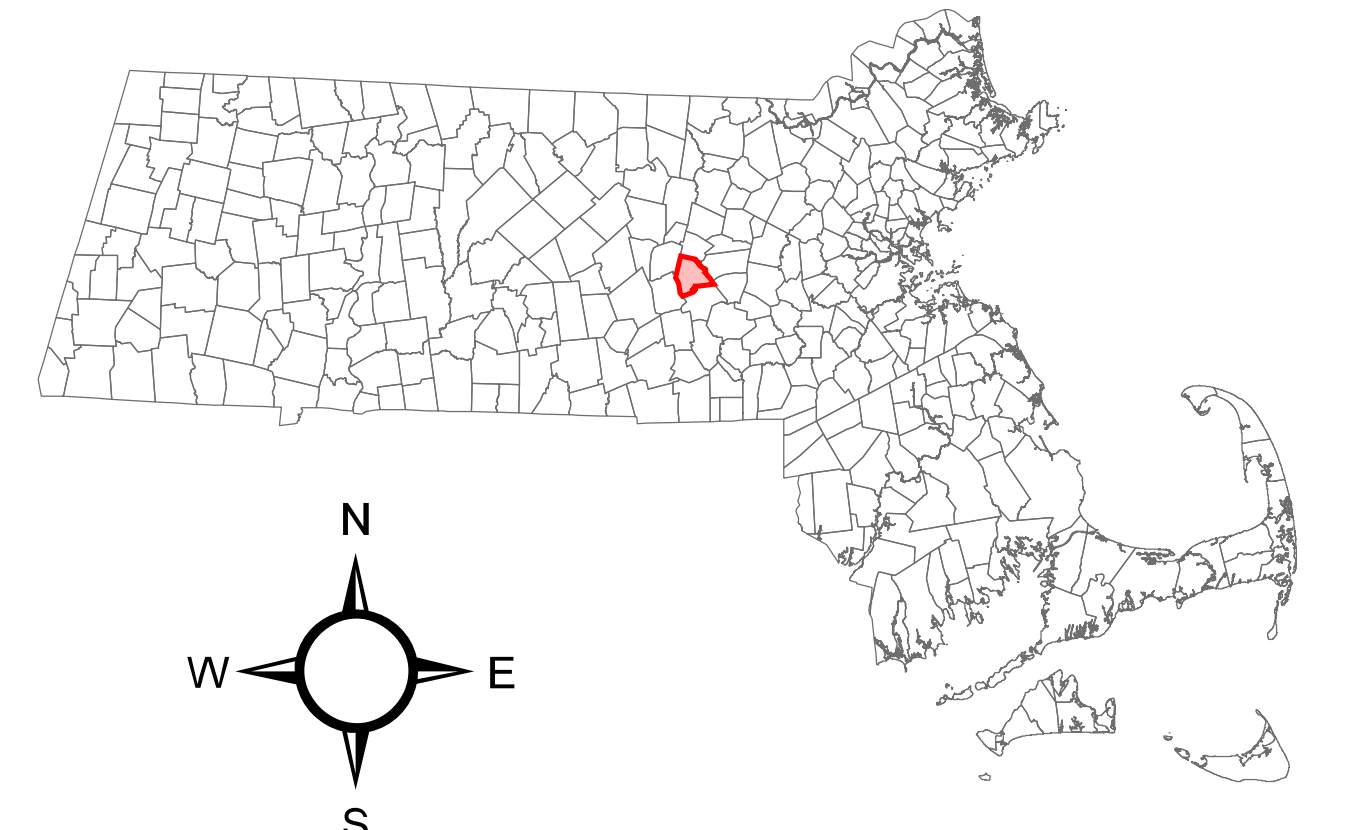
July 2024

Legend

- Assisted Living
- Clinics
- Elderly Housing
- Emergency Shelters
- End Of Life Facilities
- Misc Data
- Nursing/Rest Homes
- Daycare
- Electric Distribution
- Electric Substation
- EOC
- Courts
- Water Treatment Plant
- Waste Water Treatment Plant
- Airports
- Town Halls
- Local Police
- Fire Station
- Schools (Pre-K through High School)
- Aqueducts
- Active Rail Line
- Town Boundaries
- Streams
- Structures
- Roads
- Water Bodies
- Regionwide Evacuation Routes

- #### Hazards
- Dams (2/2012) High Hazard
 - Significant Hazard
 - Low Hazard
 - N/A
 - FEMA DFIRM Flood Zones 1% Annual Chance Flood Hazard or Regulatory Floodway
 - 0.2% Annual Chance Flood Hazard
 - High Slope (15% and above)
 - Repetitive Loss Property Areas
 - NOAA Tornado Tracks (as of 9/2021)
 - IBTrACS Historical Hurricane Tracks (1842-2020)

- #### Locally Defined
- Hazard
 - Vulnerable Critical Infrastructure
 - Vulnerable Critical Infrastructure/Hazard
 - Non-vulnerable Critical Infrastructure
 - Non-vulnerable Critical Infrastructure/Hazard
 - Hazard
 - Vulnerable Critical Infrastructure
 - Vulnerable Critical Infrastructure/Hazard
 - Non-vulnerable Critical Infrastructure
 - Non-vulnerable Critical Infrastructure/Hazard
 - Possible Flood Area
 - Hazard
 - Vulnerable Critical Infrastructure
 - Non-vulnerable Critical Infrastructure



Key to Locally Identified Critical Infrastructure and Hazards

<u>Name</u>	<u>Type</u>	<u>Map ID</u>	<u>Vuln. - Town</u>	<u>Vuln. - GIS</u>
Police Department	CI	1	Y	
Fire Department	CI	2		
Evacuation Route - Belmont Street	CI	3		Y
Evacuation Route - Main St @ Marlborough border to SWCutoff	CI	4		Y
Evacuation Route - 520 Main St to Shrewsbury border	CI	5		Y
Evacuation Route - 12 South St to Westborough border	CI	6		Y
Evacuation Route - I-290 Interchange	CI	7		Y
Evacuation Route - I-290 Interchange (2)	CI	8		Y
Evacuation Route - Rte 9 Interchange	CI	9	Y	Y
Evacuation Route- Crawford Street Bridge	CI	10		Y
Urgent Care- Pedi-Q	CI	11		Y
Urgent Care- Carewell	CI	12		Y
Urgent Care- CVS	CI	13		
Town Facilities-Northborough Senior Center – wastewater pump station present	CI	14		Y
Town Facilities- Gale Library	CI	15		Y
Town Facilities- Northborough Historical Society	CI	16		
Communications- PD & FD Receiver, FD repeater	CI	17		
Communications- Voter - Radio, Ball St	CI	18		Y
Communications - Voter, 300 West Main St	CI	19		
Communications - Cell Site, 211 Main St, at Police Station	CI	20		
Communications - Roof Top Com Tower, on xtra storage	CI	21		
Communications- Cell Tower - 386 West Main St, Fox Meadow Crossing	CI	22		
Communications - Cell Tower, Bearfoot Rd	CI	23		Y
Communications- Cable Access TV	CI	24		
Communications- Verizon	CI	25		
Communications - Cell Tower, Southwest Cutoff (Crown Castle)	CI	26		Y
Communications- Boylston Emergency Management Cell Tower	CI	27		Y
Communications- Tower – 119 Colburn Street	CI	28		Y
Town Hall (wastewater pumping station and generator on site)	CI	29		
Highway Department- Northborough DPW Water Barn	CI	30		
Highway Department- Northborough DPW Barn	CI	31		
Highway Department- Highway Garage	CI	32		
Highway Department- MA Highway Depot #039	CI	33		
Water Supply- Edmunds Hill 1MG Water Storage Tank	CI	34		Y
Water Supply- MWRA Connection	CI	35		
Water Supply- Hudson St. Public Water Supply, Former MWRA Connection	CI	36		
Water Supply- Well - Public Brigham St. / Water/Sewer Department Building	CI	37		
Water Supply- Well - Public Crawford St.	CI	38		

Water Supply- Well - Public Howard St.	CI	39		Y
Water Supply- Well - Public Lyman St.	CI	40		
Water Supply- Cistern - Moore Ln	CI	41		
Water Supply- Cistern - Old Colonial Rd	CI	42		
Water Supply- Draft Site - Colburn St	CI	43		
Water Supply- Draft Site - Green St	CI	44		Y
Water Supply- Draft Site - Hillside Rd	CI	45		
Water Supply- Draft Site - Howard St	CI	46		Y
Water Supply- Draft Site - Howard St (2)	CI	47		
Water Supply- Draft Site - Howe Lane	CI	48		
Water Supply- Draft Site - Maynard St	CI	49		Y
Water Supply- Draft Site - Newton St	CI	50		
Water Supply- Draft Site - Tomblin Hill Rd	CI	51		Y
Water Supply- Draft Site - West St (1)	CI	52		
Water Supply- Draft Site - Smith Rd	CI	53		Y
Water Supply- Draft Site - Fisher St	CI	54		Y
Water Supply- Draft Site - Ball St	CI	55		Y
Water Supply- Draft Site - Bearfoot Rd	CI	56		
Water Supply- Draft Site - West St (2)	CI	57		Y
Water Supply- Draft Site - West St (3)	CI	58		
Water Supply- Aqueduct - Wachusett-Hultman	CI	59		Y
Water Supply- Aqueduct - Wachusett-Cosgrove	CI	60		
Important Intersections: Church St & I-290	CI	61		Y
Important Roads - Hudson St & Marlborough Boundary	CI	62		Y
Important Intersections - Hudson St & Solomon Pond Rd	CI	63		
Important Road - Rte 20 & Marlborough Boundary	CI	64	Y	Y
Important Intersection - Rte 135 & West Main St	CI	65		Y
Important Intersection - Rte 20 / W. Main St. & Church Street	CI	66	Y	Y
Important Intersection - Rte 9 & Rte 20	CI	67	Y	Y
Important Road - Rte 135 & Westborough Boundary	CI	68		Y
Important Intersection - Solomon Pond Rd & I-290	CI	69		
Important Intersection – West Main Street & US Route 20	CI	244		Y
Important Road - W. Main St & Shrewsbury Boundary	CI	70		
Important Road - 68 Otis St	CI	71		
Important Road - 290 Overpass at Whitney St	CI	72		Y
Important Road – Bartlett Street	CI	73		Y
Important Road – Cedar Hill Street	CI	74		
CSX Rail Line	CI	75		Y
RR Dock - private, Lyman St	CI	76		
RR Crossing - Bearfoot Rd	CI	77		
RR Crossing - Brigham St	CI	78		
RR Crossing - Main St	CI	79		Y
RR Crossing - Pierce St	CI	80		Y
RR Crossing - School St	CI	81		
Bridge - Allen St	CI	82		Y
Bridge - Church St	CI	83		Y

Bridge - CSX Rail Line (Lyman St)	CI	84		Y
Bridge - CSX Rail Line (Rice Ave)	CI	85		
Bridge - CSX Rail Line (Whitney St)	CI	86		
Bridge - Davis St	CI	87		Y
Bridge - I-290 Overpass	CI	88		Y
Bridge - Crawford St stone bridge	CI	89		Y
Culvert - Route 135	CI	90		Y
Bridge - Rte 20	CI	91		Y
Utilities - Crown Castle Northborough	CI	92		Y
Utilities – Verizon Communication Center	CI	93		
Utilities - National Grid Northeast Service Center	CI	94		
Utilities - National Grid Woodside (Hudson St)	CI	95		
Services - Central MA Mosquito Project	CI	96		
Services - TeamWorks, Inc.	CI	97		
Services - The Bridge of Central MA	CI	98		
Services - Juniper Hill Golf Course, Inc.	CI	99		
Beamont/Whitney Place	CI	100		
Coleman House	CI	101		
Sewer- Wastewater Pump Station - Church St	CI	102		Y
Sewer- Wastewater Pumping Station - Forbes Road (has generator)	CI	103		
Sewer- Wastewater Pump Station - Hudson St	CI	104		Y
Sewer- Wastewater Pump Station - Lincoln St (has generator)	CI	105		
Sewer- Wastewater Pump Station - Otis St	CI	106		
Sewer- Wastewater Pump Station - Southwest Cutoff	CI	107		Y
Sewer- Wastewater Pump Station - Wesson Terrace	CI	108		
Sewer- Water Booster Pump Station - Church St @ Autumn Lane	CI	109		Y
Sewer- Water Booster Pump Station - Southwest Cutoff @ Shops Way	CI	110		Y
Sewer- Wastewater Pump Station - West Main St	CI	111		
U.S. Gov Post Office	CI	112		
Dam - Assabet River	CI	113		Y
Dam - Bartlett Pond	CI	114		Y
Dam - Cider Mill Pond	CI	115		Y
Dam - Cold Harbor Brook	CI	116	Y	
Dam - Ellis Pond	CI	117		Y
Dam - Farm Pond	CI	118		
Dam - Old Adams Pond	CI	119		Y
Dam - Old Mill Pond (SW)	CI	120		
Dam - Old Mill Pond	CI	121		
Dam - Old Saw Mill Pond	CI	122		Y
Dam - Small Pond	CI	123		Y
Dam - Storage Pond	CI	125		Y
Dam - Wallace Pond	CI	126		Y
Dam - West Meadow Country Club Pond	CI	127		Y
Dam - Hop Brook	CI	128		Y

School - Robert E Melican Middle School, Emergency Shelter	CI	129		Y
School - ARHS (Comms Voter & Tower, WW Pump, Daycare, POD)	CI	130		
School - Fitzgerald Institute	CI	131		
School - Lincoln St (Northborough Extended Day Program on Site)	CI	132		
School - Peaslee	CI	133		
School – Proctor (Northborough Extended Day Program on Site)	CI	134		
School - St. Bernadette	CI	135		
School - Marion E Zeh	CI	136		Y
School - Cornerstone Academy	CI	137		
Schools - Goddard School	CI	138		Y
Special Ed – Amego, Inc.	CI	139		
Daycare/Children's Program - Skribbles Learning Center	CI	140		
Daycare/Children's Program - Skribbles Learning Center	CI	141		
Daycare/Children's Program-Aprende Spanish Immersion Daycare	CI	142		
Daycare/Children's Program-Nashoba Montessori School, Inc.	CI	143		Y
Apartments - Avalon Bay Apartments	CI	144		
Apartments- Northborough Manor	CI	145		
Faith Institution - Church of Christ	CI	146		
Faith Institution - Church of the Nativity & Nursery School	CI	147		Y
Faith Institution - First Parish Unitarian Church	CI	148		Y
Faith Institution - Jehovah Witness Church	CI	149		
Faith Institution - Rice Memorial Baptist Church	CI	150		
Faith Institution - Seventh Day Adventist	CI	151		
Faith Institution - Shri Gurusthan Sai Temple	CI	152		
Faith Institution - St. Bernadette's Church	CI	153		
Faith Institution - St. Rose of Lima Church	CI	154		
Faith Institution - Trinity Church	CI	155		Y
Bartlett Crossing - 292 Main St.	CI	156		
Cold Harbor Mall - 369 W. Main St.	CI	157		Y
Northboro Shopping Plaza - 247 West Main St.	CI	158		
Post Road Marketplace - 318 Main St.	CI	159		
Shopping Center - 308 Main St., Veenas	CI	160		
Shopping Center (2) - 276 W. Main St., Picklehouse	CI	161		
Times Square Plaza - 299 W. Main St.	CI	162		Y
Iron Mountain	CI	163		
RJ Devereaux Corp.	CI	164		
Advocates, Inc. / Northborough Housing Authority - East Main St	CI	165		
EconoLodge (is a temporary emergency shelter)	CI	166		Y
Motel 6 Boston-Westborough	CI	167		
Tier II Chem User - Natural Gas Line	CI	168		Y
Tier II Chem User - Closed Landfill	CI	169		Y
Tier II Chem User - A. Duie Pyle Inc.	CI	170		
Tier II Chem User - National Grid-New England Distribution	CI	171		

Tier II Chem User - FedEx Freight, Inc	CI	172		
Tier II Chem User - Aspen Aerogels	CI	173		
Tier II Chem User - NewCorr Pkg., LTD	CI	174		
Tier II Chem User - St. Gobain Research & Development Center	CI	175		
Tier II Chem User - Steris AST	CI	176		
Tier II Chem User - Trelleborg Sealing Solutions	CI	177		
Tier II Chem User - Sanofi Genzyme Northboro Operations Cntr	CI	178		
Tier II Chem User – Walmart	CI	179		
Tier II Chem User - Northborough Crossing Mall	CI	180		
Tier II Chem User - Bigelow Nurseries, Inc.	CI	181		
Tier II Chem User - Lakeside Oil Company	CI	182		
Tier II Chem User - Northborough Oil Co., Inc.	CI	183		
Tier II Chem User - BJ's Wholesale Club Gas Station	CI	184		
Tier II Chem User - Cumberland Farms	CI	185		Y
Tier II Chem User - Northboro Center Mobile	CI	186		Y
Tier II Chem User - Northborough Sunoco	CI	187		
Tier II Chem User - Peterson Northborough	CI	188		
Tier II Chem User - Speed Energy	CI	189		
Tier II Chem User - Top Energy	CI	190		Y
Tier II Chem User - Tradebe Treatment & Recycling	CI	191		
Northborough Housing Authority - Heritage Village	CI	192		Y
Northborough Housing Authority - Rutland Rd	CI	193		
Northborough Housing Authority - Colonial Village	CI	194		
Tougas Family Farm Worker Dorm	CI	195		Y
Alcohol / Substance Recovery Center – 144 W Main Street	CI	196		
Alcohol / Substance Recovery Center – 150 W Main Street	CI	197		
Luther Rice Home	CI	198		
Justice Resource Institute Developing Abilities	CI	199		
Community Resources for Justice	CI	200		
Residential Board and Care - Vinfen Group Home	CI	201		Y
Residential Board and Care – Advocates Inc. 178 South St	CI	202		
Residential Board and Care – Advocates Inc. 29 Thoreau Rd	CI	203		
Residential Board and Care – Advocates Inc. 342 Boundary St	CI	204		
Residential Board and Care – Mentor Neuro Restorative	CI	205		
Residential Board and Care – 8 Saddle Hill Drive	CI	206		Y
Otis Street Adult Daycare	CI	207		
Memory Care Facility	CI	208		Y
Flooding - West St & Cherry St	H	FL-1	N/A	N/A
Flooding - Fay Lane & Lower Pleasant St	H	FL-2	N/A	N/A
Flooding – US-20 @ Tomblin Hill Rd	H	FL-3	N/A	N/A
Flooding - Davis St & Davis Ave near Rte 135	H	FL-5	N/A	N/A

Flooding - Boundary St/Town Line	H	FL-6	N/A	N/A
Flooding – Howard Street	H	FL-7	N/A	N/A
Flooding – Green Street	H	FL-8	N/A	N/A
Flooding – Ball Street	H	FL-9	N/A	N/A
Flooding – West Street	H	FL-10	N/A	N/A
Flooding – SW Cutoff	H	FL-11	N/A	N/A
Flooding – Brewer Street	H	FL-12	N/A	N/A
Severe Snow/Ice - Howard St old trees, power lines down	H	SS-1	N/A	N/A
Severe Snow/Ice – Ball Street winter hazard	H	SS-2	N/A	N/A
Severe Wind/Rain - Davis St	H	ST-1	N/A	N/A
Severe Wind/Rain - Northgate Rd	H	ST-2	N/A	N/A
Wildfire - Mt. Pisgah	H	WF-1	N/A	N/A
Wildfire - Little Chauncy Pond Fires	H	WF-3	N/A	N/A
Wildfires - I-290 border (I-290 is an evacuation route)	Cl/H	WF-4		Y
Wildfire – Church Street (Church St is an evacuation route)	Cl/H	WF-5		Y
Wildfire – Brewer Street	H	WF-6	N/A	N/A
Wildfire – Edmunds Hill	H	WF-7	N/A	N/A
Dam Failure - Wallace Pond Dam on Hudson St	H	DF-1	N/A	N/A
Dam Failure - Bartlett Pond Dam on Bartlett St (Bartlett St is an evacuation route)	Cl/H	DF-2		Y
Dam Failure - Northboro Reservoir Dam on Castle & Reservoir Rd	H	DF-3	N/A	N/A
Dam Failure – Smith Pond Dam	Cl/H	DF-4	N/A	N/A
Lightning Strike – Assabet Hill Comm Tower (lightning) and 3.5 MG water storage tank	Cl/H	LG-1		Y
Lightning Strike – Davidian Brothers Farm	H	LG-2	N/A	N/A

APPENDIX B

Public Survey

Materials and

Results

DRAFT



Northborough Hazard Mitigation Plan

Survey Responses Needed

The Town of Northborough is in the process of updating its Hazard Mitigation Plan and is requesting input from residents to inform this plan. An updated HMP will help the Town assess and reduce community risk from natural hazards.



You are invited to submit your thoughts on natural hazards, such as flooding, snowstorms, or thunderstorms, in the Northborough Hazard Mitigation Plan Community Survey.

Take our survey using the QR code below.



Tip: Open your phone camera, point at the QR code, and click the pop-up link to take the survey.

Link to the survey: <https://www.surveymonkey.com/r/8QWDVCS>



Northborough Hazard Mitigation Plan Community Survey

Northborough Hazard Mitigation Plan

In July 2023, the Town of Northborough started the planning process to update its Hazard Mitigation Plan (HMP). An updated HMP will help the Town identify strategies to reduce its vulnerability to hazards like flooding, winter storms, and drought. Climate change may shift the extent and severity of certain natural hazards, including those that already impact Northborough.

By participating in this survey, you will help the Town of Northborough understand the current and future natural hazards that residents are most concerned about. Survey responses will be accepted until January 31st, 2024.

1. Check all that apply.

- I live in Northborough.
- I work in Northborough.
- I frequently visit Northborough.

2. Has your family or property, in Northborough, been impacted by any of the following natural hazards? Select all that apply:

- I have not been impacted by natural hazards in Northborough
- Winter Storms / Ice
- Thunderstorms, Microbursts, and/or Extreme Wind
- Tornadoes
- Flooding
- Extreme Heat / Extreme Cold
- Drought
- Wildfire / Brushfire
- Hurricanes
- Earthquakes
- Poor Air Quality
- Invasive Bug Hazards
- Invasive Plant Hazards
- Other (please specify)

3. Where have you observed hazard impacts in Northborough, and what were those impacts?

Examples: flooding on specific roads, drought/effects on water supply, extended power outages, trees down on roads, beaver dams affecting property and septic systems due to flooding from dams.

4. How much do you think the impacts of natural hazards and climate change will threaten your personal health, safety, or property?

- I think natural hazards and climate change will negatively impact my life.
- I'm not sure how natural hazards and climate change will impact my life.
- I don't think that I personally will be impacted by natural hazards and climate change.

5. If you are concerned about impacts to your life from natural hazards and/or climate change, what impacts are you most concerned about?

Examples: basement flooding, wells drying out / contamination of wells, ability to grow food

6. How concerned are you about the impacts that natural hazards and climate change will have on the Town of Northborough (the local infrastructure, economy, environment, and/or town residents)?

- Very concerned
- Somewhat concerned
- Unsure
- Somewhat unconcerned
- Not concerned at all

7. What community assets are you most concerned about when you consider the potential impact of natural hazards and climate change on the Town of Northborough? Rank the responses below in order from most concerned about (1) to least concerned about (5).

- Local natural resources and environments
- Resident health, safety, and property
- Local infrastructure
- Local business and the town economy
- Local government resources

8. Which of the following aspects of natural hazards and climate change would you like to learn more about? Select all that you are interested in.

- Impacts on well water quantity / quality
- Future flood risks
- Impacts on infrastructure
- Sustainability initiatives
- Public health impacts like increased risks of vector-borne disease (ex. Lyme disease, West Nile Virus, EEE - Eastern equine encephalitis)
- Impacts on town budget and finances
- Impacts on wildlife
- Impacts on the health of local forests
- Impacts on future development
- Other (please specify)

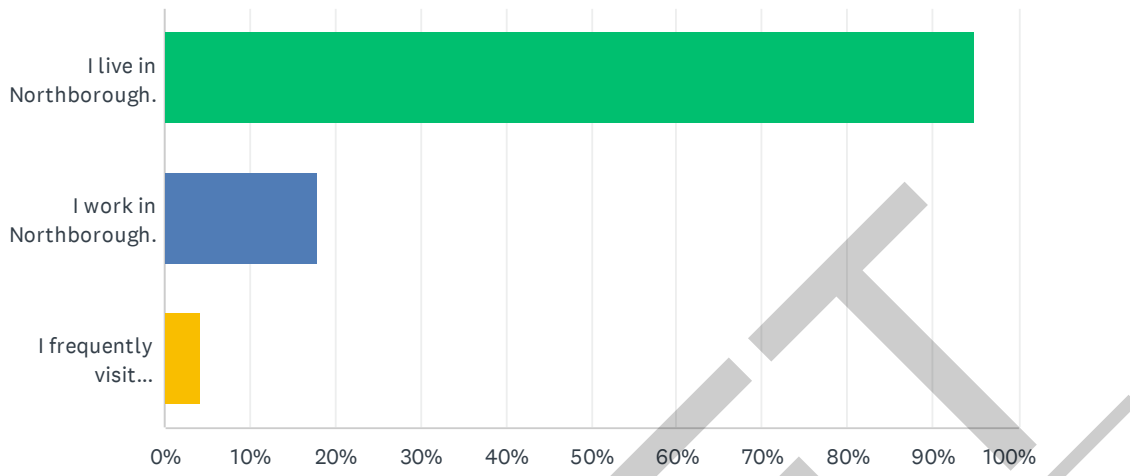
9. What actions should the Town of Northborough take to cultivate local resilience to natural hazards? Select all that you would like to see.

- Create green infrastructure which improves storm water management
- Provide more education and outreach about how climate change could impact my life
- Increase local capacity to apply for hazard mitigation grant funding and implement hazard mitigation projects
- Encourage planting new trees, especially climate-resilient tree species
- Encourage cutting/trimming dead trees beside/hanging over roads
- Continue to implement the Northborough Forest Stewardship Program by editing the Forest Management Plans to incorporate climate adaptation optimization
- Prepare/implement forest harvest plans and invasive plant control for conservation areas in town in accordance with updated forest management plans
- Other (please specify)

10. If you would like to stay informed about other opportunities to participate in Northborough's Hazard Mitigation planning process, please enter your E-mail address below.

Q1 Check all that apply.

Answered: 212 Skipped: 1

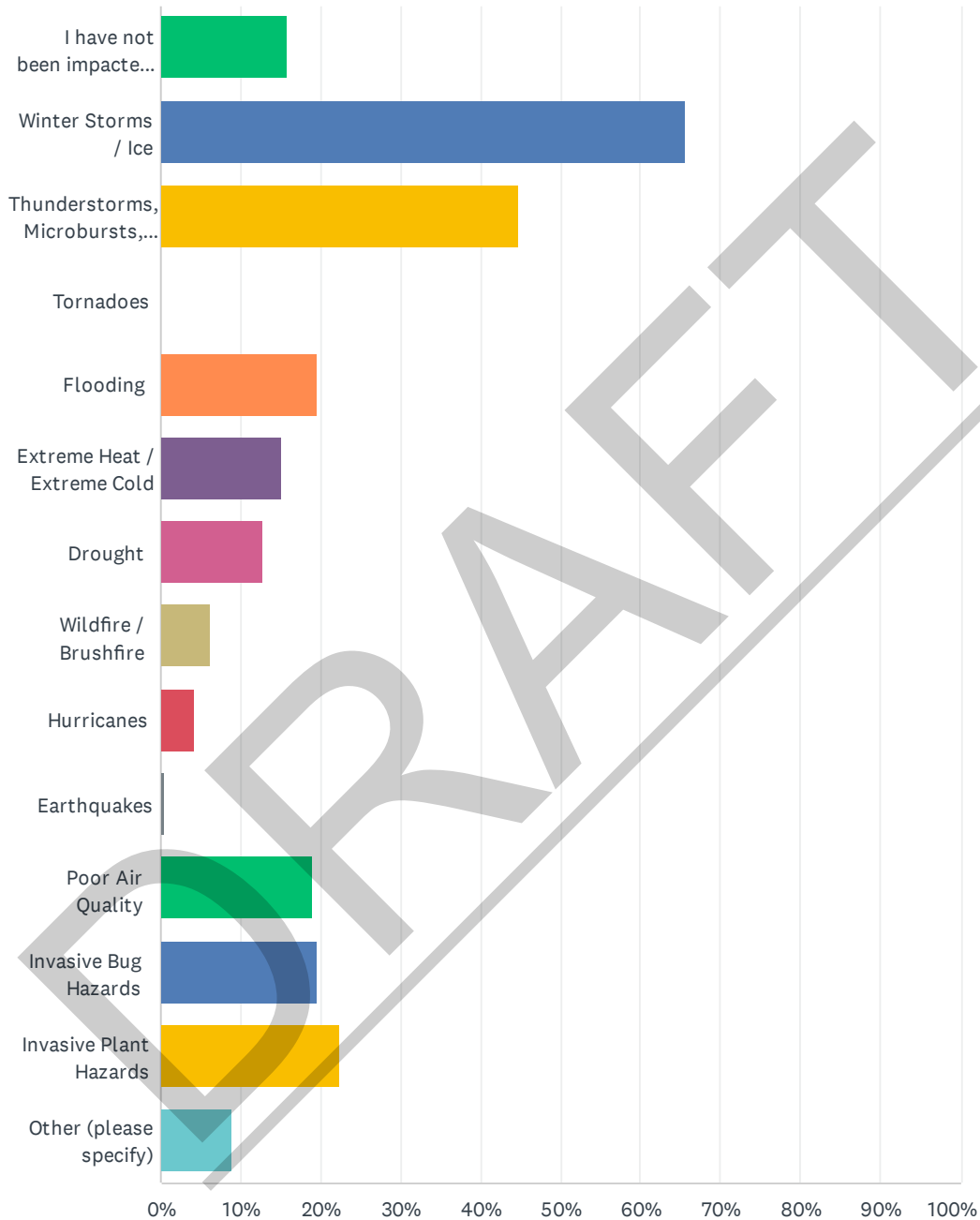


ANSWER CHOICES	RESPONSES
I live in Northborough.	94.81% 201
I work in Northborough.	17.92% 38
I frequently visit Northborough.	4.25% 9
Total Respondents: 212	

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Q2 Has your family or property, in Northborough, been impacted by any of the following natural hazards? Select all that apply:

Answered: 210 Skipped: 3



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ANSWER CHOICES	RESPONSES	
I have not been impacted by natural hazards in Northborough	15.71%	33
Winter Storms / Ice	65.71%	138
Thunderstorms, Microbursts, and/or Extreme Wind	44.76%	94
Tornadoes	0.00%	0
Flooding	19.52%	41
Extreme Heat / Extreme Cold	15.24%	32
Drought	12.86%	27
Wildfire / Brushfire	6.19%	13
Hurricanes	4.29%	9
Earthquakes	0.48%	1
Poor Air Quality	19.05%	40
Invasive Bug Hazards	19.52%	41
Invasive Plant Hazards	22.38%	47
Other (please specify)	9.05%	19
Total Respondents: 210		

#	OTHER (PLEASE SPECIFY)	DATE
1	Trees Fall, Branches Fall, No property damage, Flooding corrected with drainage diverting stormwater during winter rains [There are 2 exclamation marks next to the Invasive Plant Hazards on the paper form]	3/1/2024 1:47 PM
2	Risk from hazardous cargo carried by CSX	1/25/2024 7:47 AM
3	Overbuilding	1/19/2024 8:29 AM
4	High winds are a great concern due to tall pine and spruce trees on neighboring properties that pose a risk. in recent years we have had four trees fall across our driveway and within the past two weeks one tree some 70-feet pluss tall broke off and came within inches of driving right into our house.	1/16/2024 10:05 AM
5	Increasing infestation with ticks.	1/13/2024 7:19 AM
6	I used to live in Northboro, greatest area of impact experienced was probably from winter storms/ice	1/11/2024 11:34 AM
7	Highly senistive to people burning brush and venting fragrances into the air from dryer or chimney	1/8/2024 10:26 AM
8	high wind events	1/7/2024 3:06 PM
9	smells from SA farms	1/6/2024 12:44 PM
10	I have been living in Northboro for 20 years. There has been no indication of any sort hazard impact to my home or family. My grass is green. We are all healthy and there is no evidence to suggest there is any looming danger	1/6/2024 11:08 AM
11	Chemtrails 😞	1/5/2024 9:34 PM
12	there was alot of rain this year but luckily it didn't seep into the basement. neighbors have had water problems	1/5/2024 2:49 PM
13	wind damage to trees & some ice issues w/trees (knock on wood no issue w/home yet)	1/5/2024 12:22 PM

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14	Wind and tree branches falling on my driveway	1/5/2024 11:24 AM
15	I rent, not own, property in Northborough.	1/5/2024 11:19 AM
16	"Near Flooding" from the overflow emanating from the pond REDACTED which, I believe is the terminus of the runoff from an obsolete reservoir at Crawford/Reservoir streets.	1/5/2024 10:33 AM
17	wildlife (coyotes, bears, deer) encroaching on property and hurting pets.	1/5/2024 9:12 AM
18	Power Outages	1/5/2024 8:57 AM
19	Noise building shaking when CSX trains go by	1/5/2024 8:44 AM

DRAFT

Q3 Where have you observed hazard impacts in Northborough, and what were those impacts? Examples: flooding on specific roads, drought/effects on water supply, extended power outages, trees down on roads, beaver dams affecting property and septic systems due to flooding from dams.

Answered: 155 Skipped: 58

#	RESPONSES	DATE
1	I see no Hazards, SUASCO controls Assahet Watershed Flooding	3/1/2024 1:47 PM
2	flooding on West St;	2/10/2024 7:13 AM
3	Ball Street flooding, church street flooding , frequent power outages on Ball Hill.....	1/31/2024 5:50 PM
4	flooding on North Main, trees down all over town, poisen ivy growing over sidewalks especially along N. Main St, flooding preventing the use of town land like the fields at McAffee	1/27/2024 2:37 PM
5	Heavy rains have caused Smith Pond to overflow REDACTED, especially during the winter as snow melts.	1/25/2024 9:23 PM
6	Tree limbs down on School Street Flooding where 135 passes under route 9	1/25/2024 7:47 AM
7	Loss of power, repeatedly	1/23/2024 3:52 PM
8	more frequent power outages than in past decade	1/21/2024 9:36 AM
9	The majority of town open spaces and roadsides are full of invasive plants that take down trees and cause harm to local wildlife and native plants. Invasive bugs also cause damage.	1/19/2024 8:17 PM
10	Over hanging trees and Water erosion: West Main street,Davis street,and Otis street	1/19/2024 8:29 AM
11	Poor air quality from Canadian forest fires, significant forest tree loss from derechos and winter ice storms noted on town trails	1/17/2024 2:56 PM
12	Piled up snow at the end of REDACTED and then when it melted we had major flooding in our basement. Working with dpw and they are not offering any suggestions how to fix the problem.	1/17/2024 1:09 PM
13	Ridge road - trees down, extended power outages	1/17/2024 1:06 PM
14	Flooding on route 20 and Stirrup Brook near Algonquin HS. Downed trees on roads and power lines.	1/17/2024 12:27 PM
15	air quality in Melican; mold and mildew in halls and classrooms, vents in bathrooms not working properly. Extreme heat in classrooms.	1/17/2024 8:00 AM
16	On Howard Street. Frequently lose power. Flooding down the street damages the road. We have a brush fire last spring visible from our home. Lastly there are invasive bitter sweet vines we are fighting that have destroyed numerous trees (dozens)	1/16/2024 6:03 PM
17	Invasive plant growth affects northborough open space and private property wooded margins. Few who live in town have any awareness to identify and remove plants, thus the problem continually spreads. Wildlife habitat has diminished as lawns, pavement, and invasive growth dominate. More attention to preservation and conservation goals, hiring broader expertise in town government, and fostering community partnership and education are needed.	1/16/2024 4:01 PM
18	they're several roads with depressions that are easily flooded; strom drains that are clogged and back up water	1/16/2024 10:05 AM
19	There are many invasive plants on our trails.	1/15/2024 11:50 AM
20	Flooding on West St near Shrewsbury line. Mosquitoes carrying EEE, Gypsy moths	1/15/2024 7:36 AM
21	drought affects my well on Macalister drive, downed trees on road, West Street flooding	1/15/2024 7:17 AM

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22	Downed trees due to high winds and rain. Ice dams causing leaks in the house.	1/14/2024 7:49 PM
23	Flooding on Church ST	1/14/2024 10:08 AM
24	assorted areas in Town have experienced several of these impacts.	1/13/2024 11:12 AM
25	All on our property, which borders Edmund Hill woods	1/13/2024 9:40 AM
26	We've had extended (> 1 day) power outages on Smith Road in Northborough frequently over the years, some as long as 6 days. We've lived here since 1992, and didn't suffer an extended power outage until 2008. Since then, we've had half a dozen extended power outages. The problem seems to be getting worse.	1/13/2024 7:19 AM
27	Flooding impacting Longfellow road intersection when Davis Ave failed, earthquakes caused cracking REDACTED	1/12/2024 8:09 PM
28	Bittersweet vines smothering lilacs, forsythias, evergreens, etc.	1/12/2024 4:48 PM
29	Above ground electric lines going thru tree branches across many neighborhoods. Cut the tree or branches close to powerline.	1/12/2024 4:45 PM
30	Nothing seen	1/12/2024 3:21 PM
31	Extended power outages	1/12/2024 1:26 PM
32	Knotweed encroaching from flood control lands. Wildfire smoke causing breathing difficulties.	1/12/2024 11:37 AM
33	Recent flooding of Church St., prolonged power outages during winter storms.	1/12/2024 10:22 AM
34	Unexpected flooding at the Church Street and route 20 area during recent heavy rain storms (in the past 10-12 months).	1/12/2024 10:01 AM
35	From my home	1/12/2024 9:49 AM
36	Flooding on Church, trees and limbs on wires/roadways green street area to Maynard st.	1/11/2024 7:18 PM
37	Lost one tree to high winds just after the holidays. Have a few Winged Euonymous bushes nearby (invasive species). Also have potential problem with neighbor's pine trees - in 10 years they'll block all the sun on my back yard, and eventually the solar panels I want to put on my roof. Gotta find some way to take them down.	1/11/2024 5:54 PM
38	Trees down, power outages, invasive plant overgrowth, invasive bugs on Howard Street. Frequent flooding on West Street. Wildfires on Mount Pisgah.	1/11/2024 4:24 PM
39	The road frequently floods by 422 West Main Street.	1/11/2024 3:32 PM
40	1. Storms causing various trees down resulting in power outages and blocking roadways along Green Street and connecting roadways. 2. Poison ivy, Japanese knotweed and Kudzu (?) vines choaking areas of property- constant fight to keep it at bay. 3. Mosquitos and ticks make it almost impossible to enjoy the outdoors on our property. 4. Recent forest fire (Mt. Pisgah), various "farm compost piles/properties" and poor air quality warnings are common in the northern areas of town.	1/11/2024 3:13 PM
41	Trees down under ice load wreking fence and came close to falling on the house, in addition to ice load damaging landscaping.	1/11/2024 12:53 PM
42	None	1/11/2024 11:38 AM
43	Some flooding on town streets (West St., Church St.) fallen tree hazards seem to occur more often.	1/11/2024 11:34 AM
44	We have lost a lot of trees at the parks due to ice storms and thunderstorms.	1/11/2024 8:39 AM
45	Flooding on Church Street	1/10/2024 4:14 PM
46	Flooding on 20 at the rt 9 overpass and on rt 9 W at the Westboro town line (in front of Casa Vallarta/motel 6. Any accident involving poles on Church St wipe out half the town's power	1/10/2024 4:05 PM
47	Down power lines	1/10/2024 3:51 PM
48	Leaking roof in town hall (Accounting Dept), septic back up in basement (storage area)	1/10/2024 2:30 PM

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49	North side of town	1/10/2024 1:26 PM
50	We have some invasive plant encroachment on our property.	1/10/2024 1:16 PM
51	Invasive species of plants such as Milfoil are spreading through most fresh water bodies in the area. Also Asian Long horned beetle and lantern flies are some invasive insects affecting this area.	1/10/2024 11:57 AM
52	Heat issues, building flooding, frozen/ruptured pipes and sprinkler pipes due to no heat	1/10/2024 11:46 AM
53	Power outages - trees down	1/10/2024 11:22 AM
54	Flooding on West & Cherry and In backyard	1/9/2024 5:46 PM
55	Storms causes extended power outages. Invasive bugs (ticks) and Lyme disease.	1/9/2024 4:52 PM
56	Downed trees in and around our property due to Asian bittersweet. Icy/windy storms then force trees that are compromised to fall.	1/9/2024 4:42 PM
57	REDACTED Brigham Street. We are recently getting a lot of water from road. Curbs are not sufficient in height and water is rushing down our property and eroding soil and landscape. Installation of additional storm drain and curbing sufficient to funnel water to drains in place rather than down through properties.	1/9/2024 4:38 PM
58	flooding on East Main street due to heavy rain which spills over into my yard; high water REDACTED causing my property/house to subside caused by poor drainage under Rt 20	1/9/2024 4:33 PM
59	Flooding on Church St and West St.	1/8/2024 3:13 PM
60	Proctor Elementary- Always flooded	1/8/2024 11:05 AM
61	I live on Washburn St. Every time we have a lot of rain the Howard St end of Washburn floods	1/8/2024 10:29 AM
62	Work was done recently on the corner of Meadow and Chesterfield. Now that corner is almost continuously flooded, puddles filling half the road, road surface disintegrating, ice. Was better before. We have had occasional power outages in the Northgate area, but not recently. Snow and ice removal are a challenge. General impact on health from local brush burning/pit fires/ Canadian wildfires. Neighborhood is too closely developed not to be affected by neighbors' smoke etc.	1/8/2024 10:26 AM
63	Sporadic power outages during high periods and ice/wet snow storms	1/8/2024 8:50 AM
64	An ice storm many years ago took out our power for 5 days. In general, our home has been pretty lucky.	1/7/2024 7:14 PM
65	Beaver dams at several locations, road flooding due to runoff, septic systems failing around Smith Pond.	1/7/2024 6:07 PM
66	The roads in my neighborhood frequently have flooded areas. Ball Street in particular has runoff that seems to be drastically affecting the integrity of the road.	1/7/2024 4:35 PM
67	Flooding causing road closures on West st near church st. Flooding of assabet onto private property. Ice & wind storms causing downed trees/branches and hazardous road conditions	1/7/2024 3:06 PM
68	extended power outage snowtember storm.	1/7/2024 2:42 PM
69	I am concerned about floods, droughts and powerful storms taking down trees, power and home damage.	1/7/2024 11:37 AM
70	Power outages. A tree fell on our neighbor's house.	1/7/2024 10:12 AM
71	Flooding on West St, but that's been there for all 22 years I've lived in town. Power outages, more with respect to frequency than duration, have always been a problem - seems like power goes out at our house at least 3-5 times a year, and that's just not ok. It's especially painful because Shrewsbury, which is right down the street from me, always has power because of their municipal power generation while we, with National Grid, fall over almost every time there's even a semi-decent, (but incredibly foreseeable and "plan-for-able"?) storm.	1/7/2024 10:06 AM
72	Heavier rains we have seen more of recently is eroding road embankments. More rain pools water in low wetlands which creates mosquito issues in those areas. With all the great trails we	1/7/2024 8:54 AM

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have in town, the tick population has boomed over the years and due to warmer winters, they are around all year.

73	Flooding nearby, west st between Crawford and Church floods frequently.	1/7/2024 8:19 AM
74	Flooding on West Street	1/7/2024 8:16 AM
75	Assabet Hill. The road situation in our neighborhood is dire. Every time a winter storm hits and the roads are plowed the roads get worse and worse - manhole covers become dislodged, curbs are damaged. The extreme temperatures cause cracking and further damage to the pavement and the drainage system underneath. Extreme wind has caused property damage and is becoming more frequent. Dry years bring concerns of well running dry.	1/6/2024 10:55 PM
76	Down trees and power lines in Chapinville	1/6/2024 9:53 PM
77	Streets flooded in Northgatd neighborhood.	1/6/2024 8:54 PM
78	Power outages seem to be frequent, and are occasionally extended. We have also had large tree branches come down in our yard because of wind or snow.	1/6/2024 8:20 PM
79	at my home and surrounding neighborhood...the smells have caused us to not be outside some summers	1/6/2024 12:44 PM
80	My street has flooded and my basement flooded for the first time a few weeks ago - despite having a sump pump that previously prevented flooding.	1/6/2024 11:15 AM
81	flooding on Rte20	1/6/2024 11:12 AM
82	There have been no hazardous impacts to my property	1/6/2024 11:08 AM
83	Flooding on Rt 20 due to heavy rains	1/6/2024 8:22 AM
84	Flooding at intersection of Fay Lane and Church St. Take a look at cleanout of culvert. Sticks, branches, beavers possible impacts.	1/6/2024 6:56 AM
85	Downed trees everywhere. Frequent power outages north of rte 290. Smoke from fires nearby and far away. Flooding in low-lying areas blocking roads and destroying buildings.	1/6/2024 6:32 AM
86	No where.	1/5/2024 10:33 PM
87	dying law, damaged trees from wind & snow	1/5/2024 10:04 PM
88	Ball Street needs to be improved. Lots of wild water and rocks surging down the hill during rain storms.	1/5/2024 9:34 PM
89	Downed trees and boughs on streets after high winds.	1/5/2024 9:00 PM
90	Invasive plants. Oriental bittersweet and Japanese knot weed on Bartlett / East Main area on town property.	1/5/2024 8:11 PM
91	Beaver dam impact to trail flooding, but not associated with climatic events.	1/5/2024 4:40 PM
92	Flooding during rain events on Main St near the Marlborough line.	1/5/2024 3:20 PM
93	During the last rain storms there was a huge puddle almost in front of the self storage plan on the way to marlborough. (It was nothing like the water in Marlborough pouring down the hill by the light after linguines). Water levels look high on Bartlett pond and others recently.	1/5/2024 2:49 PM
94	Gypsy moth invasion. The oak trees on our property were weakened by moth exfoliation twice within 5 years causing some to die with a need for them to be cut down near the house.	1/5/2024 2:48 PM
95	Flooding in open area behind houses on chesterfield rd. Frequent power outages during storms	1/5/2024 2:09 PM
96	The only issues I've had in my 14 years of living here have been down trees and power outages due to wind, snow, ice, etc.	1/5/2024 2:00 PM
97	Mostly in my yard only when the storms are extreme.	1/5/2024 12:59 PM
98	Water pools REDACTED Brigham REDACTED. Erosion evident at my property REDACTED as the "drop off" from yard to street has declined significantly in a few years.	1/5/2024 12:54 PM
99	Flooding on Ball St. near Tougas farm; wildfire in Mt. Pisgah; basement flooding; low water in wells and iron saturated wells (all in the Green St.,, Smith Rd. area)	1/5/2024 12:53 PM

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100	Flooding on Church Street between Fay St. and Pleasant St. causing closure and detours. Also, automobiles crashing into telephone/power poles causing power outages.	1/5/2024 12:37 PM
101	Flooding West St. Beaver dams on Howard brook near cemetery	1/5/2024 12:32 PM
102	Street flooding and water running off into driveways and yards due to a lack of berms to control flows.	1/5/2024 12:32 PM
103	Trees down on both sides of my house on the same street. Neighborhood had an infestation of brown marmorated stink bugs. Multiple houses in Stone, Whitney and Coolidge had infestations.	1/5/2024 12:23 PM
104	East Main Street trees down (in the past)	1/5/2024 12:22 PM
105	Extended power outage	1/5/2024 12:12 PM
106	Overflow flooding of the pond/stream located REDACTED School Street. REDACTED	1/5/2024 12:11 PM
107	trees down from wind damage and extreme cold	1/5/2024 12:09 PM
108	Whitney Street under 290 always has standing water which freezes to ice in the winter.	1/5/2024 11:43 AM
109	flooding on Washburn Street	1/5/2024 11:31 AM
110	Wetlands dumping of yard debris REDACTED Lincoln Street REDACTED	1/5/2024 11:27 AM
111	Church ST needs upgrades - many vehicle accidents causing power outages.	1/5/2024 11:19 AM
112	Flooding in yards, and in basements	1/5/2024 11:09 AM
113	None	1/5/2024 11:09 AM
114	Basement flooding and spongy moss in the yard caused from excessive rain on Goodnow Circle, Northborough MA.	1/5/2024 10:58 AM
115	Trees down on roads (School Street). But the town has recently been removing the dead trees to mitigate the problem.	1/5/2024 10:54 AM
116	I think the power lines that go along 135 are vulnerable. Based on an extended power outage a few years ago for the homes near Rt. 9.	1/5/2024 10:47 AM
117	flooding on Bartlett Street between Rte 20 and Algonquin and flooding on rte 20 at Marlborough end near self storage	1/5/2024 10:40 AM
118	I have seen flooding on Church Street and Fay St. Trees often come down on Church Street causing power outages.	1/5/2024 10:39 AM
119	Trees down after high wind on Chapin street. Power out after snowstorm/ice storm	1/5/2024 10:35 AM
120	We seem to be the victims of more Power Outages than one would expect.	1/5/2024 10:33 AM
121	occasional extended power outages during storms, increased utility bill d/t extreme heat/cold weather	1/5/2024 10:31 AM
122	When we first moved here in 2010, we had several extended (multiple-day) power outages in the Davis Street/Indian Meadow area though it hasn't been bad in a while.	1/5/2024 10:22 AM
123	We live in a wooded area on Howard St REDACTED. We frequently experience limbs or trees on the power lines, and we have power lines going right through the forest REDACTED. Power line maintenance is important around us, but for future prevention, underground lines would be amazing (though I know it would be a whole ordeal).	1/5/2024 10:11 AM
124	Northboro (or Whitney St) seems to have frequent power outages, some short-lived but longer when due to downed power lines during storms.	1/5/2024 10:10 AM
125	Home on Howard St. loss of power, poor air quality due to wildfires	1/5/2024 10:08 AM
126	power outages due to storms on Hudson St. Have also seen flooding on Hudson and Church St. in strong rainstorms	1/5/2024 10:04 AM
127	Power outages	1/5/2024 10:00 AM

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128	I consistently observe invasive species like bittersweet, knotweed, and common reed in our waterways and natural areas. Bittersweet has also been on our property since we purchased it. I understand these feel like a less immediate concern than a weather hazard, but I am extremely concerned at how these are impacting our local wildlife and thus our ability to grow our own food, maintain biodiversity, etc. I see some light mowing type mitigation around some areas, but I would like to see a more intense removal of some of these areas, particularly those around bodies of water (the displacement of cattails by common reed is especially concerning for birds and aquatic wildlife)	1/5/2024 9:59 AM
129	our road is paved poorly, so water pools in front of our driveway, then when it freezes it's very dangerous, also with more wind, we have a TON of branches coming down in our yard w every wind	1/5/2024 9:50 AM
130	Trees down on roads, power failures throughout town, branches down on our property, roof damage, water in basement	1/5/2024 9:49 AM
131	Rare, extended power outages. Downed trees in yard.	1/5/2024 9:44 AM
132	The wetland behind us generates lots of mosquitoes.	1/5/2024 9:38 AM
133	Power lines down in the South St area. Snow and Ice	1/5/2024 9:32 AM
134	Extended power outage due to down trees from winter storms	1/5/2024 9:28 AM
135	Just classic storm damage and power outages. Trees and power lines affected.	1/5/2024 9:27 AM
136	REDACTED We had the wildfire. We had multiple air quality issues m. We had a microburst take a 12+” diameter tree down in our front yard and we lost several trees to the ice storm years ago. Our well water quality was also impacted by drought and likely the composting operation at the time. High tannins wiped out my water systems ion exchange resin.	1/5/2024 9:16 AM
137	The storm drains on Treetop Circle often flood during heavy rain. The three storm drains on Whitney Street between Rice Ave and the Cemetery do not drain, since they are higher than the road.	1/5/2024 9:12 AM
138	Reservoir St is prone to excess runoff from Barlet Hill. There is no functioning in street drainage, so the street has massive ice build up in the winter. Reservoir also has a major problem with Knotweed and Bitter Root. These invasive plants are invading property owners, destroying the asphalt on the street. The bitter root plants are killing the trees along Barlet Hill.	1/5/2024 9:08 AM
139	I believe that the DPW & the town does an outstanding job keeping the roads, bridges and landscaping in good condition. I have lived in Northborough for 47 years and we have an excellent town employees in every department.	1/5/2024 9:01 AM
140	Downed trees and impact on electricity	1/5/2024 8:57 AM
141	Fallen trees and limbs due to drought and serious wind storms and heavy snow and ice.	1/5/2024 8:53 AM
142	Ground water levels are higher in the Catherine Dr/Joseph Rd area. Much more standing water than it was which attracts disease-bearing mosquitoes. Also, the street pavement deteriorates faster.	1/5/2024 8:53 AM
143	Trees down on roads and power lines, minor flooding, needing to run sump pumps	1/5/2024 8:48 AM
144	There are certain places where large puddles form after a rain storm. Rte 20 by Tomblin Rd, Rte 20 on the curve near where new fire station is to be built.	1/5/2024 8:46 AM
145	Trees down on roads and power lines. Air quality warnings	1/5/2024 8:44 AM
146	Power outages Flooding where 135 goes under route 9	1/5/2024 8:44 AM
147	At my house - extended power outages, poor air quality (smell), flooding in basement.	1/5/2024 8:44 AM
148	Extended and frequent power outages on Lincoln Street and surrounding areas. Flooded basement from high water table and excessive rain/snow	1/5/2024 8:43 AM
149	Winter storms lead to power outages. Rains lead to flooding/backed up street drain on Jefferson Rd REDACTED after recent storms.	1/5/2024 8:41 AM
150	Church Street	1/5/2024 8:41 AM
151	Japanese knotweed on side of roads near ball street and Crawford. Typically mowed down in	1/5/2024 8:41 AM

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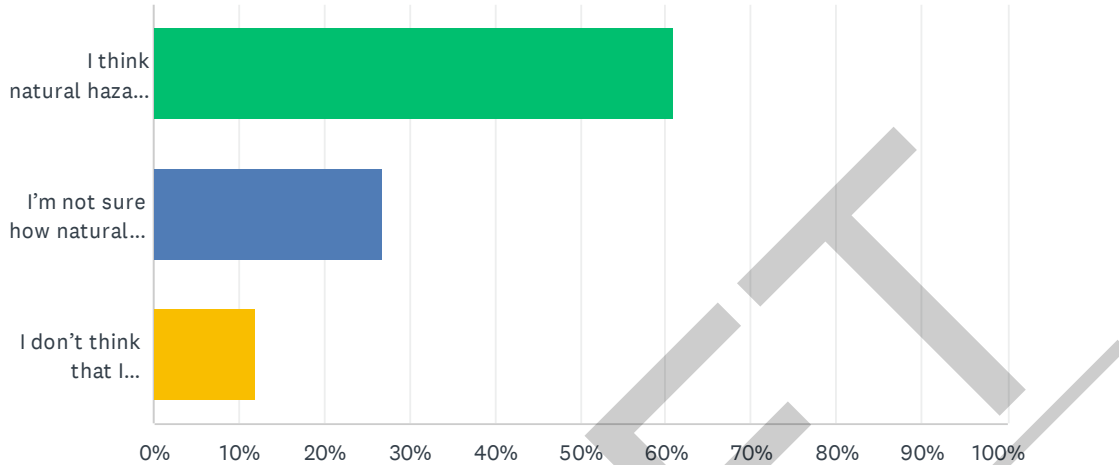
summer but any remedies available to eradicate?

152	Trees coming down during large thunderstorms. Pine Knoll neighborhood	1/5/2024 8:40 AM
153	Property owners and/or town DPW not managing trees near power lines and storms causing trees/limbs to fall and cut power.	1/5/2024 8:39 AM
154	Trees down and power lines down, flooding on my street (milk porridge)	1/5/2024 8:39 AM
155	Trees down, damage to fence on property, loss of trees due to insects	1/5/2024 8:38 AM

DRAFT

Q4 How much do you think the impacts of natural hazards and climate change will threaten your personal health, safety, or property?

Answered: 208 Skipped: 5



ANSWER CHOICES	RESPONSES	
I think natural hazards and climate change will negatively impact my life.	61.06%	127
I'm not sure how natural hazards and climate change will impact my life.	26.92%	56
I don't think that I personally will be impacted by natural hazards and climate change.	12.02%	25
TOTAL		208

**Q5 If you are concerned about impacts to your life from natural hazards and/or climate change, what impacts are you most concerned about?
Examples: basement flooding, wells drying out / contamination of wells, ability to grow food**

Answered: 150 Skipped: 63

#	RESPONSES	DATE
1	I think this is not a local hazard but a global sealevel rise, temperature/uninhabitable conditions and climate migration population hazard	3/1/2024 1:47 PM
2	well drying out, trees down and impacting lines;	2/10/2024 7:13 AM
3	Contaminated well water(from pesticides used for years by farms) , well drying out....	1/31/2024 5:50 PM
4	#1 - contamination of our private well, our house flooding, the energy costs to heat and cool in extreme temperatures	1/27/2024 2:37 PM
5	My biggest concern re: climate change is water availability, especially as the town population grows, and energy usage in extreme temperatures.	1/25/2024 9:23 PM
6	air quality	1/25/2024 7:47 AM
7	electric companies that insist on putting downed lines back on poles	1/23/2024 3:52 PM
8	Extreme weather and loss or degradation of environmental values	1/19/2024 8:17 PM
9	Extreme weather - temperatures, frequency of significant storms, hazardous winds and rains	1/17/2024 2:56 PM
10	Basement flooding and yard flooding	1/17/2024 1:09 PM
11	Basement flooding, ability to grow food	1/17/2024 1:06 PM
12	water and moisture coming up through the floors in classrooms and in the Teaching Center. Old air systems unable to keep up with moisture and heat levels. Extreme heat to the point of unsafe working environment for students and staff in the schools.	1/17/2024 8:00 AM
13	Storm intensity increases the odds of power outages. We had both a forest fire AND flooding that damages the road and may damage our house and others.	1/16/2024 6:03 PM
14	Frozen pipes Many trees down because of storms Water quality (nano plastics and other harmful chemicals in water)	1/16/2024 4:54 PM
15	Immediate town impacts: unforeseeable rainstorms that affected western MA, VT river valleys, and towns like Leominster, with unprecedented flash-flooding and washout of road, railway, buildings. Perhaps clearing storm drains of leaves and litter could help. Extreme heat waves and hurricane like 1938's, are increasingly probable. Coastal flooding will displace large populations, at some point in the next decade(s) Last spring the town had multiple wildfires. Red flag warnings were not heeded. Backyard burning is a largely uncontrolled, all year, every day and night, practice. It contributes to air pollution, the need to run AC and close windows and use energy that produces more carbon emissions, and wastes long-stored carbon in wood converted to greenhouse gas carbon dioxide instantaneously. Open burning is all around harmful, for human health, for nesting animals in smoke plumes, for wildfires, and for accelerating climate change.	1/16/2024 4:01 PM
16	Severe storms and possible tornadoes; severe heat	1/16/2024 10:05 AM
17	We topped our trees to prevent wind damage at the cost of \$6000. We also installed a french drain to reduce basement flooding issues.	1/15/2024 11:50 AM
18	Basement flooding. Viruses, killing of trees.	1/15/2024 7:36 AM
19	wells drying out and well contamination	1/15/2024 7:17 AM

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20	Trees falling on my house	1/14/2024 7:49 PM
21	Basement Flooding, Ability to grow food	1/14/2024 10:08 AM
22	Basement flooding.	1/13/2024 1:31 PM
23	I am not concerned about climate change. It's important to be aware of natural hazards.	1/13/2024 12:39 PM
24	*Fires* especially due to *drought* and *invasive insects* causing *tree rot & falls*	1/13/2024 9:40 AM
25	Wells drying out, forest fires, power outages.	1/13/2024 8:21 AM
26	The increasing prevalence of ticks has completely changed my relationship with the outdoors. I've pulled ticks off me countless times, and have been stricken with tick born diseases twice (not fun). I only go outside to work in the yard or walk in the woods once a day, I undress in the garage, immediately shower, throw my clothes into the dryer for 20 minutes to kill the ticks before putting them into the laundry. This protocol seems to work, but it certainly restricts my outdoor activity. Power outages can have a significant affect too.	1/13/2024 7:19 AM
27	Work with National Grid to cut the trees or branches that are close to the roads/dwellings.	1/12/2024 4:45 PM
28	There is no climate change caused or can be altered by man. Many natural disasters can impact us/me including tornados, hurricanes, fires, etc.	1/12/2024 3:21 PM
29	Contamination of wells	1/12/2024 1:26 PM
30	Excessive rain. More severe storms as temperatures increase.	1/12/2024 11:37 AM
31	Trees and branches on neighbor's property coming down on my house, deck, and yard Needing to drive during flash flooding Ability to grow food Prevalence of tick-borne and mosquito-borne disease	1/12/2024 10:22 AM
32	Decline in biodiversity, especially birds, insects and amphibians, will destabilize our habitat and increase the challenges to grow food in our area.	1/12/2024 10:22 AM
33	Personal injury, property damage, food insecurity, poor air quality.	1/12/2024 10:01 AM
34	Unprecedented nor previously see weather patterns. Gross and widespread damage from storms, forest fires, higher temperature index.	1/11/2024 7:18 PM
35	Too much shade from unnecessary pine trees: blockage of sun from solar panels and pool.	1/11/2024 5:54 PM
36	Drinking water quality and air quality.	1/11/2024 3:32 PM
37	ability to grow food, greater difficulty breathing outdoors, well drying up...	1/11/2024 3:13 PM
38	Air quality impact on family member with asthma. This can come from far off wild fires such as we experience in 2023 (Canadian Wildfires) as well as local sources of air pollution.	1/11/2024 12:53 PM
39	Basement flooding, flooding in the backyard	1/11/2024 11:38 AM
40	It seems as though certain episodic weather may be more extreme, wind, heat, winter storms. Being prepared for changing weather patterns, damage to home, property and persons remain a concern. Contamination of water supplies is a concern. Having previously lived somewhere where the electric system was underground, the above ground poles seem to be a huge and repeated problem.	1/11/2024 11:34 AM
41	I am concered about the wear and tear on park land and structures such as courts playing fields.	1/11/2024 8:39 AM
42	No sure	1/10/2024 3:51 PM
43	excessive rain causing roof leaks and septic back up which in turn damage files and legal records.	1/10/2024 2:30 PM
44	damage from increasing frequency and severity of major storms, including hurricanes and tornadoes, in the area	1/10/2024 12:05 PM
45	air quality, weather patterns disrupting food growth, etc	1/10/2024 11:22 AM
46	Air quality, flooding, mold, food availability	1/10/2024 11:08 AM

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47	Basement flooding.	1/9/2024 5:46 PM
48	Extreme heat, global food supply disruption	1/9/2024 4:42 PM
49	My concerns are more global/national in nature... impact of drought, rising sea levels, etc and the downstream effects on supply chain, economy, and the like	1/9/2024 4:33 PM
50	Basement flooding, brown lawn all summer, not enough access to fresh fruits and vegetables due to climate change in other parts of the country	1/8/2024 3:13 PM
51	Contamination, flooding, greater animal encounters	1/8/2024 11:05 AM
52	I believe climate change will impact us in many ways. Plant growing seasons and the type of plants we grow will change. Air quality changes which can lead to health issues, the impact will be immense over time	1/8/2024 10:29 AM
53	Increasingly hot summers will impact energy use. We have mini-splits which have made the house more comfortable, but power outages would cause those to fail.	1/8/2024 10:26 AM
54	Tree damage, well water	1/8/2024 8:50 AM
55	All listed. Unpredictable weather. A much hotter climate will cause species to disappear, plants may not get pollinated.	1/7/2024 7:14 PM
56	Wells Droughts Flooding	1/7/2024 4:35 PM
57	More severe and more frequent rain & wind storms causing higher rivers and groundwater saturation will lead to well water issues and property issues not seen in the past. Rains instead of snow base will cause erosion and soil quality issues	1/7/2024 3:06 PM
58	excess heat, water contamination.	1/7/2024 2:42 PM
59	Basement Flooding	1/7/2024 12:06 PM
60	Flooded roads/ washouts and drought in the summer/ long stretches of just too hot. Severe wind storms damaging my home.	1/7/2024 11:37 AM
61	Excess water/flooding in our basement. Trees falling on our house.	1/7/2024 10:12 AM
62	More power outages. More wind knocking down branches / over trees. More people cutting down trees, thereby both making climate change worse as well as further throwing off the town's developed vs undeveloped space balance, (it's already much worse / skewed from undeveloped to developed space than it was when I chose to move here 22 years ago).	1/7/2024 10:06 AM
63	Road erosion may cause more flooding on our property and we do have mosquito issues due to wooded areas and wetlands. So much rain will start to effect the root systems of so many pine trees and older trees. When those fall - how will that effect our property, power outages, etc. Rain is feeding into all the invasive weeds that end up growing and choking out healthy trees.	1/7/2024 8:54 AM
64	Unsafe to drive on West Street after rain storms.	1/7/2024 8:16 AM
65	Septic and property damage. Extreme heat events	1/6/2024 9:53 PM
66	Downed trees and flooding	1/6/2024 8:54 PM
67	Power outages and trees falling over.	1/6/2024 8:20 PM
68	overall well being	1/6/2024 12:44 PM
69	Flooding, bee populations/growing food.	1/6/2024 11:15 AM
70	I am more concerned about what our government is spraying in our skies. Geoengineering and cloud seeding is a fact.	1/6/2024 11:08 AM
71	Basement flooding; septic system failure; loss of potable water for drinking and watering crops; extreme heat killing crops	1/6/2024 8:22 AM
72	Flooding, severe weather, town electric/utility resiliency	1/6/2024 6:56 AM
73	Extended power outages. Food variety shortages followed by all food shortages. Collapse of Civilization. Oh boy! Should I sign up for survivalist training, or plan on an early exit?	1/6/2024 6:32 AM

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74	None	1/5/2024 10:33 PM
75	basement flooding will occur more often damaging the heating system.	1/5/2024 10:04 PM
76	Climate change is a hoax. Look up and watch the planes spraying multiple times on a daily basis. Research Haarp and DEW'S.	1/5/2024 9:34 PM
77	Contamination of water supplies.	1/5/2024 9:00 PM
78	REDACTED DPW {was encouraged to plant} the little bluestem in the field at Watson Park by letting it go to seed by not mowing in Sept, then mow it down in Oct instead. They said no. Letting it go to seed would favor the native grass, and eventually it would out compete the non-native grass in the field that does not belong. Native grass will retain more storm water and Co2 b/c it has deep roots.	1/5/2024 8:11 PM
79	Effects on quality of life from extreme heat.	1/5/2024 4:40 PM
80	Heavier precipitation events causing more widespread flooding	1/5/2024 3:20 PM
81	basement flooding, contamination of wells. There is a lot of development - we shouldn't cover whole parcels with impervious paving	1/5/2024 2:49 PM
82	basement flooding from excessive rain storms. Excessive heat in summer.	1/5/2024 2:48 PM
83	basement flooding, street flooding, noise pollution	1/5/2024 2:48 PM
84	More extreme weather leading to more damage and inconvenience	1/5/2024 2:09 PM
85	Heat, drought, ability to grow food.	1/5/2024 2:00 PM
86	Water shortages, more damage from trees	1/5/2024 1:31 PM
87	I don't have any concern climate change.	1/5/2024 1:08 PM
88	well contamination	1/5/2024 1:03 PM
89	Climate Change in general	1/5/2024 12:59 PM
90	climate change is real and even if not affecting my property at this moment, it is the most important thing for us, as human beings to address seriously and now	1/5/2024 12:54 PM
91	Basement flooding, erosion of property, Ice Dams, Lyme Disease / tick/mosquito increase due to warmer weather.	1/5/2024 12:54 PM
92	Wells drying out; wild fire; loss of trees due to invasives	1/5/2024 12:53 PM
93	Yes, but being elderly, I am more worried for my kids and grandkids	1/5/2024 12:48 PM
94	Flooding, and possible hurricane/tornado threats.	1/5/2024 12:37 PM
95	flooding impacting property values	1/5/2024 12:32 PM
96	I think natural hazards and climate change will continue to have a negative financial impact on my family. Extreme weather leads to higher utility costs. Damage from storms leads to clean up costs.	1/5/2024 12:32 PM
97	Concerned about worse storms as well as animal and insect migrating into human spaces. Worse storms will bring down trees and utility poles.	1/5/2024 12:23 PM
98	Not sure. Having had extended power outage in the past, we have installed a generator.	1/5/2024 12:12 PM
99	I am concerned with basement flooding due to the pond/stream REDACTED School Street overflowing it banks and that my property is not able to drain water into the pond. The significant amount of rain we had in December 2023 flooded my yard with 2-3 feet of water. If this had happened during the warmer months, this water would have been prime breeding ground for mosquitos and the diseases they carry. I've already had Lyme twice from working in my yard, I don't want to get EEE, West Nile, or any other of those borne by mosquitos.	1/5/2024 12:11 PM
100	short-term hazards and inconveniences	1/5/2024 12:09 PM
101	Basement flooding, wells drying up or contaminated	1/5/2024 11:43 AM
102	Trees blowing down or dropping large limbs.	1/5/2024 11:27 AM

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103	Wells drying out, extreme heat, bug infestation	1/5/2024 11:24 AM
104	basement flooding	1/5/2024 11:09 AM
105	None	1/5/2024 11:09 AM
106	basement flooding and the mold that could result from the wetness.	1/5/2024 10:58 AM
107	Not concerned.	1/5/2024 10:54 AM
108	Northborough is in a good location. We may have drought problems or new invasive insect species.	1/5/2024 10:47 AM
109	Power outage	1/5/2024 10:40 AM
110	I am concerned about power outages and increased cost for heating or electricity.	1/5/2024 10:39 AM
111	Wells drying out due to extreme heat and lack of rain and/or snow melt	1/5/2024 10:35 AM
112	All of the above examples except Ability to Grow Food.	1/5/2024 10:33 AM
113	inability to work from home during extended power outages that disable internet connection during business hours, drought affect on vegetable garden, increased utility bills d/t extreme heat/cold	1/5/2024 10:31 AM
114	Flooding and contamination of wells and other water sources. Extreme heat and cold. Drought.	1/5/2024 10:27 AM
115	Extreme heat and its associated public health and medical costs, increased rise of severe storms, drought	1/5/2024 10:22 AM
116	loss of electric power	1/5/2024 10:19 AM
117	We also are surrounded by a brook, which goes under REDACTED. During wet spells, we will see much of the wooded area around us turn marshy and experience ponding in unexpected areas. I have some concern about extended wet weather contributing to erosion, especially of the driveway.	1/5/2024 10:11 AM
118	I have a basement sump pump, so if I lose power for more than 8 hrs, my basement will flood.	1/5/2024 10:10 AM
119	Water supply, excessive heat, air quality, civil unrest and migration.	1/5/2024 10:08 AM
120	High electricity and oil bills due to extreme temperatures	1/5/2024 10:03 AM
121	I don't think we understand how quickly and how bad it will get when our food chain begins to collapse. It is intensely important to me that we ensure that native species both plant and animal can stay here and flourish.	1/5/2024 9:59 AM
122	increasing costs of things as we struggle to meet demands	1/5/2024 9:50 AM
123	Power failures, road repair costs	1/5/2024 9:49 AM
124	Power outage concerns, household storm damage on my older home, water safety. Also, weather extremes' impact on local schools where children are overheated in warm weather, cold in winter, and buildings are not environmentally sound. All schools should be updated to solar powered electric, heating, ac, insulation, windows, circulation and air quality updates.	1/5/2024 9:44 AM
125	Basement flooding and erosion are my major concerns. My house is on a tiny hill with slopes on most sides.	1/5/2024 9:43 AM
126	Well water is poor.	1/5/2024 9:38 AM
127	Basement flooding	1/5/2024 9:35 AM
128	Flooding in basement/ overflowing septic. lost of power for extneded time	1/5/2024 9:32 AM
129	Flooding of basement	1/5/2024 9:28 AM
130	Climate change is a concern everyone should have and the concerns are too numerous to list. Lack of water and weather extremes will be and are major concerns that will impact everyone.	1/5/2024 9:27 AM
131	Shorter growing seasons and more damage from increasingly harmful storms	1/5/2024 9:21 AM
132	I was concerned that the wild fire REDACTED. I felt	1/5/2024 9:16 AM

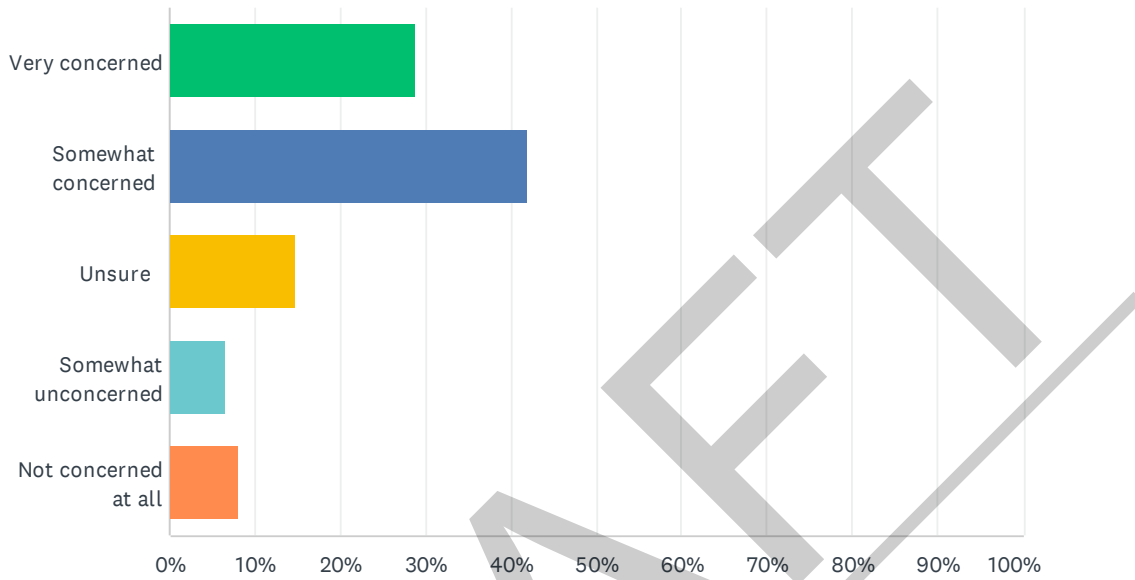
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communication from the town was completely inadequate and I wasn't confident that the resources were available to handle the fire. There are also no hydrants REDACTED and droughts dried up some sources the FD seemingly might have used.

133	Floods, change in climate will impact the ability for native plants to grow/survive.	1/5/2024 9:12 AM
134	These massive rainstorms have been pouring water into my basement like I have never seen in 25 years. Our sump pump work overtime after the recent rain storms. We are also on a private well so extensive dry periods will lead to a lack of water for our household.	1/5/2024 9:08 AM
135	Keeping warm in winter and cool in summer. Too much or not enough water for vegetable garden.	1/5/2024 9:05 AM
136	I am more concerned about the air that I, my family and friends breathe in the air.	1/5/2024 9:01 AM
137	drought, imbalance of life - less bees, invasive beetles, less native plants etc increase in pathogen borne insects and species	1/5/2024 8:58 AM
138	Basement flooding, erosion	1/5/2024 8:53 AM
139	Changes in weather patterns that bring on more storms.	1/5/2024 8:48 AM
140	Air quality, risk of power going out since our electric lines are above ground and subject to wind/tree damage	1/5/2024 8:44 AM
141	Noise pollution from CSX and trucks traveling through town	1/5/2024 8:44 AM
142	I am most concerned about power outages from sever storms.	1/5/2024 8:44 AM
143	Basement flooding. Power outages causing no heat, burst pipes, or spoiled food.	1/5/2024 8:43 AM
144	Basement flooding, property damage, trees falling due to wet soils	1/5/2024 8:41 AM
145	any damaging natural hazards in Northboro will indirectly affect my living and transportation situation.	1/5/2024 8:41 AM
146	Trees hitting my house and property by coming down due to more severe storms.	1/5/2024 8:40 AM
147	Power loss from storms.	1/5/2024 8:39 AM
148	Heat issues with global warming, hot classrooms in schools	1/5/2024 8:39 AM
149	Global warming-weather challenges;animal habitat;	1/5/2024 8:39 AM
150	Extreme weather events	1/5/2024 8:38 AM

Q6 How concerned are you about the impacts that natural hazards and climate change will have on the Town of Northborough (the local infrastructure, economy, environment, and/or town residents)?

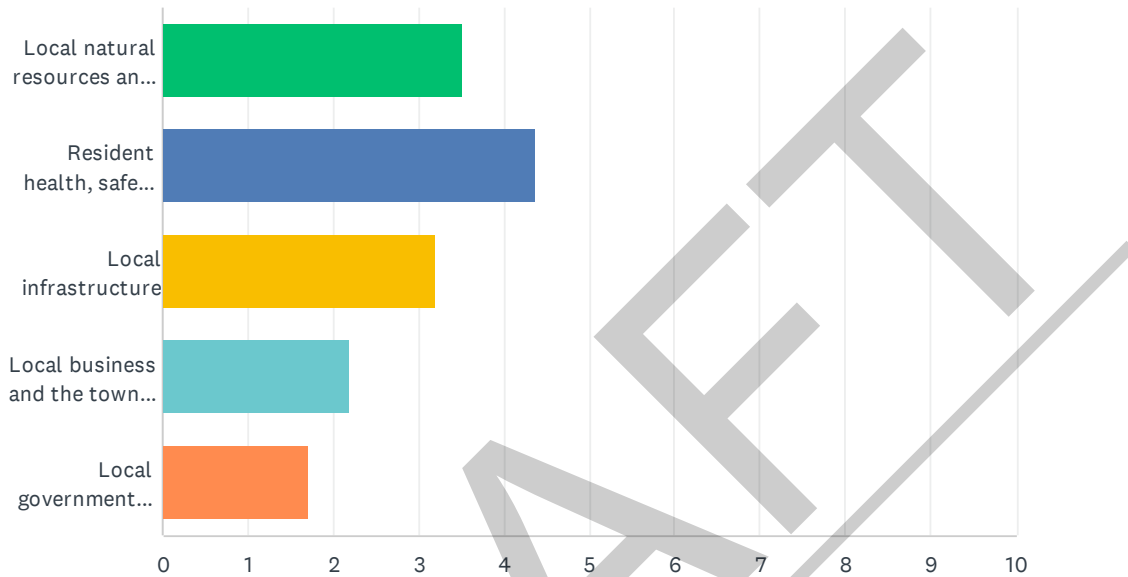
Answered: 212 Skipped: 1



ANSWER CHOICES	RESPONSES	
Very concerned	28.77%	61
Somewhat concerned	41.98%	89
Unsure	14.62%	31
Somewhat unconcerned	6.60%	14
Not concerned at all	8.02%	17
TOTAL		212

Q7 What community assets are you most concerned about when you consider the potential impact of natural hazards and climate change on the Town of Northborough? Rank the responses below in order from most concerned about (1) to least concerned about (5).

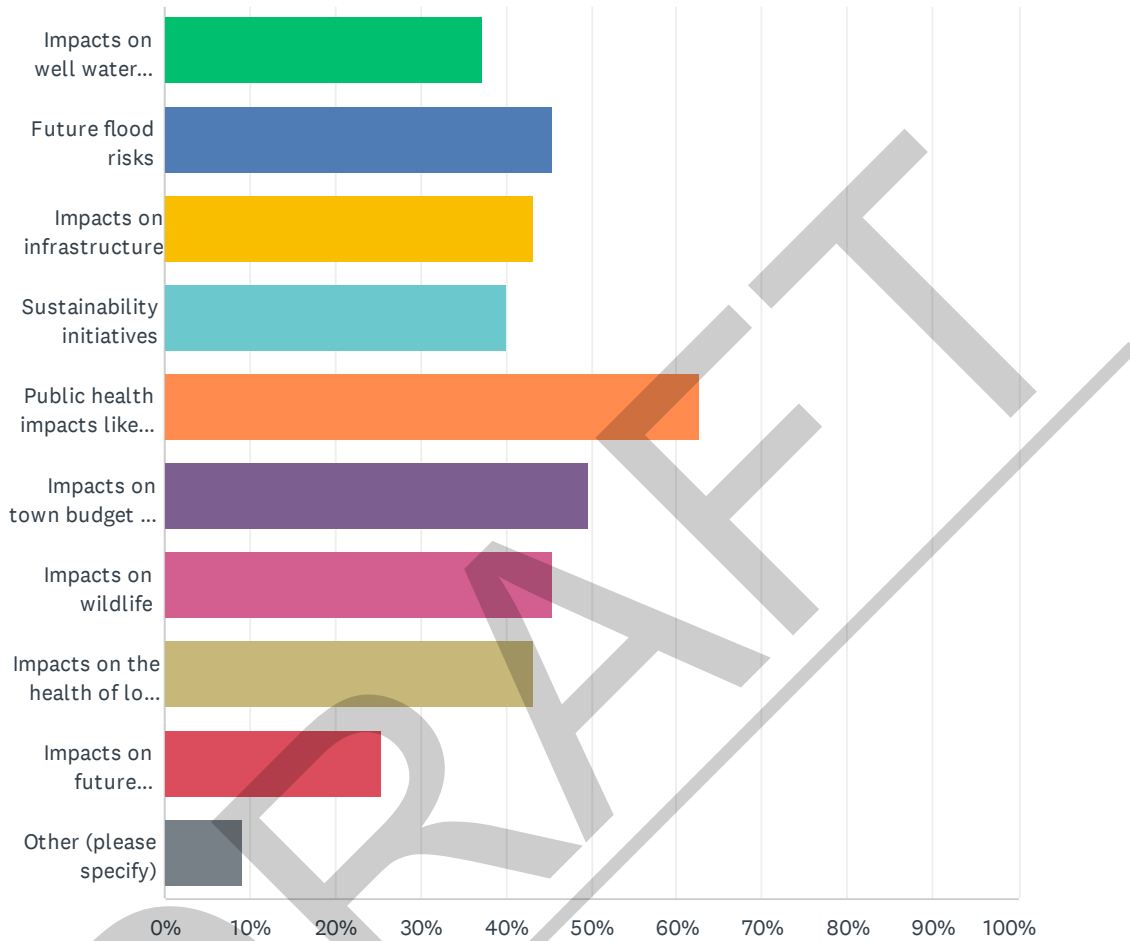
Answered: 203 Skipped: 10



	1	2	3	4	5	TOTAL	SCORE
Local natural resources and environments	26.60% 54	30.54% 62	18.72% 38	15.27% 31	8.87% 18	203	3.51
Resident health, safety, and property	58.62% 119	27.09% 55	10.34% 21	1.48% 3	2.46% 5	203	4.38
Local infrastructure	10.84% 22	29.06% 59	36.95% 75	15.27% 31	7.88% 16	203	3.20
Local business and the town economy	1.48% 3	7.39% 15	23.15% 47	45.81% 93	22.17% 45	203	2.20
Local government resources	2.46% 5	5.91% 12	10.84% 22	22.17% 45	58.62% 119	203	1.71

Q8 Which of the following aspects of natural hazards and climate change would you like to learn more about? Select all that you are interested in.

Answered: 185 Skipped: 28



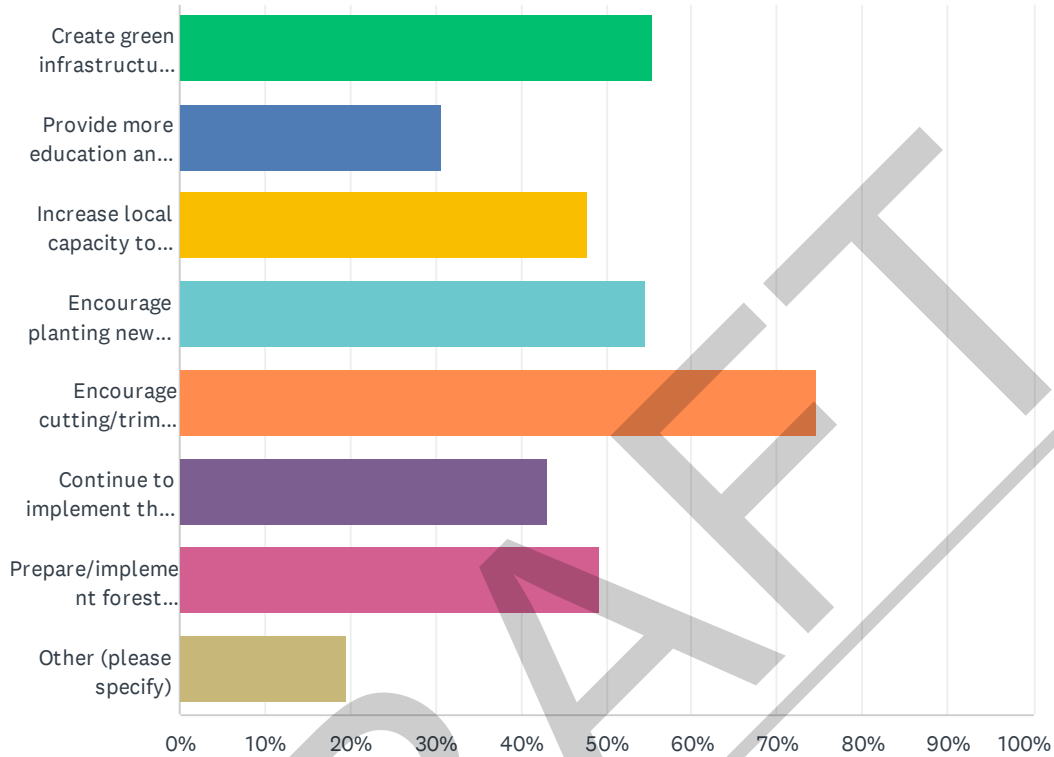
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ANSWER CHOICES	RESPONSES
Impacts on well water quantity / quality	37.30% 69
Future flood risks	45.41% 84
Impacts on infrastructure	43.24% 80
Sustainability initiatives	40.00% 74
Public health impacts like increased risks of vector-borne disease (ex. Lyme disease, West Nile Virus, EEE - Eastern equine encephalitis)	62.70% 116
Impacts on town budget and finances	49.73% 92
Impacts on wildlife	45.41% 84
Impacts on the health of local forests	43.24% 80
Impacts on future development	25.41% 47
Other (please specify)	9.19% 17
Total Respondents: 185	

#	OTHER (PLEASE SPECIFY)	DATE
1	How do we house climate/sea level rise migrants? How do we deal with biodiversity collapse?	3/1/2024 1:47 PM
2	Proper handling and disposal of pesticides used by farms...	1/31/2024 5:50 PM
3	All of the above	1/19/2024 8:29 AM
4	Public health impacts of heat, smoke, mental stress	1/16/2024 4:01 PM
5	Economy changes needed to address climate change impacts and income inequalities.	1/16/2024 10:05 AM
6	hard to decide... all are important	1/15/2024 11:50 AM
7	Impacts on invasive species of insects	1/12/2024 8:09 PM
8	Can the old town hall be torn down? (Talk about infrastructure)	1/8/2024 3:13 PM
9	Impacts on air quality	1/8/2024 10:26 AM
10	Personal costs to me such as insurance premium increasing or repairs due to extreme weather events	1/7/2024 4:35 PM
11	stormwater runoff planning / mitigation efforts	1/7/2024 3:06 PM
12	Climate change is a narrative to keep people in fear. Spending tax payer dollars to support this narrative is criminal. Electric cars, wind turbines and solar panels have proven to be more hazardous to our environment. And they never pay for themselves.	1/6/2024 11:08 AM
13	I'd like to know about the EMF impact to residents from the smart water meters that were installed. I'd like to know about the health of the residents & their children that were coerced (especially through the schools) to take the Covid 19 shots and boosters.	1/5/2024 9:34 PM
14	impact on NATIVE pollinators (i.e. NOT honeybees...)	1/5/2024 8:11 PM
15	Efforts to protect the power grid from natural hazards should be prioritized.	1/5/2024 12:32 PM
16	Migration due to climate chaos	1/5/2024 10:08 AM
17	All of the above	1/5/2024 8:53 AM

Q9 What actions should the Town of Northborough take to cultivate local resilience to natural hazards? Select all that you would like to see.

Answered: 209 Skipped: 4



ANSWER CHOICES	RESPONSES
Create green infrastructure which improves storm water management	55.50% 116
Provide more education and outreach about how climate change could impact my life	30.62% 64
Increase local capacity to apply for hazard mitigation grant funding and implement hazard mitigation projects	47.85% 100
Encourage planting new trees, especially climate-resilient tree species	54.55% 114
Encourage cutting/trimming dead trees beside/hanging over roads	74.64% 156
Continue to implement the Northborough Forest Stewardship Program by editing the Forest Management Plans to incorporate climate adaptation optimization	43.06% 90
Prepare/implement forest harvest plans and invasive plant control for conservation areas in town in accordance with updated forest management plans	49.28% 103
Other (please specify)	19.62% 41
Total Respondents: 209	

#	OTHER (PLEASE SPECIFY)	DATE
1	Build Affordable, Multi Family Housing	3/1/2024 1:47 PM
2	Better outreach - I haven't even heard of the Northborough Forest Stewardship Program	1/27/2024 2:37 PM

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3	Now that the town is moving to buy its electricity collectively (I'm sorry, I can't think of the actual name at the moment), is there anything we can do to increase our use of green energy sources?	1/25/2024 9:23 PM
4	Stricter environmental protections and more scrutiny on development	1/19/2024 8:17 PM
5	All of the above Note: Most people are not familiar with these answers.	1/19/2024 8:29 AM
6	Fix REDACTED drainage issues. One dry well for all the neighbors water run off is not working	1/17/2024 1:09 PM
7	Update public buildings for air quality and conditioned air or air conditioning.	1/17/2024 8:00 AM
8	Begin by turning off the faucet and abating carbon dioxide emissions. Focus on sustainability, energy efficiency, net zero carbon projects. Save taxpayer money rather than spending it on unsupported greenwash solutions. Prioritise mitigation of climate change sources first and foremost - lowest emission and highest efficiency vehicles, net zero buildings, solar arrays, geothermal networks, natural landscape as minimal cost infrastructure. The biodiversity crisis is ten times worse than incipient climate change. Do all to prevent loss and promote recovery of natural areas and intact habitats.	1/16/2024 4:01 PM
9	emergency energy efficient products to help in power outages; new electric grid updates	1/16/2024 10:05 AM
10	I am concerned how heavily "climate change" is reinforced throughout this survey. Being aware of, and planning for natural hazards makes sense. Presenting it as "climate change" falsely labels these legitimate concerns as something they are not.	1/13/2024 12:39 PM
11	I see invasive plants strangling many trees. Come up with a plan to get rid of those invasive plants.	1/12/2024 4:45 PM
12	Expand composting support (and perhaps even a town composting option, rather than residents needing to manage it at our own homes) and provide programming and resources to mitigate food waste, a top offender for a household's carbon footprint Opt-into the rainwater barrel programs available in neighboring towns and provide support on how to add one to your home and use it	1/12/2024 10:22 AM
13	If you're going to plant more trees, take the effect on solar into account. If the tree(s) will eventually be detrimental to a solar installation, don't plant them. Invasive plant control is a good idea: harvesting local forests is not.	1/11/2024 5:54 PM
14	Encouraging eco friendly energy incentives	1/11/2024 4:24 PM
15	I'd like more transparency and input opportunities related to what the updated forest management plans will be before Nboro commits to moving forward on "forest management". The new state guidelines suggests NOT actively managing most forest situations.	1/10/2024 1:16 PM
16	Encourage better use of resources for lawns (drought-resistant lawns, less and later mowing to sustain pollinators, leaving leaf debris for animals and insects, etc	1/8/2024 10:26 AM
17	How about going electric, encouraging residents to do so, installing charging stations for residents to use? Unfortunately we don't have any tourists to offer them to.	1/7/2024 7:14 PM
18	Develop a sustainability committee to help guide us through options	1/7/2024 4:35 PM
19	Acquisition of key property and easements for wildlife, preservation & outdoor activity corridors	1/7/2024 3:06 PM
20	Research options, what other towns are doing, could do. Outreach, educate, update the community to help relieve mental fear on new normal and options, to help ourselves prepare and work with the environment in a green way. Reward businesses and local group efforts when they attempt, invest and make an effort to take a healthier long term approach to issues that benefit the community. Planting trees, more green architecture on buildings, stop light pollution with new rules requiring hooded lighting, not as bright, motion sensor lighting, etc. Traffic lights that work with volume and needs to reduce idling at the lights- less emissions as a result. Notify, involve other groups in town to help educate and spread the word on research findings, options and plans, so that more people will feel attached/ not removed and have power, to be part of a solution.	1/7/2024 11:37 AM
21	As mentioned above, Northborough has lost, and is continuing to lose, a whole ton of trees / green space in the past couple of decades to development and I have yet to see / hear anything about how continuing to go down that road continues to damage our ability as a town	1/7/2024 10:06 AM

Northborough Hazard Mitigation Plan Community Survey

to take CO2 out of the atmosphere and thus help mitigate / limit climate change, and I really, really think that needs to be taken much more into account in town plans, new laws / regulations, etc. It's not ok anymore to say that if you own a lot you're allowed to cut down as many trees as you want on it without having to do something to compensate for the loss of our town's CO2 removal, (not to mention how much it damages our ability to actually enjoy living here, with the levels of woods / green space that were here when we chose to move here). Going forward, we absolutely should be requiring any development and any people cutting down trees unnecessarily, (i.e. cutting down entirely dead branches / trees) thereby further damaging our town's climate change mitigation to be paying funds to the town, each and every year, (i.e. not just a one-time payment) so that the town can use those funds to try to offset that damage to our town's CO2 mitigation levels. Those funds could be used to encourage / provide incentives for other people in town to plant more trees to help increase our town's CO2 mitigation levels. They could be used to help provide incentives for conversions to heat pumps, solar, etc. Climate change is a global problem, but the choices we're making locally, like cutting down trees for additional development, absolutely either contribute to improving or furthering the problem so we need to start having maintaining / improving our town's ability to mitigate CO2 be at the very top of town concerns.

22	Really poor survey... the majority of questions link issues as a result of climate change. You should have a non-biased survey. This survey comes from a position of bias, therefore the results received will be biased, and therefore the information derived from this survey would not pass an objective peer review. Net result: discredited survey and any proposed outcomes derived from it. If you are unable to update this to be non-biased, I could do another through various town social media sites that would be unbiased and objective and publish that.	1/6/2024 6:45 PM
23	Do nothing. Americans do a good job already. Our efforts will do nothing to change our climate especially when countries like China and India who have populations over one billion people are doing absolutely nothing. Wake up!	1/6/2024 11:08 AM
24	Stop spreading misinformation regarding climate change.	1/5/2024 9:34 PM
25	Plant native all around town (example, Watson Park). Remove all non-native and replace with natives that don't need watering. Garden Club waters the Memorial Garden three times per week all summer long!	1/5/2024 8:11 PM
26	Make sure building projects include enough open space to mitigate storm water problems. Downtown seems to pave everything but there needs to be places to control the water	1/5/2024 2:49 PM
27	Add curbing to roadways to direct water runoff away from properties and into storm drains.	1/5/2024 12:54 PM
28	Stop allowing development of properties that are in or near wetlands. The new properties on Lincoln St are a great example of homes built on wet areas. Already seen impacts of water on road by schools.	1/5/2024 12:48 PM
29	Provide education to residents regarding invasive plant control on their properties.	1/5/2024 12:32 PM
30	Provide single family home preparedness resources, safety kits, food supply suggestions, etc.	1/5/2024 12:32 PM
31	Consider requiring all utility lines being placed underground and removing utility poles.	1/5/2024 12:23 PM
32	Allow special consideration for flood zones/wetlands on personal property to help abate flooding risks to homeowners.	1/5/2024 12:11 PM
33	Reduce carbon emissions for homes, businesses, and transportation. More street-side medium sized trees for shade while walking outside and to combat heat islands.	1/5/2024 10:03 AM
34	I am very concerned over the lack of wifi infrastructure in this town. When we lose power, we also lose our ability to receive emergency communications and to communicate with emergency services.	1/5/2024 9:31 AM
35	Stop building and destroying land. Plants and Animals are necessary for a healthy earth and we need to leave places for them to thrive. Concerned about recycling. It's my understanding that what we recycle just end up in landfill anyway. Would love to see this problem addressed by local, state and fed. government. Education is great and most welcome but sadly in the world we live in those that need the education will not listen - hence my reason for not checking the above.	1/5/2024 9:27 AM
36	All of the above	1/5/2024 8:53 AM

Northborough Hazard Mitigation Plan Community Survey

37	Install DC fast EV chargers. They are basically 100% paid for by the federal government right now	1/5/2024 8:44 AM
38	Bury more power lines in town.	1/5/2024 8:44 AM
39	Reduce new construction to leave natural landscape in place	1/5/2024 8:41 AM
40	Be proactive recognizing potential problems.	1/5/2024 8:41 AM
41	More aggressive tree maintenance throughout the town around power lines to mitigate risk of falling trees/limbs.	1/5/2024 8:39 AM

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[Home](#)

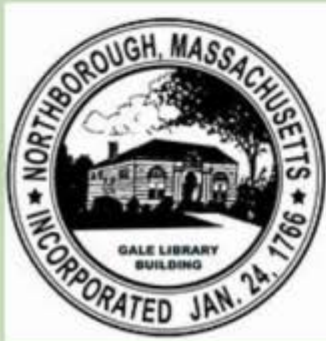
Community Survey - Northborough Hazard Mitigation Plan Survey

POSTED ON: JANUARY 5, 2024 - 8:26AM

The Town of Northborough is updating its Hazard Mitigation Plan (HMP). An updated HMP will help the Town identify strategies to reduce its vulnerability to hazards like flooding, winter storms, and drought. Climate change may shift the extent and severity of certain natural hazards, including those that already impact Northborough.

By participating in this survey, you will help the Town of Northborough understand the current and future natural hazards that residents are most concerned about. Survey responses will be accepted until **January 31st, 2024**.

<https://www.surveymonkey.com/r/8QWDVCS>



Northborough Hazard Mitigation Plan Survey Responses Needed



Northborough Fire Department

January 5 at 8:51 AM · 🌐



Northborough Hazard Mitigation Plan Survey Responses Needed

The Town of Northborough is in the process of updating its Hazard Mitigation Plan and is requesting input from residents to inform this plan. An updated HMP will help the Town assess and reduce community risk from natural hazards.



You are invited to submit your thoughts on natural hazards, such as flooding, snowstorms, or thunderstorms, in the Northborough Hazard Mitigation Plan

Take our survey using the QR code below.



Tip: Open your phone camera point at the QR



Northborough MA Town Clerk is in Northborough.

January 5 at 8:33 AM · 🌐

<https://www.surveymonkey.com/r/8QWDVCS>



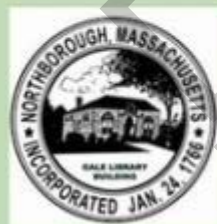
Northborough Cable Access Television

January 5 at 9:36 AM · 🌐

The Town of Northborough is updating its Hazard Mitigation Plan (HMP). An updated HMP will help the Town identify strategies to reduce its vulnerability to hazards like flooding, winter storms, and drought. Climate change may shift the extent and severity of certain natural hazards, including those that already impact Northborough.

By participating in this survey, you will help the Town of Northborough understand the current and future natural hazards that residents are most concerned about. Survey responses will be accepted until January 31st, 2024.

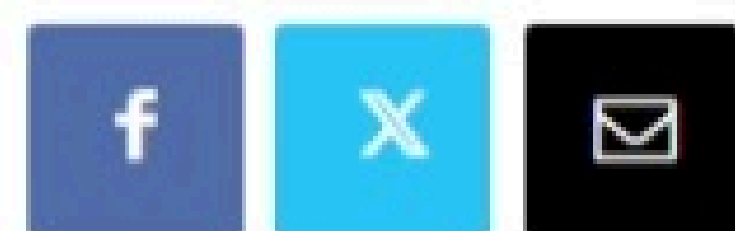
Fill out the survey here: <https://www.surveymonkey.com/r/8QWDVCS>



Northborough Hazard Mitigation Plan Survey Responses Needed

Northborough seeks input on hazard mitigation plan

By **Community Advocate** - January 12, 2024



[Click me to copy current URL](#)



Northborough is seeking input on its hazard mitigation plan. (Photo/Laura Hayes)

NORTHBOROUGH – The town is seeking input from residents as it is in the process of updating its Hazard Mitigation Plan.

Climate change may shift the extent and severity of certain natural disasters, including those that already impact Northborough. The updated plan will help the town identify strategies to reduce its vulnerability to various hazards such as flooding, winter storms and drought.

Through their participation in a survey, residents will help the town understand what current and future natural hazards are most concerning to them. People can participate in the survey until Jan. 31.

The survey can be found at <https://www.town.northborough.ma.us/home/news/community-survey-northborough-hazard-mitigation-plan-survey>.

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APPENDIX C:

Meetings



Northborough Hazard Mitigation Plan Update
Local Planning Team Kickoff Meeting

Date/Time: July 31st, 2023, 10:30am

Location: Northborough Free Library Conference Room, 34 Main Street, Northborough, MA

AGENDA

I. Introductions

II. Plan Background

- Review Contract
- Roles and Responsibilities
- Estimated Timeline

III. Project Phases & Preliminary Schedule

<u>Phase</u>	<u>Completion (proposed)</u>
○ Assembly of local planning team, kickoff	July 2023
○ Information gathering	August 2023-March 2024
○ Natural hazards	
○ Critical infrastructure and facilities	
○ Mitigation strategy development	April-August 2024
○ Stakeholder and public involvement	August 2023- August 2024
○ Plan narrative development	September 2024-February 2025
○ Plan submission (initial)	March 2025
○ Plan adoption	April-May 2025

IV. Local Planning Team Meetings/Council Presentations

- Meeting #1 (kickoff)
- Meeting #2 (hazards and critical infrastructure/facilities) (can be two meetings)
- Meeting #3 (mitigation strategies)
- Presentation #1 (summary of draft plan – setting is flexible)
- Presentation #2 (final plan and request for adoption @ BOS) (optional)

V. Review of Mitigation Strategies

- 2018 HMP Mitigation Strategies

VI. Next Meeting – Natural Hazards and/or Infrastructure

- Date/location
- What to prepare

DRAFT



Northborough MASSACHUSETTS

Meeting Name:
Northborough Hazard Mitigation
Plan Kickoff Meeting

Community: Northborough

Location: Northborough Free Library
Conference Room, 34 Main Street,
Northborough, MA

Date: July 31st, 2023

Meeting Time: 10:30 AM

Participant Name	Organization	Title	E-mail
Andrew Loew	CMRPC	Prog. Mgr.	aloew@cmrpc.org
Trish Settles	CMRPC	Dep Dir	tsettles@cmrpc.org
Michael Parr	LEPC	Hazmat Assistant	mparr@town.northborough.ma.us
Valia Paranti	Northborough Fire	Fire Chief/Emo	vparanti@town.northborough.ma.us
Sub Frederico	Northborough Ins. Dept	Ins. Insp. person	RFREDERICO@Town.northborough.ma.us mseager@town.northborough.ma.us
MICHAEL SEAGER	NORTHBOROUGH HEALTH DEPARTMENT	HEALTH AGENT	
William Lyver	Police	Chief	wlyver@town.northborough.ma.us
Laure Connors	Planning	Director	lconnors@town.northborough.ma.us
Scott D. Charpentier	DPW	Director	scharpentier@town.northborough.ma.us
NEAL P. ASPESI	FIRE	Deputy	NASPESI@TOWN.NORTHBOROUGH.MA.US
Becca Meekins	Town	Asst. Town Administrator	bmeekins@town.northborough.ma.us



Northborough Hazard Mitigation Plan Update
Local Planning Team Meeting #2

Date/Time: September 25th, 2023, 10:00am

Location: Northborough Free Library Conference Room, 34 Main Street, Northborough, MA

AGENDA

I. Introductions

II. Meeting #1 Recap

III. Community Lifelines

- When should we start including them in the planning process?

IV. Reference Documents

V. Natural Hazards Review

- a. Flooding
- b. Severe Snowstorms, Ice Storms, and Nor'easters
- c. Hurricanes
- d. Severe Thunderstorms, Wind, and Tornadoes
- e. Wildfires and Brushfires
- f. Earthquakes
- g. Dam Failure
- h. Drought
- i. Extreme Temperatures
- j. Landslides and Other Hazards

VI. Break

VII. Critical Infrastructure/Facilities and Vulnerable Populations Review

Review previous CI/F/P lists and update as necessary

- Category 1 – Emergency Response Facilities
- Category 2 – Non-Emergency Response Facilities
- Category 3 – Dams
- Category 4 – Populations and Facilities to Protect



Northborough MASSACHUSETTS

Meeting Name:
Northborough Hazard Mitigation
Plan Meeting #2

Community: Northborough

Location: Northborough Free Library
Conference Room, 34 Main Street,
Northborough, MA

Date: September 25th, 2023

Meeting Time: 10:00 AM

Participant Name	Organization	Title	E-mail
BOB FREDERICO	Northborough	Building Inspector	BFREDERICO@TOWN.NORTHBOROUGH.MA.US
VIN VIGNALY	Conserv. Comm.	Agent	VVIGNALY@TOWN.NORTHBOROUGH.MA.US
SCOTT CHARPENTIER	DPW	Director	Too Long
NEAL ASPESI	Fire	Deputy	NASPESE@TOWN.NORTHBOROUGH.MA.US
Michael Parr	LEPC	Hazmat Asst.	mparr@town.northborough.ma.us
Laune Connors	Planning	Director	lconnors@town.northborough.ma.us
MICHAEL SEAGER	Health Dept		mseager@town.northborough.ma.us
Andrew Loew	CMRPC		aloew@cmrpc.org



Northborough Hazard Mitigation Plan Update
Local Planning Team Meeting #3

Date/Time: December 12th, 2023, 10:00am

Location: Northborough Free Library Conference Room, 34 Main Street, Northborough, MA

- I. Introductions**
- II. Natural Hazards and Critical Infrastructure Meeting Recap**
- III. Community Lifelines**
- IV. Reference Documents**
- V. Existing Protection Measures Review**
 - Review/Update the Existing Protection Matrix
- VI. Community Survey Planning**
 - Review Example
 - Discuss Format/Timeline
- VII. Public Presentation Planning**
 - Purpose
 - Format
 - Date/Time/Location
 - Outreach
- VIII. Preliminary Discussion of New Mitigation Strategies**
- IX. Next Meeting – Mitigation Strategy Development**
 - Date/Time/Location
 - What to prepare



Northborough

MASSACHUSETTS

Meeting Name:
Northborough Hazard Mitigation
Plan Meeting #3

Community: Northborough

Location: Northborough Free Library
Conference Room, 34 Main Street,
Northborough, MA

Date: December 12th, 2023

Meeting Time: 10:00 AM

Participant Name	Organization	Title	E-mail
Michael Parr	LEPC	Hazmat Assistant	mparr@town.northborough.ma.us
Scott D. Charpentier	DPW	Director	scharpentier@town.northborough.ma.us
Robert Federico	Building	B/I/ZCO	RFEDERICO@TOWN.NORTHBOROUGH.MA.US
Max Grando	CMRPC	Emergency Planner	mgrand@cmrpc.org
Will Talbot	CMRPC	assistant resiliency planner	wtalbot@cmrpc.org
Vin Vignaly	Conservation	Agent	vvignaly@town.northborough.ma.us
Andrew Luen	CMRPC	Director	aluen@cmrpc.org
Louise Connors	Planning	Director	lconnors@town.northborough.ma.us
Neal Aspesi	FIRE	DEPUTY CHIEF	NASPESI@TOWN.NORTHBOROUGH.MA.US
Brian Griffin	Police	LT.	BGriffin@Town.Northborough.MA.US
David Parenti	Fire	Chief / Eng	dparenti@town.northborough.ma.us



Northborough Hazard Mitigation Plan Update
Local Planning Team Meeting #4

Date/Time: March 5th, 2024, 10:00am

Location: Northborough Free Library Conference Room, 34 Main Street, Northborough, MA

I. Introductions

II. Meeting #3 Recap

III. Community Lifelines

IV. Reference Documents

VIII. Discussion of Mitigation Strategies

- Review of last plan's mitigation strategies
- Development of new mitigation strategies
- Discussion of vulnerable populations and facilities

VI. Community Survey Results Review

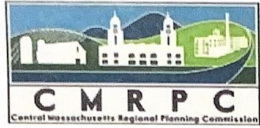
VII. Public Presentation Planning

- Purpose
- Format
- Date/Time/Location
- Outreach

IX. Review of Updates to Existing Protection Measures

X. Next Meeting

- Date/Time/Location
- What to prepare



Northborough MASSACHUSETTS

Meeting Name: Northborough Hazard Mitigation Plan Meeting #4
Community: Northborough
Location: Northborough Free Library Conference Room, 34 Main Street, Northborough, MA
Date: March 5th, 2024
Meeting Time: 10:00 AM

Participant Name	Organization	Title	E-mail
Michael Parr	Fire/CEPC	Hazmat Asst.	mparr@town.northborough.ma.us
Bob Federico	Northborough 2 Building	Building Insp.	RFEDERIC@TOWN.NORTHBOROUGH.MA.US
Brian Griffin	POLICE	CHIEF	BGriffin@TOWN.NORTHBOROUGH.MA.US
Laure Connors	Planning	Planning Director	"
Vin Vignaly	ConCom	ConCom Agent	VVignaly@town.northborough.ma.us
NEAL ASPESI	FIRE	Deputy Chief	-
David Parenti	Fire	Chief	-
Will Talbot	CMRPC	Assist Planner	wtalbot@cmrpc.org
Marie Grante	CMRPC	emergency prep planner	m.grante@cmrpc.org
Sarah Plattick	CMRPC	Asst. Planner	splattick@cmrpc.org



Northborough Hazard Mitigation Plan Update
Local Planning Team Meeting #5

Date/Time: Wednesday, May 8th, 2024, 10:00am-12:00pm

Location: Northborough Free Library Conference Room, 34 Main Street, Northborough, MA

AGENDA

I. Introductions

II. Meeting #4 Recap

III. Community Lifelines

IV. Reference Documents

V. Public Presentation Planning

- Purpose
- Format
- Date/Time/Location
- Outreach

VI. Review of Northborough MVP Recommendations

- Discuss incorporating MVP recommendations into this HMP update as mitigation strategies

VII. Community Survey Results Review

- Brainstorm new mitigation strategies from community survey results

VIII. Existing Protection Measures Updates

IX. Next Meeting

- Date/Time/Location
- What to prepare

IX. Next Meeting – Existing Protection Measures Review, Public Forum and Community Survey Planning

- Date/location
- What to prepare

DRAFT



Northborough

MASSACHUSETTS

Meeting Name:
Northborough Hazard Mitigation
Plan Meeting #5

Community: Northborough

Location: Northborough Free Library
Conference Room, 34 Main Street,
Northborough, MA

Date: May 8th, 2024

Meeting Time: 10:00 AM

Participant Name	Organization	Title	E-mail
Michael Parr	Fire/LEPC	Hazmat Asst.	mparr@town.northborough.ma.us
Bob Frederico	Northborough Building Inspector	Inspector	rbfriderico@town.northborough.ma.us
Scott D. Charpentier	PPW	Director	scharpentier@town.northborough.ma.us
Bill Griffin	Northboro Police	Lt.	wgriffin@TOWN.Northborough-MA-Us
Will Talbot	CMRPC	Asst. Planner	wtalbot@cmrpc.org
Mar Granaro	CMRPC	emergency Prep Planner	mgranaro@cmrpc.org
Laurie Connors	Planning Dep.		lconnors@town.northborough.ma.us

APPENDIX D:
Public Presentation at
Board of Selectmen Meeting
Materials

DRAFT

PUBLIC PRESENTATION

Northborough Hazard Mitigation Plan




The Town of Northborough is hosting a public presentation at a Select Board meeting on the Town's draft Hazard Mitigation Plan update.

- *Attend to hear about draft mitigation strategies that can help the Town assess and reduce community risk from natural hazards.*
- *The draft plan will be posted on the town website for public review for two weeks following this presentation.*

If you have any comments on the draft plan or would like more information, contact Will Talbot at wtalbot@cmrpc.org.

If you need assistance accessing the Municipal Center, call the Select Board's office at (508) 393-5040, extension 1.



During the Select Board meeting on Monday, July 15th, 2024 at 7pm at the Northborough Town Hall at 63 Main Street, in the Select Board's Meeting Room, on Zoom, on the Northborough Cable YouTube channel, and on Charter channel 192 and Verizon channel 30.





Work is now underway on the update of Northborough's 2018 Natural Hazard Mitigation Plan, which will help guide local efforts to reduce damage from future natural disasters. The Town of Northborough invites local residents, business operators, property owners, and other interested parties to attend a public presentation on the draft 2024 Northborough Hazard Mitigation Plan update. This presentation will take place at the Select Board meeting on Monday, July 15th, 2024

PUBLIC PRESENTATION Northborough Hazard Mitigation Plan



The Town of Northborough is hosting a public presentation at a Select Board meeting on the Town's draft Hazard Mitigation Plan update.



- *Attend to hear about draft mitigation strategies that can help the Town assess and reduce community risk from natural hazards.*

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During the Select Board meeting on **Monday, July 15th, 2024 at 7pm** at the Northborough Town Hall at 63 Main Street, in the Select Board's Meeting Room, on Zoom, on the Northborough Cable YouTube channel, and on Charter channel 192 and Verizon channel 30.



Presentation to be held on draft update to Natural Hazard Mitigation Plan

by Community Advocate - July 3, 2024



[Click me to copy current URL](#)



Northborough will be holding a presentation on its Natural Hazard Mitigation Plan. (Photo:Lexia Ishyuu)

NORTHBOROUGH – Efforts are underway to update Northborough's 2016 Natural Hazard Mitigation Plan, which will help guide local efforts to reduce damage from future natural disasters.

The town is inviting residents, businesses, property owners and other interested parties to a public presentation on the draft update to the plan on July 15 in the Select Board meeting room in Town Hall at 7 p.m. Community members will also be able to attend the presentation via Zoom, and it will be livestream with Northborough Cable Access on YouTube, Charter channel 192 and Verizon channel 30.

The plan is being developed by a team of local officials and staff with technical assistance provided by the Central Massachusetts Regional Planning Commission.

The planning process, funded through a Hazard Mitigation Grant Program grant, is a chance for the public to help protect the town from winter storms, thunderstorms, severe wind and other natural hazards. The plan will be available on the town's website for two weeks after the presentation.

The final adoption of the plan is contingent on approval from the Select Board, the Federal Emergency Management Agency and the Massachusetts Emergency Management Agency. Adoption will make the town eligible for various FEMA pre-disaster and post-fire hazard mitigation grants.



Town of Northborough, Natural Hazard Mitigation Plan

Public Presentation: July 15th, 2024

What is hazard mitigation? What is a mitigation plan?

- Hazard mitigation is the effort to reduce loss of life and property by lessening the impact of natural disasters.
- Mitigation is not disaster response; its goal is to reduce hazard impacts before a disaster occurs.
- A mitigation plan identifies natural hazards and the risks they pose to residents, infrastructure, property, and natural resources. It prioritizes projects, policies, education, and procedures for reducing these risks, now and in the future.
- Mitigation helps break the cycle of disaster damage, reconstruction, and repeated damage.

Why should Northborough complete and adopt this kind of plan?

- Natural hazard mitigation planning establishes a road map for achievable actions that can substantially reduce risks.
- The Federal Emergency Management Agency (FEMA) requires that cities and towns adopt and update a natural Hazard Mitigation Plan to be eligible for various FEMA pre-disaster and post-fire hazard mitigation grants.
- This plan is primarily funded by a grant from FEMA through MEMA (with a local in-kind match).
- FEMA and Northborough's Select Board adopted the Town's last natural hazard mitigation plan in October 2018, and this plan expired in October 2023.

What natural hazards pose the greatest risks to Northborough?

- Largest risks: winter storms, severe thunderstorms and wind
- Moderate risks: flooding, tornadoes, invasive species
- Lower risks: dam failures, extreme temperatures, drought, hurricanes, wildfires, earthquakes

Local partners

Local knowledge is essential to the mitigation planning process. Partners in Northborough to date include:

Chief and Emergency Management Director David Parenti, Deputy Chief Neal Aspesi, and Hazmat Assistant Michael Parr, Fire Department; Director Scott Charpentier, Department of Public Works; Chief Brian Griffin and Former Chief William Lyver, Police Department; Director Laurie Connors, Planning Department; Conservation Agent Vincent Vignaly, Conservation Commission; Inspector of Buildings / Zoning Enforcement Officer Robert Fredrico, Building Department; Health Agent Michael Seager, Health Department.

Planning timeline

- | | |
|---|-------------------|
| • Information gathering via mapping, research, and local input | July 2023 to date |
| • Draft plan development | April – June 2024 |
| ○ Public comments/questions requested within two weeks of the draft plan being posted on the town website | |
| • Public presentation #1 | June 2024 |
| • MEMA review | Summer 2024 |
| • FEMA approval and local adoption | Fall 2024 |
| • 5-year update | 2029 |

Recent/ongoing mitigation activities include:

- Street sweeping and catch basin cleaning
- Maintaining and replacing problem culverts and maintaining and repairing problem roadways when needed and as funding allows
- Installing backup generators at critical public facilities when needed and as funding allows
- Participation in the National Flood Insurance Program (NFIP)
- SAFE and Senior SAFE Disaster Training Programs
- Dredging fire ponds and maintaining fire roads
- Compliance with the state building code, AAB codes, and ADA codes
- Vegetative debris program
- Dam monitoring
- Tree trimming program
- Snow removal
- Hazard warning systems and notifications
- Education and outreach
- Plans, regulations, and studies

Recommended high priority mitigation strategies in the DRAFT plan

A. Structure and Infrastructure Strategies

- Map and maintain fire roads in conservation areas.
- Incorporate energy efficiency measures as part of municipal building projects.
- Explore options for working with MassDOT to construct water retention structures / swales at the RT-9 - RT-20 Interchange.
- Explore establishing a redundant MWRA connection, as recommended by MassDEP, to ensure a reliable water supply for the Town.
- Remove dams and restore streams, prioritizing continuing work on the removal of Northborough Reservoir Dam. Explore options for acquiring and removing other significant and high hazard dams within town.
- Provide critical municipal facilities (such as the town hall, senior center, and library) with backup power to provide heating and cooling in extreme conditions.
- Drainage improvements at Church Street.

B. Preparedness, Coordination, and Response Strategies

- Continue to sweep streets at least once per year to increase stormwater management capacity; capture and dispose of properly (currently budgeted).
- Continue to properly clean, at least annually, or more often as required, all stormwater structures and basins (currently budgeted).
- Continue to utilize hazard warning systems and notifications: social media, town webpages, Code Red, and other communication methods. Interns are currently taking senior citizen information to sign them up for CodeRed. Post generator safety and use info on social media. Health Dept. to put out a brochure on 72-hr kits through Town-wide mailing, school children take-home, etc. Maintain internal instant messaging system, allowing for rapid response of emergency personnel.
- Actively enforce and comply with the 2021 update of the state building codes, promote successful working relationship between Fire Marshall and Building Inspector.
- Actively enforce and comply with the Massachusetts Wetlands Protection Act and enforce local wetlands bylaw.

- Continue to engage with the Local Emergency Planning Committee (LEPC) and Central Region Homeland Security Advisory Council (CRHSAC) for increased communication and coordination between local, regional, state, and federal agencies regarding disasters and emergencies.
- Evaluate and rank projects impacting flood prone streets/areas.
- Maintain and improve emergency services for vulnerable populations such as seniors, which could require increasing emergency transportation options (rideshare options), diversifying communications, expanding planning, and ensuring reliable power.
- Protect municipal buildings and services against flooding and provide adequate staffing and training.
- Prepare a communications plan and practice emergency protocols to ensure adequate staffing and equipment, spread knowledge of evacuation routes and services, and stock the materials needed to sustain evacuated residents.

C. Education and Awareness Strategies

- Support local public health initiatives and evaluate management of public health related concerns.

D. Local Plan and Regulation Strategies

- Expand the use of the Capital Improvement Program for vegetation removal equipment, paving, and dam repair.
- Update subdivision regulations to incorporate current construction practices and stormwater mitigation measures. Create homeowners' associations to permanently maintain stormwater basins and fire protection systems (such as cisterns). Update the common driveway bylaw.
- Evaluate, update, and maintain public safety communications system infrastructure.
- Continue to actively enforce and comply with State Building Code Requirements. Ensure proper certification for inspectors.
- Actively enforce and comply with the stormwater management bylaw under the jurisdiction of the Conservation Commission.
- Update the Hazard Mitigation Plan every five years and monitor implementation by meeting to review mitigation strategies annually.

The draft plan with the full list of mitigation strategies will be available shortly on Northborough's town website.

Comments and questions should be directed to Will Talbot (wtalbot@cmrpc.org) at CMRPC within two weeks of the draft plan being posted on the town website.

This natural hazard mitigation planning activity is funded by an FY 2023 Hazard Mitigation grant from the Federal Emergency Management Agency through the Mass. Emergency Management Agency



TOWN OF NORTHBOROUGH HAZARD MITIGATION PLAN



Northborough Select Board
July 15th, 2024

Marc Granato, Emergency Preparedness Planner

Will Talbot, Assistant Planner

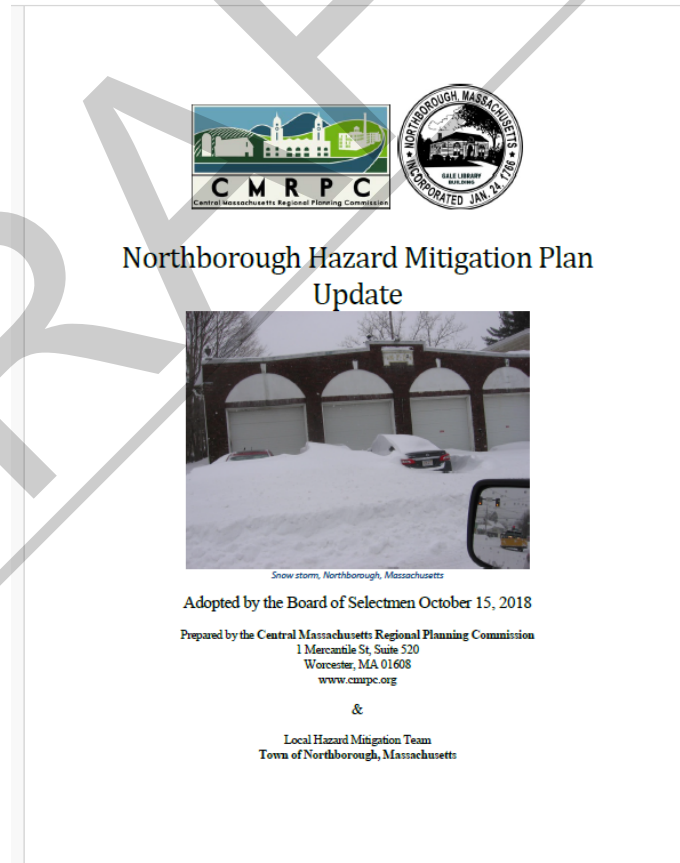
Andrew Loew, Director, Community Development &
Resiliency Planning

Central Massachusetts Regional Planning Commission



WHY IS NORTHBOROUGH COMPLETING THIS PLAN?

- The Federal Emergency Management Agency (FEMA) requires that cities and towns adopt and update a natural Hazard Mitigation Plan to be eligible for various FEMA pre-disaster and post-fire hazard mitigation grants.
- This plan will meet FEMA's requirements and help the town make good use of its resources.
- Northborough's last HMP update was approved in October 2018 and expired in October 2023.



PLAN FOR MITIGATING DAMAGES FROM NATURAL HAZARDS






- Flooding
- Severe Snowstorms / Ice Storms / Nor'easters
- Hurricanes
- Severe Thunderstorms / Wind / Tornadoes
- Wildfires / Brush Fires
- Earthquakes
- Dam Failure
- Drought
- Extreme Temperatures
- Invasive Species
- Other Hazards (Landslides, Groundwater Intrusion)

Not an Emergency Response Plan

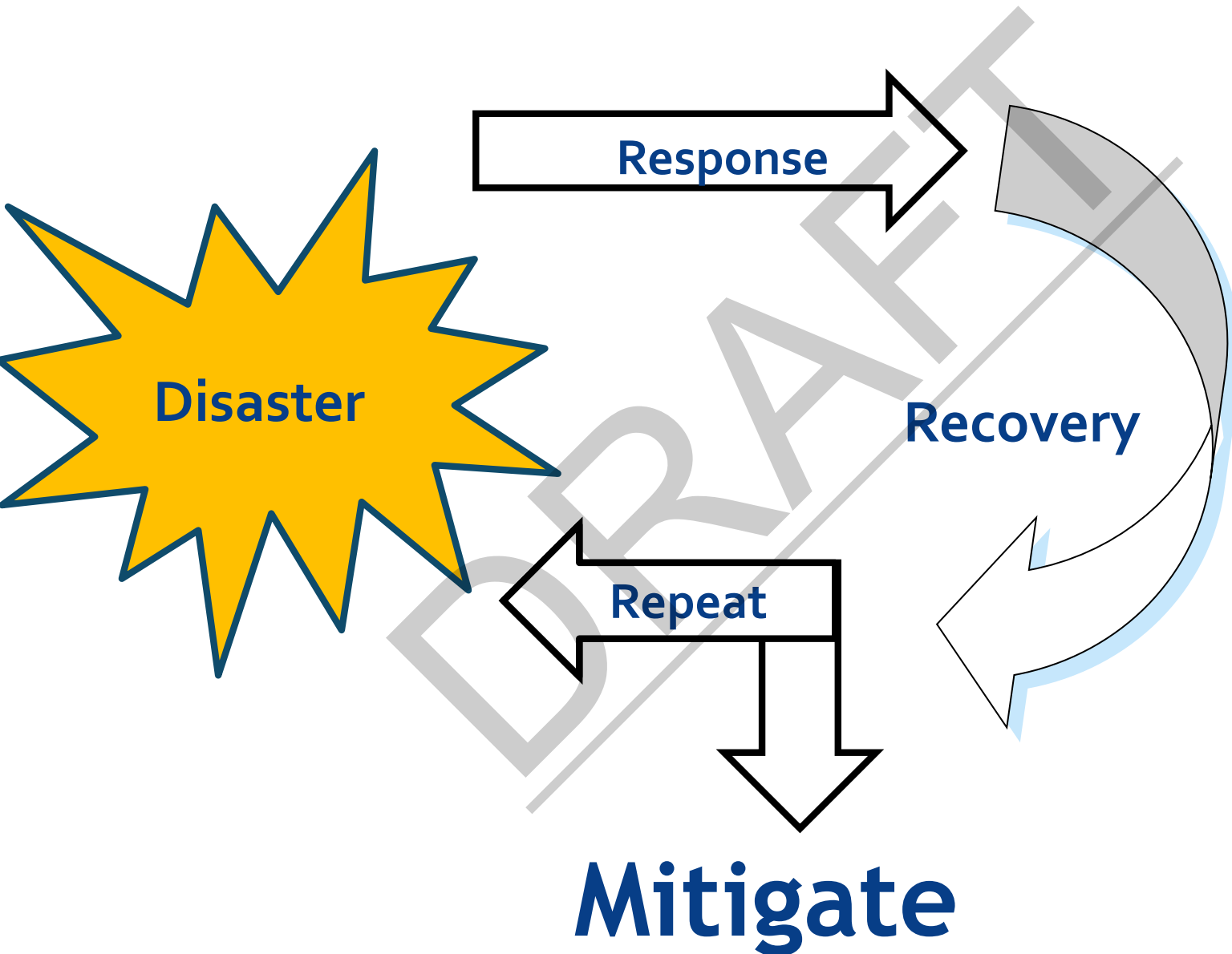
WHAT IS HAZARD MITIGATION?

- *To permanently reduce or prevent losses of life, injuries and property damage by using long-term strategies*
- *What preventive actions are being taken NOW to reduce future risks and damages?*
- *What additional actions can be taken in the FUTURE?*
- *According to the National Institute of Building Sciences Natural Hazard Mitigation Saves: 2019 Report, on average between 4 to 6 dollars is saved for every dollar spent on hazard mitigation*

THE BENEFITS OF MITIGATION

National Benefit-Cost Ratio (BCR) Per Peril <i>*BCR numbers in this study have been rounded</i>		Beyond Code Requirements	Federally Funded
Overall Hazard Benefit-Cost Ratio		\$4:1	\$6:1
 Riverine Flood		\$5:1	\$7:1
 Hurricane Surge		\$7:1	Too few grants
 Wind		\$5:1	\$5:1
 Earthquake		\$4:1	\$3:1
 Wildland-Urban Interface Fire		\$4:1	\$3:1

Breaking the Cycle of Risk



Four Tools & Techniques for Hazard Mitigation

1. Structure & Infrastructure Projects
2. Preparedness, Coordination & Response Actions
3. Education & Awareness Programs
4. Local Plans & Regulations

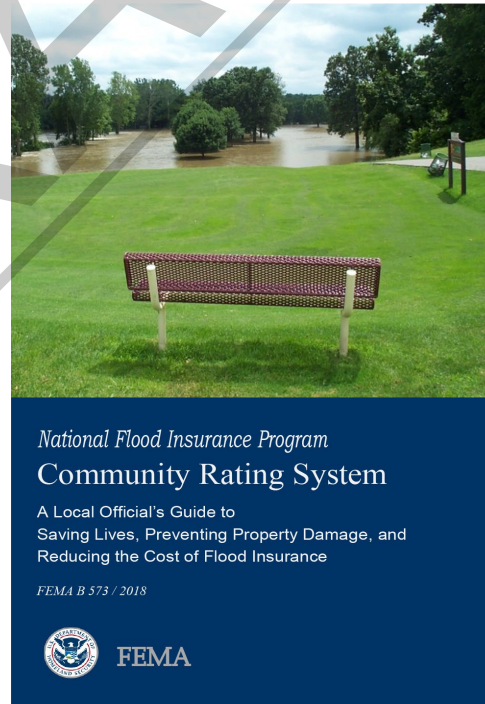
STRUCTURE AND INFRASTRUCTURE PROJECTS

- Prevent floodwaters from reaching properties
- Man-made structures to control water flows
- Culverts, dams, storm drainage facilities, pumping facilities



PREPAREDNESS AND RESPONSE

- National Flood Insurance Program
- Evacuation Planning
- Community Rating System
- Facilitate and coordinate the administration, enforcement and collaboration



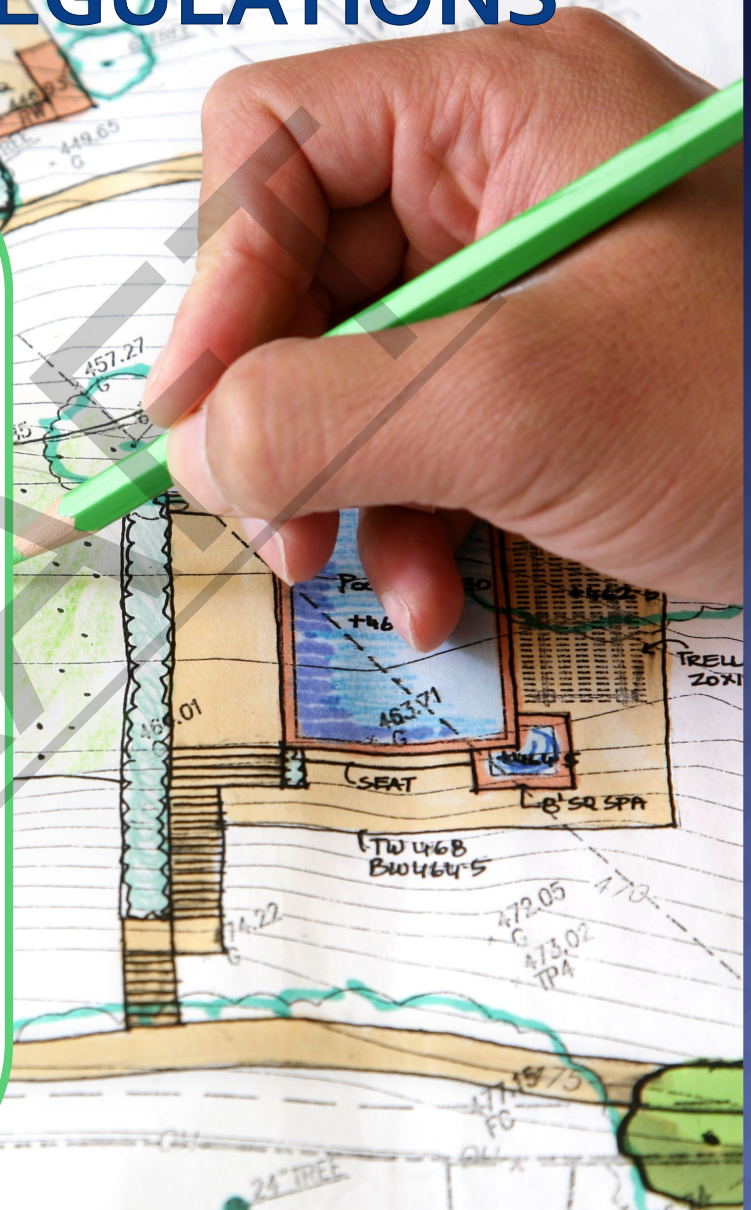
EDUCATION AND AWARENESS

- Natural hazard awareness websites
- Hazard information at libraries, schools, and public buildings
- Information brochures mailed to residents (e.g., safe operation of home generators)
- Public outreach at community events



LOCAL PLANS & REGULATIONS

- Planning & Zoning
- Subdivision and Site Plans
- Floodplain regulations
- Wetlands bylaws
- Storm water regulations
- Building Code
- Master Plans
- MVP Plans



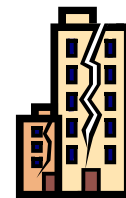
PLANNING PROCESS

- CMRPC provides technical assistance to the Town for plan development
- The Town coordinates through its Local Hazard Mitigation Team
- Public Survey
- Public presentation (tonight), during plan development and review of the draft plan
- Submittal of Draft Plan to MEMA and FEMA for review, revision, and approval
- Plan adoption by the Select Board

DEVELOPMENT OF THE PLAN

CMRPC assisted the Northborough
Local Hazard Mitigation Planning Team to:

- Identify & Map Critical Facilities
- Identify & Map Locally Identified Hazard Areas
- Identify & Review Existing Mitigation Measures
- Identify and Prioritize New Mitigation Strategies
- Gather Feedback & Input from the Public

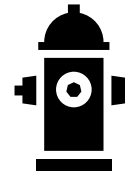
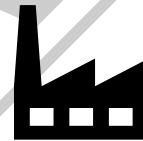


IDENTIFY CRITICAL FACILITIES

Database & GIS maps of critical facilities, infrastructure

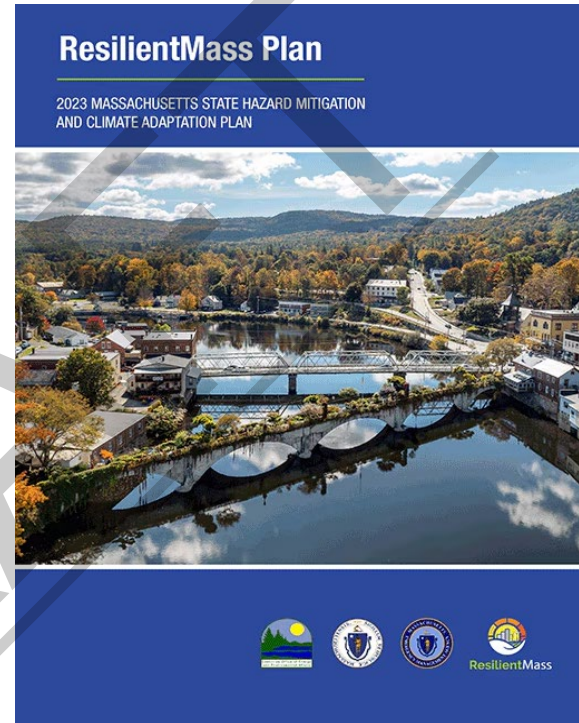
Sites identified include:

- Emergency Response Facilities
- Water Supply and Sewer Facilities, Town Facilities, and Utilities
- Dams
- Facilities and populations to protect



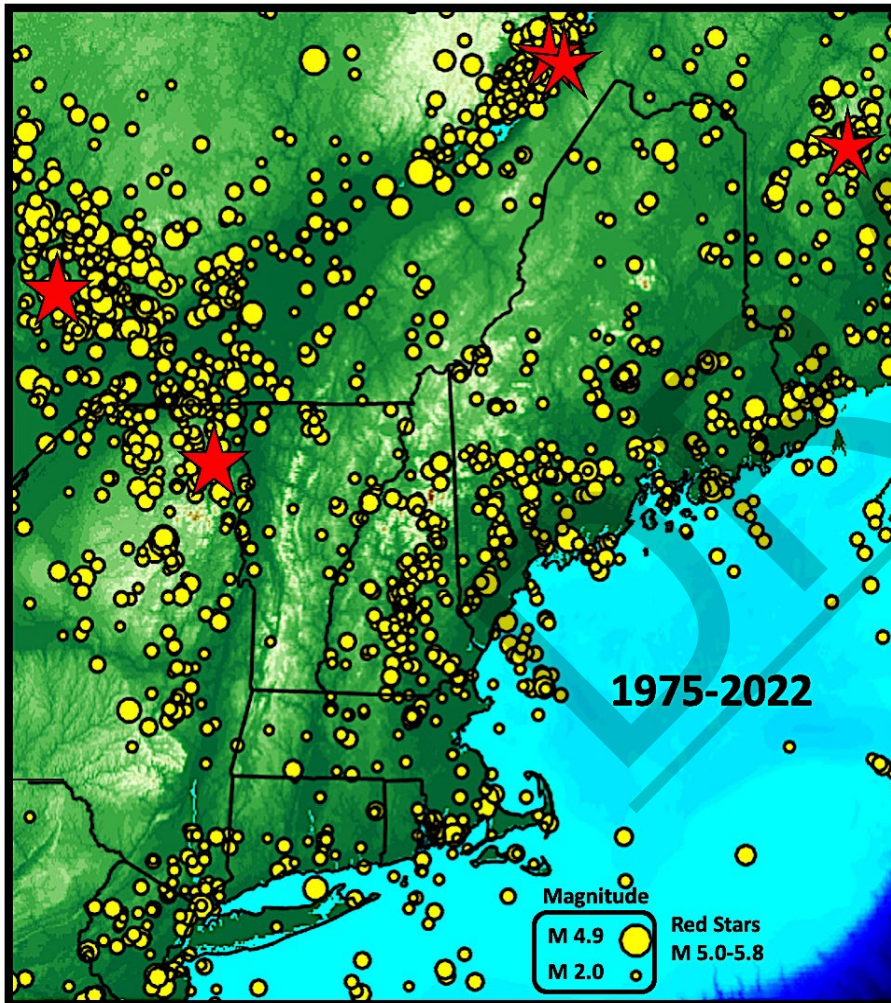
HAZARD IDENTIFICATION & MAPPING

- State & Federal data on floodplains, snowfall, wind speeds, hurricanes, earthquake risk, etc.
- Review Mass. State Hazard Mitigation Plan
- Coordinate with Local Team to get local information on hazard areas and potential future developments



OTHER HAZARDS – GEOLOGIC, WIND, & SNOW

Earthquakes from 1975 to 2022 2+ Magnitude



Recent Declared Hurricanes & Snow Disasters

Disaster	Declaration Date	Incident Period	FEMA ID
Hurricane Lee	09/15/23	09/15/23 - 09/17/23	EM-3599-MA
Mashpee Wampanoag Tribe Tropical Storm Henri	08/22/21	8/20/21 -	3566-EM-Mashpee Wampanoag Tribe

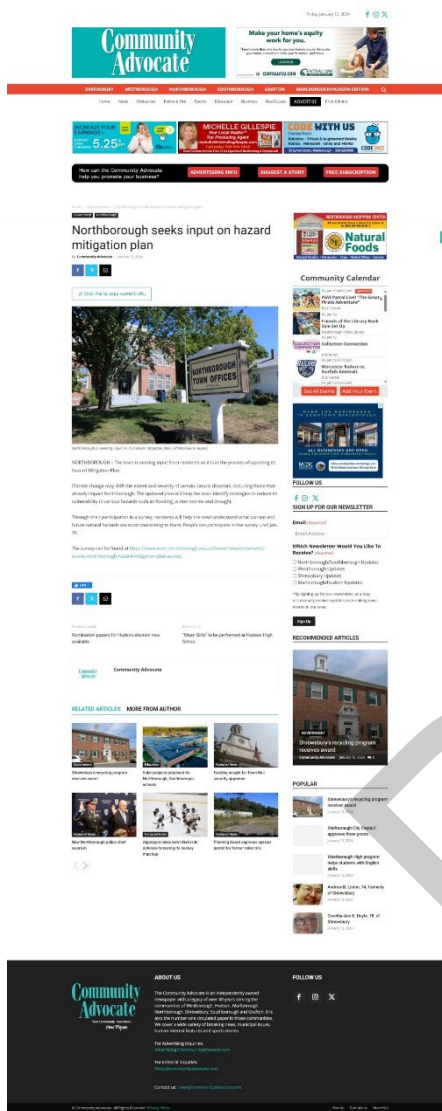
Disaster	Declaration Date	Incident Period	FEMA ID
Massachusetts Severe Winter Storm and Snowstorm	04/18/22	01/28/22 - 01/29/22	DR-4651-MA
Massachusetts Severe Winter Storm and Snowstorm	07/19/18	03/13/18 - 03/14/18	DR-4379-MA

SELECT LOCALLY-IDENTIFIED HAZARD AREAS

- Flooding
 - Several streets along Church St
 - SW Cutoff
- Severe Snow / Ice
 - Howard St
 - Ball Street
- Wildfire
 - Mt. Pisgah
 - Little Chauncy Pond
 - Edmunds Hill
- Potential Dam Failure
 - Bartlett Pond Dam on Bartlett St
 - Northborough Reservoir Dam in Shrewsbury
 - Smith Pond Dam on Otis St



PUBLIC SURVEY – Winter 2023-2024



- 213 total responses
- Hazards of greatest concern: winter storms / ice, thunderstorms / microbursts / extreme wind, and invasive plant hazards.
- The survey was promoted through the Town website, the Fire Department Facebook page, the Local Cable Access TV network, and the Community Advocate newspaper
 - Survey flyers and paper copies were also posted at several high traffic locations in town.

EXISTING MITIGATION MEASURES

MULTIHAZARD

- Comprehensive Emergency Management Plan (CEMP)
- Compliance with the state building code, AAB codes, and ADA codes
- Education and outreach
- Hazard warning systems and notifications
- SAFE and Senior SAFE Disaster Training Programs
- Plans, regulations, and studies
- Vegetative debris program

FLOOD RELATED HAZARDS

- National Flood Insurance Program
- Street sweeping
- Catch basin cleaning
- Roadway treatments
- Drainage preventive practices to reduce clogging
- Subdivision Rules and Regulations
- Zoning Regulations

DAM FAILURES

- State permits for dam construction
- DCR dam safety regulations

WIND-RELATED HAZARDS

- Tree trimming program

WINTER-RELATED HAZARDS

- Salting and sanding of roads and plowing

BRUSH FIRE RELATED HAZARDS

- Permits for outdoor burning
- Dredging fire ponds and maintaining fire roads

NORTHBOROUGH MITIGATION STRATEGIES



- Where are the GAPS?
- What actions will further reduce vulnerability?
- Where are the PRIORITIES?

DRAFT PLAN SELECT HIGH-PRIORITY MITIGATION MEASURES

- Map and maintain fire roads in conservation areas.
- Explore establishing a redundant MWRA connection to ensure a reliable water supply for the Town.
- Provide critical municipal facilities with backup power to provide heating and cooling in extreme conditions.
- Maintain and improve emergency services for vulnerable populations such as seniors.
- Evaluate, update, and maintain public safety communications system infrastructure.

PLAN APPROVAL AND ADOPTION

- The Draft plan will be reviewed by MEMA.
- FEMA will review the plan and is the agency that issues conditional approval.
- A Select Board resolution to adopt the plan can occur after FEMA conditional approval.
- FEMA issues final plan approval.
- The plan will be in effect for 5 years.



IMPLEMENTING THE PLAN

WHAT HAPPENS AFTER THE PLAN IS APPROVED?

- Establish a local implementation group.
- Prepare a timeline for implementation.
- Integrate the plan's recommendations with other local plans and policies.
- Seek FEMA and other funding sources and other resolutions for plan mitigation measures.
- Meet at least yearly to review progress of plan implementation.
- Update the plan every 5 years.

DRAFT PLAN

The full draft plan will be available on the Northborough town website.

Please send any comments or questions about the plan to wtaibot@cmprc.org within two weeks of the draft plan being posted on the town website.

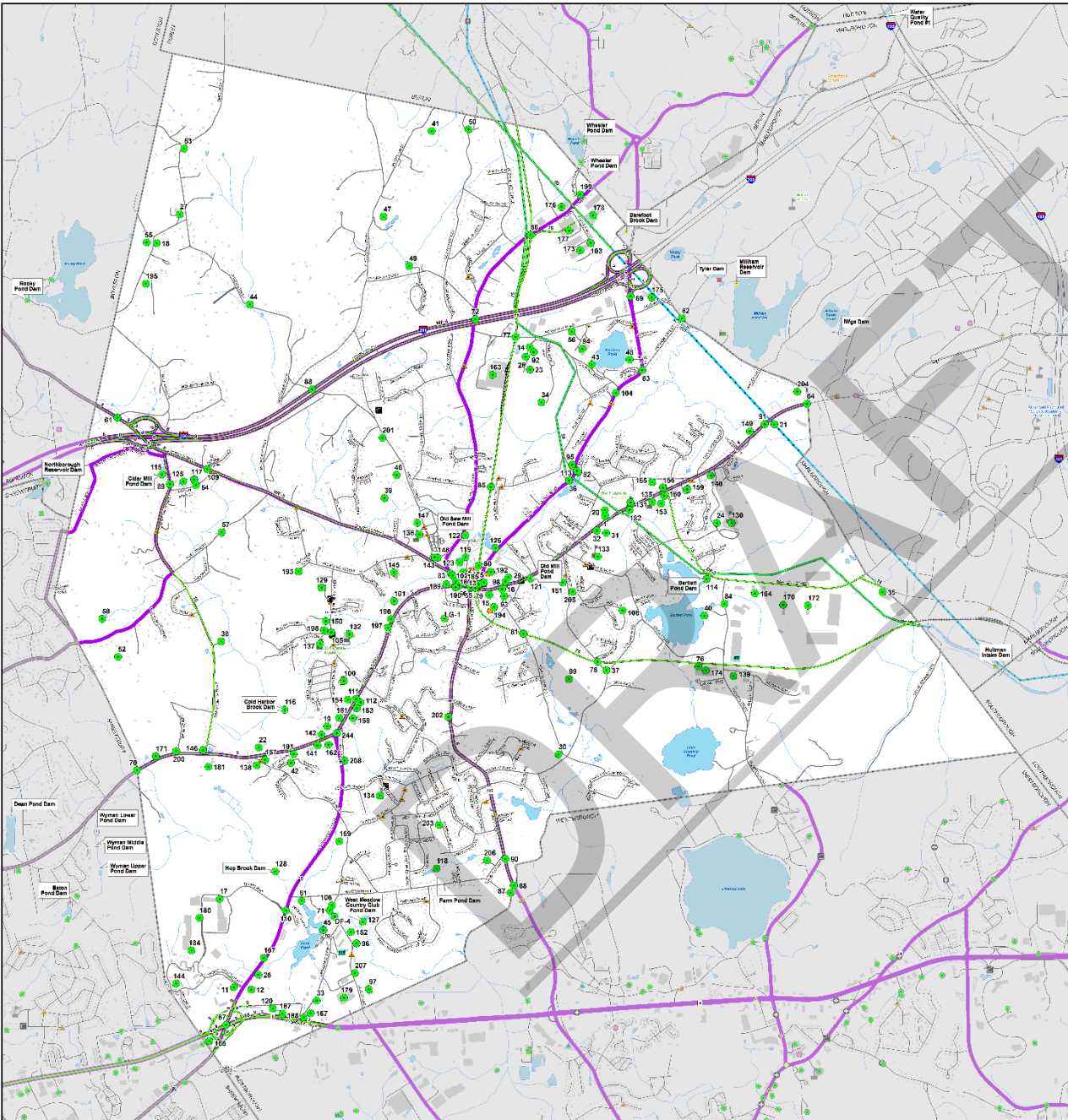
Hazard Mitigation Plan

Map 1

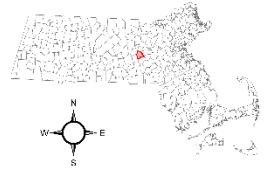
Critical Infrastructure and Facilities

Town of Northborough, Massachusetts

June 2024



- Legend**
- Assisted Living
 - Clinics
 - Elderly Housing
 - Emergency Shelters
 - End Of Life Facilities
 - Misc Data
 - Nursing/Rest Homes
 - ▲ Daycare
 - ▲ Electric Distribution
 - ▲ Electric Substation
 - ▲ EOC
 - ▲ Courts
 - Water Treatment Plant
 - Waste Water Treatment Plant
 - Airports
 - Town Halls
 - Local Police
 - Fire Station
 - ▲ Schools (Pre-K through High School)
 - Aqueducts
 - Active Rail Line
- Town Boundaries
 Streams
 Regionwide Evacuation Routes
- Structures
 Roads
 Regionwide Evacuation Routes
- Water Bodies
- Dams (2/2012) High Hazard
 Significant Hazard
 Low Hazard
 N/A
- Locally Defined**
 Critical Infrastructure
 Critical Infrastructure
 Critical Infrastructure



0.50 0.25 0 0.25 0.50 0.75 Miles

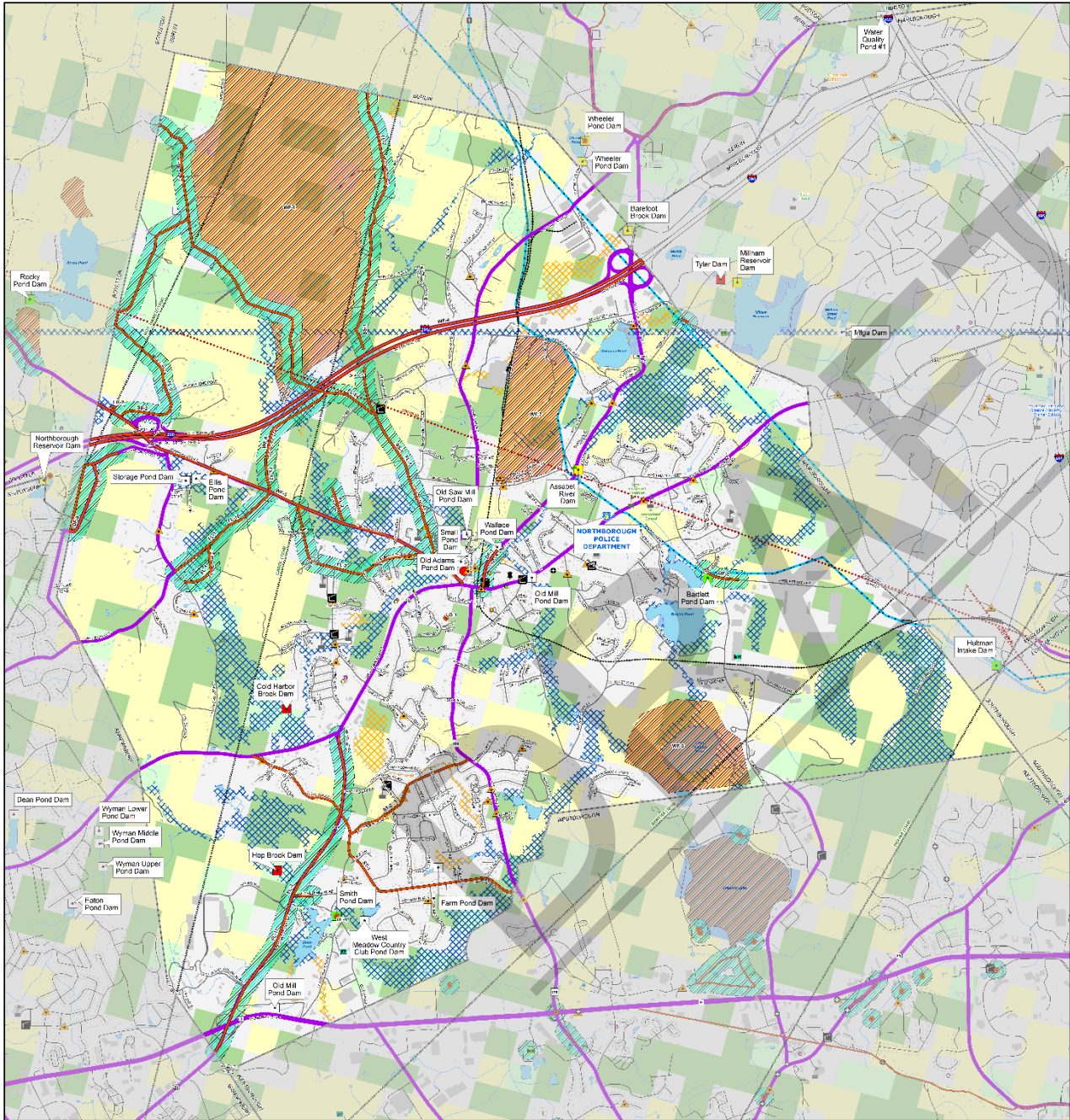
Hazard Mitigation Plan

Map 2

Hazards

Town of Northborough, Massachusetts

June 2024



Legend

- Assisted Living
- Clinics
- Elderly Housing
- Emergency Shelters
- End Of Life Facilities
- Misc Data
- Nursing/Rest Homes
- Daycare
- Electric Distribution
- Electric Substation
- EOC
- Courts
- Water Treatment Plant
- Waste Water Treatment Plant
- Airports
- Town Hall
- Local Police
- Fire Station
- Schools (Pre-K through High School)
- Aqueducts
- Active Rail Line
- Town Boundaries
- Structures
- Water Bodies
- Streams
- Roads
- Regionwide Evacuation Routes

Hazards

Dams (2/2012)

- High Hazard
- N/A

FEMA DFIRM Flood Zones

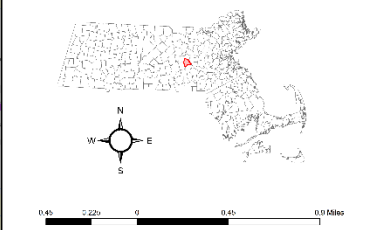
- 100-year Flood Area
- 300-year Flood Area
- Repetitive Loss Property Areas
- NOAA Historic Hurricane Tracks (1842-2022)

USDA Wildfire Hazard Potential, Version 2023

- 1: Very Low
- 2: Low
- 3: Moderate
- 4: High
- 5: Very High
- 6: Non-burnable
- 7: Water

Locally Defined Hazards

- Hazard
- Hazard
- Possible Flood Area
- Hazard



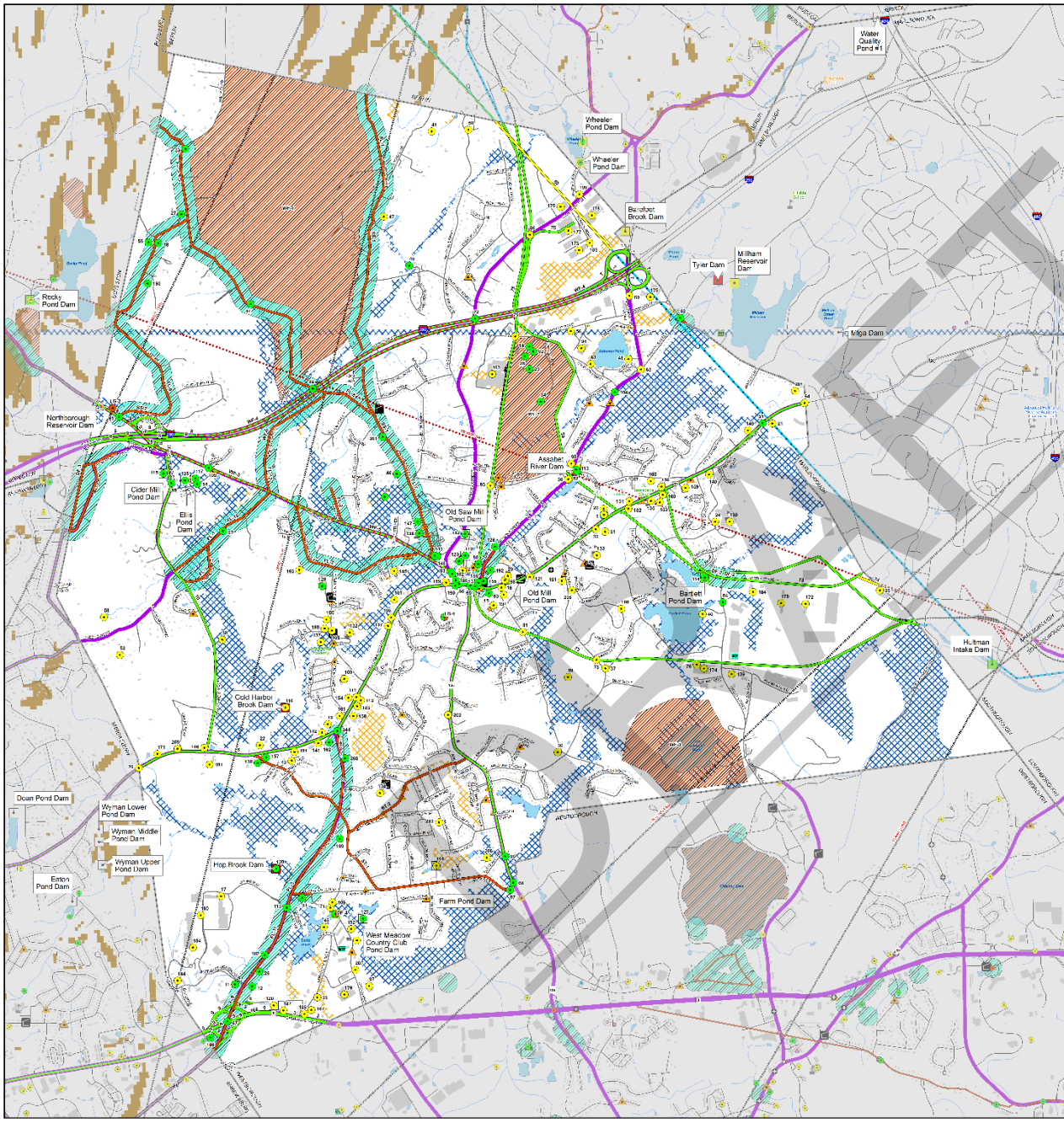
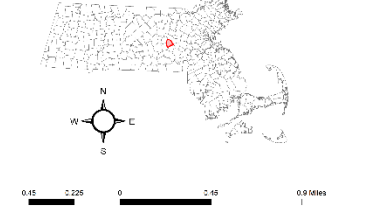
Hazard Mitigation Plan Map 3 Vulnerable Critical Infrastructure and Facilities Town of Northborough, Massachusetts June 2024

Legend

- Assisted Living
- Clinics
- Elderly Housing
- Emergency Shelters
- End Of Life Facilities
- Misc Data
- Nursing/Rest Homes
- Daycare
- Electric Distribution
- Electric Substation
- EOC
- Courts
- Water Treatment Plant
- Waste Water Treatment Plant
- Airports
- Town Halls
- Local Police
- Fire Station
- Schools (Pre-K through High School)
- Aqueducts
- Active Rail Line

- Town Boundaries
 - Structures
 - Water Bodies
 - Streams
 - Roads
 - Regionwide Evacuation Routes
- Hazards**
- Dams (2/2012)
 - High Hazard
 - Significant Hazard
 - Low Hazard
 - N/A
 - FEMA DFIRM Flood Zones
 - 1% Annual Chance Flood
 - Hazard or Regulatory Floodway
 - 0.2% Annual Chance Flood Hazard
 - High Slope (15% and above)
 - Repetitive Loss Property Areas
 - NOAA Tornado Tracks (as of 9/2021)
 - IBTACS Historical Hurricane Tracks (1842-2020)

- Locally Defined**
- Hazard
 - Vulnerable Critical Infrastructure
 - Vulnerable Critical Infrastructure/Hazard
 - Non-vulnerable Critical Infrastructure
 - Non-vulnerable Critical Infrastructure/Hazard
 - Possible Flood Area
 - Hazard
 - Vulnerable Critical Infrastructure
 - Non-vulnerable Critical Infrastructure



APPENDIX E:
Glossary

DRAFT

APPENDIX E

GLOSSARY OF TERMS

As used in this plan, these terms are defined as follows:

Blizzard – Issued for sustained or frequent gusts to 35 mph or more for an hour or greater and considerable falling and/or blowing snow. These conditions frequently occur alongside reduced to or below one-quarter mile. These conditions must be the predominant condition over a 3-hour period.

Blizzard warning - Sustained winds or frequent gusts of 35 mph or higher, occurring in combination with considerable falling and/or blowing snow. When proclaimed, these conditions are expected to prevail for a period of at least three (3) hours. Visibilities will frequently be reduced to less than one-quarter mile.

Blowing snow - Wind driven snow that reduces visibility to six (6) miles or less causing significant drifting. Blowing snow may be snow that is falling and/or loose snow on the ground picked up by the wind.

Community Lifelines - The most fundamental services in the community that, when stabilized, enable all other aspects of society to function (definition from FEMA)

Conflagration - A large destructive fire; which attains such intensity that it creates and sustains its own wind system. It is most commonly a natural phenomenon, created during some of the largest bushfires, forest fires, and wildfires.

Drifting snow - Uneven distribution of snowfall caused by strong surface winds. Drifting snow is usually associated with blowing snow.

Flurries – Intermittent light snow with no measurable accumulation; a light dusting is all that is expected.

Exposure - The people, property, systems, or functions that could be lost to a hazard. Generally, exposure includes what lies in the area that the hazard could affect.

Freeze - Occurs when the surface air temperature is 32 degrees Fahrenheit or below over a widespread area for a climatologically significant period of time. The term “freeze” is usually restrictive to advective situations or occasions when wind or other conditions prevent frost.

Freezing rain or drizzle – Rain that falls as a liquid but freezes into an icy glaze when it hits the ground or other surfaces such as trees, cars, and roads=.

Frost - The formation of thin ice crystals on the ground or other surfaces in the form of scales, needles, feathers, or fans. Frost develops when the temperature of the earth's surface falls below 32 degrees Fahrenheit, but because frost is primarily an event that occurs as the result of radiation cooling, it frequently occurs with air temperatures in the middle 30s.

Graupel - Small pellets of ice created when super-cooled water droplets coat or rime, a snowflake. The pellets are cloudy or white, not clear like sleet, and are often mistaken for hail. Same as snow pellets or small hail.

Gustnado - A whirlwind of dust or debris at or near the ground with no condensation funnel. Typically forms as an eddy in thunderstorm outflows.

Hail - A form of showery precipitation in the form of irregular pellets or balls of thin ice that occur when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice.

Heavy snow - This definition depends on the region of the USA. In Massachusetts, heavy snow means that six (6) or more inches of snow have fallen in 12 hours, or eight (8) inches in 24 hours. Heavy snow is also observed when snow is falling at a rate of one (1) inch per hour.

Heavy Snow Warning - Snow accumulations are expected to approach or exceed six (6) inches in 12 hours or eight (8) inches or more in 24 hours but will not be accompanied by significant wind. During a heavy snow warning, freezing rain and sleet are not expected.

Hurricane - An intense tropical cyclone in the Atlantic, Caribbean Sea, Gulf of Mexico, or eastern Pacific, which the maximum 1-minute sustained surface wind is 74 mph or greater.

Ice Storm - An ice storm is used to describe occasions when damaging accumulation of ice are expected during freezing rain situations. Significant accumulations of ice are recognized to pull down trees and utility lines, resulting in power loss; they are defined as one-quarter inch or greater.

Ice Storm Warning – Predicted significant coating of freezing rain; one-quarter inch or more is expected to accumulate in an area.

Invasive Species - A species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (definition from the Invasive Species Advisory Committee of the U.S. Department of the Interior).

Mitigation - The process of reducing the severity of the impact of natural hazards through planning. Each hazard requires a specific type of mitigation. In some cases, we can use engineering solutions (such as an earthquake-resistant building) to at least temporarily reduce the impact of a natural hazard. In other cases, the only form of mitigation that is guaranteed to be successful is to limit or not allow human activities where the hazard occurs (such as in floodplains).

Natural Disaster - A hazard event caused by nature or the natural process of the earth, such as a flood or tornado. Natural disasters result in widespread destruction or death to the lives of individuals, damaging their property, causing economic loss and/or the inability for a population to rebuild.

Natural Hazard - An act or phenomenon that has the potential to produce harm or other undesirable consequences to a person or thing.

Risk - Depends on all three factors: hazard, vulnerability, and exposure. Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. It refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage.

Sleet – Pellets of ice composed of frozen or mostly frozen rain drops or refrozen partially melted snowflakes. Sleet usually bounces when hitting a surface and does not stick to objects. However, it can accumulate like snow and cause a hazard to motorists. Heavy sleet occurs when a half of an inch of sleet accumulates

Snow Showers - Snow falling at varying intensities for brief periods of time. Some accumulation is possible.

Snow Squalls - Intense, but of limited duration, periods of moderate to heavy snowfall, accompanied by strong, gusty surface winds and possible lightning.

Storm Surge – An abnormal rise in sea level, accompanying a hurricane or other intense storm, whose height is the difference between the observed level of the sea surface and the level that would have occurred in the absence of the cyclone. Storm surge is usually estimated by subtracting the normal or astronomic tide from the observed storm tide. Storm surges can reach 25' high and 50-100 miles wide. This can cause severe erosion, major flooding and extensive damage to coastal areas.

Sustained Wind - Two-minute average wind measured at about 33' above the surface. BB.

Technological Disaster - A disaster that results from a technological or man-made hazard event.

Technological Hazard - A hazard that originates in accidental or intentional human activity (oil spill, chemical spill, building fires, terrorism, etc.)

Tropical Depression - A tropical cyclone in which the maximum 1-minute sustained surface wind is 38 mph or less.

Tropical Storm - A tropical cyclone in which the maximum 1-minute sustained surface wind ranges from 39-73 mph.

Vulnerability - Susceptibility to physical injury, harm, damage, or economic loss. It depends on an asset's construction, contents, and economic value of its functions. Vulnerability assessment provides the extent of injury and damages that may result from a hazard event of a given intensity in a given area.

Wind Chill Warning - Life-threatening wind chills reaching minus 50 degrees Fahrenheit or lower. Criteria varies by state.

Watch (Storm) - A watch is used when the risk of a hazardous weather event has increased significantly, but the occurrence, location and timing are still uncertain.

Warning/Advisory (Storm) - These products are issued when a hazardous weather event is occurring, is imminent, or has a very high probability of occurrence. A warning is used for conditions posing a threat to life or property. Advisories are for less serious conditions that cause significant inconvenience and, if caution is not exercised, could lead to situations that may threaten life and property.

Whiteout - A condition caused by falling and/or blowing snow that reduces visibility to nothing or zero miles; typically, only a few feet. Whiteouts can rapidly occur, blinding motorists and creating chain-reaction crashes involving multiple vehicles. Whiteouts are most frequent during blizzards.

Wind Chill - The wind chill is based on the rate of heat loss from exposed skin caused by the combined effects of wind and cold. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature. This temperature is the reading the body "feels" given the combination of wind and air temperature. At wind speeds of four (4) mph or less, the wind chill temperature is the same as the actual air temperature. The threshold for potentially dangerous wind chill conditions is about negative 20 degrees Fahrenheit.

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