2022 OXFORD HAZARD MITIGATION PLAN (HMP) & MUNICIPAL VULNERABILITY PREPAREDNESS (MVP) PLAN

Prepared by the Local Hazard Mitigation Team
Town of Oxford, Massachusetts

&

Central Massachusetts Regional Planning Commission
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<TOWN LETTERHEAD>

CERTIFICATE OF ADOPTION BOARD OF SELECTMEN

TOWN OF OXFORD, MASSACHUSETTS

A RESOLUTION ADOPTING THE *TOWN OF OXFORD HAZARD MITIGATION PLAN 2022 UPDATE*
WHEREAS, the Town of Oxford established a Committee to prepare the *Town of Oxford Hazard Mitigation Plan 2022 Update*; and

WHEREAS, the *Town of Oxford Hazard Mitigation Plan 2022 Update* contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Oxford, and

WHEREAS, duly-noticed public meetings were held by the LOCAL HAZARD MITIGATION PLANNING TEAM on February 14, 2022 and April 27, 2022 and

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

NOW, THEREFORE BE IT RESOLVED that the Town of Oxford BOARD OF SELECTMEN adopts the *Town of Oxford Hazard Mitigation Plan 2022 Update*, in accordance with M.G.L. 40 §4 or the charter and bylaws of the Town of Oxford.

ADOPTED AND SIGNED this Date. _____

Name(s)

Title(s)

Signature(s)

ACKNOWLEDGEMENTS

This Hazard Mitigation Plan (HMP) update, Municipal Vulnerability Preparedness (MVP) planning process, and Community Resiliency Building Workshop was funded by the Massachusetts Executive Office of Energy and Environmental Affairs (EEA). This report and the CRB Workshop were prepared for the community of Oxford by the Central Massachusetts Regional Planning Commission (CMRPC).

The Oxford Board of Selectmen extends its thanks to participants in the HMP and MVP Core Project Team for their time and hard work in participating in this project. Core Team members include, but are not limited to:

Jared Duval, Department of Public Works Director, Core Team Lead

Judy Lochner, Conservation Agent

Laurent McDonald, Fire Chief and Emergency Management Director

Tony Sousa, Town Planner

Rike Sterrett, Director of Public Health Services

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

Mary Hannah Smith, Associate Planner

Nina Weisblatt, Assistant Planner

Andrew Loew, Principal Planner

Matthew Franz, GIS Analyst

Gratitude is also due to the Executive Office of Energy and Environmental Affairs (EEA) and the Massachusetts Emergency Management Agency (MEMA) for guidance and feedback regarding this plan. Specific thanks to the following individuals for their help throughout this planning process:

Hillary King, MVP Central Regional Coordinator, EEA

Jeff Zukowski, Hazard Mitigation Planner, MEMA

EXECUTIVE SUMMARY

The following plan documents Oxford's assessment of its natural hazards, risks to the town posed by climate change, and actions that the Town can take to reduce its vulnerability to natural hazards and adapt to climate change. Through the Municipal Vulnerability Preparedness (MVP) program and the Hazard Mitigation Planning (HMP) process, Oxford has completed an assessment of town vulnerabilities and an action plan to address these challenges, which was informed by community outreach and community stakeholders. As a result of completing this plan, Oxford is eligible to apply for hazard mitigation funding through the Federal Emergency Management Agency (FEMA) and climate adaptation funding through the MVP Action Grant program.

Planning Process

Oxford began working on this plan in October 2021. The planning process consisted of:

1. Assembling a Core Project Team of municipal staff who led the process, developed the public survey, advertised opportunities for community input, provided detailed information on municipal activities, and organized the Community Resilience Building workshop.
2. Developing and publicizing a public survey to solicit community opinions on climate change in Oxford.
3. Updating the list of hazards, critical facilities, and vulnerable populations from the 2016 HMP.
4. Hosting the Community Resilience Building workshop to engage community stakeholders in the planning process. At this workshop, stakeholders assessed community vulnerabilities and strengths and developed an action plan to build community resilience to natural hazards and climate change.
5. Solicited public input while drafting the plan.
6. Finalized the prioritized action plan and implementation strategy.
7. Invited public comments on the final plan document.

Vulnerability and Risk

The Oxford Core Team identified flooding, severe storms (thunderstorms, wind, and tornados), hurricanes, and severe winter storms (snowstorms, ice storms, nor'easters), as the four hazards that are likely to pose the most risk to the town. Additionally, extreme heat was identified as a severe concern due to climate change. This plan also assesses the town's vulnerability to wildfires, earthquakes, dam failure, drought, and landslides.

Oxford's Hazard Mitigation Strategy

The hazard mitigation strategy captured in the action plan contains over 50 actions that the Town would like to complete during the next five years to build community resilience. These actions address, and are described by, the following plan objectives:

- Remedy known stormwater drainage issues to address existing flooding

- Prepare for future increases in precipitation caused by climate change
- Reduce the vulnerability of dams to natural hazards and climate change
- Prevent water impairments by mitigating septic system failures and addressing the lack of public sewage
- Ensure drought resilience of Oxford's water supply
- Remove potential barriers to natural hazard mitigation or community resilience
- Reduce power outages caused by falling trees, and encourage climate-resilient tree canopy
- Mitigate wildfire risk
- Support resilience of vulnerable community members
- Support resilience of the natural environment, and encourage sustainable behaviors

The plan includes one or more specific actions for each of the town's objectives. The following actions were designated the highest priority for the town to mitigate natural hazards or foster community climate resilience:

- Address structural issues at Town-owned McKinstry's Pond Dam (Significant Hazard), which is in poor condition.
- Conduct a detailed culvert inventory to assess existing infrastructure and prioritize future maintenance or replacements.
- Educate residents on the new stormwater drainage bylaw, the importance of maintaining private stormwater drainage infrastructure, and best practices.
- Complete evacuation Plan updates; re-evaluate evacuation routes considering the likelihood of roadway flooding.
- Repair privately owned Lowes Pond Dam (Significant Hazard) near Main Street and State Street; dam area is just upstream from Fire/EMS station and within the 500-year and 100-year flood zones
- Conduct education and enforcement on good septic system maintenance to prevent degradation of water resources.

Next Steps

The Town of Oxford is committed to implementing the actions outlined in this plan. Town leadership will seek funding and incorporate the projects identified in this document into ongoing work plans. The town will also strive to integrate hazard mitigation principles into future municipal plans and policy decisions. Finally, Oxford will monitor, evaluate, and update the Hazard Mitigation and Municipal Vulnerability Preparedness Plan, as needed, to reflect work completed, to note changes in local priorities, and to incorporate new best practices.

1.0 INTRODUCTION

1.1 PLAN PURPOSE

This plan identifies the natural hazards facing the Town of Oxford, 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. This plan also incorporates how the Town of Oxford must adapt to prepare for the increasing impacts of climate change.

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 Oxford. 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.

1.2 WHAT IS A HAZARD 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 (HMP) in place to qualify for future federal disaster mitigation grants following a Presidential disaster declaration. The Hazard Mitigation Plan emphasizes local policies or actions that can be implemented over the long term to reduce or prevent future disaster damages caused by natural hazards.

1.3 WHAT IS A MUNICIPAL VULNERABILITY PREPAREDNESS PLAN?

In September 2016, Massachusetts Governor Baker signed Executive Order 569, directing multiple state agencies to develop and implement a statewide comprehensive climate adaptation plan with the best climate-change data available. Recognizing that many adaptation solutions are local in nature, a key commitment of Executive Order 569 is to assist local governments in completing their own assessments and resiliency plans. The Municipal Vulnerability Preparedness (MVP) Grant and Designation Program represents the first step in fulfilling this commitment.

The MVP program provides planning grants to municipalities to complete vulnerability assessments and develop action-oriented resiliency plans. Cities and towns use the funding to hire an MVP-

certified consultant trained to provide technical assistance and complete a community's vulnerability assessment and resiliency plan using the Community Resilience Building Framework. Towns and cities are free to choose the consultant from a list of certified MVP providers. The Town of Oxford invited the Central Massachusetts Regional Planning Commission (CMRPC) to assist them in this planning effort.

Communities that complete the MVP planning process become certified "MVP Communities" and are eligible for MVP Action Grant funding and other opportunities through the Commonwealth.

1.4 HAZARD MITIGATION AND MUNICIPAL VULNERABILITY PREPAREDNESS PLANNING IN OXFORD

This plan is funded through a Fiscal Year 2022 MVP Planning Grant awarded by the Massachusetts Executive Office of Energy and Environmental Affairs. Oxford has received this funding to create a Hazard Mitigation and Municipal Vulnerability Preparedness Plan. CMRPC will work with the Town of Oxford to create one combined report for both Hazard Mitigation and Municipal Vulnerability Preparedness. Oxford's combined HMP and MVP action plan will account for natural hazards based on historic natural hazard data and future climate change projections. This combined plan will account for additional risk imposed by climate change, following the Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) example.

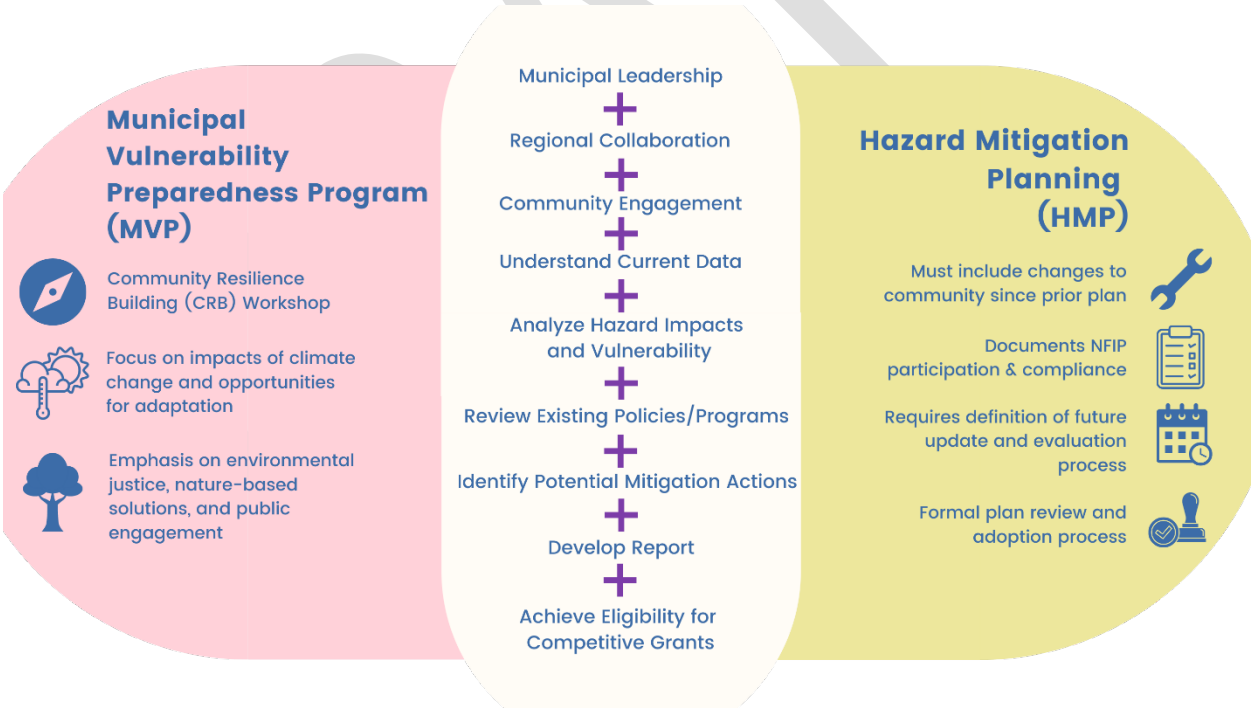


Figure 1: Similarities and differences between MVP and HMP programs.

1.5 PLANNING PROCESS SUMMARY

Oxford's planning process was composed of two distinct but related phases – data collection and technical review and public input and planning.

Identifying natural hazards impacting participating communities was accomplished by reviewing available information from various sources. These included federal and state reports and datasets, and existing plans. 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 other stakeholders was critical for 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 community sectors, and providing opportunities for public comment and input from a representative base of residents and other stakeholders in each community. CMRPC and the Oxford Core Team collected initial public opinions on natural hazards and climate change through a public survey, discussed below in *Section 1.6*.

Next, this process phase included the Community Resilience Building (CRB) workshop, which brought together local stakeholders to discuss local vulnerabilities to natural hazards and climate change. The CRB workshop was divided into two virtual sessions on January 20th and 27th. Oxford invited forth-seven stakeholders to the meeting, including …. Eighteen stakeholders participated in over the course of the two workshop sessions (see Appendix C for a list of invitees and attendees).

This workshop was followed by a public listening session held during a Planning Board meeting, where CMRPC presented the HMP and MVP process and progress to date and invited attendees to comment on the project. There were members of the public present for the planning board meeting, though no members of the public attended the meeting to participate in the listening session. No public comments were received at this meeting.

[Edit this paragraph and add additional information after the listening sessions are complete.] After completing a first draft of the plan, the Oxford Core Team and CMRPC hosted four public listening sessions to present the draft and solicit additional public comments. Three of these listening sessions were hosted at Oxford sites within the town's two Environmental Justice areas. The CRB workshop and public listening sessions helped CMRPC gauge community priorities for hazard mitigation and climate change adaptation and understand local resources and existing policies and procedures. With this information in hand, the planning team developed an informed and community-specific list of hazard mitigation and climate change adaptation strategies for Oxford.

The Oxford Planning Board is the primary town agency responsible for regulating development in the town, which is an important tool for hazard mitigation. Feedback to the Planning Board was ensured by hosting one of the project's listening sessions during a Planning Board meeting in February. Tony Sousa, the Director of Planning & Economic Development, was also an active Core

Team participant throughout the project. More generally, Oxford's Planning & Economic Development department works closely with the Department of Public Works to ensure that local infrastructure meets current and future community needs.

In addition, CMRPC, the State-designated regional planning authority for Oxofrd, 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 Oxford Hazard Mitigation Plan, the operational policies and any mitigation strategies or identified hazards from these entities were incorporated.

The Oxford core team was comprised of:

- Jared Duval, Department of Public Works Director, Core Team Lead
- Judy Lochner, Conservation Agent
- Laurent McDonald, Fire Chief and Emergency Management Director
- Tony Sousa, Town Planner
- Rike Sterrett, Director of Public Health Services

CMRPC and EEA staff members supported the Oxford team throughout the planning process, including:

- Mary Hannah Smith, Associate Planner, CMRPC
- Nina Weisblatt, Assistant Planner, CMRPC
- Hillary King, MVP Central Regional Coordinator, EEA

1.6 SURVEY

In October, the team created an introductory survey for the Oxford HMP/MVP. This survey was intended to gauge the understanding of Oxford residents' thoughts on climate change impact and natural hazards. The survey was initially created using ArcGIS and allowed residents to geolocate the areas that concerned them. However, the ArcGIS platform created technical problems for some users, so the survey platform was switched to SurveyMonkey.

The survey consisted of 8 questions. The survey began by asking residents how natural hazards may have impacted their lives. The questions then began to ask about the larger community and for individuals to identify aspects of life in Oxford that natural hazards have affected. The list of survey questions and the full results are in Appendix B. Twenty-five residents participated in the survey, which is a small sample size that is not necessarily representative of all town resident. However, the residents that participated offered opinions on hazards and vulnerabilities, concerns about climate change, and priorities and suggestions for future climate adaptation actions. Responses focused on flooding, winter storms, extreme wind, and power outages.

Of the 25 responses received:

- Winter storms and thunderstorms/microbursts/extreme wind are the types of hazards that have personally impacted the most Oxford residents. However, many people have not been impacted by natural hazards while living in Oxford.
- Most people think that climate change will impact their life for the worst or are not sure how it will impact their life.
- There was a wide variety of specific concerns about the potential impacts of climate change.
- 64% of respondents were very concerned or somewhat concerned about climate change.
- Resident health and safety, followed by local natural resources and environment, and local infrastructure, are the Oxford community assets that respondents are most concerned about in the context of potential climate impacts.
- Residents are most interested in learning more about climate change's impact on local water quality and water supply, wildlife, sustainability initiatives, and the health of local forests.
- Two respondents expressed skepticism about climate change in general, as well as concern about current and future town spending.

Figure 2 shows the approximate locations of the hazard impacts that survey respondents reported for Oxford. The survey results in Appendix B include several more general hazard impacts.

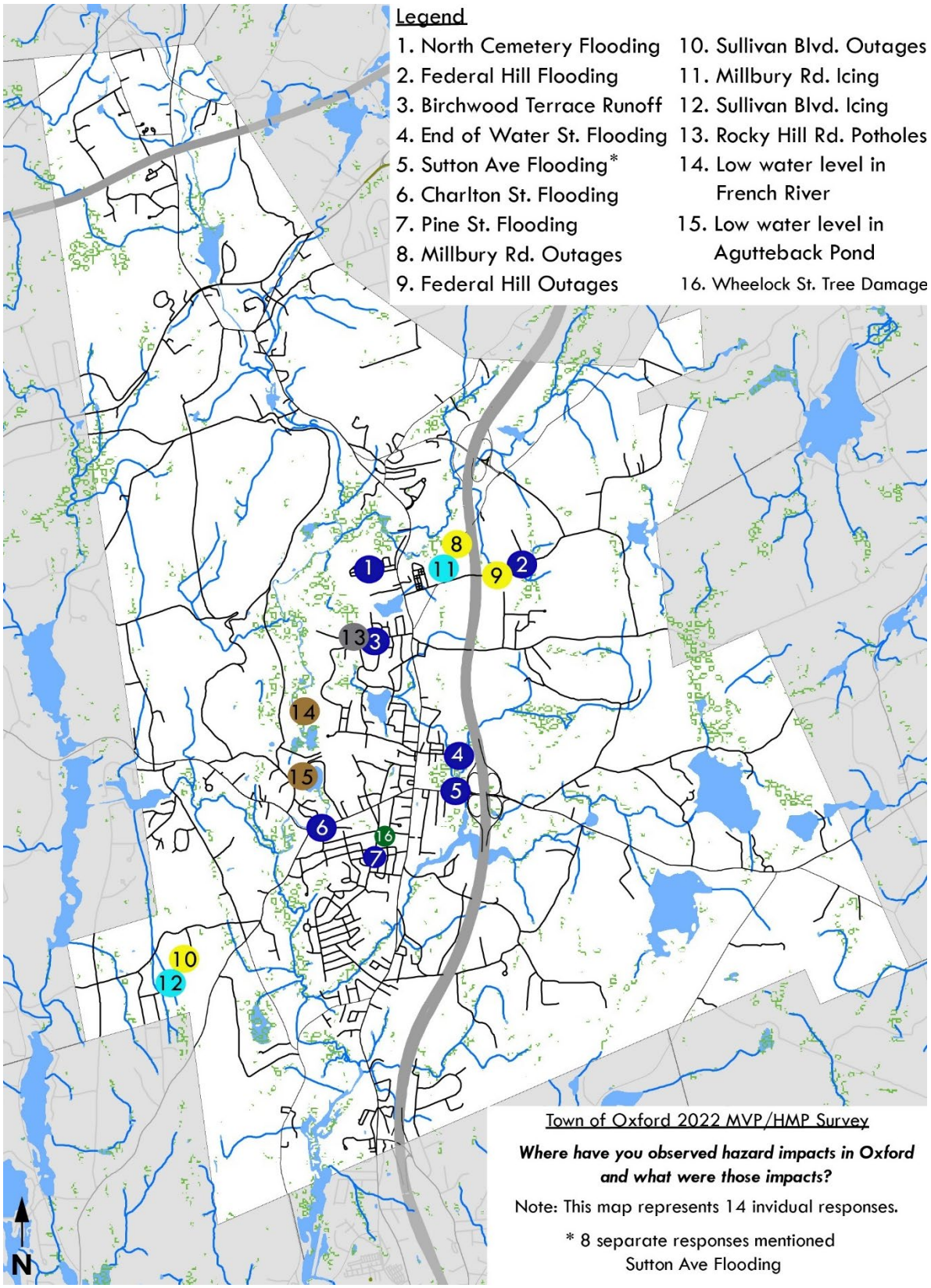


Figure 2: Map of hazard impacts reported by survey respondents

Survey respondents had lots of ideas about how the town could cultivate local resilience to natural hazards, including:

Encourage planting if climate resistant tree species and educate townspeople on possible effects of climate change on our town

Explore alternative energy sources (wind, solar) to lessen dependence on fossil fuel

Improve storm water management and impact on roads

Maybe fix storm drains or install bigger ones

Improve storm water management. Offer services like mercury thermometer collection (Auburn does), hazardous waste disposal, town dump for a fee. I think all of these services would reduce the high volume of trash along the roads. People don't know where to get rid of certain things nor does everyone have access to a truck or trailer to dispose of bulky items for bulk collection day. Such as tires, building construction waste. Small home improvement projects generate waste that can be hard to dispose of properly.

How can Oxford reduce its carbon footprint? Designated open space, planting native climate resilient plant life, trees as well as bushes, flowers. Warming stations in winter, cooling stations in summer. Educational materials for township to help each household reduce carbon footprint

Outreach to the community is very important as well as ensuring that the community is involved in the programs to mitigate these hazards. Looking to "green" solutions for some problems while not always the cheapest can produce long term benefits such as using stormwater storage to water the town common and beautiful planters.

A plan to protect power lines from damage, removal of trees and or limbs from power line areas

Access to renewable energy sources like solar farms, more trees planted on big parking lots, modifying big parking lots to prevent runoff and heat retention. More solar panels on rooftops. More farmer's markets to improve access to quality produce at reasonable prices.

Education and outreach about how climate change could impact my life; encourage planting of climate-resilient tree species

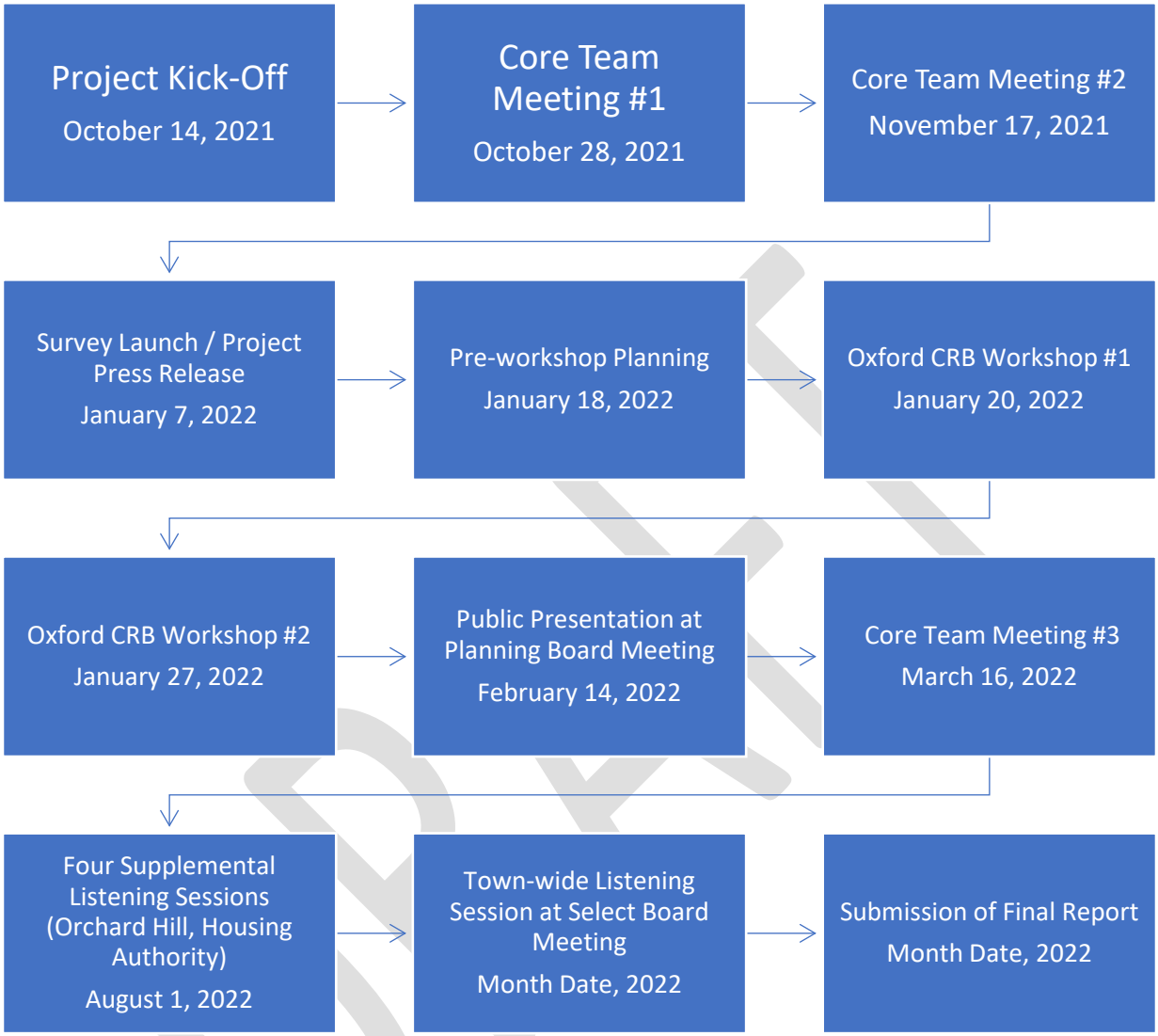
Education is key. Climate resilient trees and bushes should be planted, along with honey bee friendly gardens. Ban the use of certain pesticides and all rat poisons that end up harming wildlife

All of the above: Improve storm water management; more education and outreach about how climate change could impact my life; encourage planting climate-resilient tree species; create community shelters for use during heat waves, etc

Create community shelter for use during extreme cold or heat, Improve street drainage at flooding areas.

Sustainability. Reducing energy usage. Monitoring water supply and contamination and providing funds to maintain supply etc.

1.7 PLANNING TIMELINE



2.0 COMMUNITY PROFILE, LAND USE, AND DEVELOPMENT TRENDS

2.1 OXFORD 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, the second-largest city in Massachusetts and New England, with a population of 206,518 as of the 2020 Decennial US Census. Nearly 588,141 people live in the CMRPC Region, of whom 5,928 reside in Oxford (American Community Survey Data, 2020).

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. Oxford is located in the Southcentral sub-region consisting of five towns within the French River watershed, including Auburn, Leicester, Webster, and Dudley.

Massachusetts has a humid continental climate, with maritime influences increasing from northwest to southeast. According to the National Oceanic and Atmospheric Administration'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 (National Weather Service, Worcester Observed Weather, 2000-2021). With a temperate climate and a location some 30 miles from the Atlantic coast, Oxford and its neighboring communities are subject to severe weather, including hurricanes, nor'easters, thunderstorms, and blizzards.

The Town of Oxford, Massachusetts, was incorporated in 1713. Oxford is located on I-395, 11 miles south of Worcester, and is primarily a bedroom community. Much of Oxford lies within the French River Basin, except for the extreme eastern edge in the Blackstone River Basin. Dudley and Charlton border Oxford on the west, Millbury and Sutton on the east, Douglas and Webster on the south, and Leicester and Auburn on the north.

Oxford has a total area of 27.5 square miles and a population of 13,347 (2020 Decennial Census). Oxford has a stable population, with population growth slowing as buildable land has been built out following a 1990s population surge. According to the Central Massachusetts Regional Planning Commission's (CMRPC) Long Range Transportation Plan *Mobility 2040,* the Town of Oxford is expected to experience medium growth, similar to the Central Massachusetts average.

Oxford is a predominantly white community, with 88% of residents identifying within that group (2020 Decennial Census). People who identify as 'two or more races' comprise the largest minority group, at 6%. 'Black or African American' is the largest single-race minority group in Oxford at 1.6% of the population.

While most Oxford residents speak English, approximately 98 households in Oxford are considered "limited English-speaking households" (2019 ACS 5-year estimates, S1602). According to 2019

Oxford census data, 18.9% of Spanish-speaking households, and 18.2% of households speaking Asian or Pacific Island languages, have limited English language capabilities.

Oxford's median age is 39.5 years, consistent with the state-wide median age (2019 ACS 5-year estimates, S0101). 20% of the total population is under 18, which is slightly above the statewide figure. 13.5% of the total population is over age 65, above the statewide figure of 16.2%.

At $76,373, the median household annual income is well below the state ($81,215) and Worcester County ($74,679) median income levels (2019 ACS 5-year estimates, S1901). According to Oxford's 2017 Master Plan, the town's median household income is also lower than several nearby communities, including Sutton, Charlton, and Douglas. Households that own their own home have a much higher median household income ($89,045) than households that rent ($36,462) (2019 ACS 5-year estimates, S2503).

Housing costs are relatively inexpensive, with a median owner-occupied home valued at $264,500, compared to $386,200 for Massachusetts and $284,900 for the county (2019 ACS 5-year estimates, S2506). 66.5% of occupied homes are detached or semi-detached single-family houses; the remainder is multi-unit structures. At 4.7%, vacancies are well below the percentage of vacancies overall in the state (8.3%) and county (5.7%) (2020 Decennial Census).

Oxford has a diverse range of housing at present, and this diversity helps address the housing needs of current and future residents. A recent community survey found that many current residents were attracted to Oxford because of the availability of affordable housing and the perceived housing value (2017 Town of Oxford Master Plan). Most residential development extends off Main Street into small neighborhoods with inter-connected street grids. In recent years, residential development has sprawled outward into the outlying agricultural lands that nestle in among the hills.

Central Massachusetts Regional Planning Commission (CMRPC) population and housing projections are based on the 2018 Long Range Transportation Plan. According to CMRPC, in 2030, the population is projected to be at 15,070, and in 2040 the population will continue to grow to 15,781 (Demographics, 2018). This population projection is based on expected demographic and development trends in the Central Massachusetts region.

2.2 SOCIETAL FEATURES

Many features make up the Town of Oxford, and community spirit is an important concept that contributes to the overall character of the town (Master Plan, 2017). As mentioned in the preceding section, Oxford's population has risen to just over 13,000 according to most recent census data. The town's population is predominately white, and the most populous demographic is between the ages of 55-59 years old (ACS 5-year estimates, S0101).

Oxford has two Environmental Justice (EJ) populations (Massachusetts Executive Office of Energy and Environmental Affairs, 2020). The EEA designates census tract block groups as environmental justice populations when they meet specific income-, race- or language-based criteria. The EJ

population block group that includes part of Downtown Oxford meets the Income criteria, meaning that the annual median household income of the population in this area is equal to or less than 65 percent of the statewide annual median household income. The median annual income of households in this area is $31,212, less than half of the town-wide annual median income ($76,373). This geographic area includes the Oxford Housing Authority, which provides affordable housing to town residents.

The second environmental justice population area covers most of the town east of I-395. The population in this area meets the state's Minority EJ criteria, meaning that racial minorities make up at least 40% of the population. The total minority population for this block group was 29%, compared to 11.2% within the town as a whole. This is generally a low-density residential area. However, it includes Orchard Hill Estates, a low- to moderate-income multi-unit apartment development, which may influence the block group's demographic profile. The total population living within either Oxford EJ area is 3,341, or 24.4% of the town's total population.

2.2.1 CRB WORKSHOP DISCUSSION OF SOCIETAL FEATURES

Community Resilience Building (CRB) workshop participants identified the features within Oxford that are most likely to be impacted by climate change-related natural hazards. The breakout group discussed potentially vulnerable groups of residents, town volunteerism, and specific housing developments that may be especially vulnerable to natural hazards. Both groups discussed the Orchard Hill Estates as a potentially vulnerable feature. Attendees noted its isolated location, history of power outages, and the lack of improvements made at the property as causes for reporting this location as a vulnerability. Oxford's places of worship and their charitable activities were highlighted as a town strength and a way for the town to find volunteers. However, a general decline in volunteerism and interest in civic participation was noted as a challenge. The need for volunteers to supplement staff capacity limits the number of projects the town can undertake in any given year.

Table 1: Societal features discussed at the Oxford CRB Workshop

Strengths

- Changing demographics – a more diverse population and new residents who may want to get involved in town
- Code Red Emergency Alert System – software town can use to contact residents during emergencies
- Food Shelf food pantry – run by a network of faith organizations and already coordinates with the town during emergencies
- Future development – could attract new businesses and diversify the tax base, lessening residential tax burden and enabling investment in necessary town projects
- Large businesses – would like to give back to the community, a potential source of volunteers and funding
- Local volunteer organizations (Lions Club, Women's Club, VFW, Small Oxford Business Association) – a resource to the town during disaster recovery, might be a resource for hazard mitigation
- Oxford Housing Authority – provides housing to potentially vulnerable low-income seniors and families
- Places of worship – lead charity drives and already work with potentially vulnerable populations, including people experiencing homelessness
- Emergency response – town maintains SALT list that seniors can opt into for check-in from dispatch or first responders if there is no answer; fire department can bring citizens to shelters or other family members; police sergeants are aware of other vulnerable residents who might need help
- Senior Center – provides services to town seniors and is very familiar with this potentially vulnerable population

Vulnerable features

- Elderly residents –some may need assistance during major disasters
- Evacuation routes lie in floodplains
- Lack of family day care – this is a significant financial stressor for families, influences household decision-making, and compounds challenges for low-income households
- Lack of volunteers in town
- Long-term town finances – Oxford is not a wealthy town and may not be able to afford necessary town hazard mitigation projects without state assistance
- Low-income residents – may need assistance during or after significant disasters
- Orchard Hill – this multi-unit development houses potentially vulnerable populations, including a growing minority population, is isolated (limited entrances/exits), does not have good access to public transportation; the owner has high vacancy rates and may leave the current property in the future; has lost power in previous storms; town needs to ensure it has an emergency plan
- Oxford Housing Authority - houses potentially vulnerable residents, so the town needs to ensure each building has an emergency plan (Wheelock Street, Blueberry Lane & Liberty Lane)
- Public transportation – not readily available in Oxford, limiting mobility for residents without cars, especially during poor weather
- State designated environmental justice areas – see Orchard Hill, above

Vulnerable features

- The town needs to adapt to changing demographics with translation services and proactive outreach to minority populations

2.3 ECONOMIC FEATURES

Many economic features aid the town of Oxford. The town has an excellent regional location, several areas zoned for business/industrial development, and benefits from having three I-395 interchanges within the town and an active freight rail line. Land zoned for business and industrial uses is concentrated along Route 20 and Route 12 and near highway interchanges. There is also a significant amount of land in Oxford still used for commercial agriculture.

According to the town's Master Plan, Oxford seeks to maintain and enhance business and economic development within the community. Over the years, these efforts have been supported by the Oxford Business Association, the Industrial Development Commission, and other entities. As of 2017, local economic development efforts have led to over 3,700 jobs in Oxford (2017 Town of Oxford Master Plan). Major employers include manufacturers, retail, and service providers. In addition to business or industrial development, Oxford considers other uses which provide more in tax revenue than they require in municipal expenditures to be a form of economic development (2017 Town of Oxford Master Plan). This could include certain residential developments ("empty nester" housing, assisted living facilities, congregate housing, some multi-family developments), as well as significant infrastructure projects (such as solar farms).

The downtown area in Oxford is a community focal point and an important element of the 2017 Master Plan. Oxford residents want to strengthen and improve the Town Center. In past years, downtown Oxford was an integral part of the daily lives of Oxford residents since people lived and worked in and near the downtown, and this was where the business, civic, social, and cultural activities took place. In the 2017 Master Plan, the town identified that enhancing the downtown area for its residents and local businesses would be crucial.

2.4 INFRASTRUCTURE FEATURES

There have been many recent updates to the infrastructure around Oxford through the Department of Public Works (DPW). Some of them include Sacarrappa Road and rebuilding sidewalk ramps on Main Street as a part of the shared streets and spaces improvements (Sacarrappa Road Culvert Replacement, n.d.). The 2017 Master Plan also identified other infrastructural needs, such as road maintenance and congestion issues. Additionally, it noted ongoing water system challenges. Water service in most areas of Oxford is provided by the Aquarion Company (Town of Oxford Master Plan, 2017). While the company has been making significant water system improvements and increasing its accessibility, some businesses are still without water service, especially in South Oxford. Water quality protection has also proven to be an issue because of the transmissivity of the soil type around the Aquarion's wells (Town of Oxford Master Plan, 2017).

As noted in the 2017 Master Plan, much of the town relies on septic systems. However, the Master Plan pointed out that one of the town's future objectives is to expand the sewer system. The lack of existing sewer infrastructure could potentially inhibit future development.

The Hodges Village Dam, owned and operated by the United States Army Corps of Engineers, is the most notable infrastructure project in town. This dam was completed in 1959 and "has prevented $153.5 million in flood damages since it was built (as of September 2011)" (United States Army Corps of Engineers, 2021a). To build the Hodges Village Dam and the Buffumville dam in Charlton, "862 acres in Oxford and 463 acres in Charlton were taken, including about 85 houses in the Greenbriar section of North Oxford" (Oleson, 2009). The dam's flood storage area was not designed to hold water permanently, so much of the project's nearly 1200 acres is used for recreation.

Finally, Oxford is a member of the Worcester Regional Transit Authority. It provides fixed route and complementary para-transit service between Worcester, Auburn, Oxford, and Webster. Amtrak train service and commuter rail into Boston are available in Worcester (Town of Oxford Master Plan, 2017).

2.4.1 CRB WORKSHOP DISCUSSION OF INFRASTRUCTURE FEATURES

Community Resilience Building (CRB) workshop participants identified the features within Oxford that are most likely to be impacted by climate change-related natural hazards. Both breakout groups discussed stormwater infrastructure like culverts as a concern because localized flooding affects multiple roadways in Oxford. Another conversation focused on the resilience of private wells and septic systems to flooding. Both groups discussed the town's private provider Aquarion, which was generally perceived as a town strength, and the town's existing, albeit limited, sewer system. Trees and power lines were another primary concern, including the burden of tree removal for town staff and the backlog of trimming needed town-wide. Three specific dams were also mentioned as town vulnerabilities due to their condition and the growing potential for extreme precipitation events due to climate change.

Table 2: Infrastructure features discussed at the Oxford CRB Workshop

Strengths

- Aquarion water system – no problems with the system to date; company has access to an artesian well
- High school and senior center – currently used as emergency shelters during power outages or heat waves, both sites work well for 8-10 people that typically use this service
- Hodges Village Dam – robust emergency planning and regular maintenance
- Updated stormwater bylaw makes enforcement more manageable and will hopefully improve drainage related to private property
- Sewer system – new developments value connections to this utility, expansion of the sewer system is an economic development opportunity; sewer lines are potentially more resilient than septic systems and take less space; unwelcome development has been deterred by existing lack of water/sewer

Vulnerable Features

- Aquarion water system – concern about future supply availability, worry about future PFAS identification, concern that pumping station is surrounded by floodplain on three sides
- Asbestos water pipes used town-wide
- Bridges – some general concern that old bridges may be impacted by flooding
- Communication technology – a concern that some residents do not have reliable broadband access or may be cut off from communication during a major storm
- Dams – Bartlett, McKinstry & Lowes Pond Dams were all mentioned, detailed discussion can be found in the table within *Section 4.10: Location*
- Department of Public Works (DPW) needs additional professional staff to keep pace with the growing list of duties and planned projects
- DPW Infrastructure – building age and condition is a safety concern, and funding for the final design was denied at Town Meeting
- Electrical lines – outage risk, especially on outlying roads with large trees
- Groundwater supply – abutting properties concerned about water supply for new development proposals
- Hodges Village Dam – in a high water scenario for the dam, some roadways in town may be flooded; the dam may not be able to release water depending on downstream conditions
- Interconnections with neighboring towns – mutual agreements were identified as a strength but also a vulnerability if towns do not consider the potential for cascading failures and complications of interconnected systems
- Moscoffian Mill building – concern over structural integrity and close to a dam; town using EPA Brownfields funds to assess contamination before determining next steps
- Oxford Community Center – has a small backup generator, and the town has ordered a replacement, but delivery may be delayed up to a year
- Police station (emergency operations center room) – windows need reinforcement in case of high winds or flooding
- Private wells – flooding could impact water quality, drought could affect water availability, and some wells have had to be refracked in the past to reach groundwater

Vulnerable Features

- P&W Railroad – vegetation along rail line is a fire hazard, but the company has done a good trimming job recently; derailment is a concern; there is a need for better communication and coordination between company and town
- School buildings – may have roofing issues related to wind/storms
- Septic systems – flooding may jeopardize septic systems
- Sewer system – north service area vulnerable to inflow and infiltration, which eats up capacity, but south service area is in better shape; town needs to complete long-range waste water planning process
- Steep hill near Worcester Gears and Racks – flooding behind homes in this area, which homeowners have diverted onto roadway creating a secondary icing hazard
- Stormwater drainage – swales/depressions may be filled in by residents after site plan approvals; limited capacity for inspections; Oxford is working to meet MS4 permit requirements
- Trees – those marked as hazardous to power lines are only those close to the edge of the road, and National Grid does not account for taller trees further from the road; town responsible for hazard trees that fall; backlog of hazard trees for town tree warden to take care of
- Undersized drainage infrastructure – route street flooding at multiple areas around town (CRB workshop discussed Wellington Road, Old Webster Road, Holly Street, Swamp by Lovett Road, Industrial Park Road W.); some culvert replacements are underway, but more funding is needed
- Waste transfer – no hazardous waste collection or drop-off has been a challenge for Oxford; no mandatory recycling collection is also a sustainability challenge

2.5 ENVIRONMENTAL FEATURES

Water is one of the most prominent features in Oxford. Oxford residents rely on wells (either public or private), making them a crucial environmental feature and form of infrastructure (Town of Oxford Master Plan, 2017). There are two watershed areas within Oxford. The main watershed is that of the French River. A small portion of southeast Oxford, around Stump Pond, lies in the Blackstone River watershed. The drainage divide between these two watersheds lies between Sacarrappa Pond and Singletary Pond (Oxford Open Space and Recreation Plan, 2007).

The French River is the town's most notable water feature. It enters Oxford just south of Stafford Street (at the Leicester border), traverses along the western edge of the town, before leaving Oxford at the Webster border. The French River passes through Oxford and nine other Massachusetts communities on its way south to its convergence with the Quinebaug River in Connecticut. From 2005 to 2021, the non-profit French River Connection led local environmental action focused on the river and worked to develop a greenway trail that would connect the Quinebaug rail trail to the mid-state trail.

In addition to the French River, other water bodies in Oxford include: Augutteback Pond, Eames Pond, Robinson Pond, Batty Brook, Grassy Pond, Sacarrappa Pond, Barber's Hollow Brook,

Howarth's Swamp, Stump Pond, Buffum Pond, Hudson Pond, Stumpy Pond, Bugg Swamp, Little River, Texas Pond, Carbuncle Pond, Lowes Brook, Thayer Pond, Cedar Swamp, Lowes Pond, Wellington Brook, Chimney Pond, McKinstry Pond, and Clara Barton Pond (Oxford Open Space and Recreation Plan, 2007). Many of these ponds were created by damming stream flow.

Hodges Village Dam is the largest outdoor recreation area in Oxford. The dam's reservoir has no permanent pool of water; however, the land is typically swampy and floods in the springtime. The US Army Corps of Engineers manages the natural resources for multiple uses: flood control, wildlife habitat, forest production, watershed protection, and outdoor recreation (Oxford Open Space and Recreation Plan, 2007). Currently, Hodges Village Dam has over 22 miles of trails for hiking, nature study, mountain biking, cross country skiing, and horseback riding (United States Army Corps of Engineers, 2021b). On the west side of the French River, dirt bikes and snowmobiles are allowed on designated trails. Hunting is allowed in season on the west side of the river. Fishing and canoeing are also allowed, with access at Auguttebeck Pond in Greenbriar Park (Oxford Open Space and Recreation Plan, 2007).

Oxford's most recent Open Space and Recreation plan was published in 2007. It notes many other areas of open green space such as the Joslin Park, Hodges Village, golf courses, Camp Clara Barton, and Huguenot Fort. Some of the primary preservation areas in the town include the Mid-state Trail, the French River Corridor and trail, and Buffalo Hill Farm. Preservation of Open Space and Natural Resources has been identified as one of the most important factors of the town's vision for the future (Town of Oxford Master Plan, 2017).

2.5.1 CRB WORKSHOP DISCUSSION OF ENVIRONMENTAL FEATURES

Table 3: Environmental features discussed at the Oxford CRB Workshop

Community Resilience Building (CRB) workshop participants identified the features within Oxford that are most likely to be impacted by climate change-related natural hazards. Both breakout groups were concerned about tree health and the impact of climate change on this critical natural resource. Participants discussed the effects of the recent gypsy moth infestation and the likelihood that invasive pests could damage trees. Workshop attendees also discussed ongoing water quality challenges in town waterbodies, brushfires in open areas like the Greenbriar area, and the current lack of a local environmental group to organize volunteer activities.

Strengths

- Eagle Scouts – a resource for environmental projects; conducted trail mapping a few years ago in the Greenbriar area
- Fallen trees – fallen trees, like those in the French River, can be a vital part of a healthy ecosystem and form habitat for native wildlife; tree health is a challenge, but trees should be removed carefully; Conservation Commission regulates tree removal in wetlands and waterways
- French River – a recreational and scenic asset to Oxford; there is untapped recreational potential for kayaking, but residents need better river access

- Midstate Trail – recreational asset though sections outside of Hodges Village need improvements
- Open space – naturally challenging for future development due to rocks and ledges
- Wetlands – MS4 compliance for nutrient loading, and the Conservation Commission is still going through the process to identify issues

Vulnerable Features

- Agriculture – potentially vulnerable to climate change-related hazards
- Beaver activity – recent activity near Sutton Ave, Sneade Drive/Old Webster Road, Wellington Road; has impacted drinking water wells
- Brush Fires – Some during the past summer due to vegetation and railroad (Railroad Ave); two in one day over summer (Rocky Hill Area)
- Carbuncle Pond – water lilies and algae blooms are a problem; little natural turnover in water; the Conservation Commission tests for diseases and hazards like algae and treats Carbuncle Pond annually; runoff from storms may carry nutrients and cause water quality problems
- Contaminants in water bodies –E. Coli has been found in one stream, and it has been challenging to identify the source; PFAS is a concern but has not been identified in significant quantities in Oxford
- French River – extreme precipitation could induce flooding; concern if flooding or other disturbance in the river stirs up polluted sediment
- Greenbriar Recreational Area– recreational facilities on Army Corps land might be impacted by flooding; mosquito/tick disease concern due to adjacent wetlands; the area is an access point to trails; recent brushfires have occurred in this area; off-highway vehicles and motorcycles are a noise issue and are tearing up waterways and land
- The impact from new industrial development – 40-acre proposal in North Oxford; project approved by Planning Board who are working with the Conservation Commission to limit potential negative impacts; project has potential to impact a cold-water fishery and brook
- Invasive species – Japanese knotweed is a challenge; Conservation Commission has tried to stop infiltration; report of invasive species placed in Bartlett Pond intentionally
- No watershed group - since the French River Connection disbanded, there is no watershed group to care for the river
- Pollinators – they are essential to agriculture and native plants; populations are declining globally
- Septic systems – many are older systems; septic systems can flood; septic systems require larger lots, which can lead to sprawling development patterns
- Solar fields – recent developments have been in open fields (Maple Ave, Joe Jenny Road); cause for resident complaints during and after construction; they cause more water runoff downstream, and stormwater regulations can be difficult to enforce
- Tree health – trees have suffered from gypsy moths; some trees are more at risk from beetles; need data/insight from tree warden to understand patterns in tree health over time; concern about the impact of future drought and spread of invasive species; more frequent and severe storms could exacerbate tree damage and increase the management burden for the town (see *Infrastructure – Vulnerable Features,* above)

Vulnerable Features

- Volunteers – there are opportunities to improve the Oxford environment and recreation in nature, but the town lacks an organization focused on this and potentially also lacks volunteers to perform the physical labor

2.6 LAND USE, RECENT AND POTENTIAL DEVELOPMENT

According to digital mapping of the community, Oxford contains approximately 17,551 acres of land. Most of the land in Oxford is zoned for residential use though there are certain parts along Route 20 and Route 12 that are zoned for Business and Industrial (Town of Oxford Master Plan, 2017). In 2005, Oxford adopted Chapter XXI of the Zoning Bylaw, limiting the number of building permits issued to no more than 5 per month and 36 per year (Town of Oxford Master Plan, 2017).

Recent development in Oxford since 2016 has occurred across the town. Most new buildings are single-family homes built on Approval Not Required (ANR) lots. According to the Planning Department's records from 2016 to 2021, most recent development has occurred on the edges of town rather than the more developed area along Route 12. There have been 49 new single-family homes constructed, along with two duplexes and two triplexes. Figure 3 illustrates the location of new development in Oxford. None of these recently developed buildings intersect flood zones. This may be because much of the town's flood zone is part of the Hodges Village Dam area or is located on back lots away from developable frontage. The location of new development since 2016 in Oxford seems unlikely to significantly impact the town's overall vulnerability to any natural hazards.

Future development in Oxford is constrained by the location of water lines and the existing sewage capacity. Many homes rely on private wells and septic tanks, limiting minimum lot sizes. Participants in the CRB workshop observed that these utility constraints discourage new development, including 40B projects. CRB workshop participants also observed that the town's hilly topography deters new development of some existing open space. Permanent protections on open space include Hodges Village Dam (and most of the French River flood plain in Oxford), the Merrill Pond Wildlife Management Area, and a few agriculture preservation restrictions. A conservation district is also in effect in the Greenbriar/Hodges Village Dam area (Oxford Open Space and Recreation Plan, 2007).

Only single-family homes are permitted in Districts Rural R-1, Suburban R-2, and Village R-3. In multifamily R-4, single, two, and three-family dwellings are allowed. The 2017 Oxford Master Plan encourages Smart Growth principles. This includes encouraging open space and multifamily development. Some of the action steps included in the Oxford Master Plan include amending the Zoning Bylaw to limit new 2+ family dwellings to certain areas.

Large areas with Industrial zoning include the north portion of Old Webster Road, land to the south of Federal Hill Road, the northern section of Old Worcester Road, and Route 56, both near Route 20 and in the Mill Street/Comins Road area. Additional areas zoned Light Industrial are to the north and east of Millbury Road. One area of Oxford, where Sutton Avenue intersects with Route 395, is zoned Highway Interchange. Oxford recently approved a 40-acre distribution center construction proposal within the North Oxford industrial zone.

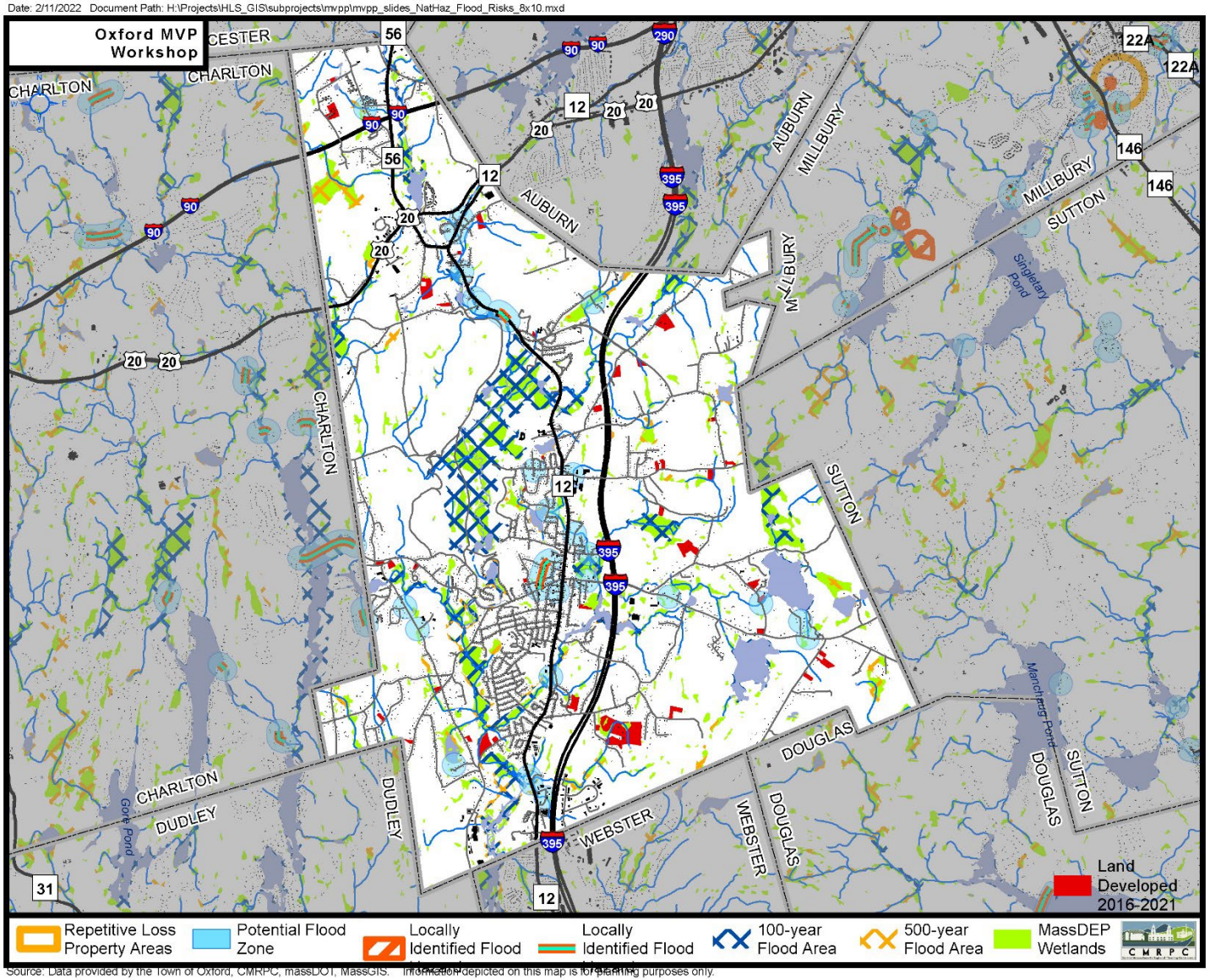


Figure 3: Map highlighting recent development in Oxford.

3.0 CRITICAL FACILITIES & 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 OXFORD

The 2016 Oxford Hazard Mitigation plan identified a list of critical facilities utilizing several sources, including:

- Oxford'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.

This list of critical facilities was reviewed and updated by the project Core Team, and some critical facilities were also discussed during the Community Resilience Building workshop.

Oxford's Hazard Mitigation Team has broken up the list of critical facilities into four categories:

- Emergency Response Facilities needed in the event of a disaster
- Non-Emergency Response Facilities that have been identified by the Committee as non-essential. These are not required in an emergency response event, but are considered essential for the everyday operation of Oxford
- 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	Oxford Police Dept./EOC	503 Main Street		Yes

Type	Name	Address	Details	Has Emergency Generator?
Fire Station	Fire Station # 2 (North Station)	656 Main Street	Evacuation assembly point. Roof issues many past snow and rain storms. Roof replacement project in progress (1/2022)	Yes
Fire Station	Fire Headquarters	181 Main Street	2010 Basement Flooding. Roof replacement slated for FY23 in CIP. Designated as back-up Emergency Operations Center.	Yes
Communication Facilities	Oxford Town Hall	325 Main Street		Yes
Communication Facilities	Public safety radio site (Crown Castle)	40 Federal Hill Road	Struck by lightning in 7/11, 9/11.	Yes
Communication Facilities	IPG Photonics Corporation (repeater site)	50 Old Webster Road		Yes
Highway Department	DPW Headquarters	450 Main Street		Yes
Highway Department	DPW Garage	34 Charlton Street		Yes
Primary Evacuation Routes	I-395			N/A
Primary Evacuation Routes	Route 20			N/A
Primary Evacuation Routes	Route 12 (Main St.)			N/A
Primary Evacuation Routes	Route 56			N/A
Primary Evacuation Routes	Sutton Ave.		Final road reconstruction/drainage project planned for Spring 2022	N/A
Primary Evacuation Routes	Charlton St.			N/A
Primary Evacuation Routes	Depot Rd.			N/A

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 Oxford.

Type	Name	Address	Details	Has Emergency Generator?
Water Supply	Oxford Rochdale Wastewater Treatment Plant	Leicester Street (28 Comins Rd)	Owned by Oxford/Rochdale Sewer district, not the Town of Oxford.	Yes
Water Supply	#1 North Main Street Well Station	579 Main Street		No
Water Supply	#3 Nelson Street Well Station	12 Nelson Street		No
Water Supply	Pumping Station #1	495 Main Street (OHS/OMS)	Sewer pump station	Yes
Water Supply	Pumping Station #2	Old Worcester Road (Greenbriar)	Sewer pump station	Yes
Water Supply	Pump Station #3	Thayer Pond Village	Sewer pump station	Yes
Water Supply	Pump Station #4	Old Webster Rd - IPG	Sewer pump station	Yes
Water Supply	Pump Station #5	Rt12/56	Sewer pump station	Yes
Water Supply	Prospect Hill Water Tower	Prospect Hill		No
Water Supply	Sutton Avenue Water Tank	Sutton Avenue		No
Town Facilities	Oxford Public Library	339 Main Street	Emergency shelter. Leaking roof after heavy rains - project complete in 2021 to address leaking	Yes
Utilities	Mobil Oil Fuel Line	Runs through town	Large leak in 1980s.	No
Utilities	Verizon Oxford Co (MA862606)	8 Wheellock Avenue	Long-term power loss during Storm Nemo (2013 Blizzard).	Yes
Utilities	P&W Railroad	Runs North/South through center of town		No
Utilities	National Grid Pumping Station	Behind schools		

3.4 CATEGORY 3 – DAMS

The third category is a listing of dams in Oxford.

National ID	Dam Name	Owner Type	Hazard Potential	Notes
MA01954	Stone's Pond Dam	Private	N/A	
MA00669	Lowes Pond Dam	Private	Significant Hazard	DCR program to fund reconstruction in progress. Design underway. Town to take ownership after construction
MA00992	Buffumville Pond Dam	Private	Significant Hazard	
MA03365	Texas Pond Outlet Dam	Private	N/A	
MA00671	Stumpy Pond Dam	Private	Significant Hazard	
MA01952	Lapa Farm Pond Dam	Private	N/A	
MA01955	Turner Pond	Private	N/A	
MA01948	Old Scythe Shop Pond Dam	Private	N/A	
MA01956	Clara Barton Pond Dam	Private Association or other non-profit	N/A	
MA00670	Robinson Pond Dam	Private	Significant Hazard	
MA01946	Bartlett Pond Dam	Private	Significant Hazard	
MA01947	Slaters Pond Dam	Town of Oxford	Significant Hazard	
MA00674	Hudson Pond Dam	Private	N/A	
MA01951	Cominsville Pond Dam	Private	N/A	
MA01005	Gordon Pond Dam	Private	Significant Hazard	
MA01950	Eames Pond Dam	Private	Significant Hazard	
MA00967	Hodges Village Dam	ACOE - U.S. Army Corps of Engineers	High Hazard	
MA01953	Mckinstry's Pond Dam	Town of Oxford	Significant Hazard	In poor condition. On State list of 100 critical dams.
MA00675	Chimney Pond Dam	Private	High Hazard	

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

3.5 CATEGORY 4 – FACILITIES/POPULATIONS TO PROTECT

Type	Name	Address	Details	Emergency Generator
Special Needs Population/Elderly Housing/Assisted Living	Sandalwood Nursing Home	3 Pine Street	Partial roof collapse and removal of 78 residents in late 1990s.	Yes
Special Needs Population/Elderly Housing/Assisted Living	Colonial Valley Apts/Elderly and handicapped housing	Liberty Lane	Long term power loss during Storm Nemo.	Yes
Special Needs Population/Elderly Housing/Assisted Living	Huguenot Arms Elderly Housing	23 Wheelock Street		No
Public Buildings/Areas	Oxford Community Center	4 Maple Road	Heavy rains, roof and floor damage in 2010.	Yes
Public Buildings/Areas	Oxford Senior Center	323 Main Street	Warming/cooling center, emergency shelter.	Yes
Schools/Daycares	Little Big Kid's Family Daycare	154 Main Street		No
Schools/Daycares	Grace Church Preschool & Parish Hall Daycare center	268 Main Street		No
Schools/Daycares	Jack and Jill Preschool	693 Main Street	Roof damage from Storm Nemo.	No
Schools/Daycares	Tiny Toes Childcare	5 Wayne Ave		No
Schools/Daycares	Little Movers Home Daycare	132 Federal Hill Rd		Yes
Schools/Daycares	Sunshine Hill Daycare	11 Henry Marsh Rd		No
Schools/Daycares	Brouthers (childcare)	13 Quobaug Ave		Unknoown
Schools/Daycares	Charbonneau (childcare)	64 Holbrook Road		Unknown
Schools/Daycares	Cordova Del Cid (childcare)	7 Corbin Road		Unknown

Schools/Daycares	Dwyer-Hurley (childcare)	6 Sigourney Street		Unknown
Schools/Daycares	Fazah (childcare)	6B Henry Marsh Road		Unknown
Schools/Daycares	Fournier (childcare)	154 Main Street		Unknown
Schools/Daycares	Gendron (childcare)	43 Hall Road		Unknown
Schools/Daycares	Holley-Kowalewski (childcare)	9 Ashton Street		Unknown
Schools/Daycares	Kinhan (childcare)	9 Marshall Street		Unknown
Schools/Daycares	O'Toole (childcare)	23 Westview Drive		Unknown
Schools/Daycares	Palin (childcare)	132 Federal Hill Road		Unknown
Schools/Daycares	Rodrigues (childcare)	71 Walnut Street		Unknown
Schools/Daycares	Salter (childcare)	12 Old Charlton Road		Unknown
Schools/Daycares	Smith (childcare)	12 Patton Street		Unknown
Schools/Daycares	Walsh (childcare)	11A Henry Marsh Road		Unknown
Schools/Daycares	Zografos (childcare)	34 Joe Jenny Road		Unknown
Schools/Daycares	Alfred M Chafee School (shelter) & Preschool	9 Clover Street	Evacuation assembly point. Long term power loss during Storm Nemo.	Yes
Schools/Daycares	Clara Barton School	30 Depot Road		Yes
Schools/Daycares	Oxford High School	495 Main Street	PRIMARY shelter. Designated as emergency response Point of Distribution.	Yes
Schools/Daycares	Oxford Middle School	497 Main Street	Designated as emergency response staging area. Evacuation assembly point.	Yes

Historic Buildings/Sites	According to the Massachusetts Cultural Resources Information System (MACRIS) online database accessed in January 2022, there are 14 Areas, 342 Buildings, 5 Burial Grounds, 11 Objects, and 6 Structures listed for Oxford. The Local Team did not specifically identify any of these sites as Critical Facilities or Infrastructure.

EMPLOYMENT CENTERS

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

Company name	Address	Number of employees
IPG Photonics Corp	Old Webster Rd	1,000-4,999
Walmart Supercenter	Main St	250-499
Home Depot	Sutton Ave	100-249
La Mountain Brothers Inc	Federal Hill Rd	100-249
Market Basket	Sutton Ave	100-249
Schmidt Equipment Inc	Southbridge Rd	100-249
Technetics Group	Old Webster Rd	100-249

ENVIRONMENTAL JUSTICE AND VULNERABLE POPULATIONS

The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) Environmental Justice policy sets the state's official definition for Environmental Justice areas. The policy states that EJ populations are those segments of the population that EEA has determined to be most at risk of being unaware of or unable to participate in environmental decision-making or gain access to state environmental resources, or are especially vulnerable. They are defined as neighborhoods (U.S. Census Bureau census block group data for minority criteria, and American Community Survey (ACS) data for state median income and English isolation criteria) 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;
- minorities comprise 40 % or more of the population;
- 25 % or more of households lack English language proficiency; 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 the EEA's Environmental Justice Map Viewer[1], there are two environmental justice neighborhoods in Oxford:

- South Downtown and Lowes Pond (Block Group 3, Census Tract 7532): This neighborhood was designated based on income. The median household income in this area is $32,212, or 37.5% of the statewide median income. Approximately 1,205 people live in this area, and 12.2% of this population identifies as a minority. According to town staff, this area is home to the Oxford Housing Authority buildings, contributing to the area's low income relative to Oxford. The west side of this area is a mix of relatively high-density residential and village business zoning, while the east side of the area includes I-395, a shopping area, and suburban residential zoning.
- East Oxford (Block Group 5, Census Tract 7531): This neighborhood was designated based on its minority population. The minority population of this area is 29.3%, and the neighborhood's median household income is $101,848 (118.46% of the statewide median income). According to town staff, Orchard Hill Estates is located within this area, and it is home to many of the town's minority residents. This multi-unit apartment complex serves low- to medium-income renters.

The location of these environmental justice neighborhoods is shown on Map 1 & 3 in Appendix A.

4.0 HAZARD PROFILES, RISK ASSESSMENT & VULNERABILITIES

The following section includes a summary of natural hazards that have affected or could affect Oxford 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

[1] As of February 2022, the map viewer used 2019 American Community Survey 5-year estimate data to determine Environmental Justice Neighborhoods. Link: https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts

- Drought
- Extreme Temperatures
- Other hazards

4.1 TOP HAZARDS AS DEFINED IN THE CRB WORKSHOP

The top hazards discussed at the CRB workshop were based on the highest rated hazards from the 2016 Hazard Mitigation Plan and an October 2021 Core Team discussion. These hazards were:

- *Flooding*
- *Severe Snowstorms / Ice Storms / Nor'easters*
- *Hurricanes*
- *Severe Thunderstorms / Wind / Tornado*

One of the breakout groups also discussed *Extreme Temperatures* as a concerning climate change-related hazard. All of these hazards are discussed in more detail in the following sections.

4.2 STATE-WIDE OVERVIEW OF HAZARDS

4.2.1 MASSACHUSETTS STATE HAZARD MITIGATION AND CLIMATE ADAPTATION

The state of Massachusetts and Governor Baker's administration has instituted the State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) through Executive Order 569. This plan outlines how the state of Massachusetts must prepare strategies to prevent, respond to, and mitigate natural hazards. The plan is the first of its kind to incorporate climate change adaptations into the mitigation plan. The plan makes Massachusetts eligible for federal disaster recovery and hazard mitigation funding and is effective under FEMA from September 19th, 2018, to September 18th, 2023. The Massachusetts SHMCAP is a valuable model for incorporating climate change interactions into the natural hazard mitigation planning process.

4.2.2 CLIMATE CHANGE INTERACTIONS

The State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) outlines four major climate change interactions that influence natural hazards in Massachusetts. These four interactions are described as follows on p.3-4 of the Massachusetts SHMCAP:

1. Changes in precipitation: Changes in the amount, frequency, and timing of precipitation—including both rainfall and snowfall—are occurring across the globe as temperatures rise and other climate patterns shift in response.
2. Sea level rise: Climate change will drive rising sea levels, and rising seas will have wide-ranging impacts on communities, natural resources, and infrastructure along the Commonwealth's 1,519 tidal shoreline miles.
3. Rising temperatures: Average global temperatures have risen steadily in the last 50 years, and scientists warn that the trend will continue unless greenhouse gas emissions are significantly reduced. The 9 warmest years on record all occurred in the last 20 years (2017, 2016, 2015, 2014, 2013, 2010, 2009, 2005, and 1998), according to the U.S. National Oceanographic and Atmospheric Administration (NOAA).
4. Extreme weather: Climate change is expected to increase extreme weather events across the globe, as well as right here in Massachusetts. There is strong evidence that storms—from heavy downpours and blizzards to tropical cyclones and hurricanes—are becoming more intense and damaging, and can lead to devastating impacts for residents across the state.

4.3 NATURAL HAZARD IDENTIFICATION AND ANALYSIS

This section examines the hazards in the Massachusetts State Hazard Mitigation Plan, which are likely to affect Oxford. 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.

4.3.1 HAZARD DESCRIPTION

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

4.3.2 LOCATION

Location refers to the geographic areas within the planning area 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 4: 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

4.3.3 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.

4.3.4 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.

4.3.5 PROBABILITY OF FUTURE EVENTS

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

Table 5: 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

4.3.6 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 6: 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.

This section also describes aspects of Oxford's infrastructure, environment or society that may experience disproportionate impacts of specific hazards relative to the rest of the town.

4.3.7 CLIMATE CHANGE IMPACT

Each natural hazard is influenced by one or more of the climate change interactions listed in 4.2.2 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 2018 State Hazard Mitigation and Climate Adaptation Plan (SHMCAP).

4.3.8 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.

Table 7: Hazard Identification and Analysis Worksheet for Oxford

Type of Hazard	**Location of Occurrence**	**Probability of Future Events**	**Impact**	**Climate Change Impact**	**Hazard Risk Index Rating**
Flooding	Small	Low	Minor	Increase extent; increase probability	3
Severe Snowstorms / Ice Storms/ Nor'easter	Large	Very High	Limited	Increase extent	2
Severe Thunderstorms /	Small	Moderate	Minor	Increase extent; increase probability	2
Winds/	Small	Moderate	Limited	Unclear	2
Tornadoes	Small	Very Low	Limited	Unclear	3
Hurricanes	Large	Low	Limited	Increase extent;	3

Type of Hazard	**Location of Occurrence**	**Probability of Future Events**	**Impact**	**Climate Change Impact**	**Hazard Risk Index Rating**
				increase probability	
Wildfire / Brushfire	Small	Moderate	Minor	Increase extent; increase probability	4
Earthquakes	Large	Very Low	Minor	None	5
Dam Failure	Small	Very Low	Minor	Indirect effects related to flooding	5
Drought	Large	Very Low	Minor	Increase extent; increase probability	4
Extreme Temperatures	Large	Moderate	Limited	Increase in average temperature; increase in probability of extreme heat	4

Source: based on Massachusetts State Hazard Mitigation Plan, 2013; modified to reflect conditions in Oxford.

4.4 FLOODING

Flooding was the most prevalent natural hazard identified by local officials in Oxford. 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 Oxford, 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.

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 100-year 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 500-year flood zone.

LOCATION

Flooding and flood-prone areas in Oxford are closely associated to the course of the French River and associated tributaries. According to a GIS analysis performed by CMRPC, there are 628 parcels in Oxford in areas that FEMA has assigned a 1% or .2% annual risk of flooding. Buildings on these parcels may be secure depending on their elevation within the parcel, building characteristics, and other factors. However, 46 buildings intersect with the 1% annual risk flood zone, and an additional 56 intersect with the .2% annual risk flood zone. 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.

Many roadways in Oxford are prone to occasional flooding, as depicted on Map 2. These flood-prone locations often coincide with undersized stormwater infrastructure like culverts and underground storage basins, which may be unable to handle the volume of water that flows through them during extreme weather. Other reasons for flooding are beaver dams and low-lying areas. Resident behavior, such as changing stormwater drainage configurations on private property, has also led to limited flooding in some areas.

Oxford hosts the Hodges Village Dam, which is a flood risk management dam owned and operated by the United States Army Corps of Engineers (USACE). The USACE completed a risk assessment on the dam in 2020 and rated it as low risk. The USACE risk assessment included breach and non-breach scenarios for the dam, which could result in impacts with varying levels of severity. The Intermediate High scenario represents "a realistic operating condition that could be experienced during a major flood where the reservoir pool elevation exceeds Top of Active Storage" and some

water is discharged downstream from the dam spillway. If a dam breach followed this scenario, thousands of lives and buildings would be at risk. However, the USACE actively monitors the dam and conducts maintenance to mitigate the risk of dam breaching (United States Army Corps of Engineers, 2021).

At this time, the Town of Oxford 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.

EXTENT

The average annual precipitation for the closest weather station to Oxford[2] has been 47.6 inches for the period from 2010 to 2021. Annual rainfall levels recently peaked in 2018 at 65.16 inches (National Weather Service, n.d.).

Water levels in Oxford'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 2010 and 2021, Oxford[1] received the most precipitation in the months of August, October, and December (National Weather Service, n.d.). Heavy rainfall may create conditions that raise water levels in rivers and streams above the bank full stage, overflowing adjacent lands. Additionally, some of Oxford's older stormwater infrastructure cannot accommodate the volume of water following heavy rainfall. For example, in August 2021, Oxford was significantly impacted by stormwater flooding as the remnants of a tropical storm passed through Massachusetts. Throughout July 2021, there were also frequent intense rainfall events, and Oxford received 11.94 inches of rain in that month alone.

Saturated soil is a secondary impact of high precipitation and flooding, which causes its own challenges. The saturated ground may lead to basement flooding and make trees more likely to topple over in high winds. In 2021, a tree fall linked to water saturation caused damage to a home in Oxford. Trees may fall onto roadways and across powerlines, creating public safety hazards for town residents.

Based on past records and the knowledge and experience of members of the Oxford Hazard Mitigation team and residents, the extent of the impact of localized flooding would be minor. The most typical impact is basement flooding, roadway flooding, and roadway icing in the winter months.

PREVIOUS OCCURRENCES

[2] Buffumville Lake weather station in Charlton, MA, just over the Oxford border.

In addition to the floodplains mapped by FEMA for the 100-year and 500-year flood, Oxford periodically experiences minor flooding at isolated locations due to drainage issues or problem culverts. The following specific flooding locations (Appendix A, Map 2 & 3) were identified by the Oxford Hazard Mitigation Team:

- Holman Street
- Dana Road Flooding – this culvert was recently replaced, but flooding is still a concern
- Main Street – roadway flooding in this location is linked to overwhelmed underground drainage
- Turk Hollow Rd.
- Sutton Ave & Turk Hollow
- Old Webster Rd & Country Ln.
- Hartwell Rd. Flooding
- Hall Rd. Flooding
- Wellington Rd.
- Main St & Chestnut Hill Rd
- Birchwood Ter – the DPW has recently completed drainage improvements at this location, but flooding may still be an issue
- Main St S of Pratt Ave
- Water St.
- Sutton Ave & Lind St
- Sutton Ave between Lovett Rd & Fort Hill Road – flooding caused by a beaver dam
- Main St near State St & Lowe's Brook
- Prince Street
- Pinedale Drive Culvert and Pond Overtopping
- RT 12 Flooding (676 Main) – drainage overwhelm
- Route 12 – flooding and icing on roadway
- Jackson Court
- Backyard flooding south of Grassy Pond
- West Industrial Drive – culvert problems and road washout
- Robins Road Culvert

Most of the flood hazard areas listed here were identified due to known past occurrences in the respective area. There are many areas with no record of previous flood incidents that could be affected in the future by heavy rain and runoff.

PROBABILITY OF FUTURE EVENTS

Based upon previous data, there is a high probability of localized flooding occurring in Oxford in the next year.

IMPACT

The Town faces a minor impact, with less than 5% 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 Oxford is unlikely to destroy any buildings completely. However, a .2% annual chance flood event could displace residents and come with a significant economic cost.

Utilizing the GIS analysis noted in Location, above, the total building value of the 46 parcels with structures that are susceptible to a 1% annual chance flood is approximately $16,635,400. The total building value of the 56 parcels with structures that are susceptible to a .2% annual chance flood is approximately $11,727,200. This estimates the property value at risk of flooding rather than the estimated financial impact of a major flood event.

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.

Table 8: Estimated Damages from Flooding

	.2% annual chance flood event
Building Characteristics	
Estimated total number of buildings in Oxford	5,032
Estimated total building replacement value (2014 $)	$ 1,878,649,000
Building Damages	
# of buildings sustaining minor damage (1-10%)	2
# of buildings sustaining moderate damage (11-40%)	21
# of buildings sustaining severe damage (41-50%)	1
# of buildings destroyed	0
Population Needs	
# of households displaced	299
# of people seeking public shelter	124
Value of Damages	
Total property damage (buildings and content)	$ 17,460,00
Total losses due to business interruption	$ 7,290,000
Total Economic loss	**$24,750,000**

Though there are no recorded instances of a flood event of this size in Oxford, at least since the USACE dam system construction, this model was included 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 Oxford'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 3.0. These features include:

- Low-lying areas, including but not limited to the FEMA 1% and .2% annual chance flood zones.
- Areas with a high water table, where water cannot easily be drained into the ground.
- Specific locations with undersized or outdated storm water infrastructure that cannot handle sudden surges in precipitation.
- Residences on isolated parcels or cul de sacs with a single evacuation route.
- 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.
- Private wells 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.

Additionally, the Nelson Street Well Station is located within the 1%a annual chance flood zone. Additionally, sections of evacuation routes including Routes 12 and 20, and also Critical Facilities, including the DPW Headquarters and Fire Station #2, are located in or adjacent to areas prone to local flooding. Moreover, the local team identified 24 locations in Oxford susceptible to flooding, including those 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.

CLIMATE CHANGE INFLUENCE

According to the 2018 State Hazard Mitigation and Climate Adaptation Plan, there are three major ways that inland flooding can be influenced by climate change:

- Changes in precipitation may lead to more intense and more frequent downpours. Intense downpours that generate a high volume of precipitation in a short period of time may overwhelm stormwater infrastructure, saturate soils, and make them unable to absorb additional moisture, and cause river or stream flows to rise.

- Climate change may result in more frequent severe storms, which would increase the frequency of flooding, and make it more likely for multiple storms in a short duration to cause cumulative damage.
- "Vegetated ground cover" can slow down runoff water, making it more likely to absorb into the ground rather than flow into streams and rivers. Climate change could create more frequent drought conditions, and drought can stress or kill plants, limiting their ability to mitigate runoff from heavy rainfall.

In summary, climate change is likely to increase the extent and probability of future flood events in Oxford.

VULNERABILITY

Based on this analysis and the assessment of the Oxford Core Team, Oxford faces a hazard index rating of "3 - medium risk" from flooding.

4.5 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 that often results in heavy snow, high winds, and rain.

LOCATION

The entire Town of Oxford is susceptible to severe snowstorms, which means the location of occurrence is "large." Because these storms occur regionally, they would impact the entire Town. However, winter storms caused challenges to traffic along Route 20 and Route 12. One point along Route 12 is a particular problem for roadway icing due to meltwater running off a nearby slope and onto the roadway.

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 9: Northeast Snowfall Impact Scale Categories

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

Source: National Centers for Environmental Information, (n.d.).

PREVIOUS OCCURRENCES

Based on data available from the National Oceanic and Atmospheric Administration, there have been 66 high-impact snowstorms since 1958 that have affected the Northeast Corridor. Of these, approximately 36 storms resulted in snowfalls in Oxford of at least 10 inches. These storms are listed in the table below:

Table 10: Winter Storms Producing over 10 Inches of Snow in Oxford, 1958-2021

Start Date	NESIS Value	NESIS Category	NESIS Classification
1/30/21	4.93	3	Major
12/14/2020	3.21	2	Significant
3/11/2018	3.16	2	Significant
3/5/2018	3.45	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
2/2/1961	7.06	4	Crippling
1/18/1961	4.04	3	Major
12/11/1960	4.53	3	Major

Start Date	NESIS Value	NESIS Category	NESIS Classification
3/2/1960	8.77	4	Crippling
2/14/1958	6.25	4	Crippling

Source: National Centers for Environmental Information, (n.d.).

PROBABILITY OF FUTURE EVENTS

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

Research on climate change indicates that there is great potential for stronger, more frequent storms as the global temperature increases (see *Climate Change Influence*, below).

IMPACT

The Town 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.

Utilizing the total value of all property, $1,629,494,675 (MA Department of Revenue Division of Local Services, 2022), and an estimated 5 percent of damage to 10 percent of all structures, approximately $ 8,147,473 worth of damage could occur from a severe snowstorm. This is a rough estimate and likely reflects a worst-case scenario. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Other impacts from snowstorms and ice storms include:

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

EXPOSURE

Certain features within Oxford's community infrastructure, society, and environment may face more exposure to winter storms or may 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 3.0. These features include:

- Elderly residents, who may have more difficulty clearly 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, 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.

CLIMATE CHANGE INFLUENCE

According to the 2018 State Hazard Mitigation and Climate Adaptation Plan, there are three major ways that severe winter storms (including ice storms and nor'easters) can be influenced by climate change:

- Warming surface waters in the ocean will cause air moving over the water to retain more moisture, and as a result, certain winter storms will be capable of dropping more snow than is typical for Massachusetts.
- Rising ocean temperatures may lead to changing atmospheric circulation patterns that make the formation of winter storms along the US East Coast more likely.
- Nor'easters may increase in frequency and intensity and may become more concentrated in the coldest winter months.

In summary, climate change is likely to increase the extent of winter storms in Oxford.

VULNERABILITY

Based on the above assessment, Oxford has a hazard index rating of "2 — high risk" from snowstorms and ice storms.

4.6 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. Hurricane 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 (2018 State Hazard Mitigation and Climate Adaptation Plan).

LOCATION

Because of the hazard's regional nature, all of Oxford 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 five being the most intense.

Table 11: Saffir-Simpson Scale

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

Source: National Hurricane Center and Central Pacific Hurricane Center, n.d.

PREVIOUS OCCURRENCES

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

Table 12: Major Hurricanes and Tropical Storms Affecting Oxford (1970-Present)

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

Source: Office for Coastal Management, 2021.

Hurricane Henri was also mentioned as an example of a recent storm (2021) that Oxford was well-prepared for and had only minor impacts on the town.

PROBABILITY OF FUTURE EVENTS

Oxford's location in central Massachusetts, approximately 55 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 Oxford. Climate change is projected to result in more severe weather, including an 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:

Table 13: Hurricane Damage Classifications

Storm Category	Damage Level	Description of Damages	Wind Speed (MPH)
1	MINIMAL Very dangerous winds will produce some damage	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
2	MODERATE Extremely dangerous winds will cause extensive damage	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
3	EXTENSIVE Devastating damage will occur	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. Terrain may be flooded well inland. An example of a Category 3 hurricane is Hurricane Ivan (2004).	111-129
4	EXTREME		

	Catastrophic damage will occur	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
5	CATASTROPHIC Catastrophic damage will occur	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+

Source: National Hurricane Center and Central Pacific Hurricane Center, n.d.

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 100-year and 500-year hurricane event; storms that are 1% and .0.2% likely to happen in a given year and are 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.

Table 14: Estimated Damages from Hurricanes

	100-Year storm (85 mph winds)	**500-Year storm (102-103 mph winds)**
Building Characteristics		
Estimated total number of buildings	5,032	
Estimated total building replacement value (2014 $)	$ 1,879,000,000	
Building Damages		
# of buildings sustaining minor damage	116	736
# of buildings sustaining moderate damage	10	119
# of buildings sustaining severe damage	0	6
# of buildings destroyed	0	2
Population Needs		
# of households displaced	2	28
# of people seeking public shelter	2	16
Debris		
Building debris generated (tons)	415	2,238
Tree debris generated (tons)	8,776	21,340
# of truckloads to clear building debris	17	90
Value of Damages (thousands of dollars)		

Total property damage (buildings and content)	$ 10,999,840	$39,317,690
Total losses due to business interruption	$ 293,620	$1,928,570

Though there are no recorded instances of a hurricane equivalent to a 500-year 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 Oxford affected.

EXPOSURE

Certain features within Oxford'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 3.0. Vulnerable community features include:

- 150 priority "hazard" trees that have been identified by the Department of Public Works. The town is in the process of cutting down these trees. However, it is difficult for the town to keep up with the volume of sick or dead trees that are likely to create problems during hurricanes or high wind events. This challenge has been exacerbated by a recent gypsy moth resurgence, which damaged many trees. Climate change is expected to place further stress on local trees and therefore increase the management burden for the town.
- 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. Certain residents, such as people dependent on life support machines or ventilators, may be more vulnerable to outages.
- Municipal buildings with structural problems are vulnerable to hurricane damage. Damage to these buildings could impact critical town functions and be a distraction from other essential emergency response and recovery activities. The Barton Street DPW building and Fire Station #2 are both vulnerable to high winds.
- Tall structures adjacent to roadways are a potential concern for the town during high wind events. The Buffumville Mill Chimney and the chimney at 627 Main Street were identified as potentially vulnerable to hurricanes, though these chimneys have not been analyzed for structural deficiencies.
- 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 also apply to hurricanes.

CLIMATE CHANGE IMPACT

According to the 2018 State Hazard Mitigation and Climate Adaptation 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, extent, and impact of hurricanes in Oxford.

VULNERABILITY

Based on the above analysis, Oxford has a hazard index rating of "3 – medium risk" from hurricanes.

4.7 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 (Massachusetts State Hazard Mitigation and Climate Adaptation Plan, 2018).

The wind is air in motion relative to the 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 it can stall or change direction abruptly. Within Massachusetts, tornadoes have occurred most frequently in the Connecticut River Valley and in western Worcester County, with Oxford some 20 miles east of the zone of most frequent past occurrences. 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 Oxford 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.

Within the last five years, there have been two tornadoes in nearby communities, though neither event impacted Oxford:

- 2018 Tornado (East Douglas)
- 2018 Tornado (Webster)

EXTENT

An average thunderstorm is 15 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 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 15: Enhanced Fujita Scale Levels and Descriptions of Damage

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.

EF-Scale Number	Intensity Phrase	3-Second Gust (MPH)	Type of Damage Done
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.

Source: (National Oceanic and Atmospheric Administration, n.d.-B).

Table 16: Extent Scale for Hail

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

Source: (National Oceanic and Atmospheric Administration, n.d.-A).

PREVIOUS OCCURRENCES

Because thunderstorms and wind affect the town regularly on an annual basis, there are no 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, immediately east of Oxford.
- In 1981 an F3 tornado struck Westminster, resulting in just three 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 five years, there have been two small tornadoes in nearby communities, though neither event impacted Oxford:

- 2018 Tornado (East Douglas)
- 2018 Tornado (Webster)

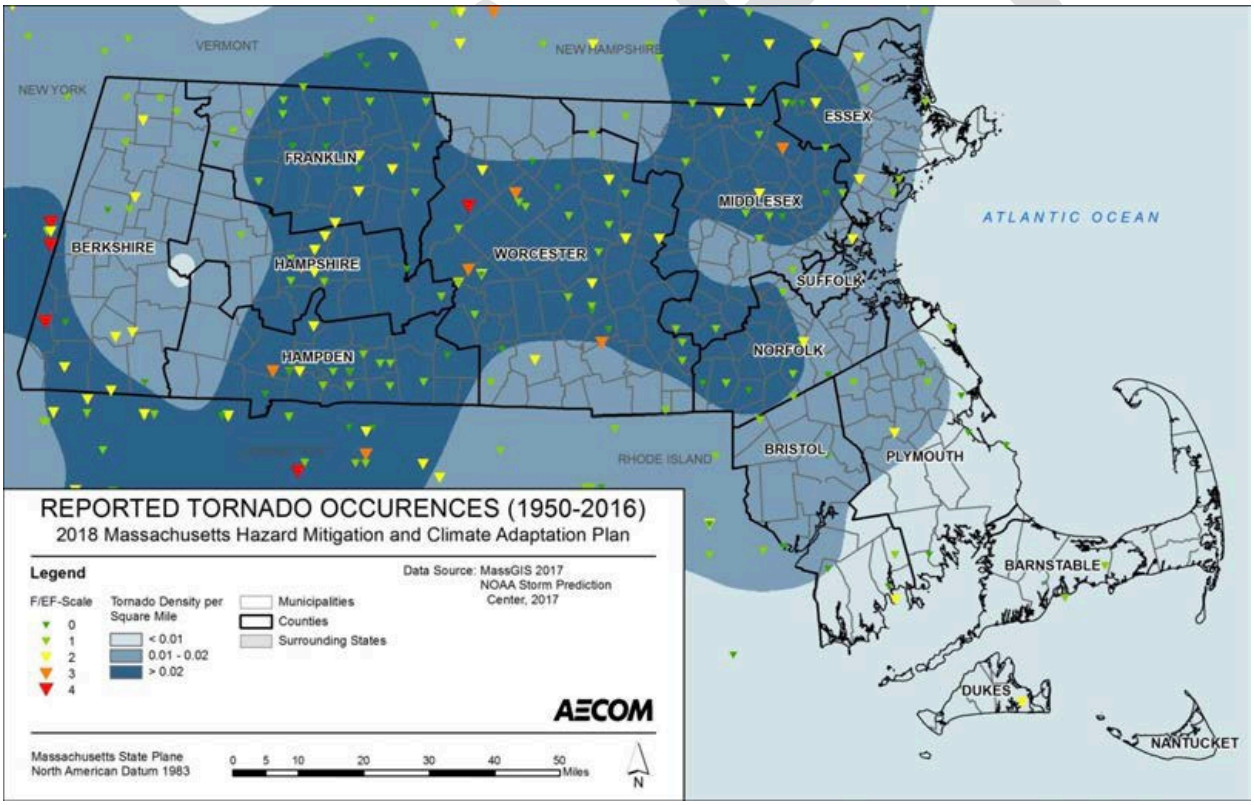


Image 1: Density of Reported Tornados per Square Mile (1950-2016). Source: Massachusetts State Hazard Mitigation and Climate Adaptation Plan, 2018.

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

PROBABILITY OF FUTURE EVENTS

According to the 2018 State Hazard Mitigation and Climate Adaptation Plan, Massachusetts experienced 171 tornados between 1950 and 2017, or an average of 2.6 tornado events per year. The report goes on to state that "Massachusetts ranks 35th among the states for the frequency of tornadoes, 14th for the frequency of tornadoes per square mile, 21st for injuries, and 12th for cost of damage." Tornado activity may become more variable due to climate change, so it is difficult to predict the likelihood of future events in Oxford (see below, Climate Change Impact).

Based upon the available historical record, as well as Oxford'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, Oxford 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 (see above, Extent) for tornados describes the likely impacts of tornados on the physical environment.

The potential for locally catastrophic damage is a factor in any tornado, severe thunderstorm, or wind event. In Oxford, 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 there has been less

development. 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 65.7% percent of the town's 5,531 occupied housing units was constructed in 1979 or earlier (2019 American Community Survey, 5-year estimates, Table DP04). Utility lines throughout town are also vulnerable, particularly where trees have not been trimmed recently.

Utilizing the total value of all property, $1,629,494,675 (MA Department of Revenue Division of Local Services, 2022), and an estimated 10 percent of damage to 5 percent of all structures, the estimated amount of damage from a tornado would be $8,147,473. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

EXPOSURE

Certain features within Oxford'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 3.0. Vulnerable features to severe thunderstorms/wind/tornadoes overlap with features vulnerable to hurricanes) and flooding.

CLIMATE CHANGE IMPACT

The 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) notes that it is not currently possible to predict how tornados will be impacted by climate change. Tornados are too small to be simulated with accuracy by climate models. Also, they are measured based on their impact rather than inherent physical characteristics, so it's difficult to state whether tornados will increase in frequency and intensity because that depends in part on how many people live in the areas where tornados occur. These challenges make specific predictions about the changes to tornadoes from climate change impossible. However, the SHMCAP report goes on to note that "the conditions that are conducive to tornadoes (which are also conducive to other weather phenomena, such as hurricanes and tropical storms) are expected to become more severe under global warming" (pg. 4-246).

The SHMCAP report also does not draw clear conclusions about the impact of climate change on thunderstorms. It notes that while a warming climate will increase the capacity of the atmosphere to hold water vapor, precipitation rates are dependent on other factors that complicate predictions at local scales. It is likely that annual precipitation will increase, and some studies seem to indicate that precipitation rates will increase the temperatures when peak participation rates are likely to occur (pg. 4-465).

VULNERABILITY

Based on the above assessment, Oxford has a hazard index rating of "2- high risk" from severe thunderstorms and winds and a "3 – medium risk" from tornadoes. The risk of tornadoes was rated as "4 – low risk" in the 2016 plan.

4.8 WILDFIRES / BUSH 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 and 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" (U.S. National Park Service, 2021). When relative moisture drops, light fuels like grasses become drier and burn more easily (2021).

FEMA has classifications for three 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 lightening
- 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

62% of the total land area in Southern Worcester County is forested land (Mass GIS, 2016). Much of this region of Massachusetts, including the Oxford area, have a high risk of wildfire. In Oxford, an estimated 57% of the land is forested (Mass GIS, 2016). While Oxford is developed in a mostly low-density suburban pattern and few uninterrupted tracts of forest are present, the substantial expanses of vegetation present some risk for wildfires and brush fires.

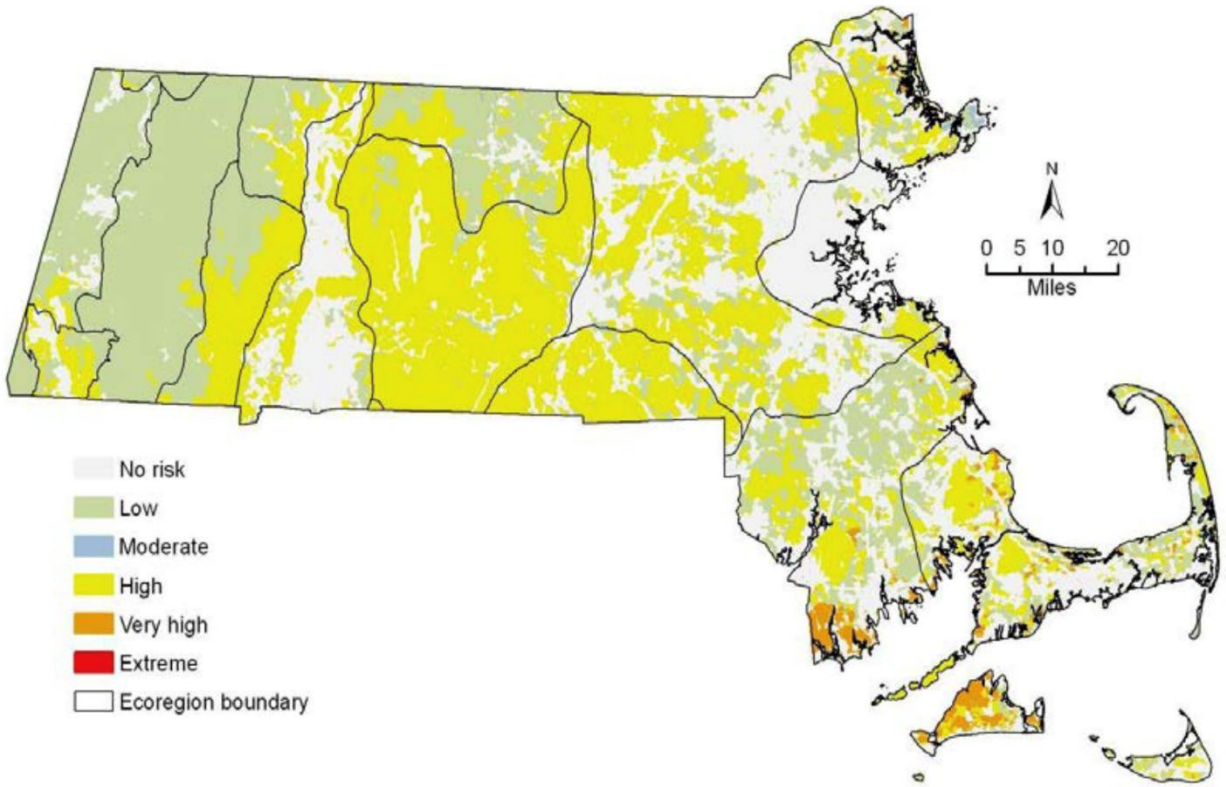


Figure 4: Wildfire Risk Areas for the Commonwealth of Massachusetts. Source: 2018 SHMCAP.

Two areas of Oxford have an elevated risk of wildfire. Sparks on the Providence and Worcester (P&W) rail line may result in brushfires if vegetation along the tracks is not regularly cut back. The P&W railway is responsible for maintaining this vegetation, and they have done a good job with this in recent years. Another fire-prone area is off Rocky Hill Road, in the Greenbriar recreation area. This portion of the Hodges Village Dam spillway is used in the summer by off-road vehicles and has experienced small brushfires in recent years. Oxford has also been seeing increasing numbers of peat and duff fires in recent years, perhaps due to the impact of dry weather on local wetlands.

Only 30-35% of the town lies in areas with fire hydrants supplied by the Aquarion water system. The fire department deploys 1000-gallon tanker trucks to fire calls in other areas of town, rather than relying on a dry hydrant system. The water for the tanker trucks is drawn from public fire ponds.

While much of Oxford contains vegetation that could produce brushfires under the right conditions, historically, brush and wildfires in Oxford have been small and were contained by the fire department. Therefore, the total amount of Oxford that would be affected by a wildfire is categorized as "small," or less than 10 percent of the total area.

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 Oxford, approximately 57% percent of the town's total land area is deciduous forest, and an additional 9% of the town consists of grassland or shrub. These areas are at risk of fire, but this forested area is generally scattered throughout the community, with developed areas, rivers, and major transportation corridors (I-395 and I-90) breaking up the forest. In drought conditions, a brushfire or wildfire would be a matter of concern.

There have not been any major wildfires in Oxford in recent decades. Based on historical data for 2011-2020, the 133 natural vegetation fires in Oxford during that period burned 99.1 acres of land (Massachusetts Department of Fire Services, 2021). Therefore, the average fire size over that period was only .74 acres per incident.

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

Table 17: National Fire Danger Rating System

Rating	Basic Description	Detailed Description
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.

Source: U.S. National Park Service, 2021.

PREVIOUS OCCURRENCES

Oxford has a mixed fire department with professional firefighters supported by on-call volunteers. There have not been any major forest fires in Oxford in recent decades. During the period 2011-2020, there were between 6 and 25 brush fires per year in town. 99.1 total acres burned over that 10-year period, causing one firefighter injury and $3,285 of property damage (Massachusetts Department of Fire Services, 2021). Brushfires along the rail lines in town are a perennial source of small brushfires, and another notable fire occurred in 2021 in the Greenbriar recreation area off Rocky Hill Road.

PROBABILITY OF FUTURE EVENTS

In accordance with the 2018 State Hazard Mitigation and Climate Adaptation Plan, the Oxford Hazard Mitigation Team found it difficult to predict the likelihood of wildfires in a probabilistic manner because of the number of variables involved - fuel availability, weather and climate conditions, and human activity all factor into wildfire occurrences. However, based on regular previous occurrences of minor brush fires, the planning team determined the probability of future damaging wildfire events to be "moderate" (10 percent to 40 percent probability in the next year).

Climate scenarios project that by mid-century, the mean summer temperatures in the French River basin will increase by .55° F to 4.55° F (Northeast Climate Adaptation Science Center, n.d.). 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 Oxford, 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, $1,629,494,675 (MA Department of Revenue Division of Local Services, 2022), and an estimated 5 percent of damage to 1 percent of all structures, the estimated amount of damage from a wildfire is $814,747. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

EXPOSURE

Certain features within Oxford'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 3.0. Vulnerable community features include:

- People who are sensitive to smoke, including children, the elderly, and individuals with other health conditions. Wildfires outside of Oxford 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, forcing the Massachusetts Department of Environmental Protection to issue an air quality alert (McAlpine, 2021).
- Properties on private wells without access to fire hydrants may be at elevated risk if fires occur during a drought when fire pond levels are lower than normal. However, the Oxford Fire Department has a Tanker Task Force plan in place with neighboring communities to mitigate this risk and ensure access to water for firefighting purposes.
- First responders. One firefighter was injured during a brushfire in Oxford between 2011 and 2020.

CLIMATE CHANGE IMPACT

According to the 2018 State Hazard Mitigation and Climate Adaptation Plan, there are two major ways that wildfires/brushfires can be influenced by climate change:

- Seasonal drought risk is projected to increase, and summer temperatures are expected to rise. Rising temperatures and changes in precipitation could cause vegetation to dry out and become more flammable.
- Rising temperatures may cause the frequency of lightning strikes to increase, which could spark more wildfires.

In some areas, seasonal drought may also make it more difficult to ensure a reliable water source for fire-fighting. Areas of town connected to the Aquarion water system in Oxford are also supplied with fire hydrants, but areas without public water rely on water brought in by tanker trucks. Oxford already has mutual aid agreements with other fire departments to haul in additional water if Oxford FD encounters supply shortages.

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

VULNERABILITY

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

4.9 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 services, 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 Oxford 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 (Michigan Tech, n.d.).

Table 18: 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.

Magnitude	Effects
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.

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 19: Modified Mercalli Intensity Scale for and Effects

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

Source: (U.S. Geological Survey, n.d.)

PREVIOUS OCCURRENCES

The last earthquake to cause major damage in New England occurred in 1755 (Northeast States Emergency Consortium, n.d.), 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 (MA State Hazard Mitigation and Climate Adaptation Plan, 2018). Earthquakes occur without warning and may be followed by aftershocks. Image 4 shows the locations of earthquakes that have occurred across the New England region and beyond over the last 45 years.

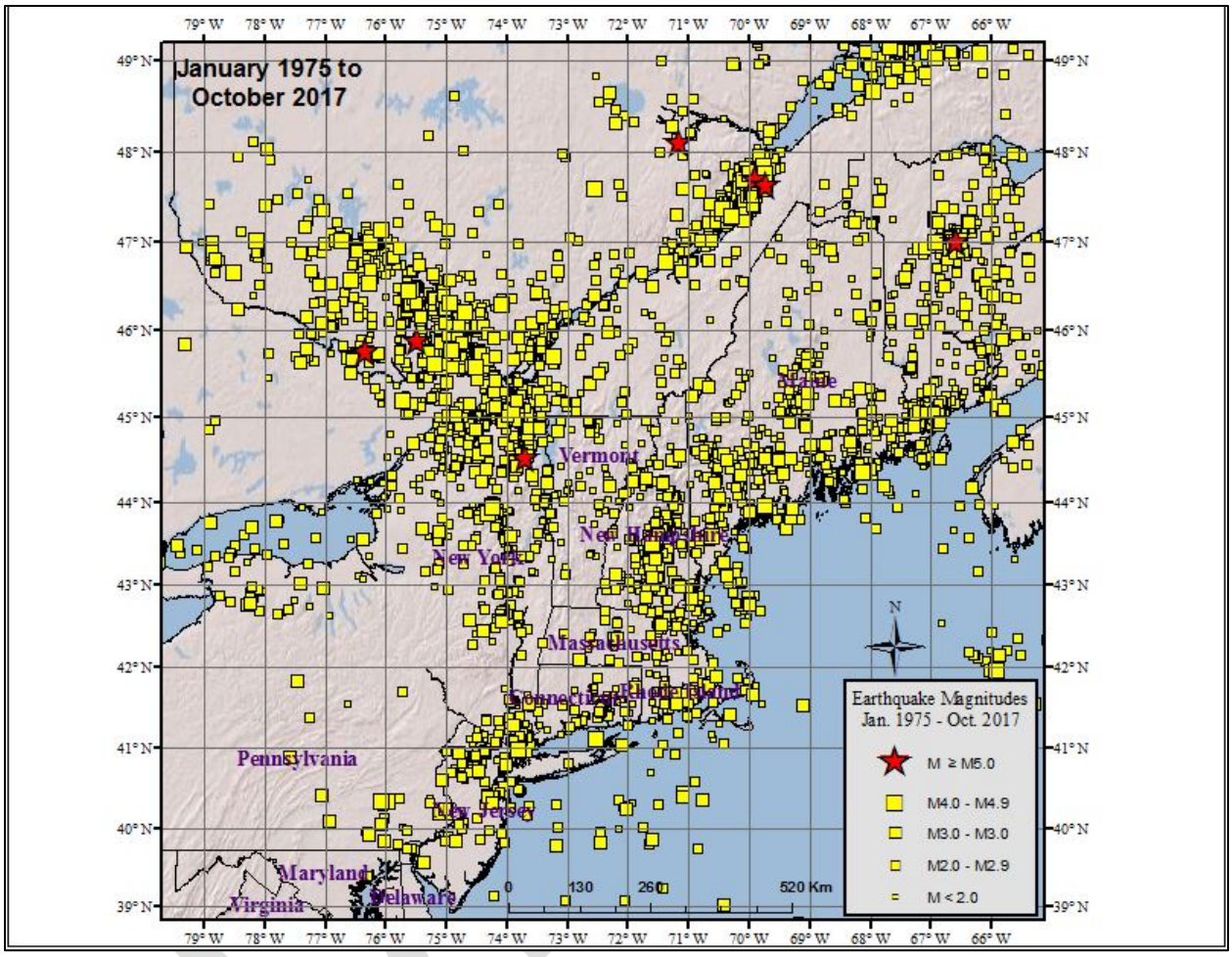


Image 3: Map of Earthquakes of the Northeastern US and Southeastern Canada 1975 to 2017. Source: The Northeast States Emergency Consortium website.

PROBABILITY OF FUTURE EVENTS

The 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) notes that "Earthquakes cannot be predicted and may occur at any time." Additionally, the report notes that a strong earthquake could occur anywhere within the New England Region rather than in specific hotspots. Therefore, it is difficult to estimate the probability of a future damaging earthquake in Oxford.

The local Hazard Mitigation Team reports that no earthquakes have been felt in Oxford. Based upon existing records, there is a "very low" frequency (less than 1 percent probability in any given year) of a damaging earthquake in Oxford.

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 65.7% percent of the town's 5,531 occupied housing units was constructed in 1979 or earlier (2019 American Community Survey, 5-year estimates, Table DP04) were upgraded with the 1997 revision of the State Building Code. Despite its older housing stock, Oxford faces a "minor" impact from earthquakes, with little damage likely to occur 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 magnitude 5.0 earthquake was selected for analysis. Historically, major earthquakes are rare in New England, although a magnitude 5.0 event occurred in 1963.

Table 20 - Estimated Damages from an Earthquake

	Magnitude 5.0
Building Characteristics	
Estimated total number of buildings	5,032
Estimated total building replacement value (2010 $)	$ 1,878,000,000
Building Damages	
# of buildings sustaining slight damage	1,489
# of buildings sustaining moderate damage	787
# of buildings sustaining extensive damage	210
# of buildings completely damaged	52
Population Needs	
# of households displaced	199
# of people seeking public shelter	114
Debris	
Building debris generated (tons)	48,000
# of truckloads to clear debris (@ 25 tons/truck)	1,160
Value of Damages (dollars)	

Total property damage	$258,020,000
Total losses due to business interruption	$33,542,600

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

EXPOSURE

Certain features within Oxford'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 3.0. Vulnerable community features include:

- Older buildings constructed prior to the first edition of the Massachusetts State Building Code.
- The Buffumville Mill Chimney and the chimney of the building at 627 Main Street could be vulnerable to earthquakes and create compounding risks for the town. These chimneys were identified as potential compounding risks because they are adjacent to roadways, not because of known structural deficiencies.

CLIMATE CHANGE INFLUENCE

According to the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan (SHMCAP), earthquakes in Massachusetts are not influenced by climate change.

VULNERABILITY

Based on the above analysis, Oxford has a hazard index rating of "5- lowest risk" from earthquakes.

4.10 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. Others failures are caused by foundation defects, inadequate maintenance, internal erosion caused by seepage, and many other specific causes (Association of State Dam Safety Officials, n.d.). Dam failure may be influenced by storm floodwaters, but most are caused by structural, mechanical, or hydraulic failures (FEMA, 2013). Dam breeches can lead to catastrophic consequences as the water rushes in a torrent downstream, flooding an area that 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 19 dams in Oxford, of which 2 are High Hazard, and 9 are Significant Hazard. In addition to the 19 dams in town, the Buffumville Dam (High Hazard, MA00964, owned by the Army Corps of Engineers) in neighboring Charlton lies roughly a quarter-mile upgradient from a populated section of Oxford and the Significant Hazard Buffumville Pond Dam in Oxford. The names and hazard levels of dam structures within Oxford are:

National ID	Dam Name	Owner Type	Hazard Potential	Notes
MA01954	Stone's Pond Dam	Private	N/A	
MA00669	Lowes Pond Dam	Private (transferring to Town of Oxford)	Significant Hazard	Absentee owner. DCR will fund dam replacement and Oxford will take ownership. Design is partially complete.
MA00992	Buffumville Pond Dam	Private	Significant Hazard	
MA03365	Texas Pond Outlet Dam	Private	N/A	
MA00671	Stumpy Pond Dam	Private	Significant Hazard	
MA01952	Lapa Farm Pond Dam	Private	N/A	
MA01955	Turner Pond	Private	N/A	
MA01948	Old Scythe Shop Pond Dam	Private	N/A	
MA01956	Clara Barton Pond Dam	Private Association or other non-profit	N/A	
MA00670	Robinson Pond Dam	Private	Significant Hazard	Absentee dam owners. The town is concerned that they may not be keeping up with inspections.
MA01946	Bartlett Pond Dam	Private	Significant Hazard	Dam is susceptible to seepage. Owners are seeking funding to remove the dam and restore stream flow.
MA01947	Slaters Pond Dam	Town of Oxford	Significant Hazard	

National ID	Dam Name	Owner Type	Hazard Potential	Notes
MA00674	Hudson Pond Dam	Private	N/A	
MA01951	Cominsville Pond Dam	Private	N/A	
MA01005	Gordon Pond Dam	Private	Significant Hazard	
MA01950	Eames Pond Dam	Private	Significant Hazard	
MA00967	Hodges Village Dam	ACOE - U.S. Army Corps of Engineers	High Hazard	
MA01953	Mckinstry's Pond Dam	Town of Oxford	Significant Hazard	In poor condition. Town is addressing structural issues. Town is completing design and applying for construction permits. Will apply for state construction funding.
MA00675	Chimney Pond Dam	Private	High Hazard	Part of a proposed distribution center project. If the project proceeds, they will be required to repair this dam.

Inundation areas for these dams cover less than 10% of the town or a "small" portion of its area.

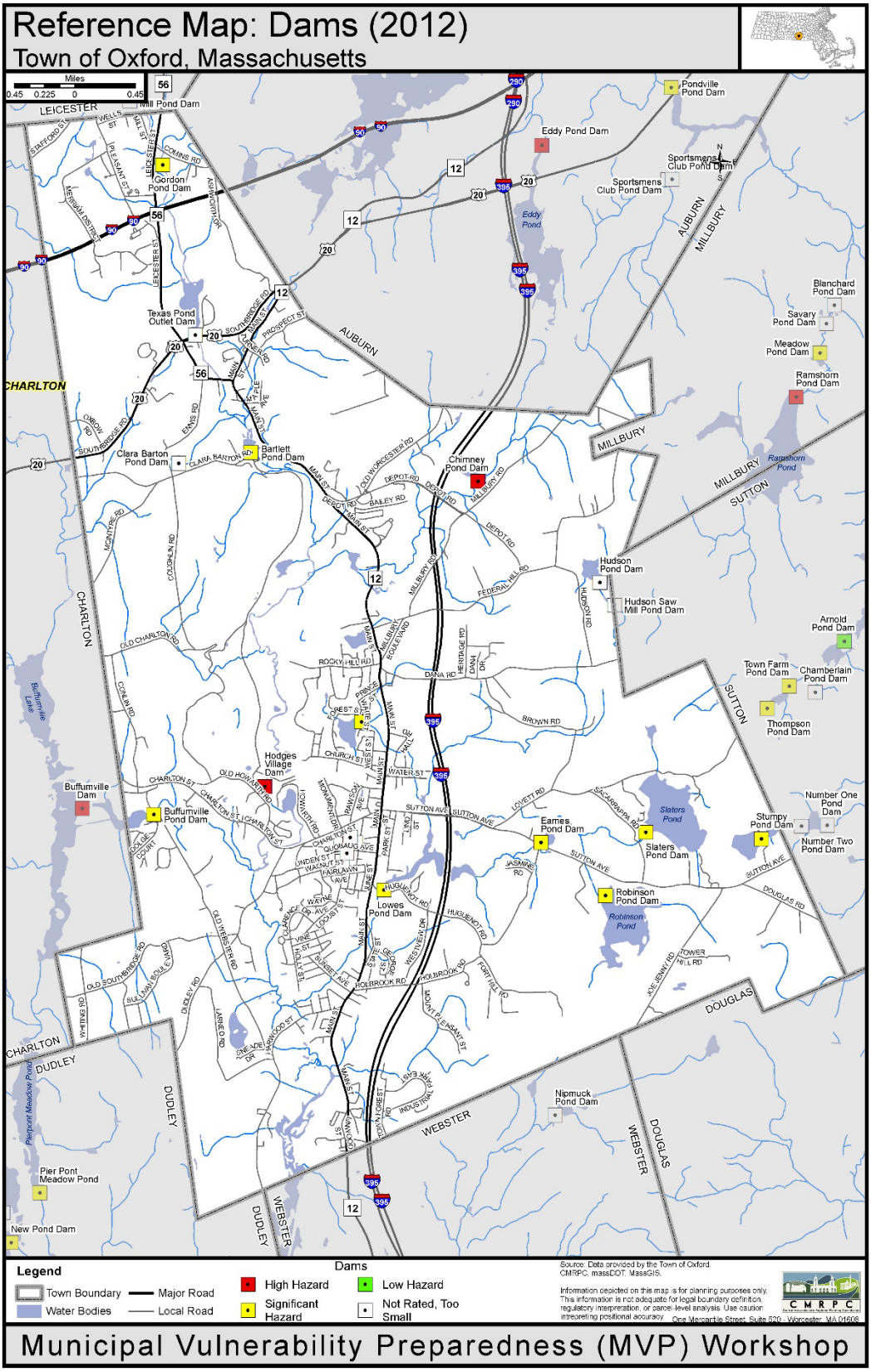


Figure 5: Oxford Dam Locations

EXTENT

Often dam or levee breaches lead to catastrophic consequences as the water ultimately rushes in a torrent downstream, flooding an area that 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 Oxford.

PROBABILITY OF FUTURE EVENTS

While Oxford has a fairly high number of High and Significant Hazard dams, there are no reported previous dam failure events in the 150-plus years that dams have been present. Therefore, the probability for future failure events is "very low," with less than a 1 percent chance of a dam bursting in any given year.

IMPACT

The Town faces a "limited" impact from a dam failure, with 10 to 25 percent of the affected area likely to be damaged.

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 the failure of an individual dam could be significant but would be geographically limited to portions of the dam's inundation zone.

EXPOSURE

Certain features within Oxford's community infrastructure, society, and environment may face more exposure to dam failure 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 3.0. Vulnerable community features include:

- Residents living in dam inundation areas who may have trouble evacuating from their residence due to age, health concerns, or lack of a vehicle.

CLIMATE CHANGE INFLUENCE

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. See Section 4.4 Flooding: Climate Change Influence for more details.

VULNERABILITY

Based on a mostly qualitative assessment, Oxford has a hazard index rating of "4-limited" from dam failure.

Locally, there is a specific concern about vulnerability from the Lowes Pond Dam (significant hazard), which lies roughly 300 yards upstream on Lowes Brook from Oxford Fire Department and EMS headquarters. In addition, the poor structural condition of McKinstry's Pond Dam (also Significant Hazard) threatens several residences in the northern part of the town center, as well as nearby Main Street (Route 12), a key evacuation route. Similarly, failure of the (High Hazard) Chimney Pond Dam would threaten on/off ramps for I-395 at Exit 5 (Depot Road). I-395 is an evacuation route. Bartlett Pond Dam is also in declining condition and is susceptible to seepage.

4.11 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. Roughly 47% of residents (6,260 out of 13,327 people) and numerous businesses are served by a private water system operated by the Aquarion Water Company (Aquarion Water Company, 2020). A few receive water from

the public Cherry Valley and Rochdale Water District based in neighboring Leicester, while most others utilize individual private well water. The National Drought Mitigation Center also records information on historical drought occurrences. 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 21: U.S. Drought Monitor

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
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

Source: (National Drought Mitigation Center, n.d.-a)

PREVIOUS OCCURRENCES

In Massachusetts, six major droughts have occurred statewide since 1930, though the Oxford area has been spared the most severe impacts in each case, according to USGS Water Supply Paper for Massachusetts #2375. These major historical 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:

Table 22: Annual Drought Status

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 Feb. 3)	No drought

Source: National Drought Mitigation Center, 2016.

In Oxford, the last known drought event with substantial impacts occurred in 1999, when private wells serving several homes ran dry.

PROBABILITY OF FUTURE EVENTS

In Oxford, 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 Oxford due to climate change influences, which will result in annual increases in consecutive dry days.

IMPACT

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

Table 23: Historical Impacts of Drought in Massachusetts

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
	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

Source: National Drought Mitigation Center, n.d.-b.

The 2018 Massachusetts State Hazard Mitigation and Climate Adaptation 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 (Commonwealth of Massachusetts et al., 2018).

Specific impacts in Oxford may vary among customers of the water system and private well users. In 1999, some residential wells ran dry, while the two larger systems comprising the Town's water service area were able to maintain service. 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 parts of town that are not located within the Town's water service area. Figure 6 on pg. 82 illustrates the geographic limits of the service area.

EXPOSURE

Certain features within Oxford'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 3.0. Vulnerable community features include:

- Local farms, especially livestock farms who may be reliant on water for pasture growth.

- Golf courses, such as Pine Ridge Golf Course, who may be reliant on rainfall.
- Recreational fields.
- Wild plants and animals, including trees.
- Residences and buildings not connected to the Aquarion water system.

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, though PFAS has not been detected in significant quantities in Oxford to date.

CLIMATE CHANGE IMPACT

According to the 2018 State Hazard Mitigation and Climate Adaptation 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.

VULNERABILITY

Based on the above assessment, Oxford 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. Vulnerability is higher in areas outside the municipal water service area (see Figure 6).

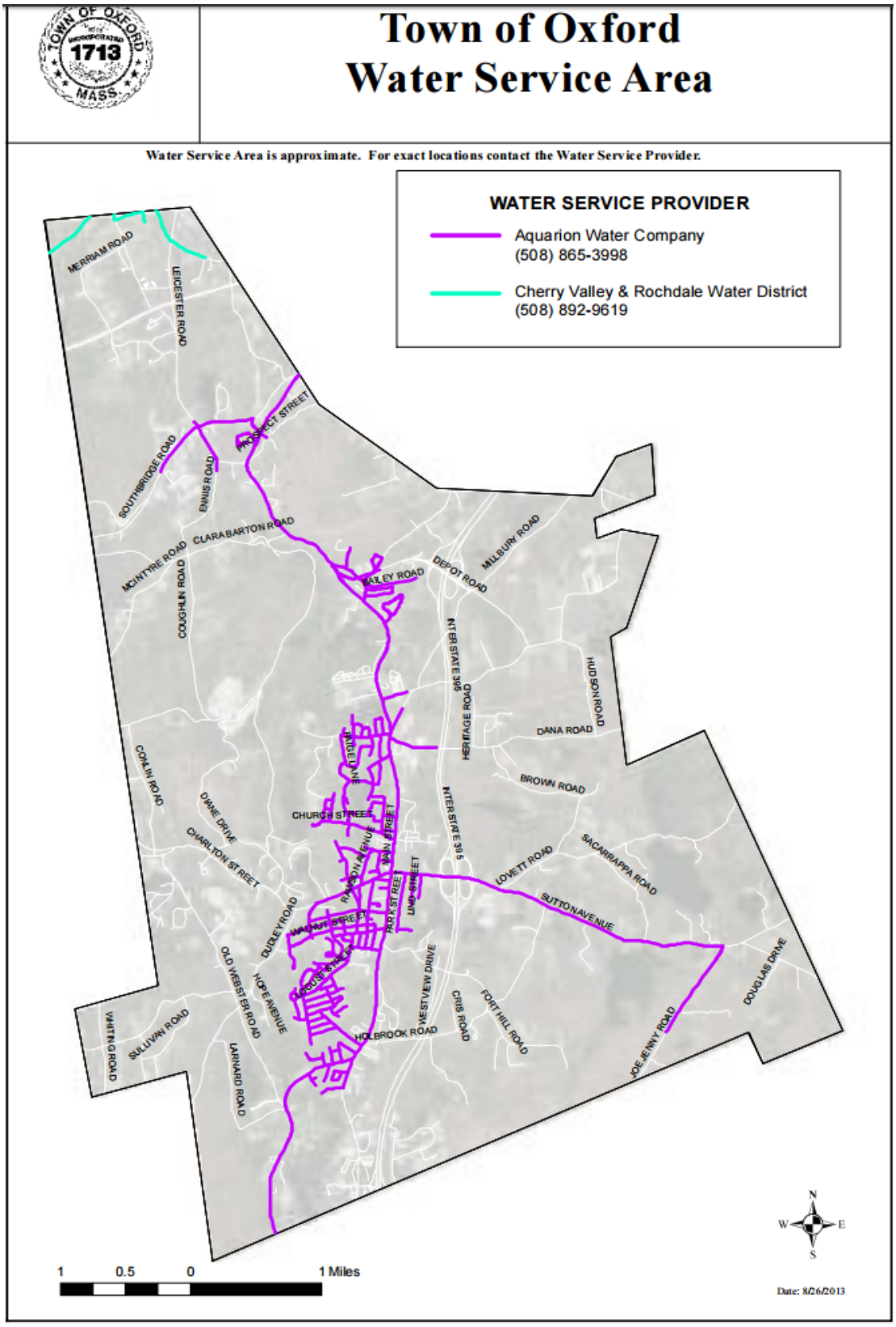


Figure 6: Oxford Water Service Area (2013)

4.12 EXTREME TEMPERATURES

As per the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan, there is no universal definition for extreme temperatures, with the term relative to local weather conditions. Extreme heat in Massachusetts is typically defined as a period of 3 or more consecutive days with temperatures above 90 °F (Commonwealth of Massachusetts et al., 2018). Extreme heat may also refer to any prolonged period of especially hot weather (a heatwave), 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 for the Oxford area are:

Table 24: Monthly Climate Normals (1991-2020) - Buffumville Lake, MA

	July (Hottest Month)	**January (Coldest Month)**
Average High (°F)	82.5°	34.1°
Average Low (°F)	60.3°	14.6°

Source: National Weather Service, n.d.-b.

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 Oxford 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

2018 Massachusetts State Hazard Mitigation and Climate Adaptation 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 cold. 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.

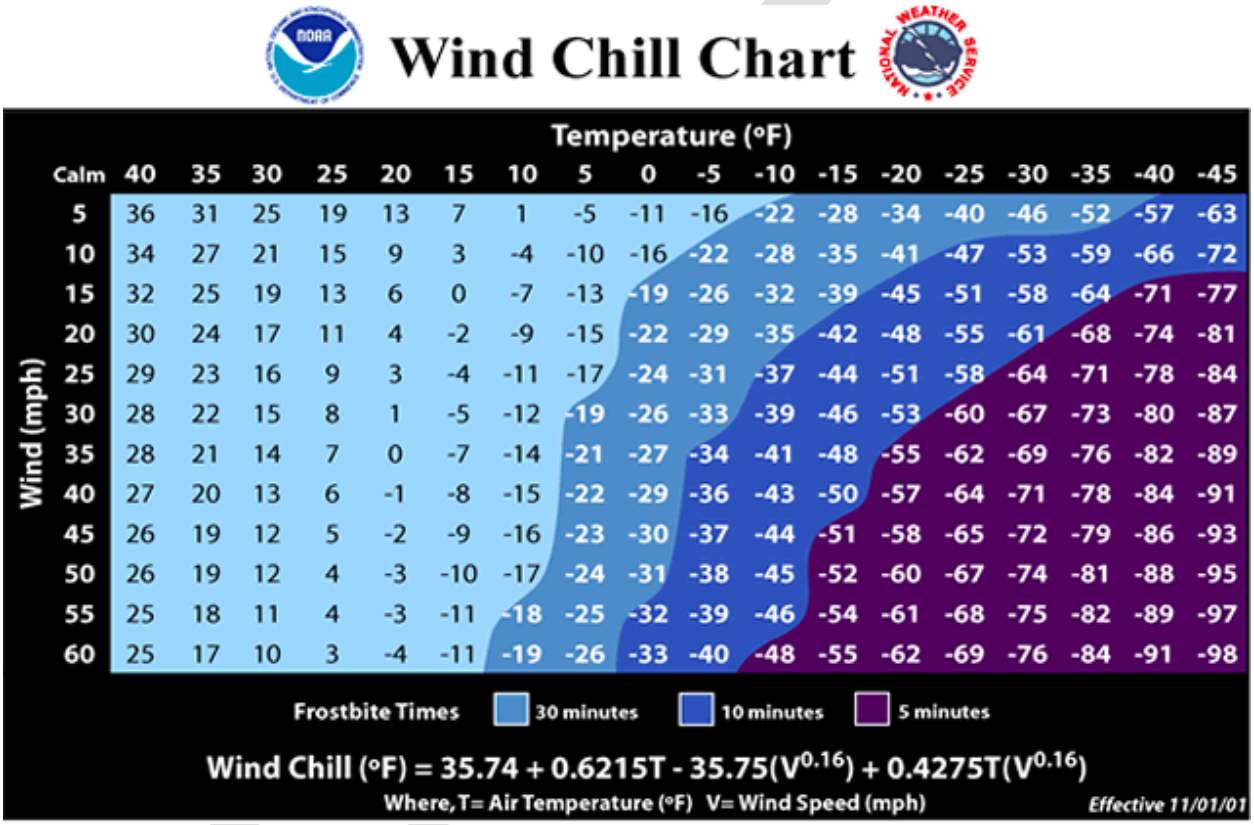


Figure 7: NWS Wind Chill Temperature (WCT) index. Source: National Weather Service, 2001.

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 two or more hours. The NWS issues an Excessive Heat Advisory if the heat index is forecast to reach 95°F-99°F for two or more hours over two consecutive days, or 100°F-104°F for two or more hours over one day. The NWS defines a heatwave as three or more days of ≥ 90°F temperatures. The following chart indicates the relationship between heat index and relative humidity:

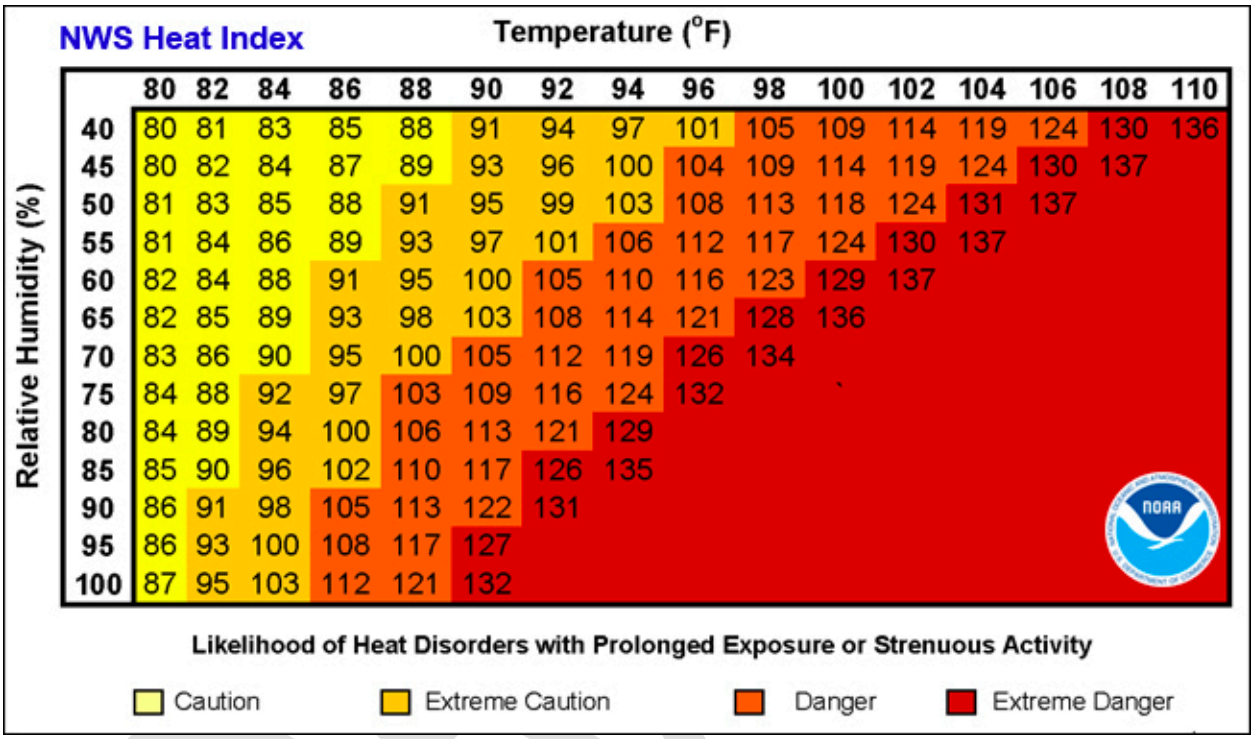


Figure 8: Heat Index. Source: (National Weather Service, n.d.-a)

Extreme heat causes more fatalities in the United States than all other weather-related natural hazards combined (Commonwealth of Massachusetts et al., 2018). Extreme heat can be the underlying cause of death or can worsen other medical conditions like heart disease, hypertension, alcohol poisoning, and drug overdoses (Vaidyanathan, 2020). The heat-related mortality rate is higher among males and people aged 65 years and older (Vaidyanathan, 2020). Table 22 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 25: Heat Effects on Body

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.

Source: National Weather Service, n.d.-c.

Other impacts of high temperatures include drought, wildfire, and the formation of ground-level ozone (Commonwealth of Massachusetts et al., 2018). Prolonged heat can cause power use to spike and overload the electrical grid, causing outages (2018). 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 (2018). Carbon monoxide poisoning is another risk during cold weather, especially when households lack adequate power or heat (2018). 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 (2018).

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 and 43 warm-weather events between 1995 and 2018 (Commonwealth of Massachusetts et al., 2018). 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 Oxford.

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 Oxford is considered to be "limited," with no property damage and a limited effect on humans.

EXPOSURE

Certain features within Oxford'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 3.0. Vulnerable community features include:

- Children and elderly residents, who may find it difficult to regulate their body temperatures in extremely hot or cold conditions.
- Low-income residents who are 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.

CLIMATE CHANGE INFLUENCE

According to the 2018 State Hazard Mitigation and Climate Adaptation Plan, there are two major ways that temperature in Massachusetts may be influenced by climate change:

- High temperatures overall will result in higher extreme temperatures in the summer months. By 2100, extreme heat could occur between 13 and 65 days during the summer.
- By 2100, annual average temperatures are expected to increase by 3.8 to 10.8 degrees compared to the 1971-2000 baseline.

In summary, climate change is likely to increase the frequency of extreme heat in Massachusetts. Changes to average annual temperatures will also impact Oxford. Seasonal temperatures may shift, with spring and summer temperatures extending through more of the year (Commonwealth of Massachusetts et al., 2018). Winters may also be milder than historical norms (2018). 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 species of plants and animals may need to migrate to new ranges to find suitable habitats (2018).

VULNERABILITY

Oxford's vulnerability from extreme heat and cold is considered to be "4 - Low Risk."

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, nor'easters, and tsunamis. It was determined that these hazards are either irrelevant to Oxford due to the town's location, or in the case of nor'easters, that the hazard is already included within another hazard described above (Section 4.5: Severe Snowstorms / Ice Storms / Nor'easters).

4.13.1 LANDSLIDES

One other hazard that can affect Oxford 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 Oxford. The town is relatively flat, and most of its rivers are slow-moving and frequently dammed, which can minimize landslide risk. Roadways are not generally built close to river channels, reducing undercutting risk from stormwater-induced bank erosion. High slope terrain (defined as 15 to 25% grade) cover 1,080 acres, or only 6.1% of the town; very high slopes (higher than 25% grade) cover 150 acres, or less than 1% of the town's area. Little development is present in these areas. Should a landslide occur in the future in Oxford, 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 Oxford.

Oxford, like nearly all communities in the CMRPC region, has few areas with susceptibility for landscapes according to figure 4-16 in the 2018 State Hazard Mitigation and Climate Adaptation. 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).

5.0 EXISTING PROTECTION

The Town of Oxford makes use of locally-controlled tools to mitigate the consequences of natural hazards, including: zoning regulations, planning, and physical improvements. The Town does not participate in any federal programs such as StormReady certification or Firewise community certification.

Oxford has several no-cost or low-cost hazard mitigation capabilities in place. Land-use zoning, subdivision regulations, and an array of specific policies and regulations that include hazard mitigation best practices, such as limitations on development in floodplains, stormwater

management, tree maintenance, etc. Oxford also has appropriate staff dedicated to hazard mitigation-related work for a community of its size, including a Town Manager, an Emergency Management Director, a Department of Public Works, a Planning and Economic Development Direction, a Conservation Agent, Director of Public Health Services, a Facilities Director, and a Tree Warden.

Oxford also has several plans in place that influence or encourage hazard mitigation, including a Comprehensive Emergency Management Plan and a Master Plan. 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 Regional Emergency Planning Committee (Tri-EPIC) and has opted into fire protection mutual aid agreements through MEMA. Oxford 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. Mainstreaming hazard mitigation and climate adaptation into future plans developed by Oxford will supplement the actions outlined in *Section 7.6* and help ensure gradual progress towards community resilience.

The table in *Section 5.1* describes existing mitigation protections in Oxford. 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.	Oxford monitors building activity within the flood plain to ensure compliance with provisions of state building code.	Effective; There are no repetitive loss properties in Oxford. Oxford should seek to further limit development in the 100-year 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. Oxford should educate its residents about NFIP.
Floodplain Zoning District bylaw in place	Requires all development to be in compliance with state building code requirements for construction in floodplains	Oxford has a Flood Plain District (Chapter VIII) in its Zoning Bylaw. This Chapter was last updated in May of 2011.	Very effective; no changes recommended
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.	Oxford enacted a Stormwater Management and Erosion Control Bylaw in January 2005, which is included as Chapter 65-67 in the Town's General Bylaws. Oxford also participates in the Central Mass Stormwater Coalition. Said By-Law was updated and approved at Town Meeting in May 2021 to include LID requirements & other regs for MS4 Permit Compliance.	Very effective; no changes recommended.

Existing Measure	**Description**	**Action**	**Effectiveness & Recommendations**
Local Open Space and Recreation Plan	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, but it does identify environmental challenges and important natural resources in Oxford, which may relate to hazard mitigation.	Oxford's Open Space and Recreation Plan was issued in March 2007. Oxford is planning to undertake a plan update in the near future.	Somewhat effective; Plan is expired as of 2014. Oxford should prepare a plan update as per Mass. DCS guidance. Where allowable, Oxford should use the update to integrate hazard mitigation activities and recommendations.
Comprehensive Wastewater Management Planning Process	Oxford has initiated a Comprehensive Wastewater Management Planning Process, which is a 20-year sewer master plan to determine where there are needs for sewer and to determine the best way to meet the need.	Complete the CWMP.	Somewhat effective; Oxford must complete this plan to realize its impact on municipal wastewater

Existing Measure	**Description**	**Action**	**Effectiveness & Recommendations**
Local wetlands protection bylaw and regulations in place (Mass. Assoc. of Conservation Commissions, 2006 data)	Local bylaws building upon the State's Wetlands Protection Act and Regulations. These add regulatory oversight provisions for development within the jurisdictional buffer zone, adding increased attention to alteration of wetlands and the opportunity to preserve capacity and quality.	Oxford does not have a local town-wide wetland bylaw in place; however, the Town implemented the Robinson Pond Protection District to regulate development around that water body.	Very effective; Oxford should examine enhanced development controls at other wetlands to sustain natural barriers to flooding; Conservation Commission should begin examining surrounding communities by-laws and model by-laws; Conservation Commission should begin draft wetlands protection bylaw document
"Pond Use" By-Law	This local bylaw was enacted at the May 2021 Town Meeting.	It restricts the use of gas or diesel engine boats on Carbuncle Pond, Sacarrappa Pond, and Robinson Pond. The intent is to prevent negative water quality impacts from boat fuel and motor activity.	Effective; no further action recommended
Drainage system maintenance and repair program	Plan to keep municipal drainage facilities (storm drains, culverts, etc.) in good order	Oxford performs street sweeping and catch basin cleaning from April to November; town performs routine inspections and annual outfall inspections pursuant to MS4 permit; town also makes drainage upgrades as part of routine maintenance work; the Conservation Commission also routinely posts best practices on stormwater management to social media	Effective; no further action recommended

Existing Measure	**Description**	**Action**	**Effectiveness & Recommendations**
Routine Tree Trimming	Plan to ensure routine maintenance of trees to reduce likelihood of vegetative debris in response to storm events	Oxford conducts roadside mowing from April-November to remove juvenile trees.	Effective; Oxford should work with its electrical utility to coordinate a more systematic tree trimming program
Priority Tree Removal Program	Plan that prioritizes high risk trees within public right of way for removal.	DPW developed and is implementing priority tree removal program.	Very effective; continue implementing, updating, and monitoring plan
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.	MassDOT is replacing a problem culvert at Clara Barton Road/Main Street. The Town has historically maintained and replaced other problem culverts when needed and as funding allows; Design for culvert replacements at Old Webster Road and Hall Road underway; DPW replaced culverts on Prospect St (#12), Industrial Park Rd W, Dana Road (#21) since 2016	Somewhat to very effective; Current efforts are piecemeal and are limited by a lack of resources and systematic approach. Oxford should develop a prioritized inventory of problem culverts for use in seeking external financial support. Planning must comply with 2014 Mass. Wetlands Protection Act update; culverts may not be replaced in-kind.

Existing Measure	**Description**	**Action**	**Effectiveness & Recommendations**
Pavement Management Plan	Town-wide inventory and distress survey of roadway pavement in ArcGIS. Run budget scenarios to prioritize roadway repairs based on Roadway classification (Arterial, Local, etc.) i.e. Arterial Streets (evacuation routes) receive highest priority for repair, Avg. Daily Traffic (ADT), and Pvm't Condition Index (PCI).	DPW developed robust paving plans in 2020 ($15M) and 2021 ($5M) to address many of Oxford's deteriorating streets. The plans required the Town borrow funds for design/construction. On both occasions the borrowing was approved at Town Meeting but failed at the ballot box.	Very effective; Continue to advocate for increase in Ch. 90 funding
		DPW continues to implement our PMP at current funding levels ($1M per year - amount required to maintain level avg.)	Somewhat effective, merely maintaining network PCI, no net gain given funding level
	The purpose of the Town of Oxford Comprehensive Emergency Management Plan (CEMP) is to establish the overall framework for integration and coordination of emergency management and response activities and to facilitate coordinated response to any emergency or event in the Community requiring multi-agency response or support. This plan outlines the Town's emergency response plan in detail. It determines the list of critical emergency response facilities, and therefore contributes to the town's hazard mitigation priorities.	Oxford recently completed a 2022 update of its CEMP, which is pending adoption by the Board of Selectmen.	Effective; no further action recommended

6.0 STATUS OF MITIGATION MEASURES FROM 2016 PLAN

Town staff provided updates on the status of mitigation measures from Oxford's 2016 Hazard Mitigation Plan. Certain measures were incomplete as of 2022 and deemed "still relevant." These actions were reviewed by the Core Team. Some actions were re-incorporated in the 2022 Hazard Mitigation Plan action strategy based on whether they could be completed in the next 5 years and their perceived effectiveness (see *Section 7.6: Mitigation Strategies*).

2016 Task	2022 Status	2022 Notes	Include in 2022 Plan?
High Priority			
Address structural issues at Town-owned McKinstry's Pond Dam (Significant Hazard), in poor condition	In progress	Still relevant. The town has a nearly finalized design (95% complete), but is still submitting for permitting. Plan to apply through Dam & Seawall program for construction funding.	Yes
676 Main Street area needs culvert replaced; near North Oxford Post Office and Fire Station #2; adjacent to wetland and 100- and 500-year flood zones	Incomplete	MassDOT has not taken any action to resolve this flooding. Still relevant.	Yes
Glass replacement and roof improvements at Police Station (EOC) to withstand hurricane force wind damage	Partially complete - windows in EOC room have been complete but not others in the building	Still relevant – funding needed.	Yes
Tree trimming needed across the town to protect utility wires	On-going	Last year, National Grid made a push to reduce the number of hazard trees in town but there will always be more hazard trees. Still relevant.	Yes

Replace emergency generator and associated wiring at former school (4 Maple Road) to provide power to building and food storage and preparation areas for use as shelter	Complete	The community center currently has a small emergency generator, and a larger generator has been ordered (delivery has been delayed due to supply chain issues).	No
Continue to participate in National Flood Insurance Program (NFIP) (or other) training offered by the State and/or FEMA that addresses flood hazard planning and management	Incomplete – delayed	Key personnel have transitioned into new roles since 2016. DPW Director and EMD need to coordinate training and planning. Still relevant.	Yes
Road information coordination and planning for snow removal	On-going	Still relevant.	Yes
Evacuation Plan updates	Incomplete – delayed	Key personnel have transitioned into new roles since 2016. DPW Director and EMD and Police Chief need to coordinate training and planning. Still relevant.	Yes
Maintain fire access roads in isolated areas	On-going	The Army Corps of Engineers maintains the fire access roads in their areas. They have been conducting regular maintenance on these roads. We have not encountered any problems with accessing them in the recent past (2-3 years). The DCR maintains those roads connected with Douglas State Forest and other state areas. They have been properly maintained and	Yes

		there have not been any issues with access to them. The DPW maintains Town owned access roads and again, they've conducted routine vegetation and access maintenance to these areas.	
Improve vegetation and debris management along P&W Railroad rights-of-way; recurrent brush fires reported near tracks	On-going	CSX now has control of the former P and W right of way and has increased their vegetation control efforts. Fires have been down to 1 or 2 a year along the tracks based on their efforts.	Yes
Provide information to residents and businesses on water conservation through low-impact landscaping and other measures (to conserve water for firefighting)	On-going	From 2018-2021, the Town has posted on the DPW facebook page the benefits of using a rain barrel, including conserving water, in connection with Oxford's annual Rain Barrel Program. This program allows residents to purchase rain barrels at a discounted price.	Yes
Monitor implementation of Hazard Mitigation Plan	On-going		Yes
Medium Priority			
Drainage and culvert upgrades at Sacarrappa Road due to repeated flood incidents; adjacent to 100-year flood zone	Complete	Reconstructed structure.	No
Undersized drainage system replacement at Rawson Ave due	In progress	Flooding issues and impacts to wetland is completed - 2nd phase of project is to potentially	Yes

to repeated flood incidents; adjacent to wetland		improve drainage and address high groundwater table. Still relevant.	
Multiple drainage issues need addressing on Water Street between Cedar St. and Sibley Cir, including, but not limited to culvert size and beaver dam control. Within wetland, 100-year flood zone, 500-year flood zone	Incomplete	This primarily refers to the stream passing beneath Water Street. DPW has not conducted structural improvements yet. May need to re-evaluate priority and impact because this area floods less frequently. Still relevant.	Yes
Privately owned Lowes Pond Dam (Significant Hazard) needs repair near Main Street and State Street; dam area is just upstream from Fire/EMS station and within the 500-year and 100-year flood zones	In progress	Dam has an absentee owner, so town is participating in DCR program for orphaned dam. After repair work is complete, Oxford will take ownership of dam. Design is partially complete. Still relevant.	Yes
Culverts at Main St./Prince St./Holman St./Dana Rd. under Main Street and parking lot need replacement; one residence with recurrent flooding	Partially complete (Dana Road culvert was replaced recently)	Will be included in town-wide culvert assessment, more investigative work is still relevant. Issue seems to be high-groundwater rather than culvert size or condition.	Yes
General drainage upgrades in area of Clara Barton Road near Main Street; adjacent to French River, wetland, and 100- and 500-year flood zones	Incomplete	DPW is unsure what specific issue occurs at the Clara Barton intersection. There is lots of flooding in that area, so further investigation may be still relevant.	Yes
Drainage and structural upgrades at Birchwood Terrace;	Incomplete	Still relevant. This area has high groundwater so there is no great solution to the drainage	Yes

dead-end street floods regularly and is only access to 3-5 homes		issues. There was work done prior to 2016 but it hasn't addressed issue. Timeline may need to be extended to 3-5 years.	
Drainage improvements at Route 12 (Main Street) under P&W Railroad (near Industrial Park West); area is within wetland and 100- and 500-year flood zones	Incomplete	This is part of a larger flooding issue. Still relevant, but action should address the broader problem.	Yes
Review and update local plans and development review processes (planning, zoning, stormwater management, conservation, etc.) to ensure new construction will not be affected by hazards	On-going	Stormwater Management By-Law revised and updated.	Yes
Low Priority			
Identify/resolve issue causing flooding problem on MassDOT-responsible road at Main Street, south of Pratt Ave	Incomplete	This task refers to the P&W railroad bridge. It is still relevant but may need an increased priority because this is an evacuation route (south of Pratt Ave at the Railroad Bridge). This task is a matter of coordinating with MassDOT. Still relevant.	Yes
Address combination of undersized drain and hardened cement which has been poured into the system at Sutton Ave at Lind Street; adjacent to wetland	Incomplete	More investigative work needs to be done and timeline may need to be adjusted. This area still routinely floods. Still relevant.	Yes, but incorporated into a broader action addressing Sutton Ave flooding

Undersized drain replacement at Sutton Ave between Lovett and Fort Hill Roads; adjacent to wetland and 100-year flood zone	Incomplete	Beaver dams behind properties still accumulate water, and undersized culvert doesn't pass high enough volume of water. Homes not being impacted but water is impounded on one side of culvert and isn't able to flow across Sutton Ave. Still relevant.	Yes
Area near Sutton Ave and Turk Hollow Rd is low lying; roadbed could be raised; area is adjacent to wetland	In progress – plan to complete in 2022	Going to reconstruct road and elevate roadbed to some extent over wetlands. This area does not see too much flooding.	Yes
Culvert upgrade/replacement at Hartwell Road; irregular reports of flooding in area; area within 500-year flood zone	Incomplete	There does not seem to be a drainage back-up issue in this area, so still relevant but a very low priority.	Yes
Culvert upgrade/replacement at Hall Road at stream crossing; adjacent to wetland	In progress – design is underway	Town needs to identify funding for construction. Identifying a funding source is still relevant, but it may not be the highest priority for construction (it's a remote location and when it floods people still have egress to Main Street).	Yes
Drainage and structural upgrades at Wellington Road; area within wetland and 500-year flood zone	Incomplete	Still relevant, still floods. Low-lying spot and wetland that floods routinely. Not a heavily populated area, and road is usually still passable.	Yes
Dam (Texas Pond Outlet Dam, N/A hazard tier) and/or roadway repair at Main St. (state route) at Chestnut Hill Rd;	Incomplete	This may still be relevant but it has not been a concern in the last several years.	Yes

irregular flooding; adjacent to 500-year and 100-year flood zones			
Structural repair to clock tower attached to Town Hall	Complete	Repairs have been made to address water damage above entryway, rebuild the first and second wythe of the interior 3 wythe masonry wall on the clock mechanism level, and the interior clock tower masonry wall at the main attic floor level.	No
Drainage improvements under P&W Railroad near Cudworth Road and the Whistle Stop; area is adjacent to wetland and 100- and 500-year flood zones	Incomplete	This is one part of a larger connected flooding issues. Homes not being impacted but water is impounded on one side of culvert and isn't able to flow across Sutton Ave. Still relevant.	Yes, but incorporated into broader action addressing Sutton Ave flooding
Investigate Community Rating System (CRS) benefits and requirements and decide whether to participate	? Checking with town manager's office	Still relevant	

7.0 MITIGATION STRATEGY

The Oxford 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 OBJECTIVES

The Core Project team reviewed the information on natural hazards in Oxford, the list of critical infrastructure and facilities, notes from the Community Resilience Building workshop, and the public survey results to generate a list of objectives for Oxford's natural hazard mitigation strategy. Each objective captures a priority for hazard mitigation or municipal vulnerability preparedness within Oxford. These objectives are used to categorize mitigation strategies. General objective statements for Oxford include:

- Remedy known stormwater drainage issues to address existing flooding
- Prepare for future increases in precipitation caused by climate change
- Reduce the vulnerability of dams to natural hazards and climate change
- Prevent water impairments by mitigating septic system failures and addressing the lack of public sewage
- Ensure drought resilience of Oxford's water supply
- Remove potential barriers to natural hazard mitigation or community resilience
- Protect critical infrastructure and ensure emergency preparedness
- Reduce power outages caused by falling trees, and encourage climate-resilient tree canopy
- Mitigate wildfire risk
- Support resilience of vulnerable community members
- Support resilience of the natural environment, and encourage sustainable behaviors

7.2 PRIORITY

Following the ranking of each strategy for its mitigation impact, real-world considerations were brought back into the analysis to inform the priority ranking process. 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.

- High Priority – strategies that 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 that 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 that have relatively low mitigation impacts that do not necessarily justify their costs and that may have difficulty being funded, completed in a timely fashion, administered effectively, and locally supported

7.2.1 FACTORS INCLUDED IN PRIORITY CONSIDERATION

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 demonstrated political and/or public support through positive involvement by the public, including through the 2021 HMP/MVP Survey, prioritization in previous regional and local plans initiatives that were locally initiated or adopted, 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, Tri-EPIC regional emergency planning, etc.) are prioritized. Considerations include grant application requirements, grant administrative requirements (including audit requirements), procurement, and staff time to oversee projects.

Impact - The 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 potential theoretical 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) based on the relevant hazard(s) as assessed in Chapter 4, and the geographic extent of each strategy's benefits (other factors being equal, a larger area equals higher impact).

- High Impact – actions that help mitigate several hazards, substantially reduce loss of life and property (including critical facilities and infrastructure), and/or aid a relatively large portion of the community
- Medium Impact – actions that help mitigate multiple hazards, somewhat reduce loss of life and property (including critical facilities and infrastructure), and/or aid a sizeable portion of the community

- Low Impact – actions that help mitigate a single hazard, lead to little or no reduction in loss of life and property (including critical facilities and infrastructure), and/or aid a highly localized area

7.3 ESTIMATED COST

Each implementation strategy is provided with a rough cost estimate based on available third-party or internal estimates and past experiences 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 not generally available, so costs are summarized within the following ranges:

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

7.4 TIMELINE

Each strategy is provided with an estimated length of time it will take for implementation. If funding has been secured for a project, 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. Strategies are grouped by 1-2 year timeframe, 3-5 year timeframe, 5+ year timeframe, and ongoing items.

7.5 STRATEGY TYPES

Mitigation strategies were broken into four broad categories to facilitate local implementation discussions, especially regarding budget considerations and roles/responsibilities:

Structure and Infrastructure Projects - Construct "bricks & mortar" infrastructure and building improvements in order to eliminate or reduce hazard threats or to mitigate the impacts of hazards. Examples 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. Integrate disaster prevention/mitigation and preparedness into every relevant aspect of town operations, including Police, Fire, EMD, EMS, DPW, Planning Board, Conservation Commission, and Board of Selectmen; coordinate with neighboring communities where appropriate. Recommendations in this category tend toward standardizing and memorializing generally-practiced activities.

Education and Awareness Programs - Integrate education and outreach into the community to 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, essentially altering a culture. 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 - Review and propose updates to local bylaws, ordinances, and regulations to protect vulnerable resources and prevent further risk to those resources. Formally adopt these updates into the local regulatory framework. Review the effectiveness of past mitigation projects, programs procedures, and policies. Incorporate mitigation planning into master plans, open space plans, capital improvement plans, facility plans, etc.

Planning and regulatory activities tend to provide extraordinary benefits 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 its benefits. 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, for each strategy, we also identify what hazard(s) it is intended to address, as described in *Section 4.0* of this plan. Each strategy also identifies the lead organization that serves as the primary point of contact for coordinating efforts associated with that item and identifies potential funding sources for implementation. See *Section 8.4* for more information on potential funding.

7.6 MITIGATION STRATEGIES

Objective	Specific Action	Implementation Responsibility	Estimated Cost	Potential Funding Source	Timeframe	Overall Priority
Ensure drought resilience of Oxford's water supply	Require water conservation measures (drought resistant landscaping, grey water infrastructure) in new construction.	Planning and Economic Development	Low	No cost associated with this activity	1-2 years	Medium
Ensure drought resilience of Oxford's water supply; *also relates to Remedy known stormwater drainage issues to address existing flooding*	Research and consider incentives to reduce the amount of impervious surface on properties.	Planning and Economic Development	Low	No cost associated with this activity	1-2 years	Medium
Mitigate wildfire risk	Communicate with P&W maintenance rep about fire risk along the rail lines, possibly in collaboration with other towns.	P&W Railroad, Fire, DPW	Low	No cost associated with this activity	Ongoing	High
	Provide information to residents and businesses on water conservation through low-impact landscaping and other measures (to conserve water for firefighting and household use)	DPW, Conservation, Aquarion Water, Cherry Valley & Rochdale Water District	Low	No cost associated with this activity	Ongoing	High
	Maintain fire access roads in isolated areas	Fire, DPW	Low	Department budgets	Ongoing	Medium
Prevent water impairments by mitigating septic system failures and addressing the lack of public sewage	Education and enforcement on good septic system maintenance to prevent degradation of water resources.	Board of Health, Conservation Commission	Low	No cost associated with this activity	Ongoing	Top Priority
	Complete comprehensive wastewater management plan and assess the long-term pros/cons of expanding the shared sewer system and possibilities of acquiring funding.	DPW	More information required	ARPA, MassWorks Infrastructure Grant, EEA Planning Grant	3-5 years	High

Objective	Specific Action	Implementation Responsibility	Estimated Cost	Potential Funding Source	Timeframe	Overall Priority
	Pursue resources for financial assistance for private septic system upgrades and funding opportunities to test private wells.	Board of Health	Low	Mass DEP, CDBG	Ongoing	Low
Protect critical infrastructure and ensure emergency preparedness	Evacuation Plan updates; re-evaluate evacuation routes considering the likelihood of roadway flooding.	Local Emergency Management with DPW	Low	DHS grants	1-2 Years (update every 5 Years)	Top Priority
	Road information coordination and planning for snow removal	DPW, MassDOT	Low	No cost associated with this activity	Ongoing	High
	Glass replacement and roof improvements at Police Station (EOC) to withstand hurricane force wind damage	Local Emergency Management	Low	DHS grant; town capital funding	1-2 Years	High
	Work with Oxford's Fire and Emergency Services Department to ensure town has up-to-date emergency preparedness plan, and that town government, residents, and businesses understand where to go or how they can assist during certain emergencies. Also, assess CodeRED sign-up rate and evaluate whether town should conduct more public outreach to boost CodeRED participation.	Local Emergency Management	Low	No cost associated with this activity	Ongoing – plan updated in 2022	High
	Assess all critical links between Oxford and neighboring communities (ex. sewer and water system interconnections, major roadways, etc.) and work with other towns to ensure resilience of this interconnected infrastructure.	Local Emergency Management	More information required	More information required	3-5 years	Low
Reduce power outages caused by falling trees, and encourage climate-resilient tree canopy	Tree trimming needed across the town to protect utility wires	National Grid, Tree Warden, Private property owners	More information required	More information required; town funding for Tree Warden	Ongoing	High
	Coordinate with the utility company to develop tree trimming standards to	National Grid, Tree Warden,	Low	No cost associated with this activity	1-2 years	High

Objective	Specific Action	Implementation Responsibility	Estimated Cost	Potential Funding Source	Timeframe	Overall Priority
	ensure tree health and minimize disruptions to power.	Private property owners				
	Reassess development regulations and zoning bylaws to encourage "climate-resilient" tree species, rather than simply "native" tree species.	Planning Board	Low	Staff time	1-2 years	Medium
Reduce the vulnerability of dams to natural hazards and climate change	Repair work to privately owned Lowes Pond Dam (Significant Hazard) near Main Street and State Street; dam area is just upstream from Fire/EMS station and within the 500-year and 100-year flood zones	DPW	Funding through DCR Orphaned Dams Program	DCR Orphaned Dams Program	3-5 Years, design in progress	Top Priority
	Address structural issues at Town-owned McKinstry's Pond Dam (Significant Hazard), in poor condition	DPW	High	MassWorks grants; DCR grants; town funding	1-2 years, permitting in progress	Top Priority
	Remove Bartlett Pond Dam (and possibly other dams) on the French River, as needed, to create resilience of the French River waterway and the town against catastrophic failure/flooding risk from climate change.	Private owners	High	Private funding; MVP Action Grant funding; Dam and Seawall Repair or Removal Program	3-5 years	High
Remedy known stormwater drainage issues to address existing flooding	Educate residents on the new stormwater drainage bylaw, the importance of maintaining private stormwater drainage infrastructure, and best practices.	DPW, Conservation Commission	Low	Staff time	Ongoing	Top Priority
	Conduct a detailed culvert inventory to assess existing infrastructure and prioritize future maintenance or replacements.	DPW	Medium	CMRPC culvert program; staff time	1-2 years	Top Priority
	Address flooding along Sutton Ave between Wolcott St and I-395	DPW	More information required	More information on issue required	1-2 years	High
	Continue to participate in National Flood Insurance Program (NFIP) (or other) training offered by the State and/or FEMA that addresses flood hazard planning and management	DPW, Local Emergency Management, Planning	Low	No cost associated with this activity	Ongoing	Medium

Objective	Specific Action	Implementation Responsibility	Estimated Cost	Potential Funding Source	Timeframe	Overall Priority
	676 Main Street area needs culvert replaced; near North Oxford Post Office and Fire Station #2; adjacent to wetland and 100- and 500-year flood zones	MassDOT	More information required	MassDOT	1-2 Years	Medium
	Identify funding source and complete construction of culvert upgrade/replacement at Hall Road at stream crossing; adjacent to wetland	DPW	High	MVP Action Grant; DER funding	3-5 years	Medium
	Address Industrial Park Road West flooding, and flooding on Main St (Rt12) adjacent to P&W RR bridge, through zoning changes, collaboration with Mass DOT, and potential changes to evacuation routes.	DPW, MassDOT, P&W Railroad	More information required	More information required to determine the root cause of the flooding	3-5 Years	Medium
	Explore a holistic solution to chronic flooding near the steep hill next to Worcester Gears & Racks, which floods resident backyards and causes icing problems along Route 12.	DPW, MassDOT	More information required	More information required to determine the root cause of the flooding	3-5 years	Medium
	Culvert upgrade/replacement at Hartwell Road; irregular reports of flooding in area; area within 500-year flood zone	DPW	High	Culvert Replacement Municipal Assistance Grant Program; Mass Works grant; local funding	3-5 years	Low
	Drainage and structural upgrades at Birchwood Terrace; dead-end street floods regularly and is only access to 3-5 homes	DPW	More information required	More information required to determine the scope of the issue	3-5 years	Low
	Dam (Texas Pond Outlet Dam, N/A hazard tier) and/or roadway repair at Main St. (state route) at Chestnut Hill Rd; irregular flooding; adjacent to 500-year and 100-year flood zones	MassDOT, Private dam owner	More information required	More information required to determine the scope of the issue	3-5 Years	Low
	Undersized drain replacement at Sutton Ave between Lovett and Fort Hill Roads; adjacent to wetland and 100-year flood zone	DPW	High	Mass Works infrastructure grant; local funding	3-5 years	Low

Objective	Specific Action	Implementation Responsibility	Estimated Cost	Potential Funding Source	Timeframe	Overall Priority
Remedy known stormwater drainage issues to address existing flooding	Culverts at Main St./Prince St./Holman St. under Main Street and parking lot need replacement; one residence with recurrent flooding	DPW	More information required	More information required to determine the scope of the issue	1-2 Years	Low
	General drainage upgrades in area of Clara Barton Road near Main Street; adjacent to French River, wetland, and 100- and 500-year flood zones	DPW	More information required	More information required to determine the scope of the issue	1-2 Years	Low
	Investigate Community Rating System (CRS) benefits and requirements and decide whether to participate	DPW, Local Emergency Management, Planning	Low	Staff time	1-2 Years	Low
	Area near Sutton Ave and Turk Hollow Rd is low lying; roadbed could be raised; area is adjacent to wetland	DPW	More information required	More information required to determine the scope of the issue	1-2 Years, already in progress	Low
	Improve drainage and address high water table near Rawson Ave; adjacent to wetland	DPW	High	Local funding; Mass Works infrastructure grant	1-2 Years	Low
	Multiple drainage issues need addressing on Water Street between Cedar St. and Sibley Cir, including, but not limited to culvert size and beaver dam control. Within wetland, 100-year flood zone, 500-year flood zone	DPW	More information required	More information required to determine the scope of the issue	1-2 Years	Low
	Drainage and structural upgrades at Wellington Road; area within wetland and 500-year flood zone	DPW	More information required	More information required to determine the scope of the issue	3-5 years	Low
Remove potential barriers to natural hazard mitigation or community resilience	Invest in additional DPW staff to ensure MVP/HMP project ideas, in addition to current capital projects are efficiently implemented and maintained.	DPW	High	Local funding	1-2 years	High
	Host a town "volunteer fair" to recruit more volunteers to community organizations and municipal boards; pair with educational resources on	Town Manager's Office	Low	Staff time	1-2 years	Medium

Objective	Specific Action	Implementation Responsibility	Estimated Cost	Potential Funding Source	Timeframe	Overall Priority
	town government and how citizens can get involved.					
	Review and update local plans and development review processes (planning, zoning, stormwater management, conservation, etc.) to ensure new construction will not be affected by hazards	All Town Departments	Low	Staff time	Ongoing	Medium
	Monitor implementation of Hazard Mitigation Plan	All Town Departments	Low	Staff time	Ongoing	Medium
	Educate public of need to invest in new DPW building using public outreach and a dedicated committee.	DPW	Low	Staff time	3-5 years	Low
	Collaborate with Oxford Cable Access to regularly report on resiliency success stories in town.	DPW, Oxford Cable Access	Low	Staff time	Ongoing	Low
Remove potential barriers to natural hazard mitigation or community resilience; *also relates to Support resilience of vulnerable community members*	Expand the town's capacity to reach all residents and businesses with general communications.	Town Manager's Office, All Town Departments	More information required	More information required to determine the scale of funding needed; staff time	1-2 years	High
Support resilience of the natural environment, and encourage sustainable behaviors	Education and outreach on lawn management practices and impact of fertilizers on nearby wetlands and waterbodies.	Conservation Commission	Low	Staff or volunteer time	Ongoing	High
	Encourage upcoming OSRP process to consider climate resilience as a goal during all future open space and recreation decision-making.	Open Space Committee	Low	EEA Planning Grant (secured)	1-2 years	High
	Integrate sustainability into all town administrative processes by greening operations, providing regular trainings for staff, and funding for special programs/projects.	All Town Departments	More information required	Staff time	1-2 years	High

Objective	Specific Action	Implementation Responsibility	Estimated Cost	Potential Funding Source	Timeframe	Overall Priority
	Seek funding or grants to assist with identify and remediating impaired water bodies	Conservation Commission	Low	Mass DEP 604b program; EPA grant funding	1-2 years	Medium
	Seek funding or grants to setup an annual hazardous waste day or program.	Board of Health	Low	Local funding; Mass DEP	1-2 years	Medium
	Host educational materials regarding landscaping with native plant and other practices to protect native pollinators.	Volunteers, Town Website	Low	Volunteer time	1-2 years	Medium
	Continue to implement Oxford's *Trees for Trees* program through public outreach and education.	Tree Warden	Low	Staff time	Ongoing	Medium
	Require new developments to limit light pollution to protect the health of humans, wildlife, save energy.	Planning Board	Low	Staff time	1-2 years	Medium
	Continue to promote solar energy to enhance resiliency and consider other technologies such as battery energy storage systems.	Green Communities Committee, All Town Departments	Low	Staff and volunteer time	Ongoing	Medium
	Request that Aquarion complete a water supply plan, which accounts for future climate risks, town demographic changes, and potential water quality challenges.	Select Board	Low	No cost to town	3-5 years	Medium
	Conduct comprehensive assessment of pros and cons of consolidating town schools into a single-location, which might lead to costs savings and environmental benefits.	School Department	Medium	Staff time	3-5 years	Low
	Develop an invasive species plan for town-owned land and waterbodies.	Conservation Commission	More information required	Staff and volunteer time; local funding	3-5 years	Low
	Update town bylaws to require trash haulers to offer only combined trash and recycling collection.	Board of Health, Select Board	Low	Staff time	1-2 years	Low

Objective	Specific Action	Implementation Responsibility	Estimated Cost	Potential Funding Source	Timeframe	Overall Priority
Support resilience of the natural environment, and encourage sustainable behaviors	Implement an educational campaign on landscaping strategies and options for native and "pollinator friendly" habits in partnership with homeowners and businesses.	Volunteers, Conservation Commission	Low	Staff and volunteer time	1-2 Years	Low
	Collaborate with communities within our watershed on climate resilience.	MVP Core Team	Low	Staff time	Ongoing	Low
	Establish a regional climate action competition to encourage regional mobilization to reach climate goals.	CMRPC	Low	CMRPC	1-2 years	Low
	Continue to promote Oxford Community Electricity Aggregation and encourage the option to go "100% renewable energy."	Green Communities Committee, Town	Low	Staff and volunteer time	Ongoing	Low
	Create and promote a voluntary home energy assessment, education, and upgrade program(s) that will achieve home energy savings.	Volunteers	Low	Volunteer time	1-2 years	Low
Support resilience of the natural environment, and encourage sustainable behaviors, *also relates to Remedy known stormwater drainage issues to address existing flooding*	Update zoning bylaws to incorporate a range of low-impact development guidelines that includes a variety of options relevant to all forms of new development.	Planning Board	More information required	Staff time	1-2 years	Medium
Support resilience of vulnerable community members	Work with the property owner of Orchard Hill with resident outreach regarding community needs.	Director of Planning and Economic Development	Low	Staff time	Ongoing	Medium

8.0 PLAN ADOPTION, IMPLEMENTATION, AND MAINTENANCE

8.1 PLAN ADOPTION

A public meeting was held on June 7, 2016 as part of the Board of Selectmen's meeting in order to detail the planning process to date and to solicit comments and feedback from the public on the draft Oxford Hazard Mitigation Plan then being finalized. The draft plan was provided to the Town for distribution and posted on CMRPC's website from June 8 for public review and input. A revised final draft plan was posted online for comment on August 23, 2016. 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 presented to the Oxford Board of Selectmen and adopted on November 15, 2016.

8.2 PLAN IMPLEMENTATION

The Town of Oxford has taken steps to implement findings from the 2016 Hazard Mitigation Plan into the following policy, programmatic areas and plans: its Pavement Management Plan, 2017 Master Plan, and 2022 Comprehensive Emergency Management Plan.

The implementation of this plan began upon its formal adoption by the Board of Selectmen and approval by MEMA and FEMA. Those Town departments and boards responsible for ensuring the development of policies, ordinance revisions, and programs as described in *Section 5.0* and *Section 7.0* of this plan will be notified of their responsibilities immediately following approval. The Hazard Mitigation Team will oversee the implementation of the plan.

8.2.1 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:

> ***Oxford Open Space and Recreation Plan* (2007) –** 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 needs to be updated. Oxford may begin this update process soon, so we encourage the future planning committee to incorporate the recommendations of this Plan into the updated OSRP.
>
> ***Oxford Zoning Bylaw*** –Zoning was used to 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.

Oxford Master Plan (2018) – The Master Plan was used to understand the direction of Oxford's anticipated growth and development, which is critical information for proactive hazard mitigation and climate adaptation.

Massachusetts State Hazard Mitigation and Climate Adaptation Plan (2018) - This plan was used to ensure that the town's HMP was consistent with the State's Plan.

After this plan is 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.

8.3 PLAN MONITORING AND EVALUATION

The Town's Emergency Management Director will call meetings of all responsible parties to review plan progress as 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 the meeting.

Meetings will involve evaluation and assessment of the plan, regarding its effectiveness at achieving the plan's goals and stated purpose. 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 effect of any recent hazard events?
- Has there been any damage to property since the plan was last reviewed?
- How could the existing mitigation strategies be improved upon 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 Town's vulnerability and impact from 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 assigned to individual mitigation strategies be changed based on any recent changes to financial and staffing resources 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. 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 26: 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
Flood Mitigation Assistance (FMA) Program	Cost-share grants for pre- disaster planning & projects	Annual pre-disaster grant program	MEMA	75% FEMA/ 25% non- federal
Hazard Mitigation Grant Program (HMGP)	Post-disaster cost-share grants	Post disaster program	MEMA	75% FEMA/ 25% non- federal
Building Resilient Infrastructure and Communities	National, competitive grant program for projects & planning	Annual, pre-disaster mitigation program	MEMA	75% FEMA/ 25% non- federal
Assistance to Firefighters Grants (AFG)	Training & equipment for wildfire-related hazards	Annual	FEMA	FEMA
Small Business Administration (SBA) Mitigation Loans	Pre- & Post-disaster loans to qualified applicants	Ongoing	MEMA	Small Business Administration
Public Assistance	Post-disaster aid to state & local governments	Post Disaster	MEMA	FEMA/ plus a non-federal share

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

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, elevating 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, earthquakes, 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

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 the 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** enable communities 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 two 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 into three 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 the 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

ASSISTANCE TO FIREFIGHTERS GRANTS

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. Please refer to: https://www.fema.gov/welcome-assistance-firefighters-grant-program.

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 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 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.

8.4.2 STATE FUNDING SOURCES

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

Table 27: 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
Chapter 90	Reimbursable grants	On-going	Mass DOT	State funding
Community Development Block Grants	Competitive community development grants	Annual grant program	HCD	US Department of Housing and Urban Development
Community Preservation Act (CPA)	Grants for local projects that preserve local open space or historic sites, create affordable housing, or develop outdoor recreational facilities	Annual program	Department of Revenue (DOR)	Statewide Community Preservation Trust Fund / local Community Preservation Fund
Culvert Replacement Municipal Assistance Grant Program	Competitive grants for replacing an undersized, perched, and/or degraded culvert located in an area of high ecological value	Annual program	DER	State funding
Dam and Seawall Repair or Removal Program	Competitive grants for dam and seawall repair and removal, as well as construction loans	Annual program	EEA	State funding
Division of Ecological Restoration Priority Project	Competitive grants for wetland and river restoration projects	Annual Program	DER	State funding
Land and Recreation Grants and Loans	Varies, though primarily grant funding	Varies, generally annually	EEA Division of Conservation Services	Varies
Mass Works	Competitive infrastructure grants	Annual	EOHED	State funding
Municipal Small Bridge Program	Competitive grants for small bridge replacement, preservation, and rehabilitation projects	Annual	Mass DOT	State funding
Municipal Vulnerability Preparedness Action Grants	Competitive climate adaptation grants	Annual grant program	EEA	75% EEA/ 25% non-state match

Planning Assistance Grants	Competitive grants that support efforts to plan, regulate (zone), and act to conserve and develop land consistent with the Massachusetts' Sustainable Development Principles	Annual grant program	EEA	75% EEA / 25% non-state match
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 grant program	Mass DEP	State funding
Special appropriations and legislative earmarks	Varies	Infrequent, after natural disasters or legislature vote	State Legislature	State funding
State Revolving Fund	Low-interest loans	Annual program	Mass DEP	Municipal funding with state loan

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 27 are described in more detail on the following pages.

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.

COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)

CDBG remains the principal source of revenue for communities to use in identifying solutions to address the 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.

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 the preservation of the Commonwealth's historical and natural resources. All communities in Massachusetts pay into the 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.

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.

DER PRIORITY PROJECTS

The Division of Ecological Restoration selects 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 hazard dams that communities no longer want to maintain, which may improve the health and resilience of aquatic systems.

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.

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.

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 impacts from 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.

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.

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.

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10.0 APPENDICES

A. Maps
B. Public Survey Results
C. Planning Team & Public Meetings
D. Certificate of Adoption
E. Glossary